ABSTRACT BOOK

9th International Soil Science Congress on "The Soul of Soil and Civilization"

Soil Science Society of Turkey Cooperation with
Federation of Eurasian Soil Science Societies

14 - 16 October 2014, Side, Antalya / Turkey

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Cover design by Kayrasoft

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International Standard Book Number – ISBN (print) 979-605-63090-2-1
ISBN (online) 979-605-63090-3-8

This Abstract book has been prepared from different abstracts sent to the congress secretary only by making some changes in the format. Scientific committee regret for any language and/or aim-scope.

Publication date : 15 August 2014
Press
Erol Ofset Matbaacılık Yayıncılık Ambalaj San. Ve Tic.Ld.Şti.
Pazar Mah. Necati Efendi Sok. No.41/A, İlkadım, Samsun, Turkey

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PREFACE I

Dear Colleagues,

It is our great pleasure to welcome you to the 9th International Soil Science Congress on "The Soul of Soil and Civilization" in Antalya, Turkey. After the great success of the 8th International Congress on "Land Degradation and Challenges in Sustainable Soil Management" held in Çeşme, İzmir, Turkey in May 2012, scientists from over 66 countries have expressed their interest in participating in this International Soil Science Congress (ISSC) which was organized by the Soil Science Society of Turkey (SSST) collaborating with the Federation of Eurasian Soil Science Societies (FESSS).

This congress continues its tradition of being the premier forum for presentation of research results and experience reports on leading edge issues of soil science, including latest and technological developments for soil science, multidisciplinary approach to soil science, experiments, applications, surveys and theory. The mission of the congress is to share novel access control solutions that fulfill the needs of heterogeneous applications and environments and identify new directions for future research and development. ISSC gives researchers and practitioners a unique opportunity to share their perspectives with others interested in the various aspects of soil science. I hope that these proceedings will serve as a valuable reference for security researchers and developers.

The scientific programme was carefully chosen and many distinguished presenters have sent their contributions to present the most recent achievements and effective policies in mitigating the soil degradation. Highly competent scientists from five continents will present and give an overview of fundamental and applied aspects of soil science. The Congress is open to educators, NGO's and policy-makers in order to be informed by experts in the field of application of a series of innovative measures for soil science.

I also encourage participants to attend the keynote and invited talk presentations. These valuable and insightful talks can and will guide us to a better understanding of soil management;

- Stewardship to land of the Plenary lecture I, Professor Yakov Pachepsky (who is currently at USDA, ARS, Environmental Microbial and Food Safety Lab)
- Soils Sustaining Life of the Plenary lecture II, Professor Ahmet Mermut (who is currently at President, European Confederation of Soil Science Societies)

I hope that you will find this congress interesting and it will provide you with a valuable opportunity to share ideas with other researchers and practitioners from institutions around the world. I would like to express my sincere thanks to all members and reviewers who helped to organise this great event. Finally, I thank the hosting hotel, our sponsors, and our generous corporate supporters.

I hope that you will enjoy your stay in Turkey and have a memorable time during the congress.

Dr. Rıdvan KIZILKAYA
The President of the Organizing Committee

PREFACE II

This book contains the abstracts of papers selected for presentation at the 9th International Soil Science Congress on "The Soul of Soil and Civilization" Antalya-Turkey, October 14-16, 2014. Except of 2 abstracts invited presentations included in the beginning of the book, all were voluntary submissions for oral or poster sessions. In preparation for the congress, the response vastly exceeded our expectations: we received more than 847 voluntary submissions from 61 different countries of the world. The abstracts were sent to the respective ISSC scientific committee members for their scrutiny and decision on their acceptability for oral or poster presentations. The final selected abstracts were then edited for uniformity in length (maximum 400 words), presentation format, and language.

The abstracts in this book cover fundamental aspects, technical approaches and the related areas of soil science in the following topic categories;

I. Soil Biology and Biochemistry
II. Soil Physics & Mechanics
III. Soil Chemistry
IV. Soil Erosion & Conservation
V. Soil Fertility
VI. Soil Pollution & Remediation
VII. Soil Hydrology
VIII. Soil Management & Reclamation
IX. Soil Health & Quality
X. Soil Genesis, Classification & Mapping
XI. Soil Mineralogy & Micromorphology
XII. Geostatistics, Remote Sensing & GIS
XIII. Plant Nutrition & Fertilization

This book will remain the only source of reference. Some selected presentations by the scientific committee will be developed as full-length journal articles for the special issues of Eurasian Journal of Soil Science, Kazakh Journal of Soil Science, Soil - Water Journal and The Journal of Ege University Faculty of Agriculture. But, for the majority of the full-length articles that may not be published in this journal, will be published after the congress. The proceedings book will also be made available to congress participants as a CD, and the full-length articles will be posted on the congress web-site, and retained for several months after the congress. This book represents the collective endeavor of hundreds of researchers, students and others interested in soil science and natural resources around the world. We trust that it will be useful as a source for the state of knowledge and practice of soil science.

Finally, we sincerely thank all the invited speakers, scientific committee members, authors and participants, without their cooperation and timely inputs this congress would not have been possible succesfully.

Dr. Coskun GÜLSER
Congress Secretary

PREFACE III

Civilization is often influenced by the soil quality and the kinds and quality of plants and animals grown on them. As one of the most important natural resources, soils have almost leaded great civilizations. While soil destruction or mismanagement was associated with the downfall of some civilizations, good soils had helped to build them.

The Soil Science Society of Turkey (SSST) was founded by the leadership of Prof.Dr. Kerim Ömer Çağlar in 1964. The objectives of the SSST are to bring people together to share and support their knowledge, experiences in the soil science. The SSST as a member of the International Union of Soil Science has more than 850 members and organized 21 scientific meetings, national and international levels biennially. The International Symposium series was started with the first meeting "M. Şefik Yeşilsoy Interational Symposium on Arid Region Soil" organized by SSST in 1998. Since then, the SSST has been struggling with national and worldwide problems faced by the producers and researchers through 6 international scientific meetings organized in every two years. The goal of these symposiums stimulates international scientific interactions in soil science. 9th International Soil Science Congress on "The Soul of Soil and Civilization" in Antalya-Turkey, October 14-16, 2014.

SSST Board believes that the oral and poster presentations, discussions and recommendations given during this congress will support valuable information to soil scientists for their future activities. We would like to give special thanks to Organizing and Scientific committee for their excellent efforts to develop this Congress and Sueno Hotel, for hosting the Congress and for the immense facilities they have.

As President of of Soil Science Societies (SSST), I am delighted to invite you to Istanbul to participate in the 5th EUROSOIL International Congress that will be held between 17 July and 22 July 2016. We are looking forward to recive participants from all over the world in Istanbul and to help us making all together the congress an unforgettable scientific event and feel the fascinating atmosphere of this world metropolis.

Dr.Ayten NAMLI
President, Soil Science Society of Turkey
President, Federation of Eurasian Soil Science Societies

Up to now, all these international meetings organized by SSST are given with date and locations as follows;

8th International Soil Science Congress on "Land Degradation and Challenges in Sustainable Soil Management"

May 15 – 17, 2012
Çeşme, İzmir, Turkey

7th International Soil Science Congress on "Management of Natural Resources to Sustain Soil Health and Quality"

May 26 – 28, 2010
Samsun, Turkey

6th International Meeting on "Soil Fertility and Agroclimatology"

29 October-1 November, 2008
Kuşadası, Aydın, Turkey

5th International Soil Meeting (ISM) on "Soil Sustaining Life on Earth, Managing Soil and Technology"

May 22-26, 2006
Şanlıurfa, Turkey

4th International Soil Congress (ISC) on "Natural Research Management for Sustainable Devolopment"

June 7-10, 2004
Erzurum, Turkey

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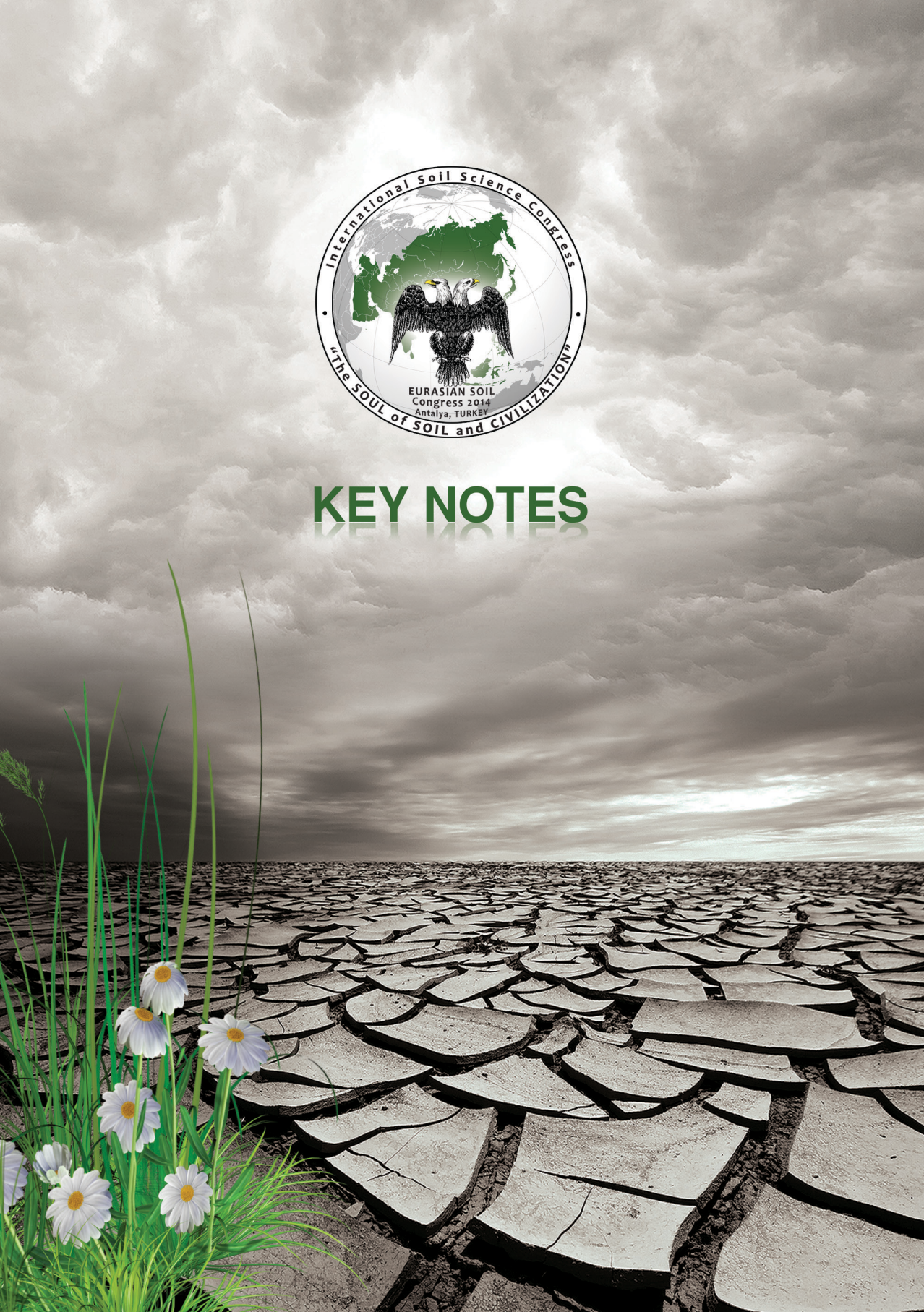
International Soil Science Congress
EURASIAN SOIL
Congress 2014
Antalya, TURKEY
"The SOUL of SOIL and CIVILIZATION"

KEY NOTES

Soil Stewardship

Yakov Pachepsky *

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Abstract

The societal interest in soils has been steadily growing recently, and this culminated in the UN resolution that designated 2015 as the Year of Soil. This talk will be an invitation to discuss why soils are moving to the center stage and what does this mean for soil science and soil users. As interest to global phenomena increased, it became very clear that soil is not to be ignored and need to be factored in any large scale estimates and policy proposals, e.g. related to carbon management and responses to extreme events. Ecological services of soils are becoming better understood and more appreciated. Soil science has developed a substantial translational component by following Hans Jenny's idea of creating a system of quantitative pedology and embracing quantitative approaches and creating new fields such as hydropedology and pedometrics. This has lead to generating information that is appropriate for modern environmental design and applications. Conceptual and methodological base of soil research is being enriched by the influx of specialists from and other disciplines who are deeply involved in soil studies and sometimes successfully spearhead it. Soil studies present an integral element of modern interdisciplinary research which continues to become more appreciated and more productive. The growing interest in soils means opportunities, challenges, and responsibilities for soil scientists. The 'big data' trends both in spatial and temporal density of soil data collection and visualization, and in genomics and proteomics of soil microbial communities, promise exiting insights into interactions is soil systems and better understanding of relationships between structure and function in soils. Soil scientists and soil community are becoming more responsive to emerging issues that can be addressed relying on soil knowledge base. As envisaged by Nikiforoff, better characterization of mass and energy fluxes from, to, and within sols becomes a key to progress. Sustainability of current soil uses is often questioned or denied, and therefore it is time to revisit Dokuchaev's holistic approach to creating sustainable land use systems where soil sustainability is warranted. The responsible soil resources management has to become the ethics tenet thus leading to soil stewardship.

Key words: Global change, ecological services, translational science, interdisciplinary research, research trends, big data, omics, mass and energy fluxes, sustainability, ethics.

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Soils Sustaining Life

Ahmet R. Mermut *

President, European Confederation of Soil Science Societies

Abstract

Soils are most important to mankind and are is the central link to the bio-geo-chemical transformations on the earth surfaces. Recently we become conscious about the irreversible damaging effects on the environment brought about by the humans. Many Religions recognized the importance of soils and thier costoms evolved into a spiritual attachment to *life-giving Earth*. Soils are used for road building, construction, ceramics, and many industries such as aluminium production which are known to mankind for a long time. Soils are regulator, buffer and filter of water, and nutrients and other dissolved and disperssed compounds in the environment. In the international Geosphere-Biosphere Program (IBP) the soil sytem especially its *carbon dynamics* is the central link between the physical climate and bio-geo-chemical sytem. In the past three decades, increasing awareness of CO_2 build-up in the atmosphere and the threat of global warming has instigated society to find methods to reduce atmospheric CO_2. We discovered that agriculture causes about 25% of world CO_2 emissions. Soils have large potentials to sequester and reduce the atmospheric CO_2. There are two fundamental approaches to sequestering carbon in the soil. These are: 1) Protection of ecosystem that store carbon so that sequestration can be maintained (increasing residence time), and 2) Manipulations of ecosystems to increase carbon sequestration beyond the current conditions. Intensification of agriculture on good soils can be achieved through the widespread adoption of : 1) conservation tillage and residue management, eleminating summer fallow, 2) irrigation and water management systems, 3) improved cropping systems, including agroforestry and 4) soil Fertility Intiative is a very important issue. It is a great challenge for soils people to discover new technologies for increasing carbon sequestration together with sustainable crop production.

Key words: Importance of soils, bio-geo-chemical transformations, carbon dynamics, ecosytem protection, intensification of agriculture.

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International Soil Science Congress

EURASIAN SOIL
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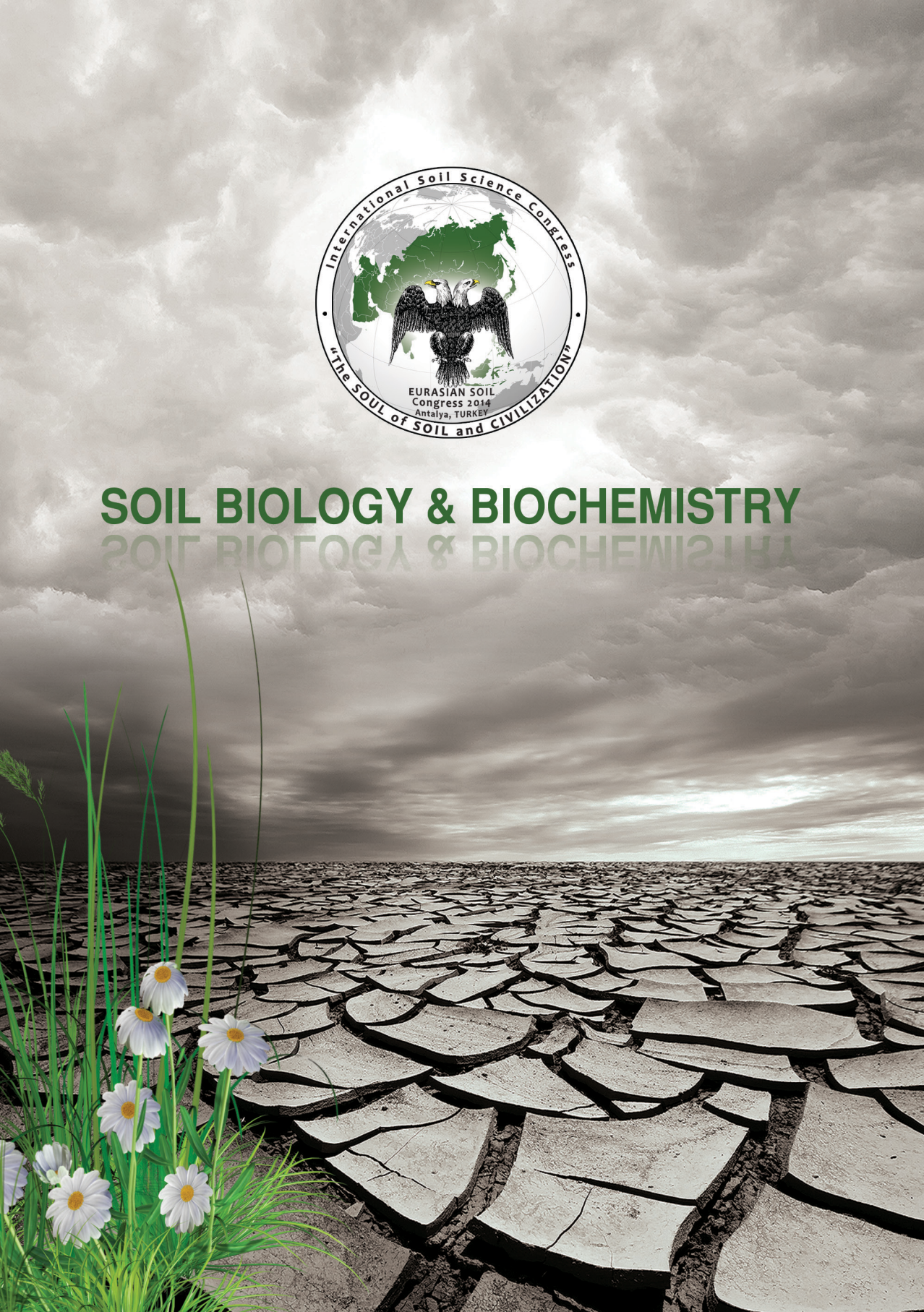
Antalya, TURKEY

"The SOUL of SOIL and CIVILIZATION"

SOIL BIOLOGY & BIOCHEMISTRY



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Effect of irrigation water salinity on growth of *Bradyrhizobium* spp.

Alaa Eadan Hasan*

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Abstract

This study was conducted to study the effect of irrigation water salinity on growth of *Bradyrhizobium* bacteria. It was characterized the genus of strain M10 and local isolate A1 which isolated from mungbean root nodules by using bromothymol blue. The first laboratory experiment had included the study of the effect of five salts NaCl, $MgCl_2$, $CaCl_2$, $MgSO_4$ and Na_2SO_4 with seven concentrations 0, 0.03, 0.06, 0.09, 0.12, 0.15 and 0.18 mol L^{-1} on growth and activity of *Bradyrhizobium* bacteria strain M10 and isolate A1 in the broth media. The viable cells of bacteria were measured by using the dilutions and plates acount. In the second laboratory experiment, a Silty Clay Loam soil was salinized with different levels of irrigation water salinity 1.4, 3, 5, 7 and 9 dSm^{-1} with two inoculation treatments (strain M10 and isolate A1) and the count of bacteria was determined after four incubation periods 3, 8, 13 and 18 days. Strain M10 and local isolate A1 were belonged to the *Bradyrhizobium* genus. The salts effected on viable cells, and they have been ordered as following: NaCl > $CaCl_2$ > $MgSO_4$ = $MgCl_2$ > Na_2SO_4. It was found that Cl^- ions were more toxic than $SO_4^=$ ions and Na+ ions were more toxic to bacteria than Ca^{+2} and Mg^{+2} ions , and the isolate A1 was more tolerant to salts than strain M10 which was more sensitive to salinity than isolate A1.

Key words: *Bradyrhizobium*, irrigation, salinity, tolerance, viable.

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9th International Soil Science Congress on
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14 - 16 October, 2014
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Wildfire effects on soil microbial biomass and soil respiration

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Abstract

Soil CO_2 efflux, which includes respiration from roots (autotrophic) and soil organisms (heterotrophic), is a key source of CO_2 from terrestrial ecosystems and plays an important role in regulating carbon pools and global carbon cycling. Soil respiration is a major flux of CO_2 to the atmosphere and in arid and semi-arid ecosystems it has been less intensively investigated than in other ecosystems. Soil microbial biomass carbon and soil respiration are often applied for understanding effects of environmental factors on soil organisms, monitoring carbon cycles. It is known that fire changes soil properties, depending on fire severity and soil type and fire is the one of the disturbances acting on forest soil carbon emission. This study deals with modifications observed in some biological soil parameters after a low severity wildfire in a semi-arid nonproductive Oak-Juniperus mixed forest in Eskişehir, Turkey. CO_2 evaluation and microbial biomass carbon were analyzed in samples taken from ash layer and 0-5 cm depths after removal of ash. One-way and two-way ANOVA tests were applied to test the effect of fire and species on ash and soil samples. The results indicated that soil microbial biomass carbon was significantly affected by the fire while soil respiration was not. Species had significant effects on soil microbial biomass carbon and CO_2 evaluation in both soil and ash samples.

Key words: Wildfire, semi-arid nonproductive forests, microbial biomass carbon, carbon dioxide evaluation.

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Population testate amoebae soils of the Mediterranean coast of Turkey

Anatoly Bobrov *

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Abstract

The testate amoebae (Protist) are a group of free-living protozoans that have an organic shell (testa). Testaceans inhabit practically all water and land habitats, but abundance and diversity are usually highest in peatlands and in the litter of coarse, humus-rich soils. Testate amoebae, being inherently aquatic, restructure their communities in response to environmental changes in, for example, ground-water table, soil moisture, pH, content of biophylic elements (N, P, K, Ca, Mg), and organic matter. Their primary role in soils is the regulation size of the soil microflora. Also involved in the testate amoebae biogeochemical cycling of silicon in soils and coniferous boreal forests occupy third place in the balance of C and N. At the same time them with confidence can be attributed to the group of the least studied soil Mediterranean microfauna. Known to only a few publications of this vast region, including only one article on the population of one mountain bogs Turkey.The present study presents the first results of testate amoebae in soils of Turkey. Soil samples were taken in different habitat types in the area of Kemer and pine forests of Marmaris and Sorgun. 96 testate amoebae taxa belonging to different ecological groups were found in 45 samples, - from hydrophilic to xerophile conditions. Species diversity ranged from 2 to 27 species , which is comparable with the species richness of this group of protozoa in soils of the boreal zone Findings such species as Geamphorella lucida, Geopyxella sylvicola, G. sylvicola var. globulosa, Awerintzewia cyclostoma, Pseudoawerintzewia calcicola, typical for coniferous and mixed forests of the Western and Central Europe , but rare in soils landscapes covered by Quaternary glaciation are undoubtedly interesting with biogeographical perspective. Knowledge of the taxonomic composition of soil microfauna, its size, and composition of functional groups is an important addition to the understanding of modern soil processes that take place with the participation of the soil biota.

Key words: Soil biota, xerophytic forests, protists

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The soil organic matter and the microbial community in sealed urban soils of Rostov-on-Don, Russia

Andrey Gorovtsov *, Sergey Gorbov, Tatyana Varduni, Sulejman Tagiverdiev, Olga Bezuglova

Southern Federal University, Rostov-on-Don, Russia

Abstract

The soil microbial community of urban territories has been poorly studied at the moment, despite it is very important for soil quality, which plays a key role in sustainable development of urban ecosystems. Among different soil types, found in cities, soils that have been sealed with impermeable layers such as asphalt or concrete are least covered in current scientific literature. Soil sealing can lead to heat-island effect and cause overflooding of unsealed areas. The state of soil organic matter and preservation of biological properties of soil after sealing are important if possible recultivation of sealed soils is considered. The paper presents new data on soil properties and microbiological characteristics of sealed urban soils of Rostov-on-Don, Russia. The quantity of bacteria utilizing organic and inorganic nitrogen, denitrifying bacteria and anaerobic diazotrophs as well as numbers of actinomycetes and soil fungi have been estimated. Total organic carbon, extractable soluble nitrogen and soluble carbon compounds have been measured to calculate the C:N ratio in soil samples. It has been shown, that under the conditions of soil sealing, the quantity of bacteria, capable of utilizing inorganic nitrogen is dependent both from amounts of available soluble nitrogen and carbon compounds, whereas the organic nitrogen-utilisers, presented in studied samples primarily by spore-forming genus *Bacillus*, are not dependent from it. However, spore-forming bacteria, together with soil fungi tend to depend from the soluble C : N ratio in soil, and are more abundant in samples with balance shifted to carbon. The quantity of bacteria, capable of denitrification and nitrogen-fixation in sealed soils is quite low and doesn't depend from carbon or nitrogen content in samples which indicates that that both groups of bacteria need more available organic matter to serve as electron donors for up mentioned processes. The genotoxicity of sealed urban soils was studied on root meristem of pea (*Pisum sativum*). Evaluation of mutagenic activity of sealed soils combined with the study of microbial community will expand knowledge about the sealed soils of Rostov-on-Don.

Key words: Sealed soils, microbial community, genotoxicity, organic carbon, soluble nitrogen.

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Biological activity of peatland cryogenic soils in North Taiga ecosystems of Western Siberia

Anna Bobrik*, Olga Goncharova, Georgiy Matyshak

Lomosonov Moscow State University, Faculty of Soil Science, Moscow, Russia

Abstract

How do cryogenic soils of peatlands function in discontinuous permafrost zone? It's the main question of our work. The research area is located in the north of Western Siberia within the northern boundary of north taiga. The research was carried out at two peatland sites. The frozen peatland represents flat and slightly inclined main surfaces of peatlands with cloudberry-sphagnum cover. Permafrost occurs below 80 cm. The soil profile consist of 5 horizons: O (0-5 cm, total organic carbon (TOC)=36.7%, pH=4.3), T (5-15 cm, TOC=42.8%, pH=4.1), Te (15-40 cm, TOC=38.1%, pH=4.7), Bhf (40-60 cm, TOC=1.5%, pH=4.9), BC (60-80 cm, TOC=0,3%, pH=4.6). The soil type is classified as Turbic Cryosols. The relic frozen peatland is characterized with locally bare peat spots, sparse vegetation and permafrost from 60 cm in the peat layer. The soil profile consist of 3 horizons: T1 (0-20 cm, TOC=51.20%, pH=4.1), T2 (20-40 cm, TOC=52.10%, pH=4.4), T3 (40-60cm, TOC=52.5%, pH=4.6). The soil type is classified as Cryic Histosols. The average annual temperature of peatland soils on 20 cm is about 0ºC. The values of CO_2 emission are low in this region (90 ± 30 $mgCO_2/(m2*hr)$ of Cryosols, 40 ± 15 $mgCO_2/(m2*hr)$ of Histosols), which indicates the low soil biological activity. Mean values of emissions are virtually identical for the 4 years of measurement and placed in the confidence intervals for ecosystems. The depth of permafrost determines the value of CO_2 concentration in the soil profile and the processes of gas diffusion and immobilization. The clear daily dynamics of gas emission and concentration, with a maximum in the afternoon, is associated with the daily air temperature dynamics. Research soils are characterized with high variation of labile organic carbon (WEOC) and the microbial carbon (MC) (WEOC=0.35-1.10% of TOC and MC=1.16-1.62 mg C/g soil in Histosols; WEOC=0.5-0.6% of TOC and MC= 5.33-5.65 mg C/g soil in Cryosols) in organic profile of the soils. The values of microbial biomass are high, but geocryological and hydrothermal conditions low down all soil processes. Cryogenic soils of peatlands are characterized by the low biological activity which leads to the preservation of organic matter, so these ecosystems are sink of CO_2.

Key words: Cryogenic soil, biological activity, carbon dioxide emission, microbial carbon, frozen peatland

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External and internal nitrogen affect the corn residues mineralization in different ways

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Institute of Physicochemical and Biological Problems in Soil Science of RAS, Pushchino, Moscow Region, Russia

Abstract

The impact of external and internal nitrogen on plant residues decomposition was studied in a series of long-term laboratory incubation experiments. Experiment 1 was conducted with corn leaves with variable C/N ratios 22, 34, 47 and 62. C:N ratios in Experiments 2 and 3 were adjusted to 47, 32, 22 and 10 by adding NH_4NO_3 (Experiment 2) or KNO3 (Experiment 3) to corn residues with initial C/N ratio of 62. Mineralization rates of labile and recalcitrant carbon pools of plant residues were estimated by kinetics of cumulative CO_2 losses during one year incubation simulated by the double exponential decay function. The internal organic nitrogen was shown to affect the decay constant (k_1) of the labile pool only, while the internal mineral N had impact the labile pool size. KNO_3 as an external N form influenced the size and k_1 value of the labile pool. NH_4NO_3 affected all the parameters of the double exponential decay model including second decay constant (k_2) of recalcitrant pool. Thus, mineralization of plant residues depends significantly both on concentration and form of available nitrogen.

Key words: Plant residues mineralization, nitrogen, CO_2, C/N, labile pool of SOM, stable pool of SOM, decay constants.

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Preliminary characterization of iron oxidizing bacteria in soil covered gleyic processes

Anna Zięba *, Zagorski Zbigniew

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Abstract

The iron compounds play an important role in soil. They are a component of the soil substrate, which undergoes a number of changes under the influence of chemical and biological agents. The identification of specific forms of iron is especially important in determining gleyic processes that occur in the soil. Important role in the transformation of iron in the soil microorganisms such as bacteria fulfill. The paper presents preliminary results of Iron Oxidizing Bacteria (IOM) isolated from Gleyic Chernozem (WRB 2006). The bacterial culture was carried out on liquid nourishment which is specifically designed for a wide range of IOM (Starkey substrate). Basis on the macroscopic observations identified the presence or absence of iron bacteria in the sample. The results show that both aerobic and anaerobic bacteria located in the test tubes which oxidize iron and optionally iron-reducing bacteria. Currently further work on more detailed characteristics of IOM is planned.

Key words: Iron oxidizing bacteria, gleyic process.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Microbial biomass C and organic C content of natural soil aggregates

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Abstract

Soil carbon stabilization is known to depend in part on its distribution in structural aggregates, and upon soil microbial activity within the aggregates. However, the influence of different soil types on continued soil C storage within aggregates of different size classes is unknown. In this study, we applied a dry-sieving technique to separate bulk soil into eight fractions (< 0.250 mm microaggregate, 0.250-0.425 mm. 0.425-1.00 mm. 1.00-1.40 mm. 1.40-2.00 mm. 2.00-4.75 mm, 4.75-6.30 mm, > 6.30 mm), and measured microbial biomass C and total organic C analyses. Soils in the study area (Kuşkonagı Basin in Samsun, Turkey) were classified as *Typic Haploxerept, Typic Calcixerept, Lithic Xertorthent, Vertic Xerofluvent, Typic Calcixerert* and *Chromic Haploxerert.* It was determined that microbial biomass C and organic C contents of natural soil aggregates taken from the surface soils were 1.0-7.9 µg CO_2-C g^{-1}.24 h dry soils and 0.2-1.9% respectively. Also, although macroaggregates contained organic C in more levels, ratio of microbial biomass C in the organic C was determined as decreased. Microbial biomass C at <0.250 µm diameters of microaggregates and 250-425 µm diameters of macroaggregates was generally found at higher levels.

Key words: Microbial biomass, macroaggregate, microaggregate, organic carbon.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil fungi of the Harran plain and salinity relations

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Abstract

Soil fungal pathogens were determined in 9 soils out of 240 soil samples collected at 0-30 cm depth in the Harran plain, Şanlıurfa. These are *Aspergillus* sp., (12.10^5 CFU g^{-1} soil), *Trichoderma harzianum* (5.10^5 CFU g^{-1} soil), *Penicillium* sp., (5.10^5 CFU g^{-1} soil), *Fusarium* spp., (21.10^5 CFU g^{-1} soil) and *Verticillium* sp., (1.10^5 CFU g^{-1} soil). In order to investigate the relationships between soil variables and the existence of fungi, soil samples from the Harran Plain were grouped based on soil chemical, physical and biological properties using K-means non-hierarchical clustering method. In addition, Principal Component Analysis method was used. According the results obtained, there have been found relationships between soil fungi pathogens and soil quality parameters such as soil electrical conductivity, soil organic matter, K and catalase enzyme activity and soil salinity supports the existence and living environment of fungi.

Key words: Soil, fungi, Harran plain, soil salinity, cluster analyses.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biochar amendment affects soil enzyme activities and tomato, pepper, lettuce plants productivity

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Abstract

Biochar (BC) application to soils is being considered as a means to sequester carbon (C) while concurrently improving soil functions. Biochar is an organic material produced via the pyrolysis of C-based feedstocks (biomass) and is best described as a 'soil conditioner'. The objective of this study was to evaluate the effect of BC from the pyrolysis chicken manure used as a fertilizer in maintaining health of soil and tomato, pepper and lettuce plants under greenhouse conditions. Five treatments-including control, chemical fertilizer, 200, 400 and 600kg/da BC amendments were examined for their effect on soil properties, soil enzymatic activities, plants growth. For all plants, 15.15.15 composite fertilizer was used as a N, P, K fertilizer. Soil samples from each pot analyzed for physicochemical analysis and enzymatic monitoring after the plants harvest. Compared to the control, the soil pH and especially SOC were significantly increased after BC amendments. The activities of ß-glucosidase and alkaline phosphatase enzyme activities in soil were notably increased by the BC applications ($P<0.05$). The soil urease enzyme activity also increased with the BC treatments but this was not statistically significant. Plant height and dry weight of all 3 plants were higher in the 4kg/da BC treatment to the other treatments. The highest N contents of tomato and lettuce plants were found in the application of chemical fertilizer, but the highest N contents of the pepper plant was found in the BC treatments. The replicate greenhouse experiments showed that BC amendment may be potential in improvement of soil properties to some extent to achieve the agricultural use.

Key words: Biochar, chicken manure, soil enzyme, plants, organic amendments.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological activity of Agrochernozem under different anthropogenic loads according to real-time PCR data

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Abstract

Microorganisms are the first to respond to soil changes under the impact of exogenous factors, when many other soil properties remain unchanged. Under the impact of long-term continuous action of some agent on a soil, a stable community of microorganisms differing from that in the unaffected native soil is formed in the soil. We studied the impact of mineral fertilizers on the biological properties of agrochernozems of the Kamennaya Steppe Experimental Site of the Dokuchaev Research Institute of Agriculture in the central chernozemic region of European Russia, Voronezh oblast. The biological activity of plowed horizons was determined from real-time PCR data for the following trials: NPK-0, NPK-60, and NPK-120 (kg/ha); a long-term fallow plot was used as an absolute control. DNA isolated directly from the soil samples was purified by gel-electrophoresis. Purified DNA samples were used as a template in the PCR (95°C, 3 min; 95°C, 10 s; 50°C, 10 s; 72°C, 20 s; overall, 50 cycles). The maximum biological activity was found in the soil of trial NPK-60. The concentration of copies of ribosomal operons reached 5.0 log $c \cdot \mu l^{-1}$ for micromycetes and 7.1 log $c \cdot \mu l^{-1}$ for bacteria. The minimum number of prokaryotes (6.3 log $c \cdot \mu l^{-1}$) was found in the plow horizon of the trial with zero fertilization. At the same time, the minimum amount of microscopic fungi (3.7 log $c \cdot \mu l^{-1}$) was found in the fallow soil, which could be due to the development of anaerobic conditions in this soil in comparison with plowed soils. The biological activity of the agrochernozem in the trial with maximum fertilization rate (NPK-120) was somewhat lower than the maximum in trial NPK-60 and comprised 4.3 log $c \cdot \mu l^{-1}$ for micromycetes and 6.7 log $c \cdot \mu l^{-1}$ for bacteria. It can be supposed that the high rates of mineral fertilizers have a toxic effect on the soil microorganisms. The soils of the fallow plot and of the plot with zero fertilization had close characteristics of the biological activity. The concentrations of ribosomal operons in them comprised 3.7 and 4.0 log $c \cdot \mu l^{-1}$ for micromycetes and 6.5 and 6.3 log $c \cdot \mu l^{-1}$ for bacteria, respectively. It is argued that the microbiological activity as determined from data on DNA isolated from the soils and subjected to real-time PCR is the most precise indicator of the microbiological activity, because it takes into account both cultivated and uncultivated species of microorganisms. This characteristic can be used as a indicator of the ecological status of soils, including the soils used in agriculture.

Key words: Soil DNA, PCR Real-Time, soil microorganisms, mineral fertilizers, Agrochernozem.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Molecular identification of strains producing Chitinase enzyme in *Streptomyces* 19

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Abstract

Fungal phytopathogens pose serious problems worldwide in the cultivation of economically important plants. Chemical fungicides are extensively used in current agriculture. However, excessive use of chemical fungicides in agriculture has led to deteriorating human health, environmental pollution, damaged to ecosystem and development of pathogen resistance to fungicide. Because of the worsening problems in fungal disease control, a serious search is needed to identify alternative methods for plant protection, which are less dependent on chemicals and are more environmentally friendly. Microbial antagonists are widely used for the biocontrol of fungal plant diseases. Many species of actinomycates, particularly those belonging to the genus sterptomyces, are well known as antifungal biocontrol agents that inhibit several plant pathogenic fungi. Another way biological control has been developed as an alternative of chemicals to tock with plant pathogenic fungi. Considering high presence of chitin in fungal cell wall, chitinase enzyme is camped as an effective biocontrol agent against phytopathogenic fungi. *Streptomyces* bacteria are able to produce various chitinase enzymes, chitinases produced by *streptomyces* belong to the families 18 and 19 glycosyl hydrolases. The antifungal activity is mostly shown by family 19 Chitinases. In comparison with bacterial family 18 chitinases, the specific hydrolyzing activity of chitinase 19 against soluble and in soluble chitinous substrates has been markedly higher. Considering the importance of family to investigate antifungal potential of streptomyces bacteria isolated from east Azerbaijan region soils based on molecular identification of family 19 chitinase. Encoding gene in these bacteria. To aim the purpose 110 soil samples were collected from East Azerbaijan and 310 strepomyces isolates were selected using macroscopic and microscopic observations. DNA genomic of all of the isolates were extracted and PCR reactions was done using chitinase 19 designed primers as marker. Totally isolates were selected with molecular selection and antagonistic test were done. One of the isolates exhibit the strongest antifungal activity. The strain was identified using 16srDNA gene, and the chitinase encoding gene were amplified partially to prove the PCR selection. Finally the bacterium were introduced as potentially biological fertilizer.

Key words: *Streptomyces*, family 19 chitinase, antifungal activity,16srDNA gene, biological control.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes in microbial biomass, soil respiration and enzyme activities in Zn contaminated soil under field condition

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Abstract

Microbial properties such as microbial biomass carbon (C_{mic}), soil respiration (SR), dehydrogenase (DHA), urease (UA) and β-glycosidase (GA) activities were measured to evaluate changes in soil microbiological characteristics of a zinc contaminated soil under field condition. Therefore, a field experiment was conducted on Typic Udifluvent (loamy soil, pH 8.25, EC 0.32 dSm^{-1}, organic matter 1.53%, lime content 11.08%) of Bafra plain, Northern part of Turkey. Six levels of Zn as $ZnSO_4.7H_2O$ (0, 75, 150, 300, 600 and 1200 mg kg^{-1}) laid down in a randomized complete block experimental design with three replications were used as treatments. The soil was sampled every month during the year from each plot to determine the changes in soil microbiological characteristics such as C_{mic}, SR, DHA, UA and GA. This field experiment indicated that all doses of zinc applied to soil would have harmful effects on GA. Levels of C_{mic}, UA and DHA in soils were sharply decreased by the addition of successive increases in the dose of Zn as compared to the control treatment. The increase in soil C_{mic}, UA and DHA due to the low Zn application doses. On the contrary, high doses of Zn were higher on SR compared to the control. Changes in microbiological characteristics up to a dose of 300 mg kg^{-1} were destroyed from these characteristics in soil can be said.

Key words: Zinc, soil, microbial biomass, enzyme activity, respiration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Microbiological activity in saline conditions: Case study of salted soils in the region of Relizane (Algeria)

Bouchenafa Nadia *, Dellal Abdelkader

Ibn Khaldoun University, Laboratory of Agro-Biotechnology and Nutrition in Semi-Arid Zone, Tiaret, Algeria

Abstract

A few researches have dealt with the properties of saline soils in terms of microbiology in Algeria counties, in considering the effects of salinity on microbial activity or nitrogen mineralization. The results obtained from this study are restricted, rather ambiguous and somewhat controversial. The experimental research has been concentrated on the effects of adding salts to non-saline, on naturally-occurring soil salinity and sodicity. The aim of this work would help to comprehend the effects of salinity and sodicity on microorganism numbers, N mineralization and releases of CO_2 from the respiration process. Samples were taken from the topsoil (0-30 cm) to carry on the experiments. Four incubation series were performed under the same working conditions, i.e., with a relative controlled humidity and a temperature of (27±2°C) and a pressure of (0.1MPa). Comparison with non saline soils demonstrated that salinity reduced the microbial biomass. The effect was not linear but exhibited a threshold value of 15.7mS/cm, where the microbial biomass will drop.

Key words: Salinity, salted soils, microbial biomass, N mineralization, Relizane, Algeria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of meadowfoam (*Limnanthes alba*, L) seed meal application on soil biological parameters

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Abstract

Meadowfoam is an oil crop and after oil extraction, great amount of meal are left. It is a common treatment to apply these meals as a carbon source to soil. In this research, meal was added soils at the rates of 0%, 1%, 3% and NH_4, NO_3, CO_2 productions were observed for 2 months in the incubation period of I, II, IV, VIII weeks at the 24 C^0 temperature. As a result; nitrification decreased by the time and changed with application rates. Similarly CO_2 released with meal applications. This reductions were results for C^{12} and C^{13}. Hydrolytic enzymes were investigated according to the rate of meal and incubation time. Hydrolytic enzymes increased by the rates of meal but, decreased by the incubation times.

Key words: Meadowfoam, nitrification, hydrolytic enzyme, CO_2.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Comparative studies for microbiological activities under normal and saline conditions

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Abstract

A few investigations have dealt with the properties of saline soils in terms of microbiology in Algeria counties, in considering the effects of salinity on microbial activity or nitrogen mineralization. The objective of this experimental work is to provide data relating to the effects of salinity and sodicity of soils of the Western North Algeria on the enumeration of the microbial biomass and the activity of the micro-organisms in the processes of mineralisation of nitrogen and release of CO_2 outburst. The results obtained from this study are restricted, rather ambiguous and somewhat controversial. The experimental research has been concentrated on the effects of adding salts to non-saline, on naturally-occurring soil salinity and sodicity. The aim of this work would help to comprehend the effects of salinity and sodicity on microorganism numbers, N mineralization and releases of CO_2 from the respiration process. Samples were taken from the topsoil (0-30 cm) to carry on the experiments. Four incubation series were performed under the same working conditions, i.e., with a relative controlled humidity and a temperature of (27± 2°C) and a pressure of (0.1MPa). Comparison with non-saline soils demonstrated that salinity reduced the microbial biomass. The effect was not linear but exhibited a threshold value of 15.7mS/cm, where the microbial biomass will drop. Lastly, in this work, as in those which were carried out before, the effects of salinity and those of the sodicity on the microbial activities are not the most important. In order to approach the mechanisms of action of salts on certain biological functions, it would be judicious to consider the parameters of the salinity (salt concentration separately, nature of the ions, pH) of those of the sodicity.

Key words: Saline soils, microbiology, sodicity, microbial activity, Semi-Arid Zone, Tiaret, Algeria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of natural petroleum acids of naphtenic type on the growth of five strains of *Pseudomonas* sp. in liquid culture

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Abstract

Contamination of soil with crude oil and its derivates are causing numerous problems and hazards. These soils need to be remediated before any further use. Application of microorganisms as bioremediating agents is one way of enhancing pollutant degradation, first of all because of their huge biodiversity and metabolitic capability. Microorganisms can utilize different hydrocarbons as source of energy, as well as carbon (C), nitrogen (N) and sulfur (S). The aim of this research was to investigate the potential of five strains of *Pseudomonas* sp. as possible bioremediating agent. Strains are from te collection of the Microbiology Department, Faculty of Agriculture, Novi Sad. Bacterial strains were cultivated on liquid King B medium (tripton: 10 g; pepton: 10 g; $MgSO_4$: 1,5 g; K_2HPO_4: 1,5 g; glicerol: 10 ml; dest.water: 1000 ml; pH 7) and incubated on shaker (BIOSAN Incubator ES-20/60), RPM 120, 28^0C. Starter culture were obtained after 24h, CFU 10^8. For the analyses of five different natural naphtenic acids influence, 24 h culture were used. Bacterial growth was determined spectrophotometrically (UNICAM sp600) through optical density, after 24h and 48h. Two bacterial strains (P Violeta and PS2) had better growth after 48h pointing out the fact that they use C from the derivates. The growth of these strains were increased 72% and 25% when conc. 10^{-5} mol/cm^3 and 10^{-6} mol/cm^3 derivates were used, respectively. The result of this research showed the potential of certain bacterial strains as bioremediators.

Key words: Petroleum acids, *Pseudomonas* sp., degradation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Diversity of soil crust ecosystem of Central Svalbard based on cyanobacteria and microalgae

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Abstract

The objective of this study was to describe various types of arctic soil crust that were collected in the vicinity of Petunia Bay, Svalbard in the three summer seasons (2011, 2012, 2013). Three different areas were compared: the top of Mummien Peak, raised marine terrace and front of the Horbye Glacier. Climatic measurements such as soil and air temperature and volumetric water content of soil crusts were conducted. During the summer in these three sites all studied parameters were increased. However in the winter time soil temperature was below 0^{o}C and available water wasn't enough for metabolic activity of main components of soil crusts such as cyanobacteria and microalgae (Chlorophyta and Xanthophyceae). To measure amount of cations, anions, pH and conductivity chemical analysis of soil crusts was made. Biovolume of cyanobacteria and microalgae was measured for three localities. Biodiversity of cyanobacteria and microalgae from the collected soil crusts was analyzed using an Olympus SZX-ZB7 stereomicroscope and Olympus BX-51 light microscope (Olympus C&S, Japan). All three sites had common representatives from cyanobacteria (Chroococcales, Oscillatoriales and Nostocales) and microalgae (Chlorophyceae, Trebouxiophyceae and Xanthophyceae). Pure cultures of cyanobacteria and microalgae were isolated from soil crusts. Molecular analysis was conducted and phylogenetic tree was build.

Key words: Soil crust, cyanobacteria, microalgae.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The investigation of lignin biodegradation by bacteria which were isolated from various organic waste composting

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Abstract

In this study, several organic waste was composted with paper mill waste. The piles comprised BP (pile 1), BP and poultry manure (PM) (pile 2), BP and hazelnut husk (HH) (pile 3), BP and sawdust (pile 4), BP and low dosage sewage sludge (SS) (pile 5), BP and high dosage SS (pile 6) and BP and grass (pile 7). All treatments were replicated two times. At the composting facility, the blended materials were placed in basket and mixed weekly. The effect of microorganisms isolated from this compost, has been examined on lignin biodegradation. As a result, it has been observed that microorganism; *Pseudomonas mucidolens*, *Stenotrophomonas maltophilia, Bacillus sp*., *Citrobacter koseri*, *Paucimonas lemoignei, Pseudomonas fluoroscens* caused 75.10%, 68.02%, 40.59%, 37.45%, 16.36% and 10% lignin lose respectively.

Key words: Lignin, bacteria, biodegradation

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Relationships between catalase enzyme activity and NPK contents of soils in Avsar Campus, Kahramanmaras, Turkey

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Abstract

Soil catalase activity can shows significant correlations with some soil chemical properties such as macro and micro nutrient contents. This study soil samples were taken from plot area of Avsar Campus, Kahramanmaras Sutcu Imam University in Turkey. In this area, there is a soil compaction in food slope and rubble accumulation in hill slope, signally. Soil was classified as Typic Xerorthent. The objectives of this study are to (i) document differentiation of the catalase activity (CA) among of thirty soils distributed in the area and (ii) determine relationships between CA and NPK contents of these soils. For our purpose 30 disturbed surface soil samples (0-15 cm depth) were collected from study area. Statistical tests were done on data by TARIST (1994) package program. N, P and K contents of soils were determined as 0.124 %, 8.36 µg g^{-1}, 1.77 $cmol_c$ kg^{-1}, respectively. CA of study soils were measured as 10.4 µl O_2 g^{-1} in minimum and 48.0 µl O_2 g^{-1} in maximum. According to variance analysis results, it is a noteworthy finding that soils are statistically different in terms of CA, N, P and K contents (P<0.001), soil 21 has the highest CA value and soil 7 has the lowest CA value. Soil compaction or loosening effects on CA that it reduces no oxygen conditions vice versa. In addition, soil chemical properties is associated with CA.

Key words: Catalase activity, macro nutrients, soil, enzyme.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological characteristics of kiwifruit orchard soils in Ordu, Turkey

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Abstract

In this study, biological characteristics and their relationships with soil physico-chemical properties and nutrient contents were investigated in kiwifruit orchards which were in Ordu, Turkey. The 25 soil samples were collected from kiwifruit orchards. As a result, soil physico-chemical properties and nutrient contents showed significant correlation with soil biological characteristics such as dehydrogenase activity, urease activity, β-glucosidase activity, CO_2-production and microbial biomass.

Key words: Kiwi fruit orchard soils, soil enzyme activity, microbial biomass, soil respiration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of biochar application on soil biological properties and plant growth

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Abstract

This study was carried in order to determine the effects of biochar application on soil biological properties and corn plant (Zea mays) growth under greenhouse conditions in clay-loam soil. The biochar thoroughly mixed with the soil at four application doses (0, 10, 20, 40 kg ha^{-1}) and three nitrogen application doses (0, 20, 40 kg ha^{-1}). Experimental desing was randomized plot desing with there replications in greenhouse. The moisture content in soil was mantained around 60 % of maximum water holding capacity by weighing the pots everday. Changes in the biological properties in the soil and plant growth were determined. At the end of experiment, the highest biochar added soil increased soil biological properties and plant growth in comparison with the control.

Key words: Biochar, soil, biological properties, plant growth.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mycorrhizas effects on nutrient interception in two riparian grass species

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Abstract

Effects of arbuscular mycorrhizal (AM) fungi on plant growth and soil nutrient depletion are well known, but their roles as nutrient interceptor in riparian areas are less clear. The effects of AM fungi on growth, soil nutrient depletion and nutrient leaching were investigated in columns with two riparian grass species. Mycorrhizal and non mycorrhizal (NM) plants were grown in a mixture of riparian soil and sand (60% and 40%, w/w respectively) for 8 weeks under glasshouse conditions. Mycorrhizal colonization, AM external hyphae development, plant growth, nutrient uptake and NO_3, NH_4 and available P in soil and leachate were measured. Mycorrhizal fungi highly colonized roots of exotic grass *Phalaris aquatica* and significantly increased plant growth and nutrient uptake. Columns containing of AM *Phalaris aquatica* had higher levels of AM external hyphae, lower levels of NO_3, NH_4 and available P in soil and leachate than NM columns. Although roots of native grass *Austrodanthonia caespitosa* had moderately high levels of AM colonization and AM external hyphae in soil, AM inoculation had no significant effects on plant growth, soil and leachate concentration of NO_3 and NH_4. But AM inoculation decreased available soil P concentration in deeper soil layer and had no effects on dissolved P in leachate. Although both grass species had nearly the same biomass, results showed that leachate collected from *Austrodanthonia caespitosa* columns significantly had lower levels of NO_3, NH_4 and dissolve P than leachate from exotic *Phalaris aquatica* columns. Taken together, these data shows that native plant species intercept higher nutrient than exotic plant species and had no responsiveness to AM fungi related to nutrient leaching, but AM fungi play an important role in interception of nutrient in exotic plant species.

Key words: Mycorrhiza, exotic and native plants, leaching, nutrient

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Potential quality of organic inputs for soil carbon sequestration in forest (*Pinus pinaster* Ait.) and grassland (*Lolium perenne* L.) habitats

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Abstract

In order to compare their potential for soil C accumulation, the chemical quality of two different above-ground plant inputs collected from grassland (*Lolium perenne* L.) and pine forest (*Pinus pinaster* Ait.) plots located in the NW of Spain, as well as their capacity to act as a source of C to the atmosphere by releasing CO_2 during the decomposition process, were compared by using both respirometic techniques under laboratory controlled conditions and analytical assays. From the topsoil, samples of the raw debris (pine needles/grass tissue) were collected in order to examine both the biochemical composition and the natural abundance of the stable carbon isotope "^{13}C" in the material that will be incorporated into the soil. The biochemical composition (lignin, cellulose, protein, etc) was determined using the acid-detergent fiber method and the isotopic $^{13}C/^{12}C$ ratios of the original bulk material as well as the isotopic ^{13}C signature of each separated biochemical fraction were determined using an automated CN analyzer coupled to an isotope ratio mass spectrometer. Solid-state cross-polarization magic angle spinning (CPMAS) ^{13}C-NMR spectra were recorded for ground material to obtain additional information on their chemical structure before decomposition as well as after 15 incubation days and at the end of the incubation period (10 months). The results indicate that significant differences on the chemical composition of these two types of material were found, particularly on the amount of structural biopolymers, exhibiting also dissimilar concentrations of C and C-to-N ratios. The percentage of total C evolved as CO_2 after long-term incubations ranged from approximately 45% for organic inputs from a forest ecosystem (pine needles) to more than 68% for grassland inputs (lolium leaves), indicating huge differences on the biodegradability of both substrates according to their C-to-N ratio. To quantify the kinetics of C released to the atmosphere during litter decomposition, cumulative values of CO_2 evolved over incubation times were fitted to a double-exponential model that considers two C pools of different lability and therefore with different instantaneous mineralization rates. The isotopic composition ($\delta^{13}C$) of the studied above-ground inputs was within the normal range of values usually found for C_3 species. However, considerable isotopic divergences between the different biochemical compounds obtained from these organic inputs were found (e.g. lignin $\delta^{13}C$ is significantly depleted as compared to the cellulose or the protein fraction), suggesting the importance of selective biodegradation (during C mineralization processes) on the final ^{13}C fingerprint of the decomposing residues and hence on the isotopic composition of the resulting soil organic matter, with the subsequent impact on the forest C reservoirs. Given that the amount of organic C stored in soils depends on both the quantity and the quality of inputs, the implications of the results obtained for comparing the soil C sequestration capacity of forest and grassland habitats under a changing climate were discussed.

Key words: Litter C dynamics, Soil-biosphere interactions, Edaphic C storage, Organic matter decomposition, Stable C isotopes, Terrestrial ecosystems, Vegetal debris biodegradability.

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Long-term (10 years) natural recovery after wildfire on temperate coniferous forests: Soil organic matter composition and dynamics

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Abstract

Long-term effects of forest wildfires on quantity, biochemical composition and mineralization activity of the soil organic matter were studied in *Pinus pinaster* Aiton stands from the humid-temperate climate zone. Soil samples from surface (0-5 cm) and subsurface (5-10 cm) layers were collected in untreated forest plots that have been burned 5 and 10 years before the sampling date; also, from the same forests, plots unaffected by the fire were established and sampled to be used as control. Lignin, holocellulose, lipids and water-soluble compounds as well as humic substances were determined by different chemical fractionation methods and total soil organic matter content was quantified by combustion; the soil C mineralization dynamics was studied using aerobic incubations and the cumulative mineralization curves fitted a double exponential kinetic model that considers two C pools decaying at different degradation rates. The results obtained from these field experiences were compared with the immediate effects of wildfires reported for the same region. The findings indicate that 5 and 10 years after the fire, the total organic matter content, particularly the unhumified components, and the parameters related to the C mineralization activity showed a notable recovery and many of the studied parameters showed similar values to those of the corresponding unburned soil. However, differences on the quality of the soil organic matter still remains visible after this prolonged period of natural evolution. The proportion of some carbon-bearing compounds and the humus composition of samples from burnt soils differed significantly from those of the corresponding unburned soils. Thus, the long-term fire effects resulted in a higher content of both the more humified organic fractions (probably generated by soil heating during wildfires) and those less humified (possibly from subsequent plant inputs incorporated into the soil). Therefore, although some signs of soil regeneration related to the size of the organic reservoir and the C mineralization activity were observed after a 10 years period of natural evolution without any human intervention, the internal composition of the soil organic pool showed a much slower recovery and the overall quality of the soil organic matter after a critical thermal event like the ones shown here seems to be highly dependent on the reestablishment of a vegetable cover of similar characteristics to those of the unburned forests.

Key words: Altered Atlantic ecosystems, burnt soils, forest fires, soil C mineralization, soil organic fractions, soil quality, soil regeneration, terrestrial C cycle.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Comparing CO_2 emissions and potential C mineralization in soils under eucalyptus plantations from the NW of Spain

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Abstract

Society's perception about the role of cultivated forests has changed during the last few decades and, at present, the environmental impacts caused by this type of silvicultural practices have began to be taken into account. The forest soil is one of the most important C pools, however the edaphic processes controlling the accumulation of organic substances with high residence time in the edaphosphere are not yet fully understood, particularly regarding those soils implanted with trees of high development rates, such as eucalyptus. Given the wide area dedicated to the monospecific production of *Eucalyptus globulus* Labill. In Galicia (NW Spain) and the recent increased interest in clonal silviculture, the purpose of this research is to obtain updated information about the edaphic C cycle and soil organic matter (SOM) biofunctioning in these allochtonous forests. Hence, a total of 9 eucalyptus plantations with a different clone: Anselmo (1st clonal generation attained by morphological selection) or Odiel (2nd clonal generation genetically obtained) developed over acidic bedrocks (granitic/schistic) were selected to monitor seasonal fluctuations of soil C effluxes over a 2-year period. In addition, the potential SOM biodegradability of soils (0-15 cm layer) sampled from both Anselmo and Odiel plantations was determined under laboratory conditions. Our findings indicate that the genetic differences between both eucalyptus clones may influence not only forest productivity and soil CO_2 effluxes but also SOM characteristics, with very variable edaphic C contents (ranging from 20 to 140 gC per kg of dry soil), granitic soils under Anselmo clones being, in general, more organic as compared with soils over the same bedrock but under Odiel clonal plants. Anselmo plantations also showed an increased instantaneous mineralization rate of the recalcitrant C fraction as well as a slightly higher soil C mineralization coefficient, although the type of parent material seems to be the main factor affecting this activity index, soils developed over schistic bedrocks exhibiting always higher potential activities than soils over granite, without taking into account the clonal type. The use of isotopic techniques (^{13}C) at natural abundance levels, that allow a better knowledge of the C cycle and the mechanisms that influence the stabilization/biodegradation of organic debris incorporated into the soil, showed significant isotopic differences between clones, samples from Odiel clone plantations being significantly more ^{13}C enriched than samples from Anselmo forests. Provided that the SOM strongly determines the fertility of forest ecosystems developed over sandy and acidic Galician soils, the study of the C cycle and its relation with other edaphic parameters, will help in the decision-making process for suitable forest managements as well as in the assessment of their contribution to global warming mitigation.

Key words: Carbon balance, clonal sylvicullture, *Eucalyptus globulus* Labill, forest ecosystems, organic matter turnover, soil carbon dynamics, stable carbon isotopes.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil microbiological and enzymes assay as influenced by intensive soybean-safflower cropping system under long term fertilizer experiments in Vertisol

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Abstract

Long-term fertilizer experiments were commenced form 2006-07 at Vasantrao Naik Marathwada Agricultural University, Parbhani, Maharashtra, India on Vertisol (*Typic Haplustert*). The present investigation was done after completion of seven rotations of soybean-safflower sequence (2012-13) to evaluate the impact of long-term fertilization, manuring and their combinations on soil microbiological and enzyme assays. The experiment was laid out in randomized block design with twelve treatments replicated four times with a fix set of nutrient management practices. viz. 50% NPK, 100% NPK, 150% NPK, 100% NPK + Hand weeding, 100% NPK + $ZnSO_4$ @ 25 kg/ha, 100% NP, 100% N, 100% NPK + FYM @ 10 Mg ha^{-1}, T_9 - 100% NPK-S, T_{10}- FYM @ 10Mg ha^{-1}, T_{11}- Control, T_{12}- Fallow plot without crop.The findings emerged out indicated that conjoint use of FYM with 100% NPK significantly improved the biological properties with respect to CO_2 evolution , soil microbial biomass carbon , soil microbial biomass nitrogen, soil bacteria, soil actinomycetes, soil dehydrogenase , acid and alkaline phosphatase enzyme activities in the treatment receiving 100% NPK+FYM@ 5 Mg ha^{-1} except that soil fungi showed their dominance in the plots supplied with only FYM@ 5 Mg ha^{-1} but it was also at par with 100% NPK+FYM@ 5 Mg ha^{-1}. In contrast, treating plot with NPK+FYM was closely followed by 150% NPK for soil microbial biomass carbon (SMBC), soil microbial biomass nitrogen (SMBN) and soil organic carbon. It can be concluded from these experiment that the balanced use of fertilizers continuously either alone or in combination with organic manures is necessary for sustaining biological soil health in predominant soybean-safflower cropping system on Vertisol.

Key words: CO_2 evolution, soil enzyme activity, soil microbial biomass, soil carbon.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of spinosad on soil microbiological characteristics in Albic Luvisol

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Abstract

In modern agriculture, it has become a common trend to apply different groups of pesticides, either simultaneously or in succession, for effective control of a variety of pests. Pesticides are deliberately introduced into agricultural systems with various formulations to protect crops against weeds, insects, fungi and other pests. However, much of the applied pesticides will finally reach the soil often leading to a combined contamination of pesticide residues in the soil environment, which may affect the growth and activity of soil microbial communities, and in turn affect the enzyme activities. Increasing use of pesticides in agriculture led to the development of soil microbial testing programme for examination of the side effects. The testing programmes include measurement of some microbiological characteristics. In this study, a field experiment was carried out at the Experimental Station of Perm State Agricultural Academy, Perm, Russia to study spinosad ($C_{41}H_{65}NO_{10}$) use and its impact on selected soil microbiological characteristics such as microbial biomass C (C_{mic}), basal soil respiration (BSR), dehydrogenase activity (DHA) and catalase activity (CA) under field condition. Experimental soil was classified as "Albic Luvisol" according to the FAO (2006). The tests were conducted on loamy soil (pH_{H2O} 6.7, EC_{H2O} 0.213 dSm^{-1}, organic carbon 0.99%, 0.5M $NaHCO_3$ extractable P 13.34 $mg.kg^{-1}$, 1N NH4OAc extractable K 1.382 $cmol(+)kg^{-1}$), to which the following quantities of spinosad (480g spinosad SC L^{-1}) were added: 0, 10, 20 and 40 mL da^{-1} of soil. Experimental design was randomized plot design with three replications. The C_{mic}, BSR, DHA and CA analyses were performed 7, 14 and 21 days after the field experiment was established. Spinosad was stimulatory to the soil microbiological characteristics at all application doses. The increased doses of spinosad applied resulted in the higher level of C_{mic}, BSR, DHA and CA in soil. The soil C_{mic}, BSR, DHA and CA showed the highest activity on the 21th day after 40 mL spinosad da^{-1} application doses.

Key words: Spinosad, insecticide, soil, microbial biomass, soil respiration, enzyme activities.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil microbiological consequences of a long-term fertilization experiment in Hungary

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Abstract

The results of long-term experiment in all over the world demonstrate that the fertilization have direct and indirect effect on soil as a life community, mainly influence the plant population and quantity occurrence and activity of soil microorganisms. The objective of the study was to evaluate the chemical and soil microbiological consequences of a 25-year old long-term fertilization experiment, where five increasing doses of NPK-fertilizers have been applied in maize monoculture. The soil type of the experiment is a typical meadow soil (Vertisols in WRB), it was set in 1988 in the Eastern part of Hungary on the "Hajdúság loess plateau" about 30 km far from Debrecen, in Görbeháza. Among the soil chemical properties the pH, in related with it the hydrolytic acidity, the available soil nitrate, phosphorus, potassium, organic carbon and nitrogen were measured. The quantity change of some microbiological groups referring to the dynamics of microorganisms' occurrence in the soil also was investigated. Furthermore the amount of microbial biomass carbon and nitrogen, carbon dioxide production, nitrate exploration, and activity of some soil enzymes were determined. In this paper the effects of different fertilization' levels on the chemical and microbiological soil properties are evaluated. Data analysis was performed using Microsoft Excel 2003 (mean values and standard deviation). Two factors variance analysis was used to get significant effect on measured parameters. The effect of continuous use of fertilizers reflected in the chemical soil properties, the uptakeable nutrient content of soil increased significantly compare to control. Most of the examined soil microbiological properties changed positively by the effect of fertilization, but for example some enzyme activity was not changed. Close correlation was found between some microbial soil properties and also between the chemical and microbial properties. Our results may contribute to get more information about long-term fertilization effect on soil nutrient supply and changes of population dynamic of soil microbes.

Key words: Long-term experiment, chemical soil properties, population dynamic of soil microbes, microbial activity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Alterations of fungal metabolism under decreasing oxygen level

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Abstract

In specific environments such as cattle overwintering areas, both dung and urine excretions onto soil surface often results in microaerobic or even anaerobic conditions in the underlying soil. Soil fungi have to cope with that by changing their metabolism. Therefore, the aim of the work was to study changes in denitrification potential as well as in fatty acid profiles of soil fungi under decreased oxygen level. Soil samples were collected at the Borová farm (48°53´N, 14°13´E) from six different sections with various intensity of cattle impact. Soil fungi were isolated by serial dilution and plating on Sabouraud dextrose -, Potato dextrose -, and Chloramphenicol glucose agar. The effect of decreasing oxygen level in fungal isolates was assessed in flasks with three treatments for each isolate: *Aerobic* – cellulosic stopper; *Microaerobic* – butyl rubber stopper, screw cap, headspace atmosphere unchanged; *Anaerobic* – butyl rubber stopper, screw cap, headspace atmosphere replaced by argon. After 7 days in a horizontal shaker at 28 °C, fatty acids composition as well as N2O production capability was examined on GC-FID and GC-ECD, respectively. In total, 90 fungal isolates were analysed. Results confirmed the dependence of fungal metabolism on the environmental conditions. Decreased oxygen level caused significant increase in saturated (14:0, 18:0, 20:0) as well as some monounsaturated fatty acids (18:1ω9, 20:1ω9), but decrease in polyunsaturated and hydroxy (18:2ω6,9, 18:1 2OH) fatty acids. Hence, the ratio of two fatty acids used as fungal biomarkers (18:2ω6,9 to 18:1ω9) could be preliminary used as significant ($p < 0.05$) indicator of anaerobic, microaerobic, and aerobic conditions in the environment. Decreasing oxygen level also altered the capability of fungi to produce nitrous oxide. One third, specifically 35.56 % and 28.89 % of fungi were producing significant amounts (> 1 µg N_2O-N per day) of nitrous oxide under microaerobic and anaerobic conditions, respectively. The results on ability of soil fungi to produce significant amounts of N2O replenished information about the extent of this type of metabolism in soil fungi isolated from soils under cattle impact.

Key words: Soil fungi, nitrous oxide, fatty acids, cattle overwintering

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The ability of microbial biomass to increase rhizosphere phosphorus availability in saline soil during the growth of six genotypes of durum wheat

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Abstract

The effect of salinity on microbial biomass or on growth of wheat separately has been studied extensively, but little is known about growth response of durum wheat to salinity in relation with the microbial biomass, the stage of growth and the availability of phosphorus to the plant. .This study was conducted at three semi-aride regions in the Center of Tunisia (Barrouta, Echbika, and Souaissi) to assess the role of microbial biomass C (MBC) during the main growth stages (tallage, flowering and maturity) of six genotypes of durum wheat (Bayadha, Souri, Agili Glabre, Razzek, Karim and Maali) on the availability of phosphorus (A P) in soils varying in texture and salinity. Soil samples were taken at 0-20 cm depth, near the rhizosphere.Evolution of MBC was studied with fumigation extraction (FE) method. Simultanous the dynamics of electric conductivity (EC) and pH were investigated.Beyond that parameters of components yields was determined at harvest.The changes in the size of soil microbial biomass and the relationship between soil microbial biomass, phosphorus availabiltity and the parametres of growth of genotypes during their stages of growth were investigated under saline and non saline soil. Considerables differences between the tested varieties could be observed , the high grain yield and the 1000 kernels weight was showed for Maali and Agili Glabre in saline soil (barrouta and souaissi) , both rely on optimal dynamics of AP and BM during of growth period .The correleation between BM and yields components remained poor in early stage , however it was possible to consistently the positive correlation between the yield components, AP and the carbone of BM in flowering and maturity stage for Maali, Razzek and Agili Glabre with values >250 mg/kg, This suggests a reinstallation of specifics microorganisms that adapt to saline stress conditions starting from flowering stage in salt stress.

Key words: Salt stress, durum wheat, microbial biomass, availability phosphorus, stage of growth**.**

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil microbial biomass and gas-production activity (CO_2) in Chernozems of different land use

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Abstract

Soil microorganisms providing optimal functions of terrestrial ecosystems are sensitive to various disturbances and soil cover transformation, including urbanization. The research was focused on the study of microbial component status in typical chernozems (Russia, Kursk region) of different ecosystems (Central Chernozem Reserve and Kursk city). In each ecosystem (virgin steppe, mowing steppe, pasture, fallow) and city zone (recreational, residential and industrial) was selected two points for soil sampling from 0-10, 10-50, 50-100, 100-150 cm layers (plant litter excluded). The soil microbial biomass carbon (C_{mic}) by substrate-induced respiration method, soil basal (microbial) respiration (BR) and the fungi-to-bacteria ratio by selective inhibition technique using antibiotics were measured. The microbial metabolic quotient (qCO_2) was calculated as ratio BR / C_{mic}. The highest C_{mic} and BR were found in the upper layer (0-10 cm) of virgin steppe and mowing steppe (1601±383 and 1678±206 μg C g^{-1}; 1.09±0.10 and 1.39±0.19 μg CO_2-C g^{-1} h^{-1}, respectively), and the lowest values were in pasture and fallow lands (by factor 1.5 and 3.5, and by 46 and 72%, respectively). The C_{mic} values in urban soil were reached in average 371±62, 513±83 and 160±86 μg C g^{-1}, and BR were 0.64±0.29, 0.36±0.14 and 0.23±0.05 μg CO_2-C g^{-1} h^{-1} for recreational, residential and industrial zones, respectively. In undisturbed soil ecosystems the qCO_2 values were less (by factor 2 in average) than urban soils. The C_{mic} soil profile (1.5 m) of natural ecosystems was reached up 1378 to 2568 μg C g^{-1}, and in urban soils it was lower (by factor 4-11). The portion of fungi in total microbial biomass of Chernozems (0-10 cm) was ranged from 61±8 to 80±13%. Thus, studied microbiological indices might be illustrated some "tension" of soil microbiological processes and deterioration of ecological soil status with increasing anthropogenic impact.

Key words: Chernozems typical, soil microbial biomass carbon, soil respiration, land use.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological activity of soils developed on heaps, determined by micromorphological methods

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Abstract

The biological activity in relation to the development of soils derived on heaps was studied. It was estimated by micromorphological methods using indicators of biological activity such as: porosity of the soil, content of non-decomposed plant residues, humus accumulation and fauna excrements forming soil aggregates. Soil samples were taken from 5 sites, from heaps remained after zinc and lead ore exploitation and the settler of flotation wastes accumulated on degraded areas in southern Poland. The soils derived on heaps differed in age, from the youngest of 50-years old (settler of flotation wastes) till the oldest heaps, from which ores were mined manually in 15-th century. All of the studied soils were heavily polluted with zinc, lead and cadmium, had similar sandy or sandy loam texture and slightly acid or neutral soil reaction. Studied soil samples differed significantly in organic carbon (17.89–97.67 g kg^{-1}) and total nitrogen (1.10–6.76 g· kg^{-1}) contents in their surface horizons. The data show that soil samples taken from young heaps had a pellicular grains microstructure composed of quartz grains covered with a thin pellicle of fine organic material and a distribution of coarse to fine material (c:f) was of gefuric type while the soil samples taken from old heaps (over 100 years old) had granular microstructure with chitonic or enaulic c:f distribution. In all soils samples the organic matter was slightly or medium decomposed but in samples taken from old heaps numerous fauna excrements occurred while in soils formed on young heaps only few excrements were observed. Studied soil samples differed in amount of pores with a diameter over 50 µm, which presence is usually connected with the soil fauna activity. The macroporosity of soil samples taken from young heaps ranged from 4 to 8%, so the soils were massive, while the soils from the old heaps were medium porous (macroporosity >10%). The results demonstrated that soils differed in microstructures, porosity and number of soil fauna excrements in spite of similar origin and features of bedrock. It is thought that it resulted from the different age of heaps on which the soils were formed. The development of the soil and its biological activity was strongly dependent on the period of time in which the soils processes were going on and the biological life of soils could be re-created.

Key words: Zinc, lead and cadmium ores mining, heaps, micromorphology, biological activity.

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Soil biological activity of chatkal biosphere reserve in Uzbekistan

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Abstract

Chatkal Biosphere Reserve is protected territory in Western Tien Shan within Uzbekistan that plays a significant part in the conservation of its unique biological diversity, because they provide important habitats for endemic and rare plant species. This aim of this study was to investigate soil microbial activities in relation to the micro-environmental and soil nutrient variability in Chatkal Biosphere Reserve. The soil microbial distribution including enzyme activities in such unique environments may thus provide valuable information on microbial activities, because those areas have not been affected with anthropogenic factors. The samples were analysed for several soil chemical and microbiological attributes including pH, microbial population and soil enzyme activities. Soil enzyme properties such as catalyse, invertase, phosphotase, dehydrogenase and urease activities were measured. Soil organic C, total N, P, K and Mg decreased with increasing soil depth and correlated with the microbial and fungal colony forming units (cfu). The highest microbial counts were recorded in the top soil (0-20 cm) layer. Soil enzymes activity influenced more by the presence of plants and it is most probably related greater transformations of organic matter by microorganisms for their increasing energy and nutrients demand for survival than assimilation in response to high temperature and other stresses. The present study concludes that the population of bacteria, fungi and actinomycetes as well as enzyme activities such as invertase, phosphotase, dehydrogenase and urease in the soils of Chatkal Biosphere Reserve are influenced by soil physico-chemical properties and vegetation cover.

Key words: Biosphere reserve, microorganisms, soil enzymes, soil nutrients, vegetation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Impact of conventional tillage on N-transforming microorganisms in saline soil under cotton

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Abstract

Agricultural management practices, particularly inputs of manure, cover crops and tillage can have large impacts on the size and activity of soil microbial communities. Changes in N dynamics in soils are closely connected with altering microbial activities involved in N cycle. Therefore it is very important to determine the factors affecting the microbial processes of N cycling in the soil. Field experiments were conducted on the effects of tillage on N transforming microorganisms under cotton (*Gossypium hirsutum* L.) on a salt affected soil of Djizak province of Uzbekistan. The experiment was established in a random block design with four replications, and c*onservation tillage* planting system *used* for cotton cultivation. Soil samples were collected in different depths (0-10, 10-20, and 20-30 cm) during the plant growth period to investigate the abundance of ammonifying, nitrifying, denitrifying and nitrogen fixing bacteria in the soil profile under different depth. The numbers of microbes and their enzymatic activities differed comparing soil time of sampling. The total number of ammonifying bacteria and nitrogen fixing bacteria tended to be highest at 10-20 cm soil depth. Seasonal changes in the numbers of soil microorganisms and enzyme activities were detected, with the lower numbers in spring and higher numbers in autumn. Soil microbial communities were significantly correlated with soil C/N ratio. This study demonstrated that tillage practice influence the number of N transforming microorganisms along with enzymatic properties under cotton crops grown in salt affected soil.

Key words: Soil bacteria, soil enzymes, nitrogen, salinity, cotton.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil respiration and GHG emission response to environment characteristics in agro-ecosystems

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Abstract

Agro-ecosystems cover ca. 45% of Europe and play an important role in the overall carbon exchange as well as GHG emission of the continent. However, the estimation of their emissions remains uncertain due to the diversity of environment and climatic indices, crops together with the strong influence of human management. Based on the continuous observation of soil-plant respiration and environmental factors in a several crops ecosystem from early June to early July in 2010, the spatial and temporal variation of soil-plant respiration and their controlling factors were analyzed. A survey was conducted to identify important criteria, and several crop fields were introduced which represent different value systems by varying criteria importance. The approach is based on the local measurement and comparing the impact of environment physical indices on agro ecosystem productivity at crop habitat scale. The study was conducted in intensive grassland, barely, winter wheat and maize ecosystems at a conventional farm (Kalvarija distr., 54°28'N, 23°38'E). The data have been collected in a real time using digital sensors of the humidity, pressure, gas concentration, solar intensity, wind speed and temperature. All the dependencies of the various physical data were valuated according to the plant growth. The data were obtained in productive grasslands with different fertilizer application and in crop fields of different geographical location. The experimental data confirm that the average meteorological data obtained from the State Meteorology Stations are quite preliminary and cannot be unambiguously considered as the environmental factors on the wide area of vegetation with different soils. The picked data set should be used when analysing ecological drivers on the fluctuation of the climate. Measurement of the properties that affect fluid storage and transport, such as macro porosity, provided soil quality indices that helped in recommending suitable soil management systems.

Key words: Environment, respiration, crop.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Screening new *Sinorhizobium* isolates for salinity, pH and drought tolerance exopolysaccharide production and improving growth of alfalfa (*Medicago sativa*)

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Abstract

Salinity, alkalinity and drought stress are the major abiotic stresses hindering the productivity of alfalfa (*Medicago Sativa*) in arid and semi-arid regions. Therefore an ecological survey was conducted to characterization of Several *Sinirhizobium* isolates of diverse geographical origin, isolated from the root nodules of alfalfa (*Medicago Sativa*). *Shinorhizobium* isolates were examined for salinity tolerance on yeast extract mannitol broth (YEB) containing 0, 1%, 2.5% and 4.5% salt (NaCl, w/v) for 18 h of incubation at 30°C Drought tolerance of all isolates examined at 0, -1, -2 and -3.5 MPa (using PEG6000, w/v) for 18 h of incubation at 30°C. Exopolysaccharide production of isolates evaluated. A positive correlation was found between the salt tolerance and the adaptation to alkaline pH and exopolysaccharide (EPS) production. A pot experiment was conducted to determine the effects of inoculating higher EPS produced from an isolate of *Shinorhizobium* sp. on the dry matter yield a high saline soil in different water stress. Bacteria were included SK 27 and SK 36 (salt-tolerant isolates) and SK 64 and SK 56 (salt-sensitive isolate). The results showed that the dried shoot weight, nodule number, dried nodule weight, nitrogenase activity, proline, root soluble sugars and soluble protein were 2.8, 4.2, 8.2, 1.8, 2.7, 2.6, and 1.1 times more when host plant (alfalfa) were inoculated with SK27 isolate compare to SK56 isolate. Results suggested that host plant inoculation by native isolates with high-efficiency and higher EPS-producing bacteria has a positive effect on plant yield and biological nitrogen fixation.

Key words: *Sinorhizobium*, salinity, stress tolerance, nitrogenase activity, exopolysaccharide.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes of microbiological properties and yield response of wheat in *Actinomadura geliboluensis* inoculated soils

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Abstract

The effect of *Actinomadura geliboluensis* on the yield response and nutrient content of wheat (Triticum aestivum L.) and soil microbiological properties such as microbial biomass, soil respiration, dehydrogenase activity, catalase activity, urease activity and alkaline phosphotase activity were investigated under greenhouse condition. The experimental pot was a completely randomized design with 3 replicates. One indigenous *Actinomadura geliboluensis* strain was used alone as biofertilizer agent in the experiment. Seeds of wheat (*Triticum Aestivum*) were inoculated with indigenous *Actinomadura geliboluensis* strain. Plants were harvested and soil samples taken were 124 days in pots after sowing. Data through green house experiment showed that the use of *Actinomadura geliboluensis* significantly wheat yield and nutrient contents of plants. In addition, microbiological characteristics of soil with *Actinomadura geliboluensis* inoculation significantly increased under greenhouse conditions. The results of this study suggest that inoculation of *Actinomadura geliboluensis* alone have the potential to increase the yield, growth and nutrition content of wheat plant and situmulate to the soil microbiological properties. It was suggested that the use of *Actinomadura geliboluensis* strains might be suitable when producing and using bio-fertilizer. (This work was funded through the TUBITAK, 2216-Research fellowship programme for foreign citizens).

Key words: *Actinomadura geliboluensis*, wheat, nutrient, bacteria, microbiological properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Antimicrobial pigment produced by desert *Streptomyces ramulosus*

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Abstract

The bacterial Pigments are secondary metabolits that help the producer to survive in different environments. The bacterial pigments have been shown different properties such as antitumor, anticancer and antimicrobial effects. The present study was conducted to isolate soil origin *Actinomyces* and evaluate their antimicrobial pigments. In total, eighty seven soil samples were collected from different areas in Kazeroun city, Iran. The samples were serially diluted (10^{-1} to 10^{-7}) and 0.1 ml of each dilution was streaked on SCA and ISP2 media and incubated at 30C° for 5 days. then pigmented *Actinomyces* were selected and subjected for propagation and pigment extraction using different solvents.To continue the experiments the antimicrobial property of each pigment was evaluated against *Staphylococcus aureus, Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa, shigella dysentriae, citrobacter ferundii, Klebsiell peumoniae, Serratia marcecens, Aspergillus* sp. and *Candida albicans*. Furthermore, identification of the promising strain was verified by 16srDNA Gene sequencing method and finally different groups in the pigment structure were determined by TLC and Reagent spray tests. The results obtained indicated that out of all isolated *Actinomyces* strains, *Streptomyces ramulosus* could produce pigment with antimicrobial property. Of all microorganisms tested *Staphylococcus aeurus* more sensitive *Aspergillus* sp. *Candida albicans* and *E.coli* were more resistant.Our finding concerning to structure of the pigment illustrated existence of Alcohols, Phenols, Steroids groups in the pigment. Overall, soil origin *Actinomyces* could produce pigments with antimicrobial property. Therefore, *Actinomyces* pigments must be considered a special remedy for investigation in order to eliminate occurrence of antibiotic resistant microorganisms.

Key words: Antimicrobial, antibiotics, *Actinomyces* pigment

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Character of interactions of saprophytic soil microflora via gaseous metabolites

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Abstract

Soil microbiocenosis is one of the most complicated biological communities. Various interrelationships occur between bacteria in the process of their activity, including those at the metabolic level. The interactions between populations via metabolites, including gaseous substances, are of crucial importance for maintaining the stability of microbial communities and the control of their species composition and production capacity. The main goal is to study the character of the interaction between soil bacteria by means of gaseous metabolites. The results obtained enabled us to assess the degree of influence of the volatile metabolites of one species of saprophytic bacteria on the growth of other species during their interaction. Among them, 42% were negative (the volatile metabolites of the study cultures inhibited the growth of the test cultures), 30% were positive (the volatile metabolites of the study cultures stimulated the growth of the test cultures), and the remaining results (28%) were neutral. The bacteria of the genera Pseudomonas and Acinetobacter revealed the highest inhibitory activity in relation to the test cultures (28% of cases). The volatile metabolites of Aeromonas exhibited the greatest stimulating activity (than 8% of cases). Analysis of the experimental data revealed direct correlation between the inhibiting and stimulating effect of the culture; the absence of stimulation correlated with the presence of inhibition. Chromatographic analysis of the volatile metabolites of Pseudomonas and Aeromonas revealed relatively high content of acetaldehyde, methanol, and ethanol. A greater content of methanol was noted in the composition of the volatile metabolites of Aeromonas, compared to Pseudomonas. A greater content of acetaldehyde was noted in the composition of the volatile metabolites of Pseudomonas. The data obtained allow us to assert that, at the metabolic level, a diverse character of interspecies interrelationships is observed between the bacteria, directly influencing their growth and preservation in soils. The volatile compounds produced by microorganisms may act as both intra- and interspecies regulators of microbial communities. In this regard, the composition of soil microbiocenosis may be regulated by the products of metabolism of saprophytic soil bacteria. An important role in this process is played by methanol released by saprophytic bacteria into the environment.

Key words: Soil microflora, gaseous metabolites, Pseudomonas, Aeromonas, methanol.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of volatile metabolites from germinating seeds of the soil bacteria

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Abstract

Different relationships are formed inside the complex associations between microorganisms and plants in natural and artificial systems. The goal - the investigation of the utilization of volatile metabolites of germinating seeds by soil bacteria. The biological activity of volatile metabolites of germinating seeds of cabbage (Brassica oleacia), carrot (Daukus carota), salad (Zactuca sativa), and corn (Zea mays L.) against Listeria monocytogenes and Yersinia pseudotuberculosis was studied. It was shown that volatile metabolites can be the sole carbon and energy source for these bacteria. These metabolites increased the reproduction of the studied bacteria by factors of 10–100 as compared to the control. An analysis of the data led to the conclusion that the soil bacteria reproduction intensity in the presence of the volatile metabolites of the plant mixture depended on the bacterial type. It is seen that volatile compounds of germinating seeds of corn, carrots, salad, and cabbage contain acetaldehyde, methanol, and ethanol in sufficiently high concentrations. The greatest amount of methanol was secreted by the corn seedlings. One of the main substances that affect the reproduction of soil bacteria was methanol. The data suggest that soil bacteria used methanol for nutrition under the conditions of a limited carbon source. Methanol is the main substance affecting their growth and reproduction.

Key words: Soil bacteria, volatile metabolites, germinating seeds, methanol.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Carbon dynamics of karst grasslands subjected to woody-plant encroachment

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Abstract

Abandonment of grasslands and their transition to forests influence many ecosystem processes. Different components of the carbon biogeochemical cycle respond strongly to woody plant encroachment; as a consequence, the carbon (C) dynamics of the invaded grasslands can strongly change. The study of C dynamics was conducted at the Podgorski Kras plateau (400 - 430 m.a.s.l., sub-mediterranean region of SW Slovenia) which was in the past subjected to agriculture land abandonment. Within the study area two study sites were chosen: grassland and forest succession site. At both sites, in July 2008, an open-path Eddy covariance (EC) was installed at 15 m and 2 m height for Succession site and Grassland site, respectively. On the average annual basis Succession site was net sink of carbon (NEE = -184 ± 19 $gCm^{-2}y^{-1}$) while Grassland site was a source of carbon (NEE = 293 ± 34 $gCm^{-2}y^{-1}$). Based on the eddy covariance measurements it can be concluded that overgrown area increased sink activity compared to the extensive grassland in observed period. In our research, we also studied the response of soil respiration (R_S) to natural succession of calcareous grassland with manual and automatic soil respiration system. Within these sites, triplicate plots were fenced for soil flux measurements. At the invaded site measurements were performed for forest patches and grassy gaps separately. Soil respiration was strongly dependent on temperature and reached 8–12 µmol CO_2 m^{-2} s^{-1} in mid-summer. R_S dependence to temperature and soil water content was similar between the different vegetation covers (grassland, gaps, forest patches). At a reference temperature of 10° C average R_S was 2.71 µmol CO_2 m^{-2} s^{-1}. A coupling of photosynthesis and R_S was also investigated which showed asymmetrical clockwise hysteresis patterns. Comparing automatic and manual soil respiration systems it can be concluded that temporal and spatial resolution can be greatly improved with an automatic system.

Key words: Carbon dynamics, soil respiration, net-ecosystem carbon exchange, eddy covariance.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

An investigation on the possibilities of using Kombucha (Kombu Tea) and mix microorganisms culture which are Kombucha production waste in agriculture as microbial fertilizer

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Abstract

This study aimed to investigate effects of the kombucha and lyophilized waste of culture of kombucha on variation of biological characteristics of soil and yield of wheat vegetable by performing two greenhouse experiment on two different soil type which have distinctive physical and chemical properties. The soil samples used for experiment were taken from Çorlu in Tekirdağ (Sandy loamy soil) and Bafra in Samsun (Loam soil). In the experiment, kombucha was used as an organic material, and culture of kombucha available in the market as a product obtained from a manufacturing plant in Samsun was used by utilizing lyophilization. In the pot experiment performing in the greenhouse, each pot were filled by the weight of 4 kg soil, and the amount of 0, 10, 20, 30 ml/pot of kombucha and 0.25, 0.50, and 0.75mg/pot of lyophilized waste of culture of kombucha were put into the each pot. Then, pandas type of wheat seeds were planted to the pot and were performed as greenhouse experiment lasting totally 138 days. After the 138th day, the effects of kombucha and lyophilized waste of culture of kombucha on the crop of wheat vegetable were analyzed by evaluating yield performance of cropped wheat. Furthermore, the changes of the biological characteristics of soil resulted in adding kombucha and lyophilized waste of culture of kombucha to the soil were investigated by performing some soil biological analysis such as microbial biomass carbon (C_{mic}) and soil respiration (BSR) to the soil samples taken from the each pot. In general, kombucha and lyophilized waste of culture of kombucha treatments influenced the soil biological properties in comparison with the control. Also, textural differences in soils affected on C_{mic} and BSR. The effect of kombucha on C_{mic} in sandy loam soil was higher than that in loamy soil. But lyophilized waste application had the highest effect on C_{mic} in loamy soil. Both applications had the highest effect on BSR in loamy sand soil. As a conclusion of the experiment, it is observed that an increase of the amount of kombucha and lyophilized waste of culture of kombucha resulted in a development of yield of wheat vegetable, and also caused an improvement of biological characteristics of soil which varies depending on the soil texture. Moreover, it is concluded that the improvements of the biological characteristics of soil is more significant for sandy loamy soil than the loamy soil.

Key words: Soil, wheat, kombucha, soil respiration, microbial biomass carbon

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Investigation of soil microbiota in Western Kazakhstan region using high-throughput sequencing

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Abstract

Traditional methods of soil analysis provide very rough and ambiguous results. For example, soils with the same characteristics agrochemical may be fundamental differences in fertility. Responsible for these differences are often difficult to identify the factors. For example, when exhaustion of the soil. The purpose of research search relationship between the structure of the soil microbiome and agro-ecological condition of the soil. To carry out molecular biological studies microbiome soil samples was used typical experimental setup. Scheme of a typical experiment is the isolation and purification of total DNA from a sample taken from the environment, PCR amplification of certain regions of the genome, followed by cloning of the identification and analysis of the nucleotide sequencing. During the research we selected 16 samples of dark brown soil. Sequencing libraries were conducted in strict accordance with the recommendations of the instrument GS Junior (Roche). All sequences were sorted into a multiplex identifiers using Pyrosequencing pipeline in the north of RDP. The primary taxonomic analysis was performed on the library server using RDP options Classifier. Visualization of the distribution of bacterial and archaeal phyla in libraries, as well as the estimation of the parameters of the taxonomic diversity was performed on the server VAMPS.According to this criterion in each soil sample identified from 94 (dark chestnut incompletely depth selection 10-20 cm) to 166 (dark chestnut moderately depth selection 0-10) families of microorganisms. Dark chestnut powerful medium soil type, depth of selection 0-10. It should be noted that in this case both measures diversity - richness (number of taxa) and eveness (Shannon) give similar results, that is not always done, because these two parameters related only very relative. Conducted a taxonomic analysis of the soil microbiome libraries, according to which the largest proportion of microbial communities in soil are analyzed phylum Actinobacteria and Proteobacteria. Significant share in the microbiome of the samples occupy archaea, and in the dark chestnut underdeveloped, their share is over 11 %, which is quite an interesting fact, as is usually the proportion of archaea in soil communities of virgin land does not exceed 5 %. In addition to the above are fairly common for soil communities phylum Acidobacteria, Bacteroidetes, Firmicutes, Gemmatimonadales, Planctomycetes, Verrucomicrobia.

Key words: Microbiome, soil microorganisms, PCR, sequencing, taxonomy, soil type, DNA, molecular biology, 16s rRNA, metagenom.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

In Forensic Sciences: Soil and CSI

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Abstract

A good criminal scene investigation in criminal cases provides important contributions in resulting of a judicial process faster and healthier. To make a good criminal scene investigation is related to the technology and science. In this context, the obtained evidence as soil, rock, dust and so on are used for preliminary investigation with the aim of resolving the criminal event. Soil can provide important information to criminal investigations as transfer evidence because many criminal cases take place under circumstances such that soil transfers to a criminal or victim. Soil evidence has been used to link criminals to crime scenes for more than a century. But in Turkey and elsewhere, the recent automation of techniques and the ability to get information from smaller samples have made soil forensics an increasingly popular tool in criminal investigations.The purpose of this study, to highlight the importance of soil in forensic science and to raise awareness in this area. In this study, the history of forensic soil use as evidence in forensic science, the importance of investigation of soil will be explained.

Key words: Soil, forensic mineralogy, autopsy, CSI.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Change of the microorganisms quantity in irrigative grey-brown and Meadow-Sierozemic under vegetable soils

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Abstract

The biological equilibrium sustained in the soils of natural ecosystems under the impact of various factors can be strongly disturbed under the impact of anthropogenic loads. The biochemical and microbiological soil properties are of particular importance in this context. In this context, data on the microbiological characteristics of soils are necessary, because they allow of evaluating the effect of agricultural practices and crop rotation systems on the biological properties of soils. Object of research are irrigated grey-brown (Irragic Gypsic Calcisols in WRB) and meadow-sierozemic soils (Irragic Calcisols in WRB) of arid subtropical zones and crop rotation and permanent cultures. Six-field vegetable-fodder crop rotation scheme in irrigative grey-brown soils (I scheme) 1. Lucerne annual + barley for green folder; 2. Lucerne two year; 3.Water-melon; 4. Potato; 5. Garlic; 6. White-head cabbage + tomato and five-field vegetable-bean crop rotation scheme (II scheme): 1. Potato; 2.Vegetable bean; 3. Water-melon; 4. Tomato; 5.Vegetable bean. For a comparison as a tomato, water-melon, potato, garlic, white-head cabbage and vegetable bean are used in constant sowing. A research - work in grey-meadow soils has been conducted in four-field vegetable fodder crop rotation: 1.Lucerne annual; 2. Lucerne two year, 3. Cucumber: 4.Tomato. A tomato and a cucumber have been used in the constant sowing (in Shirvan plain) and in five-field crop rotation: 1. Clap; 2. Corn; 3. Tomato; 4. Lucerne annual; 5. Lucerne two year (in Mugan plain). The results of the long-term investigations in dynamics for study of the conditions of taxonomic groups of microorganisms of irrigated grey-brown and meadow-sierozemic soils of the dry subtropical zone under vegetable crops in rotation with the continuous growing of these cultures have been presented. The results of the research study demonstrated an important vibration of the microorganisms quantity under growing cultures. The less quantity of microorganisms, consuming organic nitrogen is observed in irrigative grey-brown and meadow-sierozemic soils of the dry subtropical zone. Intensity of mineralization of organic matters was more in irrigative grey-brown and meadow-sierozemic soils. A quantity of microorganisms was lower, but a coefficient of mineralization was higher under continuous cultures as compared the analogous soils under crop rotation. These data shows that a type of the soil influence on the rhizosphere microflora insignificantly, while plant shows a significant effect on its quantity and compositions.

Key words: Irrigative soils of dry subtropical zones, quantity of microorganisms, crop rotation, permanent cultures, coefficient of mineralization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Change of catalase activity of clay textured soil with 2,4-D (Dichlorophenoxyacetic acid) herbicide applied

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Abstract

This study was conducted to determine effects of increasing dose application (0.5 ppb, 1 ppb and 2 ppb) of 2,4-D herbicide on changes in catalase enzyme activity and kinetic parameters (V_{max}, K_m and V_{max}/K_m) in clay textured soil depending on substrate concentrations under laboratory conditions. Moisture contents of soils were completed to 40 % of maximum moisture holding capacity by weighing every day during experiment. Kinetic parameters of enzyme activity were calculated using the time dependent enzyme activities in different substrate concentrations of soil samples taken 15, 30, 45, 60, 75 and 90 days of the experiment. In increasing applications of 2,4-D herbicide, significant differences (P<0.01) were determined among the incubation periods while effect of increasing doses on catalase enzyme activity was not significant. The highest catalase activity level was determined in 15th day of incubation in clay textured soil. When significant decreases occurred in catalase activity in the 30th day of experiment, changes in the catalase activity were found insignificant statistically after this period. Mean values of Vmax, Km, Vmax/Km parameters were determined as 0.785; 1.016; 0.923; 0.888 ml O_2 g^{-1} sec^{-1}; 2.608; 3.464; 2.953; 2.697 ml O_2 g^{-1}; 0.428; 0.410; 0.418; 0.463 $sec^{-1}sec^{-1}$ respectively in control, 0.5 ppb, 1 ppb and 2 ppb 2,4-D applications of clay soil. It was determined that, application of 2,4-D herbicide both increased product formation velocity and incubation time and substrate concentration affected kinetic parameters such as V_{max}, K_m, V_{max}/K_m because of the effect was occurred in aerobic organism population.

Key words: Clay textured soil, catalase activity, 2,4-D herbicide, kinetic parameters.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Isolation and identification of ferric reducing bacteria and evaluation of their roles in iron availability in two calcareous soils

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Abstract

Iron is an essential element for all organisms which plays a crucial role in important biochemical processes such as respiration and photosynthesis. Iron deficiency seems to be an important problem in many calcareous soils. Biological dissimilatory Fe(III) reduction increases iron availability through reduction of Fe(III) to Fe(II). The aim of this study was to isolate, identify and evaluate some bacterial isolates for their abilities to reduce Fe(III) in two calcareous soils. Three bacterial isolates were selected and identified from paddy soils by using 16S rRNA amplification and then inoculated to sterilized and non-sterilized calcareous soils in the presence and absence of glucose. The results showed that all isolates belonged to *Bacillus* genus and were capable of reducing Fe(III) to Fe(II) in vitro condition. The amount of Fe(III) reduction in sterilized calcareous soils was significantly higher when inoculated with PS23 isolate and *Shewanella putrefaciens* (*S. putrefaciens*) (as positive control) compared to PS16 and PS11 isolates. No significant difference was observed between PS11 and PS16 isolates in the presence of indigenous microbial community. The results also revealed that glucose had a significant effect on Fe(III) reduction in the examined calcareous soil samples. The amount of Fe(III) reduction increased two-fold when soil samples were treated with glucose and inoculated by *S. putrefaciens* and PS23 in non-sterilized soils.

Key words: Bioreduction, *Bacillus* sp, ferric iron, paddy soils, *Shewanella putrefaciens*.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological activity of sod-podzolic soils on different kinds of farmland

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Abstract

In recent decades, Russia has witnessed an annual reduction and throwing of productive lands. Stopping use of soils results in the loss or modification of some properties to their natural condition. Soil quality assessment is necessary to carry out not only by the physical, chemical and physical-chemical parameters, but also the biological activity of the soil is to be taken into account, as it allows to judge the condition of soil fertility. The purpose of research is to determine the influence of type of agricultural land use on the biological activity of sod-podzolic heavy loamy soils. Investigations were carried out on different kinds of land: the ploughland (45 years), fallow land (15 years). Analysis of soil samples showed that the sod-podzolic soil on different kinds of agricultural land had almost identical conditions of the physical-chemical parameters. Cellulolytic activity and nitrification power were defined for soils of different agricultural land use. The intensity of the nitrification process in the investigated soils of the ploughland and of the fallow land was low and amounted 0.8-1.4 mg N-NO3/kg of soil. The lowest nitrification power marked at the fallow land, where the conditions for the activity of nitrifying bacteria are less favorable because of lack of oxygen and very low content of organic matter in the soil. Change of use type of agricultural land led to a decrease process of cellulose decomposition in soils. So, the activity of cellulolytic microorganisms on the ploughland and fallow land amounted 29.87 and 18.01%, respectively. Thus, the cellulolytic activity of the soil at the different kinds of land is weak on the intensity scale destruction cellulose proposed by D.S. Zvyagintsev. The lowest activity of cellulolytic microorganisms and power of nitrification was noted also in the soil of fallow land. It was established that removing the agrogenic sod-podzolic soil from active use in post-agrogenic status leads to a reduction of its biological activity. Thus, in sod-podzolic soils with very low humus content (1.4-1.9%) agrochemical properties too little transformed due to changes of agricultural land use. Indicators of soil microbial activity are more sensitive than agrochemical. Recommendations have been given to improve the conditions of biological activity and actions to restore soil fertility.

Key words: Ploughland, fallow land, soil fertility, cellulolytic activity, nitrification power, sod-podzolic soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Microbial activity of different earthworms species casts

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Abstract

The indicators of biological activity (respiration, methanogenesis, nitrogen fixation, denitrification, the size and structure of the microbial complex) and functional biodiversity of microbial communities in casts of two earthworms species and sod-podzolic medium-loam soils were evaluated in the model experiment. It is shown that earthworms of different ecological trophic groups (soil-litter species Lumbricus rubellus and typically soil Arorrectodea rosea) influence the indexes of soil biological activity in different degrees. The emissions of carbon dioxide, nitrous oxide, and nitrogen fixing activity in soil and casts inhabited by worms were higher than in a control soil. However, nitrogen fixation takes place more rapidly in L. rubellus casts, and denitrification in A. rosea casts. The length of the fungal mycelium significantly decreases and bacteria, including nitrogen-fixing forms, growth in the casts of L. rubellus compared with a control soil. The length of fungal mycelium in A. rosea casts on the contrary increases with time. The evaluation of the functional diversity of microbial communities in the casts of two earthworms' species and control soil using multisubstrate test (MST) showed their significant difference not only between the control soil and casts, but also between casts of different earthworms species. The high indexes of consumed substrates, diversity and evenness, as well as very high indexes of the metabolic activity and the stability of microbial systems were determined in A. rosea casts, and in casts L. rubellus these rates were significantly lower. Assessment of microbial communities stability based on the analyses of rank distributions of test substrates consumption showed very high stability of the microbial community in A. rosea casts (d = 0,045) and very low - in L. rubellus casts (d = 1,32). So high values of the "d" index indicates significant changes in the functional soil microbial system cohesiveness and of its destabilization. Apparently, there is a significant change in the soil microbial community structure that leads to an increase in the number of members of individual microorganisms taxons in L. rubellus casts. We noted an increase in the number of bacteria and a significant reduction of the fungal mycelium length in casts of this earthworm species.

Key words: Earthworms casts, biological activity, nitrogen fixation, denitrification, number of bacteria, fungal mycelium, functional diversity of microbial community

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological degradation of chernozems under irrigation

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Abstract

We studied the changes in the state of microbial cenosis of Ukraine's chernozems under irrigation. Considerable part of Ukraine's chernozems is located in the areas where humidification is insufficient and unstable. Irrigation is a soil-reclamation measure for chernozems of Ukrainian Forest-steppe and Steppe which enables getting the assured yield, especially vegetable and fodder crops. At the same time, irrigation is a powerful anthropogenic factor that affects the soil, causes a significant transformation of many of its properties and regimes including biological ones. Often these changes are negative. The purpose of our investigation was to identify changes in the state of microbial cenoses of chernozem soils under irrigation which depend on such factors as the quality of irrigation water, the duration and intensity of irrigation, the initial properties of soil, the structure of crop rotation, usage of fertilizing systems and agroameliorative techniques. We identified direction and evaluated a degree of changes in biological properties of chernozems under influence of irrigation in different agro-irrigational and soil-climatic conditions. In the long-term stationary field experiments we identified the following biological indices of irrigated soils and their non-irrigated analogues: a number of microorganisms which belong to main ecological-trophic groups, activity of soil enzymes (dehydrogenase, invertase, phenol oxidase), soil phytotoxic activity, cellulose destroying capacity of soil, indices of oligotrophy and mineralization, summary biological index (SBI) and index of biological degradation (BDI). The results of researches showed that irrigation unbalanced the soil ecosystem and stipulated the forming of microbial cenosis with new parameters. Long-term intensive irrigation of typical chernozem (Kharkiv Region) with fresh water under condition of 4-fields vegetable crop rotation led to the degradation changes of its microbial cenosis such as reduction the number of microorganisms and the diversity of fungi species, repression of cellulose destroying capacity, decrease invertase activity and the rate of humification, intensifying mineralization processes and soil toxicity increasing. Long-term irrigation of ordinary chernozem (Kharkiv Region) with fresh water in moderate regime under 7-field crop rotation including alfalfa caused no disturbances of microbial cenosis. In this case parameters of biological indices did not deviate from the level of non-irrigated analogue. Irrigation with saline water causes more profound negative changes of microbial cenosis of chernozem, which not always can be corrected using agroameliorative techniques. Intensive irrigation with saline water with total mineralization from 1.2 to 2.2 g/l of ordinary chernozem (Odesa Region) for 13 years has led to a significant degradation changes in the structure and functioning of its microbial cenosis, its radical alteration such as oppression of microflora, decrease in the number of its main groups by 30 – 40 %, intensification of its mineralization function. Application of agroameliorative techniques (such as annually use of phosphogypsum 3 t/ha) or /and complex measures (phosphogypsum 3 t/ha annually + $N_{150}R_{90}K_{60}$ + manure 18 t/ha of crop rotation)) enable to regulate of soil biodynamic processes and partially or completely eliminate the phenomena of biological degradation. It was stated that after the cessation of irrigation the degradation changes of ordinary chernozem's biological properties caused by irrigation with saline water were gradually restored.

Key words: Irrigation, chernozem, microbial cenosis, biological indices, biological degradation, ecological-trophic group of microorganisms, soil fermentative activity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of metagenomic data for soil characterization

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Abstract

A traditional soil study involves numerous research methods, including the morphological description of a soil profile and separate horizons; chemical, physicochemical, and physical analyses of the samples; biochemical analyses of the soil humus, micromorphological description of thin sections, traditional microbiological analyses, etc. Application of the methods of molecular biology based on the isolation of total DNA directly from the soil samples opens new ways for soil characterization. The study of microbiomes in the major types of Russian soils have proved the presence of the core and accessory components in them. The core component represents a conservative stable part of the microbial community that is little-sensitive to the environmental and soil changes. The accessory component includes microorganisms that are indicative of the particular soils, processes, and conditions. Within the framework of the project on studying metagenomes of Russian soils, the structure of biogenomes was investigated in the brown solonetzic soil and shallow solonchakous solonetz in the ecotone of dry steppes and semideserts in Astrakhan oblast, light chestnut soil in Volgograd oblast, solonetzic light chestnut soil in Kalmykia, and brown arid soils in Kazakhstan. The topsoil horizons of virgin and fallow soils were examined. DNA was isolated via extraction by a buffer solution from the soil samples after their mechanical destruction; after several precipitation procedures, agarose gel electrophoresis, and purification, DNA materials were used as templates in PCR using a GS Junior Roche sequencing system. The taxonomic identification of nucleotide sequences and the comparative analysis of microbial communities were performed using the VAMPS and RDP tools. The analysis of nucleotide sequences has shown very similar structures of the microbiomes of shallow solonchakous solonetz and solonetzic light chestnut soil, which is explained by similarity of the processes in these soils and in their properties. However, the taxonomic characteristics of the microbiomes are somewhat different, which may be both to inaccuracy in determination of the taxa and to the fact that microorganisms, being highly sensitive indicators of the soil processes and conditions, have already transformed the structure of their community, whereas changes in the morphological properties of the soils require much longer periods. It is interesting that the solonetzic brown soils in complex with zonal light chestnut soils differ from the solonchakous solonetzes and solonetzic light chestnut soils, though some components of the microbial communities are common for all these soils. These are orders Actinomycetales, Rubrobacteraceae, Solirubrobacterales, cl. Actinobacteria, Gemmatimonadaceae and cl. Rhizobiales. The analysis of microbiomes in brown desert soils of Kazakhstan at the family level has shown the presence of 27 families with Cyanobacteria and Enterobacteriaceae (from Gammaproteobacteria, Pseudomonadaceae, or. Myxococcales) that are only present in desert soils, and Moraxellaceae and Acetobacteraceae (endemics) as dominants. Representatives of Enterobacteriaceae and Pseudomonadacea families were also detected as dominants in the light chestnut soil, which may attest to desertification of the territory with transformation of this soil into brown desert soils in the near future. These preliminary results indicate that modern methods of molecular biology can be applied in soil science to characterize the direction of soil processes, and accessory components of soil microbiomes can be indicative of the genetic specificity of the soils.

Key words: Soil metagenomic, soil DNA, soil diversity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological soil indicators of natural cenoses of arid ecosystems in Azerbaijan

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Abstract

The biological indicators of gray-brown, gray-meadow and meadow-gray soils of natural cenoses formed in arid environmental conditions of Azerbaijan were comparatively studied. Gray-brown soils (Siyazan, Sumgayit massive) covered with halophytic vegetation differ with minimal indicators of invertebrates with a total calculation of 11.2 ekv./km^2 biomass and 0.3 g/m^2. Insects are the dominant group - 96.4%, the share of isopods reaches 3.6%. Among insects the species are marked Brackyderma, Bulal, Pacephorus, directly related to the thistles, cruciferous plants characteristic for saline soils. In the soil under the wormwood-ephemeral community significantly increased the abundance and biomass of invertebrates to 16.8 and 1.7 g/m^2. Quantitative indicators of the microbiota are dynamically changed from grass saltwort formation 1490-2260 thousand/g. of soil. Gray-meadow soils (Salyan steppe) under saltwort-grassy phytocenosis differ from the previous few more abundance and biomass ekv./km^2 26.4 2.1 g/m^2 of invertebrates. Besides insects the xerophytic species of Isopodas are marked Armadillidium and Hemilepistus. On sagebrush habitats from wormwood ephemeral vegetation the number (28.0 ekv./km^2) and biomass (2.2 g/m^2) of invertebrates rise. Among the invertebrates, there are also representatives of the gastropods - Mollusca. The total number of microorganisms gradually increases from habitats with halophytic vegetation 761 million /gr. soil to sagebrush habitats with ephemeral vegetation 1,194 million /gr. soil. Meadow-gray soils (Shirvan steppe), formed under the wormwood herbaceus community have an average size of 19.1 ekv./km^2 and biomass of mesofauna 1.3 g/m^2. Among mesofauna dominated lumbricids (Lumbricidae) and isopods (Isopoda) dominate. Microfauna is presented with kollembulas (Collembola) with a population 42.2 million ekv./km^2 and biomass 1.0 g/m^2 and hard ticks Oribatidae with the number of 142 thousand ekv./km^2 biomass and 0.8 g/m^2. The number of microorganisms on cenosis varies between 2500-6930 thousand ekv./km^2. In saline soils microbiots in the group of composition are dominated actinomycetes and spore-forming bacteria of the genus Bacilus. Attenuated oxidative activity (catalase) and suppressed expression of hydrolytic (invertase) enzymes.

Key words: Invertebrates, microbiota, vegetation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of land use on changes in soil microbial biomass and residual indices as ecological indicators in temperate grasslands

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Abstract

The relationship between microbial biomass, residues and their contribution to microbial turnover and ecosystem C storage is not completely understood. The effects of permanent grassland (100% ryegrass - PG) conversion to modified grassland (mixture of grass and clover - MG) or maize monoculture (MM) on the dynamics of soil organic C (SOC), microbial biomass, fungal ergosterol and microbial residues (bacterial muramic acid and fungal glucosamine) were investigated. Cattle slurry was applied to quantify the effects of fertilisation on microbial residues and functional diversity of microbial community across land use types. Slurry application significantly increased the stocks of microbial biomass C and S and especially led to a shift in microbial residues towards bacterial tissue. The MM treatment decreased the stocks of SOC, microbial biomass C, N and S and microbial residues compared with the PG and MG treatments at 0-40 cm depth. The MM treatment led to a greater accumulation of saprotrophic fungi, as indicated by the higher ergosterol to microbial biomass C ratio and lower microbial biomass C/S ratio compared with the grassland treatments. The absence of a white clover population in the PG treatment caused a greater accumulation of fungal residues (presumably AMF, which do not contain ergosterol but glucosamine), as indicated by the significant higher fungal C to bacterial C ratio and lower ergosterol to microbial biomass C ratio compared with the MG treatment. In addition to these microbial biomass and residual indices, the CLPP demonstrated distinct differences between the PG and MG treatments, suggesting the potential of these measurements to act as an integrative indicator of soil functioning.

Key words: Amino sugars, grassland conversion, microbial functional diversity, microbial community structure, saprotrophic fungi

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Development of plant growth-promoting bacterial based bioformulations using solid and liquid carriers and evaluation of their influence on growth parameters of tea

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Abstract

The potential PGPR isolates are formulated using different organic and inorganic carriers either through solid or liquid fermentation technologies. Carrier-based preparations of five N_2-fixing and/or P-solubilizing microorganism based bio-fertilizers (F1: *Bacillus atrophaeus* RC11+*Bacillus megaterium* RC07+*Pseudomonas fluorescens* RC77; F2: *Bacillus subtlis* RC63+ *B. megaterium* 21/3+ *P. fluorescens* 8/4; F3: *B. subtlis* 36/10+ *B. megaterium* 42/2+ *P. fluorescens* 8/6; F4: *B. subtilis,* 39/3+ *B. megaterium* 42/4+ *P. fluorescens* 9/7; F5: *B. subtilis* RC521 + *B. megaterium* 42/4+ *P. fluorescens* 9/7), developed in seven organic and inorganic solid carriers (tea waste, peat, perlite, leonardite, zeolite, and vermiculite) and liquid carriers based formulations were evaluated for their growth promotion and yield of tea. The experiment also included applications of a biological fertilizer, and NPK-fertilizer as well as a control treatment without inoculation and fertilizer application. The experiments were conducted in a completely randomized design with four replicates (each having five rooted cutting sapling) under natural soil conditions. Growth and survival of PGPR formulations in carriers material were evaluated. The efficacy of prepared bio formulations were then evaluated on promoting tea sapling growth characteristics including plant height, trunk diameter, leaf fresh and dry weight, leaf area and chlorophyll concentration in tea. Bio-fertilizers efficiency was variable and depended on the inoculants strain, carriers and growth parameters evaluated. Of the effective bacterial and carriers formulations tested consistently gave growth and yields of tea equal to or higher than chemical fertilizers applied. The bio-fertilizers used in organic farming, increase plant growth and development of tea was concluded that positive affect (This study was supported financially by a grant (TOVAG; 107 O 360) from the Scientific and Technological Research Council of Turkey, TUBİTAK)

Key words: (*Camellia sinensis* L.), solid and liquid carriers, plant growth-promoting bacteria, bio-fertilizers

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of no-tillage on the biodiversity of soil phytopathogenic fungi in the semi arid area (case of Setif area)

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Abstract

The diversity and abundance of fungi in different soil samples conducted in direct seeding (no-till) for four consecutive years compared to the conventional system were studied through the analysis of several samples from two soil horizons with different previous cropping , using the soil dilution plate. A total of eight fungal pathogens and opportunistic were identified. The most common genera were *Fusarium, Aspergillus, Penicillium, Alternaria, Rhizopus, Blumeria, Helminthosporium* and *Cladosporium*. In terms of level of abundance, the results show a difference in the species richness and the number of pathogenic fungi according to the system of agricultural practice. We found that direct seeding promotes the development of fungi, including *Fusarium*. Because of the presence of only permanently vegetative cover. The system of direct seeding in a durum wheat crop promotes parasitism, with a high infection compared to the conventional system. Furthermore, the choice of the culture and its location in the rotation plays an important role in the distribution of the fungus. The plot conducted in monoculture for four years is the most infected compared to other plots. The trend is the gradual reduction of mushrooms while going in depth due to the lack of organic matter that is not buried by plowing.

Key words: Phytopathogenic fungi, previous crop, soil, direct seeding; rotation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of earthworm production in two different periods during the vermicomposting organic materials

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Abstract

In this paper in order to study the Assessment of earthworm production in two different periods during the vermicomposting organic materials, experiment with eight treatments was conducted using a complete block design with three replications. Eight different organic wastes including, rice hull cow manure, cotton wastes, cow manure and rice hull were used. Each organic waste was transferred to box and converted to vermicompost by the action of worms. Variance analysis results showed that increasing the period of vermicomposting cotton wastes, rice hull, and rice hull cow manure, in 2 months, the weight of earthworms and their average weight will increase and decrease, respectively. In case of cow manure vermicompost, in 3 months after vermicomposting the total weight of earthworm in each treatment increased, will the average weight of earthworms increased in 2 months and then decreased after 3 months. In between of different vermicomposts, cow manure and rice hull cow manure vermicomposts have highest total weight. The lowest total weight of earthworm production was observed in rice hull vermicompost. The highest and lowest content average weight of earthworm in cotton waste and rice hull were observed, respectively. The highest total weight of earthworm production in 3 months period cow manure vermicompost and the lowest one in 2 and 3 months periods rice hull vermicompost were observed. The highest and the lowest average weight of earthworm in treatment 3 months period cotton waste vermicompost and, 2 and 3 months period rice hull vermicompost was observed, respectively.

Key words: Earthworm, vermicompost, organic materials.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ammonia oxidizing bacteria and archaea in soil aggregates as affected by landscape position

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Abstract

Nitrifiers and their activity can be heterogeneously distributed in soil aggregates, and their distribution may change in response to landscape position. In this study we determined the spatial distribution of the ammonia oxidizing bacteria (AOB) and archaea (AOA) and the nitrification activity across a range of soil aggregate size fractions (4-1, 1-0.25 and 0.25-0.05 mm). The aggregates were collected from three different landscape positions (shoulder, backslope and toeslope) at two field sites exhibiting contrasting climatic conditions (Fereydoonshahr and Chelgerd, central Iran). In the aggregates, soil organic C (SOC) and nitrification potential were measured. Furthermore, the abundance of AOB and AOA was determined by using real-time polymerase chain reaction (PCR) assays of the amoA genes. The result illustrated that landscape position significantly affected the size distribution of the aggregates. All measured parameters were influenced by the positions and the size of the aggregates. At Fereydoonshahr site, a decreasing trend in nitrification potential was observed as the size of aggregate decreased. Distribution of nitrification potential in aggregate fractions was similar to SOC content. Generally, both AOB and AOA were higher in macroaggregate than in microaggregate fractions. At Chelgerd site, nitrification potential was higher in smallest size aggregate fractions. The lowest amount of amoA genes were observed in 1–0.25 mm aggregate size fraction. In general, the contribution of each aggregate to SOC storage and overall biological activity of the whole soil was different and varied significantly with respect to landscape positions. The contribution of macroaggregates to biological activity showed to be increased in well aggregated soils across the landscape. Results also indicate that special location of nitrification activity and the abundance of the AOA were coincided across aggregate size fractions along the landscape positions.

Key words: Real-time PCR, landscape position; aggregate size; nitrification; ammonia oxidizing bacteria and archaea.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Survival efficiency of rhizobium spp. in insecticide treated medium and their ability to promote growth of insecticide treated chickpea (*Cicer arietinum*)

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Abstract

Reduced nitrogen fixation due to seed treatment with insecticide can be improved by insecticidal resistance rhizobium strains. In this study, rhizobium survival efficiency at various concentration of imidacloprid was examined and then the efficacy of resistant strains for improving growth of insecticide treated chickpea was evaluated. Rhizobium survival on the basis of the number of viable bacterial cells through plate count was examined. Among four rhizobium spp. (CRI_{14}, CRI_{20}, CRI_{34} and CRI_{35}) two species (CRI_{20} and CRI_{35}) showed resistance against insecticide. CRI_{35} was able to tolerate insecticide concentration above the recommended dose however CRI_{20} showed relatively less growth at high concentration. The efficacy of these two strains was evaluated by conducting a pot trial. Chickpea seeds were treated with recommended dose of imidacloprid and then inoculated with respective strain. Un-inoculated treated and untreated seeds were also used for comparison. The pots were arranged according to complete randomized block design in two sets having three replications each. At flowering, plants from one set were uprooted and data regarding nodulation was recorded, whereas data regarding growth and yield parameters was calculated from other set at maturity. The results showed that inoculation not only improved nodulation but also caused a significant increase in growth and yield components of inoculated plant. Rhizobium strain CRI_{35} performed better than other might be due to its better growth promoting traits. It can be concluded that such strains can be used effectively for improving plant growth of insecticide treated seeds.

Key words: Insecticide, rhizobium, survival, chickpea, growth, nodulation

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Bio-ecological characteristics of the soil in Baku

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Abstract

Studies to identify the level of soils biological activity under highways of Baku were comprehensively on the following parameters: enzyme activity, the number of microorganisms and phytotoxicity. A level of the change of biological activity and summary phytotoxicity of soil under highways influence has been established. In comparison with the soils of the Central Botanical Garden of soil cover along highways is characterized by high phytotoxicity that can be connected with the presence of these soils under constant technogenic pressure - pollution by the vehicles emission. It is revealed that an activity of urease, invertase, and dehydrogenase was lower in the soils near highways which are subjected to intensive technogenic load in comparison with the soil of the botanic garden, for which a degree of the technogenic effect is essentially less. An availability of the reverse correlation dependence between microbiological and fermentative indices is characteristic for the soils along highways: the low activity of soil ferments corresponds with the high number of bacterial microflora. Humus content vibrates from 0.9% till 1.2%, under humus content in the soil of the control zone is 1.6%. Such low humus content is conditioned by nutrient lack in the urban soils that leads to activation of humus mineralization process. An importance of humus for urban soils along the highways is not only in formation of soil fertility, it serves as an important indicator of the ecological potential, determining a degree of the soil resistance to the effect of the technogenic factors. Thus, the investigated indices allow to judge changes of the biological activity of soils under an influence of anthropogenic pressing and can serve as a theoretic basis for the development of the condition monitoring methods of the soils along the city highways.

Key words: Biological activity of soils, enzymes of soil, microorganisms, phytotoxicity, urban soils under highways.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of *Penicillium bilaii* inoculation on growth, yield and yield contributing characteristics of wheat

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Abstract

The investigation was carried out during *Rabi* season at N. E. Borlaug Crop Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar, India with an aim to study the influence of *Penicillium bilaii* inoculation on growth, yield and P uptake of wheat crop and also to examine the inoculation effect on soil properties. The wheat crop variety PBW 343 was raised. Twelve treatments consisting combinations of different levels of phosphorus with and without two strains of *Penicillium bilaii* inoculation, were laid out in randomized block design (RBD). Treatment Pb2+50% P excelled among all the treatments with regard to plant-height (88.4 cm), total tillers (15.4%), effective tillers (16.5%), ear length (15.3 cm), number of spikelet per ear (24.8), number of grains per ear (60.8), test-weight (44.3), grain yield (42.77 q/ha) and straw yield (66.75 q/ha). Similarly this treatment showed significant increases in dehydrogenase activity by 73.9 per cent over no incolutation+0% P. Treatment Pb2+50% P also showed improving trend in organic carbon content (3.3%) over their control. The maximum nitrogen content of grain 1.80% with 77.07 kg/ha of nitrogen uptake was recorded in treatment Pb2+50% P over no inoculation+50% P alone. Whereas, treatment Pb2+100% P significantly increased P content of grain 0.40 per cent with 15.40 kg/ha of P uptake over no inoculation+100% P alone. Total fungal population was observed higher (156.25 x 10^3 propagules/g soil) with bulk increase of 119.0% in treatment combination of Pb2+0% P over no-inoculation+0% P. However, per cent increase in fungal population was 69.83 and 106.54 in treatment Pb2+0% P than 50%P and 100% P alone respectively. It can be concluded that the Pb2 with 50 % P is superior over other treatments and found economic to wheat crop which can save upto 50% fertilizer consumption and improve soil health.

Key words: Phosphorus solubilization, *Penicillium bilaii*, inoculation, wheat.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Optimization of environmental factors affecting biodegradation of chlorpyrifos in broth culture by *Enterobacter* sp. SWLC2

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Abstract

Chlorpyrifos is an insecticide, -extensively used in Pakistan and contaminating the soil and water environments at several sites. Exploration of efficient chlorpyrifos-degrading bacteria to clean-up this toxicant is of immense importance. This study reports the isolation, screening and identification of highly efficient chlorpyrifos degrading bacterial strains from different soils and water samples collected from different sites of Pakistan. Out of total 50 isolated bacterial strains, 32 were tested for their biodegradation capability in a culture medium containing chlorpyrifos as carbon and energy source. Four bacterial strains (SWLC2, SWLH2, SGB2 and SWLC1) were the most promising in their growth and biodegradation activity and were identified and characterized by biochemical characteristics and 16S rRNA sequence analyses as *Enterobacter* sp. SWLC2, *Agrobacterium* sp. SWLH2, *Enterobacter* sp. SGB2, and *Enterobacter* sp. SWLC1. These four strains exhibited biodegradation potential between 81 to 92% of the spiked amount of chlorpyrifos (100 mg l^{-1}) within 18 days of incubation in broth culture. Biodegradation of chlorpyrifos continued gradually throughout the incubation period (18 days) as examined by the HPLC-UV system. Abiotic degradation contributed only up to 15% of the spiked amount. Maximum biodegradation by the four efficient bacterial strains was observed at an initial pH of 7 and an incubation temperature of 30^{o}C, under shaking conditions. Among these strains, *Enterobacter* sp. SWLC2 was found most efficient in biodegradation of chlorpyrifos and was selected for further studies. This strain was then optimized in broth under different conditions. It showed maximum biodegradation of chlorpyrifos at pH 7, 30^{o}C temperature, under shaking conditions with inoculum size of 800 ìl. Exogenous application of sugars, yeast extract, manitol, organic acids and amino acids had stimulator or inhibitory effects on biodegradation of chlorpyrifos by *Enterobacter* sp. SWLC2. Among these, glucose, yeast extract, succinic acid and citric acid had stimulatory effects on biodegradation of chlorpyrifos. Biodegradation of chlorpyrifos by *Enterobacter* sp. SWLC2 was also checked at different initial concentrations of chlorpyrifos from 10-250 mg l^{-1}. Rate of biodegradation increased with increase in concentration of chlorpyrifos from 100-150 mg l^{-1} and suggested first order rate kinetics. In all experiments, utilization of chlorpyrifos by the strains was accompanied by a parallel increase in optical densities of broth implying that removal of this pesticide from the growth medium was a growth linked biodegradation. These results highlighted the potential of this bacterium to be used in the detoxification strategies of chlorpyrifos contaminated water and soil environments.

Key words: Biodegradation, chlorpyrifos, broth, *Enterobacter*, environmental factors.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The enzymatic activity of black soil used for sowing of spring wheat in Northern Kazakhstan

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Abstract

The aim of the work was to evaluate the fertility of southern chernozems of Northern Kazakhstan, used for sowing of spring wheat under different processing methods and to find the ways to control the soil enzymatic activity and improve its fertility. One of the main factors determining the soil fertility is the enzymatic activity that can be used as a diagnostic indicator of fertility of different soils, because the enzyme activity gives us an opportunity to determine the changes in soil biological properties under the effect of some agro-ecological factors. Data obtained have shown that when the "zero" tillage has been used, a slight decrease in the activity of catalase in the lower soil horizons can be determined. At the "minimum" tillage the catalase activity was the same in the upper and lower soil horizons. Peroxidase activity in both soil tillage methods increased from the upper to the lower soil horizons. The data obtained indicate that the highest values of enzymatic activity at both methods of tillage was determined for urease activity, which was 3.1-12.1 mg NH_4-N g^{-1} 3 h^{-1}, and 1.1-10.1 mg NH_4-N g^{-1} 3 h^{-1}, respectively, in the lower and upper soil horizons. Both methods of soil treatment had a positive effect on soil amylase activity. In general, minimizing the soil processing has a positive effect on its enzymatic activity, which in turn leads to an increase in the natural fertility of the soil. Thus, the best way to handle the soil is the most energy-efficient method, in which the biological activity of the soil is maintained at no lower than when using the traditional methods of reproduction of soil fertility.

Key words: Enzymatic activity, black soil, fertility.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of inoculates on abundance of Actinomycetes in alfalfa rhizosphere

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Abstract

This paper presents the results of the impact of microbial inoculants on the number of actinomycetes in the rhizosphere soil of alfalfa (Medicago *sativa* L.). This plant species in addition to high yield potential and quality of biomass, is characterized by an intense process of nitrogen fixation. The rhizosphere of alfalfa abounds in numerous microorganisms. The aim of the research was to investigate the effect of inoculating with two nitrogen-fixing bacteria (*Sinorhizobium meliloti* and *Azotobacter chroococcum*) and two isolates (CC657 and Coll11) of the phytopathogen fungus *Colletotrichum destructivum* on the number actinomycetes in the rhizospheric soil of alfalfa varieties (Affinity, Perry and K-28). The highest number of actinomycetes was determined in rhisosphere of cultivar Affinity which was inoculated with *A. chroococcum* + isolate Coll-11, while the lowest number was found in rhisosphere of cultivar K-28 inoculate with CC657. Results of Fisher test shows the absence of statistically significant differences in abundance of actinomycetes between treatments, meaning there were four homogenous groups: 1. treatments of cultivar K-28 with Coll-11 and CC657 + *S. meliloti;* 2. treatments of cultivar K-28 with Coll 11 + *S. meliloti* and control treatment (without inoculation) in cultivar Perry; 3. treatments with Coll 11 + *A. chroococcum* in cultivar K-28 and CC657 + *A. chroococcum* in cultivar Perry; 4. inoculation with CC657 + *A. chroococcum* in K-28 and Coll 11 + *A. chroococcum* in cultivar Perry.

Key words: Rhizosphere, fungi, actinomycetes, alfalfa

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of bio-fertilizers application on microbial diversity and physiological profiling of microorganisms in arable soil

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Abstract

In laboratory assay, the diversity of bacteria and microscopic fungi and the community-level physiological profiling (CLPP) of microorganisms were observed after the addition of bio-sludge (40 $t.ha^{-1}$) from a biogas station and addition of bio-fertilizers - AZOTER (10 $dm^{-3}.ha^{-1}$) to the arable soil with PCR-DGGE and BIOLOG® method (Eco Plates). The differences were recorded in the microbial diversity (bacteria and microscopic fungi) among variants according to the Shannon index. The differences in community of microscopic fungi were markedly higher among the soil samples with the additions of both bio-fertilizers compared to control soil samples. The occurrence of individual OTUs (operational taxonomic units) bacteria and microscopic fungi were different after 105 days of incubation from the status after the 1st day of incubation. The community metabolic diversity (CMD) was influenced by the incubation time (105 days) as well, but not by application of bio-fertilizers. We observed a significant decrease (LSD test, $P < 0.05$) in community metabolic diversity (CMD) and average metabolic response (AMR) of microorganisms *in samples* collected on the 105th day of the experiment compared to samples collected on the 1st day of the experiment in all tested samples.

Key words: Bio-fertilizers, microbial diversity, microbial physiological profiling, arable soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of microbial biomass and enzyme activities in soil under temperate fruit crops in North Western Himalayan Region

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Abstract

Microbial communities are important for the functioning of the ecosystem, both in relation to direct interactions with the plants and with regard to nutrient and organic matter recycling. A study in field condition was undertaken in Kashmir Valley, India to reveal the effect of various temperate fruit crops viz. apricot, peach, plum and cherry on microbial biomass carbon (MBC), nitrogen (MBN), phosphorus (MBP) and dehydrogenase (DHA), phosphomonoesterase (acid and alkaline) and urease activities in soil at two different depths (0-20 and 21-40 cm). All the fruit crops showed a sharp decline in microbial biomasses as well as enzyme activities with the increase in soil depth. Each of the four fruit crops showed significant (p<0.05) impact on MBC over the control and the maximum MBC was recorded in plum (1000 mg kg^{-1}) followed by peach (928 mg kg^{-1}) and apricot (852 mg kg^{-1}) and the lowest value was observed in control (457 mg kg^{-1}), at the surface layer. The same was followed in the subsurface layer too. Since there is a relationship between MBC and MBN, the similar trend was also observed in MBN as in case of MBC and the values of MBC and MBN can be arranged in a descending order: plum>peach>apricot>cherry>control, for both layers. For MBP no fruit crops showed any significant effect neither on surface soil, nor on subsurface soil layer over control. At the surface layer, unlike microbial biomass the highest DHA was observed in peach (318 μg TPF g $soil^{-1}$ h^{-1}) which was followed by plum (297 μg TPF g $soil^{-1}$ h^{-1}) and the lowest value (166 μg TPF g $soil^{-1}$ h^{-1}) was attained at control plot, however the same was not followed in subsoil. Maximum alkaline phosphomonoesterase activity was observed in peach (381 μg PNP g $soil^{-1}$ h^{-1}) followed by plum (361 μg PNP g $soil^{-1}$ h^{-1}), although for acid phosphomonoesterase the highest value recorded in apricot (306 μg PNP g $soil^{-1}$ hr^{-1}) followed by cherry (298 μg PNP g $soil^{-1}$ hr^{-1}), at surface soil. A significant positive correlation (p<0.01) was observed amongst MBC, MBN and MBP. Both the phosphomonoesterase activities were significantly (p<0.05) correlated with MBP in soil. It can be concluded that the influence of the studied fruit trees on the soil was not uniform, in terms of the measured parameters.

Key words: Enzyme activity; Kashmir valley, microbial biomass, soil depth, temperate fruit crop.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mapping of microbial activities in the widespread soil series of Amik Plain

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Abstract

In this study, it was aimed to determine and mapping of soil microbial activities in widespread soil series of Amik Plain. For this purpose, soil samples were taken from 11 soil series (Aşağıoba, Karasu, Topboğazı, Acarköy, Comba, Reyhanlı, Sazyurdu, Asi, Keçebek, Arpahan, Akkerpiç) in the autumn period. Each will represent a series of five sampling points and 0-30 cm depth of soil samples taken from the three paralleled and all soil samples were analyzed without waiting. Coordinates of sampling points were recorded with the help of GPS. Soil respiration (CO_2), dehydrogenase enzyme activity (DHA) and microbial biomass carbon (MBC) analyzes were done for the purpose of determined of microbial activity. Thematic maps were produced by placement of values of the analysis on basis of soil mapping units of related series. According to research results, the microbial point of highest CO_2, DHA and MBC values were determined as 29.0 mg CO_2 100g.ds/24 h. in Acarköy Series, 1119 g TPF 10 g.ds/24h. in Reyhanlı Series and 256 mg C/kg.ds. in Asi Series' soils respectively. The lowest values of the same parameters were determined as 11.4 mg CO_2 100 g.ds/24h in Aşağıoba Series, 392 µg TPF 10 g.ds/24h in Acarköy Series and 121 mg C/kg.ds in Reyhanlı Series' soils respectively.

Key words: Microbial activity, soil respiration, mapping, microbial biomass.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Molecular approaches in identification of ectomycorrhizae and mycorrhizal communities

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Abstract

The diversity in the fungal kingdom is estimated to several millions of species with at least 6.000 species, mainly from the groups Ascomycota and Basidiomycota, which can form ectomycorrhiza. However, only about 500 ectomycorrhizal species have been characterized by their morphological and anatomical traits so far. Several approaches are established for identification of fungi partners in ectomycorrhiza. Beside morphological and anatomical traits there are several DNA based approaches, either focused on the identification of a single species or on identification of the complete community in sites. Together, these methods provide insights into belowground fungal diversity and are the basis for further understanding physiological functions and ecological roles of ectomycorrhizal fungi and their mycelium networks in ecosystems. In our presentation we summarise state of the art approaches in identification of fungi in ectomycorrhiza or ectomycorrhizal communities from natural stands either as individuals through direct informative markers sequencing or through the overall community screening using DGGE (or TGGE), T-RFLP, in comparison with next generation sequencing (NGS). Basic data mining approaches and the subsequent bioinformatics will be presented on several relevant examples of recently performed research tasks: DGGE studies of the fungal diversity in coarse woody debris logs and the NGS to assess the time-line of wood decomposing fungi community. An example of species delimitation, identification of unknown samples, and molecular diversity of the hypogeous genus of true truffles will also be detailed using phylogenetic and phylogeographic approaches.

Key words: Mycorrhizal fungi, identification, molecular approaches, ectomycorrhiza community, diversity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Use of stable isotope dendrochronology in reconstruction of past environments

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Abstract

Trees are valuable source of environmental information. Within the physical characteristics (width, density, stable isotope composition, anatomy) of their rings they provide a record of past environmental changes which, when expressed strongly, may be used to extract climate (or environmental) information. Long tree-ring records provide the framework for the reconstruction of past variability and stable isotopes of carbon, oxygen and hydrogen in tree-rings are, beside tree-ring widths, one of the strongest and most powerful climate proxies currently available. Analysis of stable isotopes usually starts with the collection of samples – cores from the trees. Cores are then processed in the laboratory, each year increment is extracted from the core and wood is turned into the cellulose using standardized chemical treatment. Cellulose is then burnt in elemental analyser (EA) coupled with stable isotope mass spectrometer (IRMS). Stable isotope ratio of carbon, oxygen or hydrogen from each tree-ring is then merged into so called stable isotope chronology and compared with different climatic parameters (e.g. mean monthly temperature, monthly sum of precipitation, sum of sunshine hours,…). Model, based on the relationship between stable isotopes and climate data is then used to reconstruct climate or some other environmental parameter, such as influence of past air pollution on tress. The purpose of the lecture is to provide an introductory course in stable isotope dendrochronology with the main emphasis on collection of samples, processing of samples, measuring and interpretation of the results, plant-physiological background of stable isotope fractionation and use of isotopes in the reconstruction of past paleoenvironment.

Key words: Dendrochronology, stable isotopes, climate reconstruction

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Forest soils of Eurasia: comparative estimate of soil organic matter mineralization rate

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Abstract

Occupying about 30 % of the total area of Eurasia, the forest systems play a critical role in the regional and global carbon (C) budget. Microbial decomposition of soil organic matter (SOM) is the main pathway for C release in the terrestrial ecosystems, and therefore, SOM mineralization processes are central to the functioning of soils in relation to feedbacks with atmospheric CO_2 concentration and subsequent climate changes. The intensity of SOM-decomposition in forest ecosystems depends on soil texture and hydrothermal regime, dominant wood species, production and biochemical composition of organic residues.The aim of this study was estimating the SOM mineralization rate in forest ecosystems under contrast climates: temperate (both, continental and mild), Mediterranean, and monsoonal Tropical. Under laboratory conditions, the potential (PR_{min}) and specific (PR_{min}/C_{opr}) rates of SOM mineralization, eco-physiological indicators of microbial community (C_{mic}, qCO_2, C_{mic}/C_{org}), and temperature sensitivity of SOM-mineralization (estimated as a Q_{10} values) were determined in the humic epipedons (0-10 cm layer) of the soils studied. The PR_{min} values decreased following the order: Mediterranean, 57.1±10.6 mg C kg^{-1} day^{-1} > continental temperate, 49.0±17.4 mg C kg^{-1} d^{-1} > mild temperate, 21.4±2.2 mg C kg^{-1} d^{-1} > tropical, 10.4±1.6 mg C kg^{-1} d^{-1}, indicating a higher content of labile SOM in sites with contrasting seasons. The lowest SOM resistance to mineralization (estimated as PR_{min}/C_{org} ratio) was observed in *Albeluvisols* and *Phaeozems* (temperate continental climate), and in the Mediterranean site *(Acrisols)*. SOM of forest sites under tropical and mild temperate climates attributed the highest decomposition stability: specific rates of SOM mineralization were the lowest in these soils and varied from 0.31±0.13 mg C g C_{org}^{-1} d^{-1} (tropical soils) to 0.39±0.09 mg C g C_{org}^{-1} d^{-1} (*Podzols*). Carbon immobilized as soil microbial biomass contributed 0.34-2.88 % to the total pool of soil organic C. The highest sensitivity of SOM mineralization to temperature was observed in the continental temperate forest ecosystems. It allows us to suppose that the expected climate changes (announcing a temperature increase) will affect mainly to the Northern forests, causing a higher acceleration of the SOM mineralization (in relation to the Mediterranean or the monsoonal tropical ones). This study was supported by the RFBR, the NSch-6123.2014.4, and the Spanish C.S.I.C.

Key words: Soil organic matter, mineralization rate, microbial community, forest ecosystems

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of plant exudates, essential oils and or some different bacteria solution on the productivity of *P. Vulgaris* and soil microbial community

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Abstract

Plant oils and their components, and extracts of the world, using the saprophytic and pathogenic micro-organisms have been many studies for the control. As well as the physical and chemical structure of the soil microbial population in the soil directly from the soil are known. Herbal extracts and essential oils for their antimicrobial activities and accordingly direct effect on soil microbial fauna in the soil and thus the physical and chemical nature of the effect on plant productivity has to be evaluated carefully. Plants produce a plethora of secondary compounds to protect themselves from external attacks, and to chemically interact with their surroundings. Among these substances are also aliphatic molecules that obviously possess specific signaling character. This study focus on such compounds and investigate; (a) their occurrence and exudations from the roots (b) their potential to influence selected soil bacteria (c) their beneficial effects on crop plants (*P. Vulgaris*) Experimental approach From Bavarian meadows in Southern Germany, one representative plant species were collected: Achillea Species are well known for their high contents in aromatic compounds, and essential oils. Soils were collected from the 0-20 cm depth of in Southern Germany. In this study, we used three different bacterium species (0, 100, 1000 ppm), (*Rhizobium leguminosarum* biovar *phaseoli* F7, *Rhizobium leguminosarum* biovar *phaseoli* F83, *Rhizobium leguminosarum* biovar *phaseoli Ciat899*). Plants were potted and grown for several weeks to allow for the establishment of new roots.

Key words: Essential oils, Phaseolus vulgaris, Rhizobium leguminosarum, Achillea.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Different effects of degeneration on soil nutrients, microbial biomass and enzyme activities in alpine meadow and steppe of the Qinghai–Tibet Plateau in China

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Abstract

Knowledge about soil C, N nutrients, microbial biomass and enzyme activity response to degenerated grassland ecosystems is still rudimentary. We conducted field and laboratory experiment to assess grassland degeneration on the nutrient of carbon (C), nitrogen (N), soil enzyme activity and soil microbial biomass in alpine meadow and alpine steppe ecosystems on the Qinghai-Tibet Plateau of China. The results demonstrated that the soil organic carbon, total nitrogen, ammonia nitrogen (AN), ammonia nitrogen (NN), soil microbial biomass C and N (MBC and MBN), urease (Ur), protease (Pr) and cellulose (Ce) at soil depths of 0-15cm in alpine meadow was significantly higher than in the alpine steppe ecosystems. The soil organic C, total N, AN, NN, MBC, MBN, Ur, Pr and Ce were decreased by degeneration and were decreased with soil depth in both alpine meadow and alpine steppe ecosystems. In addition, the difference in soil depths was not significant in alpine meadow, while the difference in AN, NN and Pr, Ce were significant in healthy and degenerated alpine steppe ecosystems. The degeneration may hardly change the positive correlation relationships between soil enzyme activities and soil biochemical properties by statistical analysis on Qinghai-Tibetan Plateau. The results showed that there were very different responses of nutrient, soil enzyme activity and soil microbial biomass to grassland type, degeneration and soil depth

Key words: Enzyme activity, soil C, N nutrients, soil microbial biomass, alpine meadow ecosystem, alpine steppe ecosystem.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of temperature moisture and nitrogen input on soil respiration of grassland ecosystem

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Abstract

Many environment factors effect on soil respiration of grassland ecosystem. This lead to different response of soil respiration to soil temperature and moisture. This study aimed at the diurnal dynamic observation about Re (ecosystem respiration), Rs (soil respiration) and Rh (soil heterotrophic respiration) of different time and nitrogen addition level (0, 2, 4, 8, 16 and 32 g N m^{-2} y^{-1}) in growing season at Stipa krylovii grassland in Inner Mongolia, China. We detected the response of soil respiration to soil temperature and moisture. Re, Rs and Rh had significantly different ($p<0.001$) in the different period of growing season ,being largest in the middle growing season than the early and late growing season , the interactive effects of observation time and nitrogen addition level were significant ($p<0.001$). The relationships between diurnal dynamic of respiration experimental research of different nitrogen addition plots were both unimodal curve. Results showed that diurnal dynamic of soil respiration were positively related to 0-10cm soil temperature, while the correlation between diurnal dynamic of soil respiration and soil volumetric moisture content was insignificant. Q10 in different nitrogen addition plots in the whole growing season followed the same pattern: Re was the largest, Rs was the smallest. Although the results showed that Q10 were positively ($p<0.001$, $R2 =0.28$) related to soil daily mean water content, the correlation between Re or Rh and soil daily mean water content was insignificant. During the growing season, microbial biomass carbon (MBC) consistently had a negative correlation with nitrogen addition level, while dissolved organic carbon (DOC), ammonium nitrogen (NH4+-N) and nitrate nitrogen (NO3--N) were positively related to nitrogen addition level, there was no significant correlation between aboveground net primary production (ANPP) and nitrogen addition level.

Key words: Soil respiration, nitrogen addition level , soil temperature, grassland ecosystem.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The relationship between soil urease activities and plant production in the cultivated grassland on Qinghai-Tibetan Plateau

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Abstract

Soil biochemistry features such as urease activity might be affected by the plant growth. A lot of literatures have documented the different performances of soil enzyme activities among various vegetation types, while most of them neglected the relationship between urease activity and plant production. In this study, we examined the relationships between plant height, cover and aboveground biomass and urease activity in the grazed and fenced pastures on Qinghai-Tibetan Plateau of China.

Key words: Urease activity, plant production, cultivated pasture, Qinghai-Tibetan Plateau.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of temperature and organic matter change on soil respiration in a Central European oak forest

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Abstract

The increasing temperature enhances soil respiration differently depend on different conditions (soil moisture, soil organic matter, the activity of soil microbes). It is an essential factor to predicting the effect of climate change on soil respiration. In a temperate deciduous forest (North-Hungary) we added or removal aboveground and belowground litter to determine total soil respiration. We investigated the relationship between total soil CO_2 efflux, soil moisture and soil temperature. Soil CO_2 efflux was measured at each plot using chamber based soil respiration measurements. We determined the temperature sensitivity of soil respiration. The effect of doubled litter was less than the effect of removal. We found that temperature was more influential in the control of soil respiration than soil moisture in litter removal treatments, particularly in the wetter root exclusion treatments (NR and NI) (R^2: 0.49-0.61). Soil moisture (R^2: 0.18-0.24) and temperature (R^2: 0.18-0.20) influenced soil respiration similarly in treatments, where soil was drier (Control, Double Litter, Double Wood). A significantly greater increase in temperature induced higher soil respiration were significantly higher (2-2.5-fold) in root exclusion treatments, where soil was wetter throughout the year, than in control and litter addition treatments. The highest bacterial and fungal count was at the DL treatment but the differences is not significant compared to the Control. The bacterial number at the No Litter, No Root, No Input treatment was significantly lower at the Control. Similar phenomenon can be observed at the fungal too, but the differences are not significant. The results of soil respiration suggest that the soil aridity can reduce soil respiration increases with the temperature increase. Soil bacterial and fungal count results show the higher organic matter content and soil surface cover litter favors the activity.

Key words: Added litter, removed litter, carbon-cycle, CO_2 efflux, DIRT.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of herbicide's ingredients on soil microbiological processes in a small plot experiment

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Abstract

Pesticides play a very important role in the regulation system of weeds, but have to be counted with the secondary effect of chemicals on soil life and on the so called "not purposed" soil organisms. In this paper the objective of study was to examine the effect of two various herbicide's ingredients on some microbiological parameters of a chernozem soil (Chernozems in WRB) with loam texture. The active ingredients of herbicides are the acetochlor (Acenit A 880 EC) and isoxaflutole (Merlin 480 SC), applied in maize culture to the soil surface. The effect of the herbicides was investigated on the sensitivity and quantity change of soil microorganism and biological parameters of soil in small plot experiment. In the experiment the single, double and five time doses of the recommended herbicide doses were applied and examined on the number of total bacteria and microscopic fungi, on the quantitative changes of aerobic cellulose decomposing and nitrifying bacteria, on soil respiration, on quantity of microbial biomass carbon (MBC) and nitrogen (MBN) for four years. The laboratory examinations were carried out in the soil chemical and microbiological laboratories of Institute of Agrochemistry and Soil Science, Debrecen University. Data analysis was performed using Microsoft Excel 2003 (mean values and standard deviation). Two factors variance analysis was used to get significant effect on measured parameters. The significant differences were accepted at the level 1%, but the evaluation was calculating by the LSD5% values as accepted in the agricultural research. The various microbial groups had different sensitivity on the increasing doses of herbicides, the number of total bacteria decreased significantly, while the number of microscopic fungi and cellulose decomposing bacteria increased. The MBC and MBN increased in most of the treatments of acetochlor, but the isoxaflutole had negative effect on these two parameter. Close correlation was found between some microbial soil parameters. In summary those chemicals may be recommended for agricultural use, which cause less inhibition effect on soil microbiological parameters.

Key words: Herbicides, chernozem soil, soil microbes, C- and N cycle of soil, MBC, MBN, CO_2-production.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological N2 fixation and its main contributor in a flooded rice-soil system by a novel air-tight 15N2 incubation technique under natural sunshine for 70d

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Abstract

Free-living biological N_2 fixation is an important process to provide N nutrient for terrestrial and ocean ecosystems. Rice field is a typical hot spot to fix N_2 biologically, but the direct evidence of N_2 fixation and the proportional contribution of heterotrophic and phototrophic N_2 fixation and its main contributor are difficult to assess. Here we report on the development and application of a novel field-based $^{15}N_2$ labelling technique in which a flooded rice-soil system was exposed to a $^{15}N_2$-enriched atmosphere to assess the biological nitrogen fixation (BNF) in paddy fields and $^{15}N_2$-DNA-stable isotope probing (SIP) to study active microbes to fix N_2. In this experiment, we were mainly concerned with rice planting and light effects on BNF. There were four treatments: no rice, with light on soil surface; no rice, without light on soil surface; rice, with light on soil surface; and rice, without light on soil surface. One month old rice seedlings (*Oryza sativa* L.) were transplanted to non N fertilized pots of flooded soil and exposed to a $^{15}N_2$-enriched atmosphere (approx. 7 atom% ^{15}N) in a gas-tight growth chamber for 70 days. Results showed that the highest ^{15}N-enrichment 3.7551 atom% was observed in blue green algae in unplanted pots. After 70 days incubation, 49% of the total ^{15}N fixed in flooded rice-soil system was found in the plants, while 51% was found in the flooded soil. Rice planting enhanced both phototrophic and heterotrophic BNF and increased the proportion of heterotrophic BNF to phototrophic BNF from 0.50 in treatment without rice to 0.99 in treatment with rice. Clear differences were observed in diazotrophic communities during the $^{15}N_2$-DNA-SIP study that a major proportion of $^{15}N_2$-fixers were affiliated with filamentous thermophilic cyanobacteria and geneus *Aoarcus* in rice-growing surface soils while the genera *Geobacter* and *Desulfovibrio* were dominant in uncultivated soils. The main differences in diazotrophic community structure were related to light deprivation rather than rice-growing, and no significant differences in *nifH* gene abundance among treatments. The findings suggested that rice benefit greatly from BNF processes and in turn rice growing can enhance both phototrophic and heterotrophic BNF significantly, and a major improvement for quantification of BNF and active diazotrophs exploration in flooded rice fields based on field $^{15}N_2$ labelling technique.

Key words: Rice, biological nitrogen fixation (BNF), $^{15}N_2$ labelling, heterotroph, blue green algae (BGA), stable isotope probing (SIP), QPCR.

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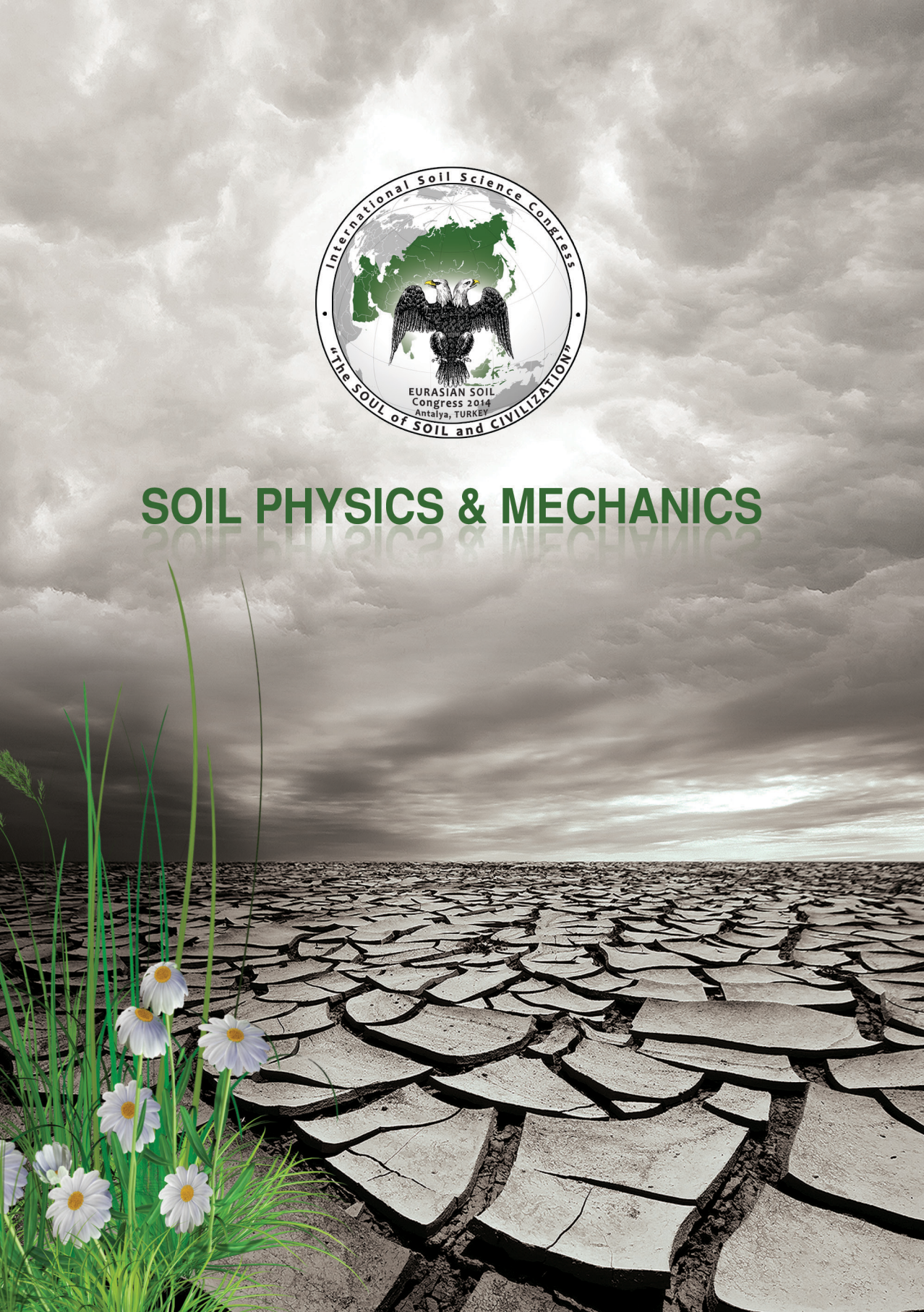

9th International Soil Science Congress on
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14 - 16 October, 2014
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Specialized soil constructions: technologies, properties, functioning

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Abstract

Gardening of urban areas is often connected with formation of a new soil cover named in Russian classification construktozem. During its creation, as usual, soil layers use, which are highly contrasted in the physical and chemical properties such as: sand, peat, soil (lower mineral horizons). Similar layers united in new general soil-constructozem system have new properties and behavior. In 2012, 28 soil constructozems designs of a different structure were created on the territory of the Moscow State University and were sowed by grassy vegetation of *Festuca Rubra* and *Olium Perenne*. At all constructions identical conditions were supported. Regular researches of physical and chemical properties and behavior of soils were conducted. It was established that specifications of the structure of the soil profile significantly influenced on the growth and development of the plants. Humates and pollutants have had a great influence on biomass. It is discussed the perspectives of formation and evolution soil-constructozems by the long-time field experiment.

Key words: Soil constructions, physical properties and modes of soils, city gardening, humates.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil architecture and preferential flow formation

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Abstract

The architecture of soils is a spatial organization of soil solid-phase components, forming active soil pore space with hierarchical and functionally differentiated structure and sustainable, varialable, organization. It is formed under the influence of biotic and abiotic factors of the environment. The aim of our experiments was to investigate the relationship soil architecture and preferential flows as a one of the main functional parts of soil architecture. We have conducted experimental studies of soil architecture on different arable and anthropogenically modified soils. We have used different approaches and methods of soil physics: structural-functional approaches, statistical analysis of time-spatial organization of soils and soil cover, methods of visualization of the pore space, our own original methods. It was found that preferential flows are important for the formation and evolution of soil architecture. The sequence of soil horizons forms the water and thermal regimes and soil productivity. Preferential pathways and cutain complex on the surface of the soil peds and aggregates contribute to the sustainable functioning of soil architecture.

Key words: Soil architecture, preferential flow, spatial organization of soil, soil structure, soil morphology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil water retention and structure stability as affected by water quality

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Abstract

In arid and semi-arid zones with a short water resources studying the effects of water quality on soil water retention and structure is important for the development of effective soil and water conservation and management practices. Three water qualities (electrical conductivity, EC ~ 2, 100 and 500 µS cm^{-1} with a low SAR representing rain, canal-runoff and irrigation water respectively) and semi-arid loam and clay soils were tested to evaluate an effect of soil texture and water quality on water retention, and aggregate and structure stability using the high energy moisture characteristic (HEMC) method. The water retention curves obtained by the HEMC method were characterized by the modified van Genuchten (1980) model that provides (i) model parameters α and n, which represent the location (of the inflection point) and the steepness of the S-shaped water retention curve respectively, and (ii) a volume of drainable pores (VDP), which is an indicator for the quantity of water released by the tested sample over the range of suction studied, and modal suction (MS), which corresponds to the most frequent pore sizes, and soil structure index, SI =VDP/MS. Generally (i) treatments significantly affected the shape of the water retention curves (α and n) and (ii) contribution of soil type, water EC, and wetting rate and their interaction had considerable effect on the stability induces and model parameters. Most of changes due to the water quality and wetting condition were in the range of matric potential (ψ), 1.2-2.4; and 2.4-5.0 J kg^{-1} (pore size 125-250 µm and 60-125 µm). The VDP, SI and α increased, and MS and n decreased with the increase in clay content, water EC and the decrease in rate of aggregate wetting. The SI increased exponentially with the increase in VDP, and with the decrease in MS. Contribution of water EC on stability indices and model parameters was not linear and was soil dependent, and could be more valuable at medium water EC. Effect of wetting rate was more pronounced at low water EC. Results indicate that effectiveness of water EC in the field condition has no simple outcome on water retention soil structure and, and that its application should consider and be adjusted to soil properties and condition, such as soil texture, and moisture content and solution EC. Detailed contribution of treatments on structure induces and model parameters are discussed in the paper.

Key words: Water retention, water quality, aggregate and structure stability, van Genuchten model.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil state perturbations as an input for Ensemble Prediction System (EPS) forecasts

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Abstract

In the beginning of numerical weather forecasts Ensemble Prediction System (EPS) was designated to accompany deterministic predictions and to present a wide spectrum of possible scenarios. As model(s) resolution increase many of weather phenomena are becoming increasingly stochastic in nature. Thus, the significance of ensemble forecasts is now greater than ever. Perturbations of the lower boundary state (namely conditions of soil and the boundary between soil and lower atmosphere) applied to EPS are also assumed to play an important role at any resolution. So far, however, uncertainties of surface condition are rarely considered in EPSs, although its importance has been shown in various surveys. In order to implement techniques for the perturbation of the soil state, the sensitivity of a model to different soil moisture and temperature initializations should be verified. At Institute of Meteorology and Water Management an analysis of the influence of various COSMO (Consortium for Small-Scale Modeling) meteorological model set-ups (parameter configurations, numerical schemes, physical parameterizations etc.) combined with simple changes of the selected soil-related model parameters (like surface-area index or depth of the last hydrological active soil layer) was carried out to test the sensitivity to the soil parameters and detect the more or the less significant ones. Subsequently further sensitivity tests were performed to judge a more detailed selection among the numerous configurations and for assessing e.g. the spatio-temporal variability of the amplitude of the perturbations. Outcome of this study – results of statistical analysis - are presented in the current paper.

Key words: Meteorological model, Ensemble Prediction System, soil processes, numerical weather forecast, sensitivity to perturbation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spectral estimation of soil water content in visible and near infra-red range

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Abstract

Soils can be examined on the basis of spectral data, using such methods with which the reflected radiation can be divided into a large number of (several hundreds) small spectral channel (some nm). Based on the spectral characteristics of the soils, or the different index numbers calculated from hyperspectral data water content of soils can be well characterized. The examined soil samples were coming from different apple orchards of which soils had different physical characteristics (sandy loamy and clay). The goals of my experiments were the evaluation of spectral measurement method for soil content detection, and to carry out algorithms for fast field scale spectral evaluation of different soil water content. The spectral measuring was carried out by laboratory scale AvaSpec 2048 spectrometer at 400 – 1000 nm wavelength interval with 0.6 nm spectral resolutions and by ASD FieldSpec Junior at 350 – 2500 nm. After drying, dry soil samples were watered by 2.5 m/m% till maximal saturation, and each wetting was measured spectrally. Based on spectral properties, reflectances were decreased in the whole spectral range within the continuous wetting due to the high absorption characteristics of water. Based on principal component analysis most water sensitive spectral ranges were selected, and based on regression such algorithms were created, with which the water content can be detectable in the certain soil. The algorithms can facilitate farmers for irrigation scheduling of their orchards. These results can also be utilizable in precision water management, since it can be a basis for such integrated active sensors with LED or laser light source, measuring reflectance at the certain spectral range, which can facilitate real time water status assessment of orchards.

Key words: Water content, spectral information.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil salinization and sodisation in the irrigated perimeter of Mina (northwest Algeria). Diagnosis by combined measurements of electromagnetic and saturated hydraulic conductivities

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Abstract

Abiotic constraints of drought and salinity are common causes some land degradations in arid and semi-arid areas characterized by low and irregular rainfall and long drought periods. In Algeria, 95% of the country area is characterized by arid and semi-arid climate. Under these conditions, soil salinization combined to sodisation often causes not only a reduction in crop yields but also a reduction in arable land by degradation. Thus, both abiotic constraints pose a threat to a food balance of affected areas. In Algeria, salinity and sodicity affect more than 15 % of total irrigated area. The irrigated perimeter of Mina located 350 km west of Algiers is one of the most affected by salinization and sodisation and occupies nearly of 10 600 hectares. In this study, we performed the diagnosis of contamination state by salinity and sodicity of a parcel of 17 hectares, which is among the most contaminated of the perimeter. This analysis is based on combined measure of electromagnetic conductivity (EMC) and saturated hydraulic conductivity (SHC). The Electromagnetic conductivity measured in situ according to a systematic mesh (30 x 25 meters), had permit to deduce by correlation with some soil samples and by processing with ArcGIS, some maps. These latter relates the electrical conductivity of the saturated paste extract of soil (ECspe), pH, soluble cations and anions and SAR. Total salinity map shows that 98 % of studied area has ECspe > 8 $dS.m^{-1}$. SAR map combined to the saturated hydraulic conductivity data, shows that the site is weakly affected by sodicity (SAR < 13, SHC = 0,4 to 1,8 $cm.h^{-1}$). In this case, it is not advised to produce salt-sensitive crops. For that soils physical properties be not affected by clay deflocculation phenomenon (clay rate 10 to 60%), it should opt for sustainable management solutions specifically preventive. Like non-destructive method, this approach to diagnosis salinization and sodisation state of soils, seems advantageous in cost and time. It allows mapping various parameters indicator of salinity and sodicity on large areas in arid and semi-arid. In this case, the analysis can be distributed seasonally in time for determining salinity and sodicity thresholds variations in soil profiles and be able to intervene by an optimized hydro-agricultural sustainable management.

Key words: Salinity and sodicity, irrigated perimeter, electromagnetic conductivity, saturated hydraulic conductivity, SAR.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of manure on organic carbon contents and fractal dimensions of

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Abstract

Effects of farmyard manure treatments on some soil structural parameters such as, aggregate stability (AS), geometric mean weight (GMWD) and mean weight (MWD) diameters, fragmentation (D) and mass (D_m) fractal dimensions, bulk density (BD) and organic carbon (OC) contents of aggregates were determined in a clay soil. Application of 67 Mg ha^{-1} farmyard manure to Vertic Haplustoll soil decreased AS 8.0% compared with the control. Manure treatment increased the proportion of microaggregates in the fractions <0.5 mm in size and decreased the proportion of macroaggregates in the fractions >1.00 mm in size. While OC contents of aggregates increased between 22.8 and 123.4%, BD values decreased between 0.8 and 16.6% with the manure treatment. Fragmentation (D) and mass (D_m) fractal dimensions were increased with decreasing numbers of macroaggregates of the clay soil. GMWD (1.16 mm) and MWD (1.86 mm) obtained in the manure treatment were lower than that in the control treatment (1.20 mm and 1.95 mm, respectively). Although OC content of the aggregates increased with the manure treatment, the number of macroaggregates of clay soil decreased with increasing AS.

Key words: Manure, aggregation, fractal dimensions, organic carbon.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Prediction of specific surface area of soils using pedotransfer functions

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Abstract

This study was carried out to predict specific surface areas of soils in different agricultural fields. Specific surface areas (SSA) of 150 surface soils changed between 43.68 and 268.13 m^2/g. Specific surface area gave a significant positive correlation with clay and significant negative correlations with sand and silt contents. Clay fraction among the soil physical properties showed the highest direct effect (50.10%) on SSA of soils. On the other hand cation exchange capacity (CEC) among the chemical properties gave the highest correlation with SSA and had the highest direct effect (95.14%) on it. SSA of soils, having significant correlations with clay, organic matter, EC, CEC and exchangeable Ca, K, and Mg contents, can be predicted by the equation derived using these properties of agricultural soils.

Key words: Specific surface area, soil physical and chemical properties, pedotransfer functions

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimating soil moisture status in peach tree orchards by using crop water stress index

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Abstract

The objective of this paper is to estimate volumetric soil moisture status by using crop water stress index (CWSI) in a peach orchard for irrigation scheduling. The paper examined the spatial distribution of tree canopy temperature (Tc) using thermal images. The variation of Tc was investigated in three irrigation regime treatments (factor A) that produced various soil moisture content (SMC) values, three cardinal points (factor B): South, North and East-West aspects combined, and five up-down vertical position measurements (factor C: upper, middle upper, middle, middle lower and lower) across the tree canopy thermal images. It was found that Tc was significantly influenced by the irrigation regime. Cardinal point showed a significant Tc difference between South on the one hand and the others. The vertical position within canopy image did not significantly influence Tc. The standard errors of the estimate (SEE) between measured and estimated SMC values range from 1.7 to about 2.2 % of volume. These values essentially show the approximate size of SMC. However, this method can be promising if it is improved by reducing differences between the conditions of determining CWSI and farming conditions. Consequently, the method could be used in orchard regions or countries with similar soil and climate conditions.

Key words: Chernozem, semi-arid, sunlit & shady leaves, vapor pressure deficit, water management.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of pumice on water retention capacity in soil, growth and yield of spring safflower in dryland conditions

Davoud Zarehaghi *

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Abstract

Application of superabsorbent material is one of the new methods for moisture storage in the soil. This research was performed in the Khajeh research station on the basis of randomized complete block design with three replications in the plots with dimension of 4×5 for investigate the effect of different amounts of pumice on water retention capacity in the soil, growth and of spring safflower in rainfed condition. Experimental treatments were five levels of pumice (A: zero, B: 5, C: 10, D: 15 and E: 50 ton ha-1). Before cultivation, amounts of pumice calculated for each plot and then mixed with soil to depth of 20 cm. Then, cultivation was performed in the seeding and the number of germinated seeds at first ten days of cultivation was determined. Soil volumetric water content and plant height was measured at various times during growth season, 1000 grain weight and grain yield of safflower was measured in the end of growth season. The results showed that application of pumice in the soil led to significant increase ($P < 0.01$) in volumetric water content, germination, 1000 grain weight and grain yield. So adding pumice soil improves soil physical conditions (total porosity, water retention capacity of the soil and prevent the formation of crust on the soil surface) that it leads to increase in growth and yield of plants.

Key words: Crust, pumice, safflower, volumetric water content.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination moisture stress pistachio tree by using sap flow measurement

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Abstract

Traditionally, methods to estimate irrigation needs and scheduling worldwide have been based on soil measurements and meteorological data. However, they do not take into account plant responses to water deficit and over- irrigation. Both methods do not reflect accurately the actual water status or uptake by the plant. To determine the onset of water stress on pistachio tree, by using the monitoring sap velocity ,the field experiment were conducted on pistachio tree (11 years old), in the agricultural and natural resources research center, East Azerbaijan, Iran. The moisture of one plot (including one tree), were retained at field capacity in the depth of 0 to 50 cm during the experiment. In other plot (including one tree), the soil was saturated in the depth of 0 to 50 cm and allowed to reduce the soil moisture to the permanent wilting point and lower. The velocity of sap flow was determined in two trees. The first steps of the experiments were continued until the differences between the sap flow velocities of two treatments were appeared. Then second round of experiment started. Sixteenth day of in the first repeat and fifteenth day of at the second repeat, the difference between the two treatments was apparent in the sap velocity. Soil moisture were 8.7% and 8% in these days, respectively. The results showed that nearly, close to 8% volumetric moisture, precedes deficit water for pistachio tree.

Key words: Crust, pumice, safflower, volumetric water content.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Use of rain water harvesting systems at increase soil moisture and pistachio seedling growth

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Abstract

Rain water harvesting method utilized for the development of surface water resources in dry regions. By which, water can be provided for domestic, livestock and small-scale agriculture. Precipitation collected and stored by water harvesting systems, and then be used in many ways. To evaluate the impact of the systems of rainwater harvesting puddles on the soil moisture and seedling growth, experimental in a randomized complete block design with four treatments and three replications during the years 1388 and 1389 in Khaja research station in East Azerbaijan province, was designed and implemented. The different treatments within each plot pit (watershed system levels) were performed. Treatments were: Control, in this treatment, the pit drilled was filled only with soil obtained thereof. Treatment B, inside pit drilled this treatment mix of perlite; composted organic matter and soil, with volumetric ratio of 1-1-2 were filled. Treatment C, at pit drilled, three pottery jug (diameter 10 and height 70 cm) at three-point with equal interval inward pit was installed. In treatment D, two columns of gravel in the vicinity of pit drilled with distance of 10 cm from the wall, was created. At pit all treatments, planted a pistachio seedling and also, a pair TDR sensor to measure soil moisture were placed. The results showed that soil moisture storage compared to control, significantly were increased. Comparison of average volumetric moisture content of at treatments in both years showed that gravel treatment (treatment D) had stored the highest moisture content and subsequently were jug(treatment C) , perlite (treatment B) and control treatment. Also, the impact of treatments on pistachio plant height, leaf area and collar diameter, was significant ($p<0.01$). Maximum seedling height, collar diameter and leaves area related to the gravel treatment and lowest they related to control.

Key words: Pistachio, Rain water harvesting, soil moisture storage.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Features of functioning permafrost soils in Cryolitozone

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Abstract

In most parts of Eastern Siberia widely developed the so-called frozen soils, the functioning of which has no analogues in the world. This is mainly due to the omnipresence of the low-temperature permafrost here, have a direct impact on the formation of specific hydrothermal regime, physical and chemical properties of soils. Regional feature of the functioning of permafrost soils is primarily due to a kind of redistribution of solar radiation flux coming directly into the soil, as some of it is spent on the process of seasonal thawing, ie by increasing the temperature to values in the range of positive active layer, and a rise in temperature within the negative deep-layer. As a result of this redistribution of solar radiation heat flux directly consumed in the warm-layer is significantly reduced, which is the main reason for the low thermal conditions of permafrost soils compared with soils of temperate latitudes. And throughout all the long cold period, starting from late October to mid-May (in the northern regions) and from late September until June (in the central regions) in the soil profile is established stable negative temperature. Naturally, in such low thermal resources flowing all biochemical, biological and physico-chemical processes slows. This situation is exacerbated by the fact that during freezing of soil moisture vertical shifts occur a certain part of the soil mass, within the seasonally thawed layer. Therefore, the character of the soil processes depends mainly from the seasonally thawed layer, because the formation of heat and water is closely related (in many cases directly) with this parameter. On the other hand, the value-layer on the flat territory, particularly in Yakutia has zonal character, ie from north to south there is a gradual increase in its capacity. In this case there is a general pattern that with the seasonally thawed layer direct influence on the course of the permafrost soil-forming processes decays.

Key words: Soil, permafrost, biochemistry, cryolitozone, soil physics, ecology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Rheological properties of different minerals and clay soils

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Abstract

The rheological properties of kaolinite, montmorillonite, ferralitic soil of the humid subtropics (Norfolk island, southwest of Oceania), the alluvial clay soil of arid subtropics (Konya province, Turkey) and carbonate loess loam of Russian forest-steppe zone were defined. A parallel plate rheometer MCR-302 (Anton Paar, Austria) has been used to conduct amplitude sweep test. Rheological properties allow quantitative assessment of structural bonds and estimation of structural resistance to a mechanical impact. Measurements were carried out on previously pounded and capillary humidified during last 24 hours samples. In an amplitude sweep method the analyzed sample is placed between two plates. The upper plate makes oscillating motions with gradually extending amplitude. Software of the device allows receipt of several rheological parameters, such as elastic modulus (G', Pa), viscosity modulus (G", Pa), viscoelasticity range (G'>>G"), point of destruction of structure at which the elastic modulus becomes equal to the viscosity modulus (G'=G"- crossover). It has been found that in the elastic behavior at G '>> G " strength of structural links of kaolinite, alluvial clay soil and loess loam constitutes one order of 10^5 Pa. Montmorillonit has a minimum strength - 10^4 Pa and ferrallitic soil of Norfolk island has a maximum strength -10^6 Pa. At the same time, montmorillonite is characterized by the greatest plasticity. Destruction of its structure (G '= G") takes place only when strain reaches 11%. Ferrallitic soil structure is destroyed at 8% strain, kaolinite at 5% and an alluvial clay soil and loess loam at 4.5%.

Key words: Soil mechanics, soil structure, rheology, storage modulus, loss modulus, linear viscoelastic range, crossover.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of amplitude sweep test on rheometer MCR-302 for determine rheological properties of chernozems various land use

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Abstract

Studying of rheological behavior of soils is an important aspect for an assessment of stability of natural complexes to anthropogenous influence. A parallel plate rheometer MCR-302 (Anton Paar, Austria) has been used to conduct amplitude sweep test. Rheological properties allow quantitative assessment of structural bonds and estimation of structural resistance to a mechanical impact. The top layer 0-10 cm of silty clay typical chernozems from native steppe, bare fallow soil, plowed twice a year since 1947 and oak forest of State Central Chernozem Reserve (Streletzkaya Steppe, Kursk, Russia) and from agricultural arable land and adjacent forest belt were used. Highest concentration of soil organic carbon (SOC) was detected in native steppe and the lowest - in bare fallow. The elastic (storage) modulus of the virgin steppe chernozem and of soil from oak forest is more than elastic modulus of arable soils. The elastic modulus of the soil of a forest belt occupies the intermediate value. The range of the linear viscoelasticity in soils of the virgin steppe and oak forest is almost twice more larger, than for soils of a forest belt, an arable land and the bare fallow soil. Destruction of soil structure of virgin steppe comes at 12% deformation, of soils from oak forest and from forest belts at 5 and 6,5%, and of soils from bare fallow and arable land at only 2% deformation. Significant differences in structural conditions have been observed between samples of virgin soils (Forest Belt, Oak Forest, and Native Steppe) and those of land use plots that were exposed to anthropogenic influence. Strengthening of the structural bonds is supported by SOC accumulation in virgin soils.

Key words: Chernozem, soil mechanics, soil structure, rheology, storage modulus, linear viscoelastic range, organic carbon.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect evaluation of selected calculation model on particle size distribution using laser diffraction

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Abstract

Nowadays, laser diffraction stands for fast and repeatable method of soil texture analysis. Two different models are used for calculation of particle size distribution: the Fraunhofer and Mie model. The first assumes a complete diffraction of laser beams and thus no knowledge on the optical properties of examined soil is required. To estimate the particle size distribution using Mie model, that takes into account diffraction, transmission and absorption, refraction and absorption indices of the soil must be known. This paper describes the effect of Mie and Fraunhofer calculation model on the particle size distribution. The comparison is based on various combinations of refractive and absorption indices. Since most of the current laser particle sizers work with a laser wavelength of 500 up to 700 nm the usage limit of methods ranges from 0.5 to 0.7 µm. However, the decision of which method to use depends not only on particle size but also on heterogeneity of the sample material and the particular application. Four samples of light and medium fine soil from the Nitra River catchment in Slovakia were used for analysis and the distribution of particle size fractions was determined according to USDA classification. The analyses were conducted using ANALYSETTE22 MicroTec plus particle sizer (FRITSCH, Oberstein, Germany) that performed measurements in the range from 0.08 up to 2000 µm and the measured data were processed and evaluated in the software MaS control and Microsoft Excel, respectively. After reviewing the available literature on particle size distribution determined by various devices applying laser diffraction principle, the effect of refractive and absorption indices on particle size distribution was tested in the range from 1.3 to 1.8, respectively from 0.001 to 0.2. Generally, higher clay content in samples was estimated when using Mie calculation model. Low value of refractive index (1.3) resulted in very significant increase of clay fraction. Less of clay fraction was estimated for those combinations when the absorption index was lower than 0,008 and the refractive index higher than 1.5, respectively. When using the refractive index equal to 1.5, absorption indices in the range 0.1 – 0.2 resulted in very similar estimates in comparison to Fraunhofer model. At such a setting, the change of refractive indices did not have a significant effect on the distribution of particle size fractions. In the contrary, when using very low values of absorption index, the course of this distribution altered significantly with the tendency to isolate the size fractions into higher amount of individual peaks.

Key words: Particle size analysis, laser diffraction, Mie model, Fraunhofer model, refraction index, absorption index

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Herbicide fate and transport in soil influenced by different irrigation management strategies

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Abstract

Herbicide use in agro ecosystems can undesirably impact soil and groundwater quality via chemical leaching. Thus, applying accurate and efficient management strategies for herbicide application, to reduce soil and groundwater resources contamination is necessary. Few studies have investigated the timing of initial irrigation effects after chemical application on herbicide transport and degradation. The objective of this study was to investigate the effects of timing of initial irrigation (0 h Delay vs 24 h Delay) on metribuzin (4-amino-6-*tert*-butyl-4,5-dihydro-3-methyltio-1,2,4-triazin-5-one) transport and degradation at a field site with silt loam soil. Herbicide was applied to 6 plots. Half of the plots received irrigation water immediately after chemical application and the remaining plots were irrigated after a 24 h Delay. Using multi-stage sampling, transport and degradation of metribuzin were determined at different soil depths. The results show, at 20 day after pesticide application, metribuzin was detected 0.4 m deeper in the 0-h irrigation Delay treatment compared to the 24-h Delay treatment. Moreover when the initial irrigation was delayed for 24 h, a 30% increase in metribuzin degradation occurred. A possible reason for this result is the potential higher degradation of metribuzin when it diffuses into soil pores and remains at surface layer of soil when irrigation water is delayed for 24 h at initiation of the experiment.

Key words: Metribuzin, degradation, transport, irrigation delay.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Variability of moisture regime of clayey soils in normal years for Sofia region

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Abstract

The objective of this study is to evaluate the temporal variability of soil moisture regime of clayey soils (Deluvial meadow soil and Vertisol) in the region of Sofia. The soil moisture regime is classified according to Soil Taxonomy (Soil survey staff. 2010) using the model of Newhall (1972) for each year of the period 1952-2012. Soil moisture control sections of Deluvial meadow soil and Vertisol are between 15 and 45 cm. Model simulations in selected years are compared with measurements of soil water regimes of Deluvial meadow soil in the experimental field Gorni Lozen, Sofia region. The results show good coincidence between measured and simulated moisture status of soil control section. The year corresponding to the mean long-term annual precipitation is with Ustic type soil moisture regime. This type occurred with lower frequency than the other established types – Xeric and Udic in the studied periods. Normal years according to Soil Taxonomy criteria are 63% of the whole sixty years period, 83% of the period 1961-1990 (contemporary climate period according to WMO) and 70% of the period 1980-2012 (recent long-term period). The frequency of the moisture regimes in normal years of the periods 1952-2012 and 1961-1990, are as follows: 29 and 32% - Udic, 34 and 32% - Ustic, 37 and 36% - Xeric, correspondingly. During the last period (1980-2012), the frequency of Xeric regimes in normal years increases up to 52% on account of Ustic type, which diminishes down to 17%.The incidence of Udic years is about 1/3 of all normal years, regardless of the period used for calculation. The driest year for the whole period is 2000 year, classified as Aridic. The results show that soil moisture regime varies significantly through the years in the region of Sofia and it is not possible to point out the dominant one even in normal years. The obtained information is useful for detecting climate trends and for soil management decisions.

Key words: Soil moisture regime, climate variability, Newhall Model, Deluvial meadow soils, Vertisols, Sofia region.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Conceptual model of water stable soil aggregate

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Abstract

Water stability of the aggregate structure is directly related to the surface properties of elementary soil particles (ESP) in the solid phase (SP) of the soil. In the case of ESP hydrophilicity, water flows through the capillaries in the dry aggregate and leads to increase of water pressure in the aggregate and to destruct it. When ESP are hydrophobic, water and ions cannot get into the aggregate, and the "dead space" is created. Two forms of organic substances determine ESP architecture of soil aggregate and a combination of hydrophilic and hydrophobic surface properties of SP. Organic compounds adsorbed on the surface of mineral ESP provide film moisture migration, and hydrophobic organic ESP localized in the pore space of the aggregate, operate the water repellent function and prevent the rapid migration of capillary moisture in the soil pore space.

Key words: Soil structure, aggregate, soil organic matter, hydrophilic and hydrophobic properties of the soil solid phase.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soils of Russia as an object of tomographic studies

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Abstract

In Russia, tomographic soil studies began in 2011 in the Laboratory of Soil Physics of the V.V. Dokuchaev Soil Science Institute of the Russian Academy of Agricultural Sciences. 3D images of soil structure and soil pore space in different horizons of soddy-podzolic and gray forest soils have been obtained on a SkyScan 1172 microtomograph with a resolution of 15.8 μm. New methodological works on a detailed comparison of the tomographic method and classical micromorphological descriptions of soil thin sections have been initiated. The nearest goals of tomographic studies include visualization of pore and aggregate structure of model soil samples; determination of major diagnostic characteristic of soil pores and aggregates important for predicting soil physical properties in 2D and 3D images; numerical modeling of soil hydrophysical properties on the basis of microtomographic data; development of the methods of description of soil structure and prediction of soil structural properties; development of numerical methods to analyze structural differences of soils with the help of the local porosity theory.

Key words: Tomographic soil studies, micromorphological description, visualization of pore space.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Tomographic studies of the soil pore space in swelling and shrinkage processes

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Abstract

Modern scanners allow us to investigate the pore space of the soil with soil water content changes, ie to study the characteristics of pore structure transformation during the swelling and shrinkage. In the field, in special cylindrical containers height 3.8 cm, diameter 3.2 cm samples were taken from basic horizons of sod-podzolic soil with natural moisture. Samples were examined on a SkyScan 1172 microtomograph with a resolution of 15.8 µm. Then the samples were saturated to field capacity and re- examined in the tomograph. Then the samples were gradually desiccated with water content and structure of the pore space in the tomograph control. Characteristic features of the pore space changes during the swelling from natural moisture to field capacity are: (i) reduction of pore volume primarily due to hairline cracks, threadlike linear forms. Pores rounded, apparently biopores retain its shapeand exemplary dimensions during swelling. Presumably, it is a stable functional pore space, (ii) in the B horizon the width of the fine pores was also reduced, and the pores of rounded shape were also stable. Provides statistics on the characteristics of the shape, squares and other geometric parameters of pores of different soil layers during swelling and shrinkage.

Key words: Tomography, soil pore space, swelling, shrinkage.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes in structural parameters of soils formed on similar conditions but under different cropping systems

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Abstract

Soil structure is one of the most important soil physical characteristics affecting on soil productivity. Structural development of soil is under the control of many inside and outside factors. The objective of this study was to evaluate changes in structural behaviors of soils under different crop management systems. It is expected that soil structural characteristics change with changes in plant pattern because of differentiations in agronomic properties, root system and amounts of organic matter incorporated into the soil. Soil samples collected from the Agricultural Farmland of Ataturk University-Agricultural Faculty under different plant management systems; sun flower, wheat, beans, corn, potatoes and alfalfa, were analyzed for physical, chemical and mechanical properties and structural characteristics were evaluated based upon plant patterns. The results indicated that soil structural characteristics significantly changed depending on plant patterns. The best structural conditions and aggregate stability (0,25 - 4 mm) were obtained in soils under alfalfa crops (A.S: % 77,41), but the worst structural conditions in soils under potatoes (A.S: % 35,28) and corn (A.S: % 38,42) production.

Key words: Soil structure, aggregate stability, cropping pattern.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of climate change on soil moisture in Aydın region and simulation by SWAP model

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Abstract

This study has focused on soil moisture of agricultural lands which affected by environmental effects of climate change due to global warming. The climate change, especially rainfall and temperature, may cause significant changes on the surface and ground water resources and amount of moisture stored in soil. In this context, this study targeted to study effects of climate change on soil moisture and likely climate changes that may occur in the Mediterranean basin. According to the possible changes foreseen in the future, some climate change scenario analyses were performed by an agro hydrological model. SWAP model was used with the data set of soil-climate and vegetation. During the summer cultivation period in the province of Aydın, the soil moisture was monitored according to soil properties of the layers in a selected area on an alluvial soil. Then, soil moisture balance on the basis of point measurements were simulated based on the soil conditions at a plot in selected area. According to the results from scenario analysis, it was estimated that the evaporation from soil and transpiration from plants will increase potentially and there will be a water movement upward from high water table to the root zone to meet this increasing demand.

Key words: Aydın, climate change, soil moisture, SWAP model.

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Soil physics in COSMO numerical meteorological model

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Abstract

With the increased resolution of the computational mesh (horizontal grid size down to 2,8 km) used in the current version of COSMO model, the existing soil parameterization schemes have to be significantly improved. Institute of Meteorology and Water Management - National Research Institute (IMWM-NRI) have collaborated with the Institute of Agrophysics Polish Academy of Science (IA-PAS) since August 2012 and started a new project entitled "New approach to parameterization of physical processes in soil in numerical model". Basing on recent theoretical and experimental analysis of the overhaul physical phenomena in soil the new set of parameterizations is being developed, taking into consideration various physical and microphysical processes in soil (including fluid dynamics in porous media, soil dynamics, water cycle in soil and soil–plant–water interaction). At the moment we are working on parameterization of bare soil evaporation, on vertical and horizontal soil water transport and runoff from soil layers. The preliminary results from new mathematical formulation of bare soil evaporation implemented in COSMO model will be presented. We have also improved theoretical description of vertical soil water transport (mainly temperature dependency of hydraulic diffusivity) to test it in next stage of the study. During the 9th International Soil Science Congress on "The Soul of Soil and Civilization" we will present our preliminary results, future plans and directions. While the current results are promising, the additional improvements are still required. In the nearest future it is planned to combine our new approach with TILE and MOSAIC parameterizations available in the TERRA model, and to use data received from IA-PAS field experiments and from Satellite Remote Sensing Center in soil-related COSMO model numerical experiments.

Key words: Parameterization soil processes in numerical model, bare soil evaporation, fluid dynamics in porous media, vertical soil water transport.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Predicting saturated hydraulic conductivity by soil parameters and morphological properties

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Abstract

Numerous of studies have been conducted to describe soil saturated hydraulic conductivity (Ks) by readily available soil properties such as bulk density, texture, porosity, pore-size distribution, and so on. However, although soil morphological properties have a strong effect on Ks, studies targeting at describing relation between Ks and soil morphological properties such as type, size, and strength of soil structure; type, orientation and quantity of soil pores and roots; consistency; plasticity; and so on, are rare. This study aimed at evaluating soil morphological properties along with soil parametric properties to predict Ks. Undisturbed soil samples were collected with plastic soil samplers (15 cm length and 8.0 cm id.) from topsoil (0-20 cm) and subsoil (20-40 cm) at sixty randomly chosen sampling locations (120 soil columns). Synchronous disturbed soil samples were taken for basic soil analyses. Saturated hydraulic conductivity was measured on the soil columns using constant-head permeameter. Following the Ks measurements, the soils were disturbed and soil morphological properties of soil color, soil structure, pores, roots, consistency, and plasticity were described by standard soil description charts used in soil survey studies. In addition, soil texture, percent gravel, bulk density, pH, field capacity, and wilting point were measured on the soil samples. The measured Ks values were correlated to soil parametric and morphological properties by multiple linear regressions. Percent gravel, COLE index, clay content, consistency, and plasticity significantly correlated to Ks. Soil morphological properties, readily available in soil survey databases, may be used along basic soil properties in predicting soil dynamic processes.

Key words: Saturated hydraulic conductivity, COLE, percent gravel, consistency, plasticity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Comparison of the methods for soil moisture retention characteristics regarding the soil texture and the various moisture ranges

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Abstract

For many years, the sand box-pressure plate apparatus are widely accepted as a reference laboratory procedure to characterize soil water retention curve (SWRC). Alternative methods for the determination of SWRC, including evaporation method (EP) were introduced to overcome the shortcomings of the sand box-pressure plate method. Eight (-5, -10, -33, -100, -400, -700,-1000 and -1500 kPa) water retention data points were obtained from sand box-pressure plate apparatus for 130 undisturbed soil samples. Later, dried and sieved soil materials were packed in rings (5x7 cm) according to their bulk densities. Evaporation measurements were performed with the commercial apparatus HYPROP. SWRCs were compared in regard to soil texture (coarse, medium and fine) and pressure ranges (low, medium and high). Estimated curves were also prepared from van Genuchten parameters computed from both methods separately. EP method measured high moisture content in all the soils at low suction ranges, although the difference between the methods was small for fine textured soils, comparing with the others. The good agreement of the curves of both methods is remarkable for all the soils at the medium and the high suction ranges. Estimated SWRC with both methods agreed well for fine and medium textured soils, but, as the sand content increased different figures obtained especially at the very low and high suction ranges.

Key words: Curve fitting, suction, soil water retention, texture, suction.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil compaction affected by the periodic field traffic at the farming of sugarbeet

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Abstract

Soil compaction soils the volumetric variation, as well as natural events that arise during the wetting-drying soil tillage and intensive use of machinery such as internal forces or external mechanical forces occur. Not suitable unavailability the physical conditions of the soil; soil water, soil temperature, etc. A negative impact in terms of features bring about seed germination and growth. This effect is to block root growth and shoot a mechanical cause to exit. The most important factor that is causing shell prevented the mechanical environment of the earth like a layer of under the surface of the earth, and the resulting soil compaction depth of processing, such as plow base. Agricultural techniques, the use of the unconscious, the 2nd to get more efficiency of agricultural lands Increased tillage, increased traffic-intensive field, soil organic matter gradually impoverishment and structural degradation suffered structural deterioration of the structure and aggregation, the formation of a layer of the shell surface and increases soil compaction. As a result of this potential land productivity is reduced significantly. In this study, the effect of sugarbeet agriculture in 3 different time period measured and compared with field traffic to compaction the soil.

Key words: Soil compaction, sugarbeet, field traffic, penetration resistance.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Investigating soil temperature variability and thermal diffusivity in grass cowered and shaded areas by trees

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Abstract

Changes in the soil temperature conditions are one of the most important components of soil microclimate and have a considerable impact on changes in soil properties and plant development processes. In this research, soil temperature and thermal diffusivity values were determined at two different fields which are grass covered and shaded areas by peach trees. Theoretical soil temperature values obtained from the solution of thermal conductivity equation were compared to experimental soil temperature values. Field studies were carried out on a farm field in Turkey, Samsun, Çarşamba Country, Yesilırmak neighborhood (36° 43.380' to the East, 41° 13.061' to the North) between August and September of 2011. Mean soil temperatures at the first experimental field covered by grass at 7^{00}, 12^{00}, 18^{00} hours were determined as 19.5°C; 28.4°C; 23.4°C at the soil surface, 20.2°C; 26.9°C; 23.3°C at 10 cm, 20.7°C; 26.0°C; 23.1°C at 20 cm, 21.1°C; 25.3°C, 22.9°C at 30 cm and 21.4°C; 24.9°C; 22.9°C at 40 cm soil depth, respectively. Mean soil temperatures at the second experimental field shaded by peach trees at 7^{00}, 12^{00}, 18^{00} hours were determined as 19.4°C; 24.7°C; 22.5°C at the soil surface, 20.3°C; 24.5°C; 22.7°C at 10 cm, 20.8°C; 24.1°C; 22.6°C at 20 cm, 21.1°C; 23.7°C; 22.4°C at 30 cm and 21.0°C; 23.5°C; 22.2°C at 40 cm soil depth, respectively. Mean thermal diffusivity in the 1st experimental field from 0 to 40 cm soil layer were 0.460 $cm^2 s^{-1}$; 0.029 $cm^2 s^{-1}$ and 0.167 $sm^2 s^{-1}$ at 7^{00}, 12^{00} and 18^{00} hours, respectively. Mean thermal diffusivity in the 2nd experimental field from 0 to 40 cm soil layer were 0.234 $cm^2 s^{-1}$; 0.115 $cm^2 s^{-1}$ and 1.677 $cm^2 s^{-1}$at 7^{00}, 12^{00} and 18^{00} hours, respectively. The mean relative error between the estimated results using the solution of heat conductivity equation and the experimental temperature measurements was 0.089 at the soil surface and 0.055 at 20 cm soil depth. Comparison of the experimental temperature measurements to estimated temperature values showed that the initial unconditional solution of the heat conductivity equation in a short period (≤ 3 days) gives much better periodic thermal changes on the soil surface and in soil layers.

Key words: soil temperature, thermal diffusivity, heat conductivity equation, measured and estimated temperatures

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Land use and soil texture are the main drivers of soil CO_2 emission response to the climate extremes

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Abstract

The likelihood of heat waves, droughts, flooding, and freezing-thawing events increases according to predictions of global climate changes for the 21st century. Weather extremes can cause direct impacts on carbon fluxes from soils via extreme temperature and moisture conditions. This study was aimed to assess the effect of extreme weather conditions on soil CO_2 emission in various ecosystems of Central Russia over the monthly, seasonal, and annual time scales. Based on observations provided by the Russian meteorological network, we carried out the analysis of medium (28-yr; 1973-2010) and short (14-yr; 1998-2012) climatic trends and estimated weather anomalies for the whole Central Federal district of Russia and separately for Moscow region. The experimental plots for carbon balance observations were located on the south of Moscow region (54°20-55'N, 37°34-37'E). The long-term soil CO_2 emission (E_{soil}) was monitored weekly through 1998-2012 in 5 ecosystems different by land use and soil type (*sandy Albeluvisols* and *loamy Phaeozems*). Our calculations showed more significant increase of aridity during the last 14 yrs in comparison to the 28-yr period both for Central Russia and for area studied. Through the period 1998-2012, every fourth year was found to be extremely dry. The summer 2010 heat wave in Central Russia was the warmest and the longest for the last 3 decades. The enhancement of aridity in the studied area evoked the negative trends of E_{soil} which were more significant in sandy soils in comparison with loamy ones and in agroecosystems versus natural cenosis. The drought effect on annual and seasonal CO_2 fluxes from soils was the most significant. We also found that extreme cold temperatures during November and January, precipitation deficit during the May, summer and autumn droughts induced the negative anomalies of soil CO_2 fluxes while the extremely high air temperature during cold period caused the positive anomalies of soil respiration. Concluding, the land use and soil texture are the main underlying drivers that determine the response of soil respiration to the current climatic changes. Due to the higher water holding capacity, the clay soils are more persistent to the extreme weather conditions than sandy soils. The dominance of more tolerant fungi microflora in the soils of natural ecosystems attributes their weaker sensitivity to climate change comparison with the soils in agroecosystems. This study was supported of RFBR, NSch-6123.2014.4, and Program of Presidium RAS #4.

Key words: Soil organic carbon, mineralization, microbial community, forest ecosystems.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of *Melia volkensii* Agroforestry system on soil – water dynamics, maize performance and biomass

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Abstract

Melia volkensii is a deciduous, open crowned and laxly branched tree with mature tree height ranging between 6 and 20 m tall and dbh of 25 cm. The bark is grey, fairly smooth, furrowing with age. Leaves are a light, bright green, bipinnate with (sub) opposite leaflets, 3-7 per pinna, up to 35 mm long, and are densely hairy when young. *Melia volkensii* (Gurke) is in the family *meliaceae* and is indigenous to Eastern Africa at altitudes of 350-1700m above sea level. The tree is normally found in sandy soils. *Melia volkensii* is one of the most prized and important multipurpose trees producing a range of useful products, especially for communities living in arid and semi-arid areas. This study was conducted in Gachoka division of Mbeere District, eastern Kenya, about 200 km north of Nairobi, at an altitude of 1155 masl in AEZ LM_4. The area receives low rainfall ranging from 600-800 mm, with temperature ranging between 20-32^{0}C. The overall objective of the study was to determine the effect of distance and lopping *Melia volkensii* on Soil water balance, performance and biomass yield of maize within an agro forestry land use system in Mbeere district. The experimental treatments were 7 thus: Lopped trees 0.5 m, lopped trees 1.5m, and lopped trees 2.5 m; unlopped trees 0.5m, unlopped trees 1.5 m and unlopped trees 2.5 m; and No trees with 3 distances thus: 0.5, 1.5 and 2.5 meters from the tree. The treatments were arranged in a randomized split-plot design with Lopped and unlopped trees as the main plots and distances as the sub-plots. Results indicated that soils in the sites were alkaline with low N, K, C and Na content, but high in P levels; textural class: Sandy clay loam, with low CEC and EC; soil classification: Nitorhodic Ferralsols and Cambisols. Further, it was observed that maize height growth increased both in the lopped and unlopped sites. However, severe effects of drought had a significant effect on height growth. Also height growth was significantly higher in the lopped sites attributable to increased light penetration and enhanced photosynthetic activity. There was not significant effect of distance on crop performance in all the sites implying that distance has no effect on crop performance. Biomass production was highest in the lopped site, especially during the second seasons of 2008/2009 and 2009/2010. It was also observed that soil hydraulic conductivity increased with distance, especially for distances 1.5 m and 2.5 m, indicating that distance significantly affected hydraulic conductivity. Soil moisture content was however higher in the unlopped site compared to the lopped site during both periods 2008/2009 and 2009/2010. However, distance did not significantly affect soil moisture content. Further, Soil bulk density increased with distance in the lopped site but the effect was not significant. Generally, bulk density was low in all the sites. In conclusion, it is important to apply nutrient replenishment initiatives like inorganic and organic fertilizers and lopping is an appropriate tree management option within an agro forestry system as it enhances crop productivity. Further, distances significantly affects soil water storage, especially at 1.5 – 2.5 meters and tree-crop interactions could be promoted at these distances. Also Soil moisture content is enhanced at sites with adequate undergrowth/ tree cover.

Key words: *Melia Volkensii*, agroforestry, soil water dynamics, maize performance and biomass.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The investigation of hysteresis and soil compaction on calibration curve of gypsum block

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Abstract

The content and soil moisture capacity depends upon various factors such as soil structure (arrangement of soil). One of the effective factors on soil structure is soil compaction. Based on the change of soil compaction during the year and in various years, the content and soil moisture capacity vary in terms of time. On the other hand, moisture hysteresis has great effect on moisture behavior of soil. In the current study, the effect of hysteresis and soil compaction on calibration curve of gypsum block was investigated. To do this, calibration curve of a gypsum block in one heavy soil (silty clay) in three bulk density (natural in the farm and plus 10% and minus 10%) for two phases of wetting and drying were provided. The results showed that block calibration curve was different in two phases of wetting and drying in different densities. The effect of moisture hysteresis on calibration curve of gypsum block is increased by reducing soil compaction (reducing of bulk density). This is due to the fact that by reducing soil compaction and because of heavy texture of soil, the fine pores - reduced and distribution of soil pores will be more non-uniform. Thus, considering the effect of ink bottle, hysteresis -increased. The effect of soil compaction on gypsum block calibration curve is reverse during drying and wetting such that for specific soil moisture during drying phase, with increasing soil compaction, the electric resistance of the block - reduced. While, during wetting phase by increase of soil compaction, the electrical resistance of the block - increased.

Key words: Gypsum block, hysteresis, soil compaction, soil moisture, bulk density.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Comparative study on the influence of the variation of initials stress on slope stability

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Abstract

The analysis of slope stability is one of the oldest research subjects in the geotechnical engineering field. The modelling of this stability is complex and remains a significant and unfinished research topic. The goal of this work is to study the influence of the variation of the initial stress field on the slope stability by the finite element method. The stability of a slope built with respect to three different configurations will be studied through calculation of the safety factor using the Plaxis software. The first way of creating a slope consists of a progressive loading of the slope weight by a multiplying coefficient, the two other methods, take into account the chronology of the events and consist of realizing cut slopes or fill slopes. Finally a comparison will be made on the results of these studied cases.

Key words: Slope stability, initial stress, finite element method, Plaxis, safety factor.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mechanical properties and damage mechanism of gradient structure earth wall prepared from modified earth based materials

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Abstract

Connected with the development of green energy-saving walls in China rural areas, an entirely new energy-saving composite wall is proposed for the first time on the base of green ecological experience which is exploring from the Chinese traditional earth building. In this paper, saline soil were taken as raw materials to prepare earth based materials, and its microstructure, physical and mechanical properties, water resistance were studied in this paper. Moreover, gradational structure of earth wall was designed, the physical and mechanical properties and damage mechanism of gradient structure earth wall was also analyzed. The results show that the reactivity of saline soil is improved greatly by using compound activators, the stimulation mechanism may be refer to the formation of silicon and aluminum dangling bonds, and associate with the formation of two sets of strength network. The gradational Structure earth-based wall presents a complex function. And more importantly, the mismatching of thermal expand coefficient and the residual stress at the interfacial zone between the layers are greatly decreased. This study not only provides a new technical approach of utilizing of saline soil, but also develops a novel energy saving wall materials for rural areas.

Key words: Saline soil, earth-based materials, modification, gradational structure wall.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The evaluation of Saxton-Rawls method for estimating the soil saturated hydraulic conductivity and soil saturated moisture in paddy soils of Iran

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Abstract

The hydraulic properties of soil and their spatial structure are important for understanding soil moisture dynamics, land surface and subsurface hydrology and contaminant transport. Hydraulic conductivity is one parameter important for estimating movement of water and contaminant dissolved in the water through the soil. These properties are often difficult and time consuming to measure. So, many attempts have been made to predict hydraulic conductivity from soil physical and chemical properties indirectly. The objective of this study was to evaluate the Saxton-Rawls method in the estimating of soil saturated hydraulic conductivity and soil saturated moisture in paddy soil of Iran. In 120 top soil samples, particle size distribution curve, organic carbon, bulk density, saturated hydraulic conductivity and saturation soil moisture were measured. This study developed a new equation from readily available data. This equation compared with Saxton et al. and Saxton-Rawls methods. Accuracy of the methods was evaluated by the coefficient of determination (R2), the root mean square error (RMSE) and mean error (ME). Results show that new equation with maximum coefficient of determination and minimum error was more accurate than other methods.

Key words: Particle size distribution, saturated hydraulic conductivity, Saxton-Rawls, soil moisture.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Canopy temperature for peach tree at various soil water contents

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Abstract

Canopy temperature measurements with infrared thermometry have been extensively studied as a means of assessing plant water status for field and row crops. Achieving high quality peach fruit depends on the ability to maintain mild to moderate levels of water stress in the crop during the growing season. The paper examined the spatial distribution of tree canopy temperature (Tc) using thermal images in a peach orchard for irrigation scheduling. The variation of Tc was investigated in three irrigation regime treatments (factor A) that produced various soil moisture content (SMC) values, three cardinal points (factor B): South, North and East-West aspects combined, and five up-down vertical position measurements (factor C: upper, middle upper, middle, middle lower and lower) across the tree canopy thermal images. It was found that Tc was significantly influenced by the irrigation regime. Cardinal point showed a significant Tc difference between South on the one hand and the other aspects. The vertical position within canopy image did not significantly influence Tc.

Key words: Thermal imagery, leaf and air temperature, cardinal points, drip irrigation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimation of dynamic equilibrium in a polydispere soil system

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Abstract

Solid phase of soils exhibits irregular distribution of nutrients. 85-95% of humus, nitrogen, phosphorus, exchange capacity and adsorbed water are associated with particles smaller than 0.01 mm (*z*). Fractions larger than 0.01 mm (*γ*) are inert; they act as mechanical "diluent" for the substances concentrated mostly in physical clay. Thus it is necessary to take this dilution effect into account. To do that, the ratio between the masses has to be introduced using the coefficient $k_1=100/z=1+ \gamma/z$. Physical clay mass is also heterogeneous. It splits into two groups: hydrophilic particles smaller than 0,001 mm (*αф*) and hydrophobic particles — 0.01-0.001 mm dust (*βф*). Particles of the first group are enriched with fulvate humus and superfine minerals with labile lattice while, the second group is characterized by humate humus type and illite minerals with rigid lattice. The ratio between these groups in physical clay varies depending on the season and year and that variability has to be considered during soil analysis. Granulometric composition has to be interpreted based on the correlation between the elements of a PSS in its functional environment. Soils exhibit the ideal state of dynamic balance, *which can be described mathematically*. It can be simulated for each physical clay value. Then the model silt content acts as a reference value (colloid reference) used to calculate the dynamic balance constants of real soil samples. Dynamic balance constants have twofold nature. On the one part, they are unique: any soil sample has its own values of the constant. On the other part, they act as a universal coefficient of the proportion between the "humus content per 100 g of soil" and "humus content per 100 g of physical clay". Knowledge of the K and "humus content per 100 g of soil" values allows predicting the humus content in physical clay with high probability (95-98%). Objective evaluation of soil humus status can be accomplished using two indicators: "humus content per 100 g of physical clay" and "physical clay saturation with humus". These indicators are absolutely comparable with each other because their K=1. At the same time, the "humus content per 100 g of soil" are incomparable.

Key words: Polydisperse system, fractions, dynamic balance constants.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

An alternative tool to predict and upscale soil saturated hydraulic conductivity apparent soil electrical conductivity

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Abstract

Apparent soil electrical conductivity (ECa) could improve the spatial and temporal estimation of some soil properties at different scales and depths. The Electromagnetic induction (EMI) technique provides a versatile and robust field instrument for determining ECa. The research question of our field case study is "is there any relation between saturated hydraulic conductivity and ECa data at field scale?" Therefore the objective of ongoing study is up scaling and providing maps of hydraulic properties. The selection of sampling locations was done by combining a design-based and model-based sampling strategy to account for the maximum variation in soil properties based on a geophysical survey with an EM38 proximal sensor. The ESAP model was used for a full sample design (20 locations). For the model based sampling, the Fuzzme software was used to classify the ECa field data set. According to the results, a classification using three classes came out best. The interesting result was that the suggested 20 locations from the ESAP model (design-based approach) exactly cover the three classes of Fuzzme output (model-based approach). Therefore the model-based sampling strategy (ESAP model) was chosen to determine the location of the sampling sites. Soil samples at suggested locations were collected and WRC and some soil properties were determined. Correlation coefficient between two surveys in 2011 and 2013 for 0-100 cm of soil thicknesses was relatively high and significant (r^2=0.89, $p<0.001$). This indicated ECa for deep soil profile is stable in our case study. The correlations between ECa data and hydraulic properties were investigated in order to predict hydraulic properties. There was no significant correlation between Eca and Mualem-van Genuchten parameters (n and α). While K_{sat} and ECa (0-100 cm) have a significant negative correlation (r^2=0.67, $p<0.001$). The estimation of saturated hydraulic conductivity from the ECa dataset based on the empirical relations of Archie's law has been assessed. We derived the linear log–log empirical relations between K_{sat} and ECa (r^2=0.61). Based on this result map of saturated hydraulic conductivity was produced.

Key words: Apparent soil electrical conductivity, saturated hydraulic conductivity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes in soil infiltration and penetration resistance resulting from agricultural practices

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Abstract

The objective of this study was to examine the influence of agricultural practices (composted tobacco waste, bio-humus, chicken manure, zeolite and lime) on soil infiltration and penetration resistance. A 2-year field experiment was conducted on a sandy loam soil. The experiment was carried out in a randomized block design with four replicates. The treatments were as follows: (i) zeolite at 1 t ha^{-1} + NPK, (ii) poultry manure at 4 t ha^{-1} + NPK, (iii) lime at 1 t ha^{-1} + NPK, (iv) NPK at 300 kg ha^{-1}, (v) composted tobacco waste at 50 t ha^{-1}, (vi) bio-humus at 10 t ha^{-1} + NPK and (vii) control. All applications resulted in a significant ($p \leq 0.05$) impact in soil infiltration when compared to control. The highest infiltration was analyzed 6.13 cm h^{-1} at the plots where zeolite was applied. There were also determined differences ($p \leq 0.05$) on penetration resistance of soil and after the treatments penetration resistance values were changed between 2.85 MPa and 3.85 MPa. The lowest penetration resistance was found by application of bio-humus and lime by decreasing rate of 25.9% and 24.15% respectively. However, there was not obtained any significant difference on penetration resistance of soil samples by the other treatments (zeolite, chicken manure, NPK and composted tobacco waste).

Key words: Soil infiltration, penetration resistance, agricultural practices.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study on clay core replacement with fiber reinforced concrete core in rock-fill dams

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Abstract

This paper is intended to present the results of an experimental investigation upon the possibility of clay core replacement with fiber (polypropylene) reinforced concrete core in rock-fill dams. Within the rock-fill dams, usually clayey soil is used as the main core material of the whole structure. Due to the fact that this kind of soil, being used; would have caused many problems such as; huge amount of clay materials required for the core, more time needed to complete the project, the clay core precise parameters monitoring and control (e.g. humidity), and etc., this paper attempts to present some kind of fiber reinforcement concrete; in order to solve these problems. In order to achieve this; different mix designs are presented; employing the polypropylene fiber; optimized form of mix designs in terms of permeability, flexibility, and concrete strengths criteria is obtained. Afterwards, a comparison between fiber reinforced polypropylene concrete, and the clay core has been made. At the end, the economic issues and environmental outcomes of the proposed concrete has been determined and explained.

Key words: Fiber reinforced concrete (Polypropylene), clay core, rock-fill dams, permeability, flexibility, strength criteria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Improvement of the engineering properties of soils using biological method

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Abstract

Improvement of the engineering properties of soils has always been an issue of interest for civil engineers. One of the newest methods that have been studied for this purpose is biological method. This method that is actually a combination of various sciences such as biology, biochemistry and civil engineering, uses biological organisms such as bacteria that are commonly found in soils. The mechanism of this improvement in properties of soil is based on the deposits of calcium carbonate by biological organisms. The purpose of this study is to investigate the feasibility of using this method in order to reduce the permeability of the soil for engineering problems that require low permeability. As a case study, in this paper the use of this technique on permeability reduction of soil base of Shiraz landfill in Fars province, Iran, is presented. For this purpose, Bacillus Sphaericus with four different value of optical density (O.D.) between 1 and 2 were used. Soil permeability was measured using the falling head method. Tests showed that the Bacillus Sphaericus, with different O.D. and soil dry densities can decrease permeability of soil of Shiraz landfill significantly. This study showed that this method can introduce a new option for changing the soil properties where low permeability soil layer such as landfill liners is needed.

Key words: Soil properties, biological method, permeability, landfill

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

An investigation of shaft resistance in pile jacking and pile driving by finite elements method

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Abstract

The piles which are used to transfer structure load to the lower firm layer soil are classified into two categories: pre-cast piles and bored piles. The pre-cast piles which are mostly steel pipes are used more widely due to their ease of installation especially in granular soils. This kind of piles is usually penetrated into the soil by dynamic hammer. Not only this method produces a lot of noise and vibration, but it also causes decrease in shaft resistance as a result of soil manipulation. Pile jacking technology allows the pile to penetrate into the soil in a static mode without making noise and vibration. In this study, the effect of pile static penetration in granular soil in 3D mode with finite elements method and Eulerian behavior using Abaqus software has been examined. The results are compared with the results of dynamic penetration for exactly the same conditions. The results of the comparison clearly show improvement in shaft resistance of pile penetrated statically due to the omitting vibration in this penetration method.

Key words: Pile jacking, pile driving, stress ratio, shaft resistance, finite elements.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Geological problems in the realization of underground geotechnical structures in the urban environment

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Abstract

For construction of shallow tunnels and underground subway method for Sofia Metro has a dynamic variation of geological conditions. Dynamic change is determined by three main factors: (i) The minimum depth of the tunnels, (ii) rapid change of the type and characteristics of the geological layers - is that Sofia is the bed of a Pliocene lake and (iii) flooding in the zone of mineral water springs spill water around the springs and damaged sewers cause profuse watering of the soil. The combination of these three factors leads to increased risk in the construction and operation of underground constructions. The increase in risk in the ground is expressed in danger of liquefaction during seismic impact, cutting and sinking of pile foundations, deformations under existing facilities and the surface thoroughly watering of trenches accompanied by intensive removal of fine soil particles, changing the terms of interaction between geological base and construction of constructions etc. The report is devoted to the problems posed by complex geological picture of building underground metro constructions. Studied solutions where theoretically and experimentally verify the basics of earth mechanics. The results contribute to risk reduction and financial optimization of underground structures in complicated geological conditions and close to existing infrastructure. It reaches the appropriate structures of constructions that are adequate to the dynamic changes in geological conditions as granted or after human intervention. The report is illustrated with graphics and pictures which are marked all the major problems and their solutions. The idea of the report (i) to be answered in what phase of the study to express clarification of the geotechnical and hydrogeological conditions in the construction of metro shallow tunnels and (ii) how geological conditions led to the formation of underground structures with reduced degree of risk in the construction and exploitation.

Key words: Tunnel, geological conditions.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Geological problems in the realization of underground infrastructure in the natural environment

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Abstract

On one hand, the climate change causing a deterioration of the geological conditions and lead to the destruction of the existing infrastructure. On the other hand the infrastructural routes pass through sites with a long-term natural balance, landslide processes may be instigated. The reason is the human intervention. The scale of this intervention is usually sufficient to break the geological balance border between the admissible human intervention and nature. Crossing this frontier is followed by increased expenditures and stop the construction and operation of road routes. The subject of this paper covers not only the measures for the ecological balance to be efficiently restored. Attention is paid also to the prevention that can be realized during the construction works and the exploitation of existing constructions The issue is illustrated with by examples.

Key words: Human intervention, ecological balance, prevention.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of different soil conditioners on soil water and modelling with Hydrus-1D

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Abstract

Olive oil waste compost (8%), perlite (4%) and hydrophilic polymer (sutut, 0.12%) were mixed with loamy and clay loam soil with three replications. Effects of soil conditioners on soil water content, some soil properties and some properties of tomato plants were investigated under controlled atmospheric environment. Additionally, HYDRUS 1D simulation models were established by using measured soil water content with sensors and soil properties. As a result, application of olive oil waste compost to loamy soil saved irrigation water 45.12%, 42.99% and 38.88% for control, perlite and polymer applications respectively. For clay loam soil applications of polymer saved irrigation water 17.82%, 46.76% and 27.29% for control, perlite and olive oil waste compost applications respectively. pH reduced and EC increased for both soils after the experiment. The highest EC was obtained under olive oil waste compost application. Tomato biomass was not affected by treatments for loamy soil. The highest plant fresh biomass and plant length were obtained under perlite applications for clay loam soil. The highest branch numbers were obtained under olive oil waste compost applications for clay loam soil. Root length and surface areas were maximum under olive oil waste compost applications for both soils. Correlation coefficient between volumetric water contents using water sensors and modeled water contents by using HYDRUS 1D were between 0.85-0.95 for loamy soils and were between 0.83-0.88 for clay loam soils.

Key words: Soil conditioner, soil moisture, HYDRUS-1D, tomato, olive oil waste compost

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Physical properties of different soil aggregate fractions

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Abstract

Study of the structural state is important for understanding processes in soils of different genesis and agricultural use. An analytical method of determining the differences in soil aggregates stability is presented. The objective of present study was to characterize the water resistance of every fraction of soil aggregates individually. Samples from the humus horizon (0-22 cm) of a weakly podzolic medium loam sod soil on moranial loam were investigated by standard methods. We may proceed by determining the samples of aggregates (size: >10, 7-10, 5-7, 3-5, 2-3, 1-2, 0.5-1, and 0.25-0.5, <0.25 mm) separately through the method of "wet sieving". The aggregates (size < 1 mm) were saturated with cations. As a result of such treatments, we obtained secondary soil formations with altered properties (so-called H^{+}, K^{+}, Na^{+}, Mg^{++}, Ca^{++}, Al^{+++}, Fe^{+++}-soil forms). The results show that there is a regular decrease in the stability of aggregates according to their size, so that smaller aggregates in the Sod-Podzolic soil are less stable than larger ones. Nevertheless, it appears that the most realistic evaluation of structure stability is obtained from samples consisting of aggregates of all sizes, according to their degree of prevalence in the soil. If only a single aggregate fraction is used in evaluating the structure stability, then it must be that fraction which is most prevalent in the aggregate composition. The differences in stability between individual fractions founded in the Sod-Podzolic soil show that the use of a single aggregate fraction cannot give a true picture of the structural stability.

Key words: Structural stability, wet sieving, Sod-podzolic soil

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Water retention potential of soil in relation to changes in fraction composition of water stable aggregates determined by physical simulation of model amelioration measures aimed at increasing soil organic matter content in three soil types and distinctive land use

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Abstract

The structure of soil and mainly its upper horizons plays a significant role in transformation of precipitation into runoff. Numerous floods have affected Central Europe in the recent decades and have given rise to questions about amelioration measures to be applied to protect and enhance soil water retention with the aim of reducing surface runoff. Laboratory physical simulation of ameliorative effects was conducted on samples taken from three soil types, each of them characterised with various vegetation covers or land use systems (preferably forest and arable land adjacent to each other – about 150-200 m). The simulation was based on samples composed of different fractions of water stable aggregates. The fraction composition reflected various soil organic matter contents as a result of different types and intensities of amelioration measures, which may hypothetically be used in the given land use. Such data may be considered as a chronosequence since all the sampled plots were historically forest land and changed to arable land about 150 years ago, as stated in historical recordings. We determined soil water retention in each sample of physical simulation as for both full water saturation and then real field saturation defined by suction in a 5 cm water column. The difference was taken as a potential retention of storm rainfall. A development model was drawn up to show the storm rainfall retention potential of the evaluated soil types with respect to different types and intensities of ameliorative measures and the soil organic matter contents.

Key words: Water retention, water stable aggregates, soil organic matter.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Temperature of soil mulching with minimal processing technology

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Abstract

To raise the temperature and prevent soil crust formation in early spring under cotton crop there were conducted extensive experiments in mulching in Golodnostepskaya regions with minimal processing of gray- meadow soil by means of mulch materials. To study the mulch as a mulch material rotted manure, lignin, and transparent plastic film with minimal processing on the properties of soil, growth, development and yield of plants were tested. As a result, temperature rise contributed mulching of the soil , especially under a transparent plastic film to a depth of 5 cm from 1.5 to 4.8 ° C in a layer of 10 cm - 1.1 to 4.9 °C , 20 cm - from 0.6 up to 5 , 9o C., 30 cm - 0.7 to 4.8 ° C, 40 cm - 0.4 to3 , 8 °C, 50 cm of from 0.3 to 2.9 °C higher than in the control uncoated mulch and temperature in a wide range of active temperature increases programming . The most significant difference between the variants occurs in late spring and early summer, when the soil temperature is lower and the plants are in need of its increasing. Effect of mulch on the onset of the daily maximum and minimum temperatures in the spring on the options in the subsurface soil horizon observed weakly. It should be noted that at 10 cm depth in the area of occurrence cottonseed minimum temperature occurs over 6 hours and the maximum at 18 hours. In the interval between the minimum and maximum intensity of warm soil is higher than the temperature decreases from a maximum to a minimum morning. Mulching the soil with manure and lignin with minimal processing compared with plastic film has a less significant effect on the temperature regime of the soil.

Key words: Mulch, soil, temperature, minimum tillage, fertility, manure, lignin, polyethylene film, cotton, and the sum of active temperatures regime.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Water-physical properties of soil of Bukhara Oasis

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Abstract

With the purposes of protection and the increases especially valuable productive irrigation of grounds in area should be determined of water-physical properties soil of a Bukhara oasis. It is necessary to lift a question on a temporary conclusion from irrigation of a part strongly salted it is not enough productive of grounds, on which at huge material inputs and discharge of water receive a low crop of agricultural cultures Now priority direction in agriculture of republic of Uzbekistan is the increase of manufacture of a cotton crop, grain, fodder and other agricultural cultures at the expense of increase of their productivity. The decisions of this rather important task is reached(achieved) by restoration and increase of fertility soil differentiated processed, is brought in of fertilizers and accommodation of agricultural cultures with the account soil land-reclamation-agro physics of conditions and water of security of territories. Within the limits of Bukhara area are allocated hydromorphic, automorphic and transitive ground of a deserted zone, formed on adjournment of various genesis and age. Are most widely distributed irrigated (old irrigated, newly rrigated and new development) meadow ground. They meet practically in all geomorphological indicator. Are formed at depth bedding of earth waters 1-2,5 (3) м, i.e. in conditions of intensive ground-capillary humidifying. Water-physical properties meadow soil basically depends on mechanical structure. In Bukhara area are widely distributed middling loam (73752 ha) and easily loam (65322 ha), and the third position borrows (occupies) heavily loam of ground. In comparison c old irrigated meadow soil of water-physical properties at newly irrigated meadow soil worse. At old irrigated meadow soil high density,, moisture and presence of dense horizons. Was revealed, that in soil of value of water properties unequal, in connection with distinction them on mechanical structure, density of addition, mineralogical to structure and degree salinification.

Key words: Irrigation, earth water, irrigation of land, meadow, sierozem-meadow, dense rest, chloride, sulfate, salt, magnesium, calsium, potassium, sodium, area, plant.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of aging on the physical properties of landfill cover layers

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Abstract

Physical properties of soil material are essential criteria for the suitability of material to be used as cover layers or water retaining layers of landfills. Important parameters, such as available water capacity and saturated hydraulic conductivity, are usually derived from easily measurable properties (such as soil texture) with the help of tables, or are measured on artificially compacted samples in the laboratory. Both methods do not consider structural changes taking place mainly in the first years after construction. Key factors for the development of the soil structure are freezing-thawing cycles, swelling and shrinking due to moistening and drying, and the influence of root growth. The investigation was carried out with dredged material (river sediments) which was planned to be used for a landfill cover layer. Freezing-thawing cycles were simulated for a few days each in a laboratory freezer; swelling and shrinkage was simulated by alternating between water saturation and complete drying in a drying oven. The vegetation experiment was carried out in the open on a site filled with 20 cm dredged material. The effects of the environmental factors result in a modification of the pore system. All variants showed a significant increase in air capacity and a significant decrease of the available water capacity at constant total pore volume. With respect to the suitability of the material for landfill cover layers, the results imply that that the legally specified minimum values for available water capacity should be rather increased due to a possible decrease over time. However, the average decline of the available water capacity of 6%vol with time due to aging, and the assumed penetration depths of the aging processes in the upper third of the cover layer, would result in a rather small increase of a few decimeters in layer thickness necessary to achieve the water storage targets. More important seems the increase in air capacity due to aging processes, which is of considerable importance for the growth of plants especially in the upper part of the cover layer. The risk of too high soil density associated with too low air capacity for optimum plant growth, thus, is somewhat reduced due to the increasing air capacity with aging.

Key words: Freezing-thawing-cycle, swelling/shrinking, available water capacity, air capacity, soil structure, pore structure, dredged material, landfill.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Coupled effects of hydrodynamic and solution chemistry conditions on long-term nanoparticle transport and deposition in saturated porous media

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Abstract

This study aims to systematically explore the coupled effects of hydrodynamic and solution chemistry conditions on the long-term transport and deposition kinetics of nanoparticles (NPs) in saturated porous media. Column transport experiments were carried out at various solution ionic strengths (IS), ion types (monovalent and divalent), and flow velocities utilizing negatively charged carboxyl-modified latex NPs of two different sizes (50 and 100 nm) using acid washed medium sized river sand. Most experimental studies of NP deposition in porous media have focused on the initial clean bed deposition. In this study the experiments were designed to obtain the long-term breakthrough curves (BTCs) in order to unambiguously determine the full deposition kinetics and the fraction of the solid surface area (S_f) that was available for NP deposition. The experimental evidence accessible in the literature on the dependency of S_f on physiochemical and hydrodynamics factors, especially for NP are very narrow. The BTCs exhibited a bimodal shape with increasing solution IS; e.g., BTCs were initially delayed, then they rapidly increased, and then slowly approached the influent particle concentration. Most research were conducted in the presence of monovalent electrolyte. In this study we compared the effect of monovalent (NaCl) and divalent ($CaCl_2$) solution chemistry. NP deposition was much more prominent in the presence of Ca^{2+} than Na^+ at any given solution IS. Deposition dynamics of NPs was successfully simulated using a two-site kinetic model that accounted for irreversible deposition and blocking (e.g., a decreasing deposition rate as the available site filled) on each site. Results showed that S_f values were controlled by the coupled effects of flow velocity, solution chemistry, and particle size. Data analyses further demonstrated that only a small fraction of solid surface area contributed in NP deposition even at the highest IS (60 mM NaCl and 3mM $CaCl_2$) and lowest flow velocity (1 m/day) tested. Consistent with previous studies conducted with clean sand, our results imply that NP deposition occurred because of physicochemical interactions between the negatively charged COOH groups on the NPs and nanoscale physical and/or chemical heterogeneities on the sand surfaces that produced localized nanoscale favorable sites. Furthermore, our results suggest that the NP interactions with the collector surfaces tended to strengthen with increasing contact time.

Key words: Colloids, column studies, breakthrough curves, two-site kinetic model, flow velocity, particle size, ionic strength.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil compaction assessment by penetrometer measurements on maize field

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Abstract

In Belgium, agricultural soils usually have compacted layers to a depth where conventional tillage techniques cannot break them. The increase in paved surfaces in Belgium certainly plays an important role in flood cases. Since the water infiltration in agricultural soils is severely hampered by compacted layers, this factor should be taken into account, especially considering the large coverage of agricultural lands. This study was conducted to determine the soil compaction of a maize field with a digital penetrometer. Soil texture of the field was loamy. The research site has conventional tillage and located in Nukerke, Belgium. To determine the soil compaction, digital penetrometer measurements were taken from 25 different points in three replications from 1.23 ha field. The penetrometer is able to provide readings for every 1 cm throughout 0-80 cm profile. Disturbed soil samples were taken from the measurement locations and soil moisture contents were measured from these samples. Nearly all the penetration resistance readings measured in research area were above the critical value for plant root growth (1.5 MPa).

Key words: Soil compaction, penetration resistance, soil degradation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Stable aggregate formation in soils treated with bat guano, pyrina and municipal waste compost

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Abstract

Improvements on soil structural characteristics are important for sustainable management of soil resources. The objective of this study was to determine effects of different organic fertilizer applications on stable aggregate formation in soils. Three different organic fertilizers (bat guano, pyrina and municipal waste compost) at four different application doses (0, 2.5, 5 and 10%) were used in a randomized plot design with 3 replications. The treated soil samples were incubated at laboratory under controlled conditions for 6-months. At the end of the experiment, soil samples were passed through a rotary sieve and geometric mean diameter and aggregate size distribution were determined. Aggregates were divided into six different size groups as of <0.42mm. 0.42-0.84 mm. 0.84-2 mm. 2-6.4mm. 6.4-12.7 mm. >12.7 mm. The wet aggregate stability was determined for each size group. Organic acid contents of the stable aggregates were determined. The effects of organic acids released by organic fertilizers and soil microorganisms on stabile aggregate formation were also evaluated.

Key words: Organic fertilizer, bat guano, pyrina, garbage compost, organic acid.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Transport of bromide in sand columns: Effect of particle size and water surface tension

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Abstract

Transport of a nonreactive solute in soils is principally controlled by soil properties such as soil texture and pore geometry. Surface tension of soil water causes capillary forces that binds the water in the soil pores. Changes in soil water surface tension due to contaminants may affect flow of soil water due to decreased capillary forces resulted from lowered soil water surface tension. This study aimed at assessing relationship between soil water surface tension and transport of bromide in sand columns. Miscible displacement tests were conducted on sand columns repacked with sands sieved from 2.0, 1.0, 0.5 and 0.25 mm screens. The miscible displacement tests were conducted with 0.05 M bromide solutions prepared using water with surface tension adjusted to 72.8, 64, 53.5 and 42 dyne/cm^2. Obtained breakthrough curves were modeled with an Equilibrum Convection Dispersion Equation (CDE) and a two-region physical non-equilibrium model. Hydrodynamic dispersion coefficient (D) increased and mobile water partitioning coefficient (β) decreased gradually with decreasing particle size while no obvious relation occurred between particle size and parameter controlling mass exchange between mobile and immobile water region (ω) in the columns. The parameter D,β, and ω showed no obvious trend against changing surface tension of solution used. However, the parameter β increased and ω decreased considerably in surface tension of 62 dyne/cm^2.

Key words: Breakthrough curve, hydrodynamic dispersion, mobile water, equilibrium convection dispersion equation, physical non-equilibrium, pore-water velocity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Initial soil water content as a factor affecting determination of unsaturated soil hydraulic conductivity in situ using tension infiltrometer

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Abstract

The unsaturated hydraulic conductivity is a key soil parameter governing water and solutes transportation processes. It can be expressed as a function of a soil water content *K(θ)* or a pressure head *K(h)*. The course of this function depends on the geometry of the pores which is determined by soil physical and chemical properties such as texture, structure, porosity, organic matter content etc. Many studies focus on comparison of soil hydraulic conductivity under different conditions such as tillage treatment, crop effect, time and space variability. Despite the recent progress in this research field, still there does not exist any reference method for measuring the unsaturated hydraulic conductivity and thus the comparison of different results is difficult. This study is focused on the effect of initial water content of the soil as a factor influencing the measured unsaturated hydraulic conductivity. The study was performed in situ on chernozem soil type of loam texture in a very short time period and with several replications close to each other in order to reduce the other factors causing variations. Two tension infiltrometers were used and compared: Hood Infiltrometer IL-2700 (Umwelt Geräte Technik, GmbH.) and Mini Disk Tension Infiltrometer (Decagon Devices, Inc.). Three different levels of water content were applied for each of the two infiltrometers (low, medium wet and wet), and three pressure heads (-0.5, -1 and -3 cm) for each measurement. According to the results the Mini Disk Tension Infiltrometer shows a significant sensitivity to the initial water content, while measurements performed using Hood Infiltrometer are more stabile. This is valid especially for the first tension applied within one measuring spot.

Key words: Unsaturated hydraulic conductivity, infiltration, mini disk tension infiltrometer, hood infiltrometer.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of hydrothermal conditions of agricultural lands in the Ob' forest-steppe

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Abstract

The characteristic feature of the Ob' climate is the uneven temporal and spatial distribution of hydrothermal conditions caused by continental location of the territory. The objective of the study was to identify the distribution patterns of hydrothermal conditions of agricultural lands in the Ob' Forest-Steppe. The area under study is a combination of placor of the fourth river terrace of the Ob River and its southern slope to the third terrace. The complexity of physical-geographical conditions and the heterogeneity of soil cover cause a great diversity in the distribution of moisture and heat within the local landscape. This was the reason of studying the moisture reserves and temperature of the soil during the vegetation of spring wheat in different parts of the relief (placor, southern slope, and padding). The Water supply in the padding was high and it was 224 mm in the braird reducing up to 96 mm to the period of the waxy maturity. The Water supply in soil at the foot of the southern slope was the least and it is 90 mm in the spring reducing to the end of the vegetation to 30 mm, which speaks for the insufficient humidifying of the area. The most optimal moisture conditions are formed on the plakor, the water supply during the vegetation season being reduced from 130 mm to 40 mm. Daily monitoring showed the essential variation of values of soil temperature with depending on the element of relief. The maximum variation in the heating of the soil surface was observed in late spring – early summer to the braird period of spring wheat. The lowest temperature at the soil surface (+27 ^{0}C) was observed at this time on placor and in padding and most warmed - temperature reaching +40^{0}C was observed in the southern slope. The deeper soil layers are warmed up gradually by the end of June (phases of tillering – heading). During this period, the padding stands out from the background of the overall temperature – the soil temperature is lower there than in the other positions of relief. The Laddeng Cehend of the padding in a set of heat from the plakor is about 12 percent for all the vegetation period. The Plakor is characterized by the most stable temperature conditions during the vegetation period. The differences of hydrothermal conditions are significant from the view point of designing of the agricultural practices. This necessitates the differentiation of the territory according to the land use practices and cultivating crops.

Key words: Hydrothermal conditions, element of relief, Ob' Forest-Steppe

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Thermal diffusivity of soils and peat/sand mixtures as related to sand and moisture contents

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Abstract

Thermal diffusivity of soils and peat/sand mixtures was studied at different water contents using the unsteady-state method described in Parikh et al. (1979). The range of sand contents in 49 studied soil samples was from 0 to 97 %. Volume sand content in peat/sand mixtures was 0 % (pure peat), 5, 10, 15, 20, 30, 40, 50, 55 and 62 % (pure sand). Thermal diffusivity of air-dry samples varied from 0.6×10^{-7} m^2s^{-1} for pure peat to 7.0×10^{-7} m^2s^{-1} for pure sand. Thermal diffusivity vs. moisture content dependencies had quite different shapes. At low sand contents the thermal diffusivity increased with water content in the whole studied range from the air-dry samples to the capillary moistened ones. The increase in sand contents resulted in more pronounced S-shape of the experimental curves. At high sand contents the curves had a pronounced maximum within the range of water contents between 0.10 and 0.25 m^3m^{-3} and then decreased. The experimental k(θ) curves, where k is soil thermal diffusivity, θ is water content, were parameterized with a 4-parameter approximating function (Arkhangelskaya, 2009). The suggested approximation has an advantage of clear physical interpretation: the parameters are (1) the thermal diffusivity of the dry sample; (2) the difference between the highest thermal diffusivity at some optional water content and that of the dry sample; (3) the optional water content at which the thermal diffusivity reaches its maximum; (4) the half-width of the peak of the k(θ) curve. The increase of sand contents in studied soils and peat/sand mixtures was accompanied by the increase of the parameters (1), (2) and (4) and the decrease of the parameter (3).

Key words: Soil thermal diffusivity, peat/sand mixtures, parameterization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Examination of relationship between soil respiration and soil physical properties

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Abstract

The soil is one of the largest carbon reservoirs. Its respiration plays a large role in atmospheric CO_2 concentration and global carbon cycling as well. It is expected that global warming will have an impact on soil respiration and as a positive feedback, this may increase further the carbon dioxide content in the atmosphere and the global warming. So it is very important to understand soil respiration process and its rate across ecosystems. Soil respiration is primarily determined by the physical properties of soil, especially by the temperature and moisture content. In the Research Institute of Nyíregyháza, in Hungary a small plot experiment was established to study the long-term effect of sewage sludge compost on the soil properties. The small-plots were treated with 0, 9, 18 and 27 t ha^{-1} compost. The aim of our experiment to examine the relationship between soil respiration and soil physical properties: bulk density, moisture content, soil temperature and air-permeability. We proved that the carbon dioxide emission of soil depends strongly on air-permeability and vegetation. Based on our results, the compost treatment effects on soil physical properties thereby on soil respiration, but furthermore measurements are needed to determine detailed soil physical effect of compost treatment.

Key words: Soil respiration, soil physics, sewage sludge compost, sandy soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The contact angle of wetting of the solid phase of soil before and after chemical modification

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Abstract

Wettability of soil affects a wide variety of processes including infiltration, preferential flow and surface runoff. Wettability of surface is usually expressed in terms of contact angle (CA) measurement. If the CA between liquid and solid surface is less than 90°, the surface is called hydrophilic, otherwise the surface is called hydrophobic. If the CA of water droplet on hydrophilic surface is in a range of 0-30° this surface is called superhydrophilic. In case of superhydrophobic surfaces the CA exceeds 150° that means that these surfaces are extremely difficult to wet. CA of wetting of mineral soil particles depends on the overlying organic and iron compounds. The object of study is a sample of the humus-accumulative horizon of typical chernozem (Kursk, Russia) and two samples (horizons A1, B2) of red ferrallitic soils (Fr. Norfolk, NE Oceania). The soil samples were analyzed for organic carbon, forms of non-silicate iron and hydrophobic-hydrophilic composition of humic substances. CA of wetting was determined in the intact samples and after removal of organic matter (H_2O_2 treatment), amorphous (by Tamm) and crystallized (by Mehra-Jackson) forms of iron. Static contact angles were determined with the sessile drop method using a digital goniometer (Drop Shape Analysis System, DSA100, Krüss GmbH, Hamburg, Germany). The contact angle was calculated by the Young–Laplace method (fitting of Young–Laplace equation to the drop shape). The measurements were repeated five times for every sample. Oxidation of organic matter (H_2O_2 treatment) causes an increase in the values of CA of wetting (in chernozem from 9.6 to 29.5º, in ferrallitic soil from 18.0 − 27.3 to 26.0 − 34.6º). CA remained constant for chernozem and slightly decreased in the case of ferrallitic soil, when the removal of amorphous and crystallized forms of iron was performed on samples pretreated with H_2O_2. CA increase occurs after successive removal of nonsilicate forms of iron from soil samples of chernozem (9.3 − 22.7 − 29.5º) and ferrallitic soils (27.3 − 34.0 − 40.5 and 18.0 − 29.0 − 29.2 º). Relative hydrophobicity of the soil solid phase surface after treatment by Tamm and Mehra-Jackson occurs in parallel to the carbon content reduction. Loss of carbon in the samples after the extraction of iron is related to the solubility of the hydrophilic components of humic substances. These results indicate that the main factor, which determines the wettability of soil solid phase, is the organic substance.

Key words: Soil solid phase, contact angle, organic matter, hydrophobic-hydrophilic humic substances, nonsilicate iron forms.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Shallot of local Palu variety responses under different watering interval, puddling and liming in Palu Valley entisols

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Abstract

Shallot of Lembah Palu variety is a priority commodity in central Sulawesi Indonesia due to its unique flavor and texture. Its minimal management has lead to low productivity particularly in Bulubaseh watershed Central Sulawesi Indonesia. Water availability often becomes the main constraints for high yield. Farmers used to puddle the soil in order to preserve water. This practice along with lime and water interval applications was studied in small lysimeters within a glass house. Puddling was done by stirring the soil with a stick at 20 and 40 rotations minute^{-1}. Water was applied at four, eight and 12 day intervals and lime was added at 0, 10 and 20 t ha^{-1}. Plant evapotranspiration during growth period was highest in combination treatments of puddling, water interval of 12 days and with no lime application. Soil physical characteristic such as bulk density was significantly affected by the combination of puddling and lime treatments with lowest value were found in no puddling and lime 10 t ha^{-1}. Water interval and puddling combination treatments had significant effect on hydraulic conductivity. Liming at 10 t ha^{-1} and no puddling resulted in highest hydraulic conductivity. Other characteristic such as field capacity and soil penetration resistance were only significant under puddling treatment. Both were highest in twice puddling treatment. Root length was only significantly affected by single treatment of puddling in which longest root was found in no puddling while plant dry weight only by water interval with four day water intervals produced largest weight.

Key words: Puddling, liming, water interval, evapotranspiration, Palu shallot.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Scale-dependence of field soil water content variability in the three-dimensional space of scale metrics 'support - spacing - extent'

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Abstract

Soil water content is a key soil state variable in the terrestrial system as it controls the exchange of water and energy between the land surface and the atmosphere. Soil water content is highly variable in space and time. Knowledge of soil water content variability provides important insight into soil functioning, and is essential in many applications. This variability is known to be scale-dependent, and various and sometimes contradicting statements about the change of the variability magnitude with scale can be found in literature. The objective of this work was to review existing literature to understand how the definition of scale can affect conclusions about the scale-dependence in soil water content variability. Support, spacing, and extent are three metrics used to characterize scale in modern hydrology, and these metrics are well suited to be used with soil water content data. Available data sets describe changes in soil moisture variability with changes in one or more of these scale metrics. We found six types of experiments with the scale change. With data obtained without a change in extent, the scale change in some cases consisted in the simultaneous change of support and spacing. This was done with remote sensing data, and the power law decrease in variance with support increase was found. Datasets that were collected with different support or sample volumes for the same extent and spacing showed the decrease of variance as the sample size increased. A variance increase was common when the scale change consisted in change in spacing without the change in supports and extents. An increase in variance with the extent of the study area was demonstrated with data an evolution of variability with increasing size of the area under investigation (extent) without modification of support. The variance generally increased with the extent when the spacing was changed so that the change in variability at areas of different sizes was studied with the same number of samples with equal support. Finally, there are remote sensing datasets that document decrease in variability with a change in extent for a given support without modification of spacing. Overall, published information on the effect of scale on soil water content variability in the 3D space of scale metrics did not contain controversies in qualitative terms. However, there were substantial differences in quantitative terms, that might reflect both the methods of changing support and site-specific differences in soil water content controls.

Key words: Scale, scale metrics, variability, soil water content, extent, spacing, support, scale change.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The relationship between soil physical properties and alpine plant diversity on Qinghai-Tibet Plateau

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Abstract

Through a large-scale research, we examined the heterogeneity of soil properties and plant diversity, as well as their relationships across alpine grassland types on Qinghai-Tibet Plateau. The soil pH and EC value increased with the constant deepening of the soil in all the three alpine grassland types which in order of absolute value in every soil layer were alpine desert steppe, alpine steppe and alpine meadow. Among the three grassland types, the alpine meadow possessed the highest SM but the lowest SBD. For plant diversity, alpine meadow was the highest, alpine desert steppe ranked the second and alpine steppe was the last. SM and SBD were the highest influential soil physical properties to species richness, but with opposite effects.

Key words: Alpine grassland, plant diversity, soil physical property

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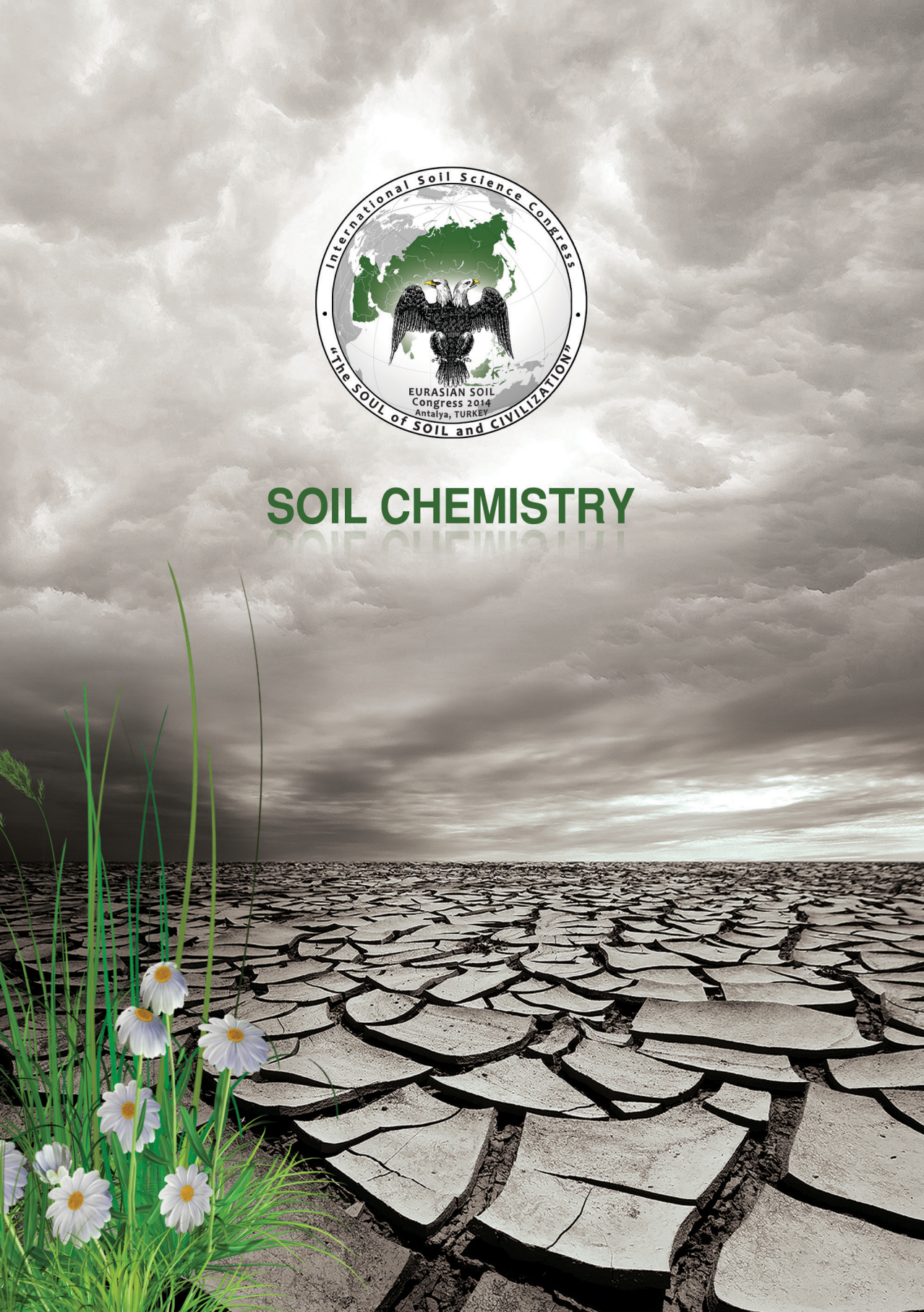

9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of different types of zeolite on drain water volume and nitrate leaching under tomato cultivated

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Abstract

Zeolites are hydrated aluminosilicate minerals that contain alkali or alkaline soil metals, especially sodium, potassium, magnesium, calcium, strontium and barium. In this study that was conducted at the lysimetery scale, the effects of three types of zeolite (sodium zeolite powder form, sodium zeolite broken form and calcium zeolite) drain water volume and nitrate leaching in tomato cultivated were studied compared to soil without zeolite (control treatment). The results showed that the lowest drain water volume was observed in the lysimeters containing calcium zeolite with an average value of 0.03 liter. Maximum of the drain water volume was measured in control treatment with the 1.86 liter amount. The results also showed that the highest and lowest concentrations of nitrate in outlet drain water was observed in soil without zeolite and calcium zeolite with average amounts of 83.5 and 6.8 mg/lit respectively.

Key words: Drain water, lysimeters, tomato, zeolite.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Scrutinizing of quality indicators of industrial waste gas compressor station Bengestan for irrigation of green spaces

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Abstract

In recent years, in Iran, due to scarcity of water, need for new water resources as well as modification of environmental complications, a particular attention has been paid to reuse of water resources. This study was conducted in the gas compressor station of Ahwaz region-1 (Bengestan) at the Karoon Company and the water, oil basin as well as the region's soil were sampled and moved to the laboratory for analyzing the water and soil qualities. The water of mixed basins was analyzed of viewpoint EC ,TDS,TSS,pH. Next, the water quality was analyzed in several levels and in various dilutions. The analyses performed on the basins include measurement of total suspended solute solids, total dissolved solutes, electrical conductivity, and soil reaction. The results showed that out of mixed samples, the one tested with treatment of 75% water irrigation and 25% of separation basin water is more suitable than other samples for irrigating the green space of the region. In this region, the sample related to Bengestan enhanced gas station has TSS=3.093 mg/lt. TDS=980 mg/lt.The results from this study indicated that the use of unconventional water for environmental purposes needs specialized management, which is not transferred the environmental hazards into soil, plants and groundwater and underground water resources while exploiting of it optimally.

Key words: Separation water, water and oil basin, Bengestan.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of nitrogen fertilization date, dose and soil properties on nitrate and ammonium distribution pattern in a soil profile

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Abstract

In the present study, leaching and distribution pattern of nitrate and ammonium were examined in the soil profiles of an olive plantation where long term nitrogen fertilization was practiced in enhanced doses. In this regard, 6 different levels of nitrogen (0-400-800-1200-1600-2000 g N/tree) in the form ammonium sulfate was incorporated under the canopy starting from the year 1994 to 1999. The soil of the experiment had a high infiltration capacity because of vertic properties of clay loam texture. In order to study the nitrate and ammonium status of the soil, 24 profiles were dug during (1997) and after (2001) the experiment. Results showed that significant amounts of nitrate can leach if excess nitrogen used. Nitrate, if compared with the study years decreased after the termination of the experiment; however, it was still over the threshold values. It can be concluded that excess nitrogen fertilization can threaten and further contaminate the underground waters.

Key words: Nitrate, ammonium, olive, leaching, nitrogen fertilization

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Pressure calcimeter as a simple method for measuring the $CaCO_3$ content of soil and comparison with Scheibler calcimeter

Ali Şenlikci *, Mustafa Doğu, Emel Eren, Ebru Çetinkaya, Sevinç Karadağ

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Abstract

A pressure calcimeter was made as an alternative to Scheibler calcimeter which is the conventional method of soil $CaCO_3$ content analyses. Since the measurement of $CaCO_3$ content of soil with Scheibler calcimeter is a slow and labor intensive method, the accuracy and presicion of the results are based on labour experience. The pressure calcimeter gives fast and accurate results by eliminating these disadvantages. The measurement of $CaCO_3$ by pressure calcimeter, as in Scheibler, is done by measuring pressure of CO_2 gas produced from reaction of soil with HCl. The gas pressure, formed by the chemical reaction in a gasproof chamber was measured by a digital manometer on the cap. The results were converted to % $CaCO_3$ by calculations. Significantly correlation (R^2=0,998) was obtained in calibration carried out with pure $CaCO_3$. Fourty six soil samples contain $CaCO_3$ between % 1 – 30 were analysed by Scheibler calcimeter and the results were compared with pressure calcimeter. It can be concluded that pressure calcimeter has given satisfactory results and can be used as an alternative to conventional Scheibler calcimeter in soil $CaCO_3$ content analysis.

Key words: Pressure calcimeter, calcium carbonate ($CaCO_3$), soil analysis, Scheibler calcimeter

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The bean (*Phaseolus vulgaris* L.) rhizospheric effect on the desorption kinetics of copper using DTPA in amended soils with sewage sludge

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Abstract

Copper (Cu) deficient soils are widespread in calcareous soils of Iran. Municipal sewage sludge as fertilizers has been increasingly used in some countries around the world because of essential nutrients such as Cu that favor crop growth. Study of desorption kinetics of Cu in rhizosphere soils give information about potential of soils to supplying Cu for plant uptake. The greenhouse experiment was performed to determine Cu desorption characteristics in the bulk and the bean rhizosphere of 10 amended soils with sewage sludge (1% w/w) using rhizobox. The kinetics of Cu desorption in the bulk and the rhizosphere soils were determined by successive extraction with DTPA-TEA in a period of 1 to 504 h at 25±1 °C. Moreover, Cu extracted by using 3 extractants (DTPA-TEA, AB-DTPA, and Mehlich 3) in the bulk and the rhizosphere soils. The results showed that Cu extracted in the rhizosphere soils were significantly (P<0.05) lower than the bulk soils. The mean of Cu desorption in the bulk and the rhizosphere soils were 15.72 and 14.74 mg kg^{-1}, respectively. Desorption kinetics of Cu conformed fairly well to power function, first order, parabolic diffusion, and simplified Elovich equations. The results of kinetics study indicated that desorption rate coefficients decreased in the rhizosphere soils compare to the bulk soils. The correlation studies showed that Cu desorption after 504 h were significantly correlated (P<0.05) with Cu extracted by using DTPA-TEA, AB-DTPA and Mehlich 3 in the bulk and the rhizosphere soils. Moreover significant correlation (P<0.05) was found between Cu uptake in shoot and Cu desorption after 504 h in the rhizosphere. The results of this study illustrated that in amended calcareous soils with sewage sludge, Cu desorption characteristics in the bean rhizosphere were different from the bulk soils.

Key words: Rhizosphere, bean plant, copper, kinetics, sewage sludge.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Relation between exchangeable sodium ratio (ESR) and sodium adsorption ratio (SAR) in some selected soils of Duhok Governorate

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Abstract

The aim of this study was to determine the relationship between exchangeable sodium ratio (ESR) and sodium adsorption ratio (SAR) in some selected soils of the north of Iraq (Duhok Governorate) . To this purpose, thirty composite surface soil samples were taken from three locations namely Summel (S), Batil (B) and Zakho (Z) classified taxonomically as (fine clay-smectiticcalcareous-cracked soils).Calculation of SAR were based on analytically determined concentrations of Na+ and Ca^{++} + Mg^{++} (SAR), SAR corrected for ion pair formation using VMinteq program (SARp), adjusted SAR and adj.RNa . The correlation between the measured and predicted values of SAR using stepwise multiple linear regression revealed that the allocation of sodium was the highest followed by calcium . Bicarbonate effect contribute more than 13% for adj.SAR and adj.RNa and 8% for SAR and SARp . The values of Gapon's constant were in the range of (0.0077-0.0138), (0.0063-0.0144), (0.0036-0.0108) and (0.0072-0.0142) (mmol-1)-0.5 in Summel, Batil, Zakho and in the region as a whole respectively . With good quality waters, all the studied soils showed high affinity for Ca^{++} and Mg^{++} as reflected by their lower KG values.

Key words: Spatial variability , adj.SAR , gapon constant, SAR, ESR.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The role of composition and properties of mineral matrix in transformation of corn residues

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Abstract

Humus plays a very important role in soils. It provides major physical and chemical properties and functions of soils and such important function as fertility. At the same time the regularities and mechanisms of processes of humus formation are studied insufficiently. Till today we have only the hypothesis of humification of plant residues, but do not have the theory of this process. The role of mineral components of soil in processes of humus formation is studied especially poorly. The aim of our investigation is to study the influence of composition and properties of mineral matrix on the transformation of plant residues (on the example of corn residues). The substrate (silica sand, loam, silica sand + 10% of bentonite and silica sand + 30% of kaolin) was mixed with 10% corn residues (milled to 3-5 mm) and incubated in stationary conditions from 6 to 19 months. Sampling for analysis was performed every month, and two times in the first month. The dynamics of mineralization and humification of plant residues was studied applying elemental and bulk analysis of neogenic organic matter (OM), densitometric fractionations of substrates; FTIR, solid-phase ^{13}C-NMR spectroscopy and scanning electron microscopy with electron microprobe. It was shown that mineralization and humification processes had a wave-like character. We explained this by the transformation of microorganisms population together with the change of amount and quality of the OM in the system. The main mechanism for stabilization of neogenic OM was adsorption on the mineral matrix with formation of relatively resistant compounds. This is selective adsorption depending on the composition and properties of mineral matrix. The FTIR and ^{13}C-NMR analyses of OM distribution in different substrates and densitometric fractions showed that sand and fraction >2.2 g/cm^3 are enriched with the compounds of aromatic nature and polypeptides. Fractions 1.4-2.2 g/cm^3 accumulate compounds containing alkyl and carboxyl groups as well. The sandy substrate and heavy fraction (>2.2 g/cm^3) have higher aromaticity indexes than light fraction (1.4 - 2.2 g/cm^3). Higher values of aromaticity index of humus substances in the sandy substrate and heavy fraction in the loamy substrate compared to light fraction (1.4-2.2 g/cm^3) testify the formation of -most steadyaromatic compounds in it which can be by kernels of humic acids. We do not exclude the possibility of the matrix synthesis of the HA -like substances.

Key words: Mineral matrix, plant residues, mineralization, humification, humic substances.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Usage of X-ray absorption spectroscopy methods in molecular-structural state studies of the Cu (II) and Zn (II) ions in soils

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Abstract

New possibilities of X-ray absorption near edge spectroscopy (XANES) for the study of the local structure of metal centers in soil are presented. We investigated the compounds of copper and zinc in ordinary chernozem by XANES. Since this technique is sensitive to changes in the local atomic and electronic structure it can be applied to determine which complexes form metals in the soil (soluble or insoluble). This study is aimed at analysis of the molecular–structural organization of Cu (II) and Zn (II) compounds in ordinary chernozem. The objects of investigation include samples of ordinary chernozem from the Rostov region artificially contaminated in a model experiment by high portions (2000 and 10000 ppm) of Cu^{2+} and Zn^{2+} nitrates and oxides. The experimental spectra of the K-edge of copper and zinc were measured on laboratory spectrometer Rigaku R-XAS Looper. Theoretical modeling of XANES spectra for nitrates and oxides of Cu and Zn was carried out by the finite difference method and the method of full multiple scattering. There are characteristic features in the XANES spectra of Cu and Zn compounds. CuO and $Cu(NO_3)_2$ were characterized by a weak pre-edge feature (~ 8975-8980 eV) that can be assigned to the 1s→3d electron transition. The weak intensity of this pre-edge is consistent with an octahedral symmetry. The main peaks in Cu K-edge XANES (~ 8985-8990 eV) are 1s→4p main-edge electron transitions. Splitting of the main edge peak indicates that the octahedral Cu binding site in soil samples is tetragonally distorted. In contrast, the XANES spectra of Zn (II) compounds don't show a pre-edge feature due to their d^{10} configuration, and only have 1s→4p electron transitions. There are different local atomic structures of Cu, including organometallic complexes with different functional groups, depending on CuO and $Cu(NO_3)_2$ forms applied in soil. XANES spectra of ZnO and $Zn(NO_3)_2$ showed that Zn^{2+} was in an identical low-symmetry coordination environment. Perhaps, this is due to a more uniform transformation of Zn containing compounds to the soil components. The good agreement between the theoretical XANES spectra and the experimental XANES spectra provides strong evidence that the models of the binding sites we propose represent the actual metal sites.

Key words: XANES, experimental and theoretical spectra, compounds, copper, zinc.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of plant available boron in agricultural soil by using voltammetric method

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Abstract

In this study, a novel voltammetric method has been developed to determine the amount of boron in soil. 50 soil samples were collected from 5 typical sites of agricultural area. After hot water extraction of available boron in the soil samples, all boron is complexed by addition of Alizarin Red S (ARS) to the extraction solutions and differential pulse anodic stripping voltammetry was used to determine the amount of the complexes. The electrochemical parameters have been optimized according to the experimental results. The optimum scan rate, stirring rate, deposition potential, deposition time and pH values were determined as 5 mVs^{-1} , 100 rpm, -0.7 V (vs. Ag/AgCl, sat.), 2 min. and 7.5, respectively. An oxidation peak was occurred at -0.3 V for Boron-Alizarin complex. The limit of detection, limit of quantification and linear working range were determined for the voltammetric soil-boron analysis. In addition, the interference effects of coexisting ions were successfully investigated. Comparison of the analytical data for analyzing real samples was carried out between the differential pulse anodic stripping voltammetric method and the Azometine H spectrophotometric method have shown good agreement. A great advantage of voltammetry over the spectrophotometric method is found to be simplicity, selectivity and shortening of the analysis time.

Key words: Voltammetric method, soil analysis, boron.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Chemical characteristics of the amorphous minerals extracted from Andisol's B Horizon from Central Java, Indonesia

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Abstract

It is known well that Andisol is a soil with high content in amorphous minerals. However, information on chemical characteristic of amorphous minerals still scarce, a particularly in Indonesia. The main objective of the research was to find out the chemical characteristics of the amorphous minerals of Andisol collected from 4 mountains located in Central Java. Soil samples was taken out from B/C Horizon from Mt.Slamet, Dieng, Merbabu and Lawu. Soil sampling considered a representative of the age of the parent materials (old and young formation). Characterization of the amorphous minerals was conducted for clay fraction obtained by applying the pipette method (Stock's Principle). The results indicated that pH-H_2O was categorized as acid to moderate, pH-NaF > 11, a high content in organic material (20.7%) and CEC 40.9 cmol(+) kg^{-1}. The amorphous minerals were composed of allophane+imogolite and ferrihydrite with a range content of 4.3 – 19.6% and 1,07 – 5,02% respectively. The P absorption capacity in average was higher than 98%. The X-ray diffraction indicated that the amorphous minerals from Mt. Slamet were dominated by allophane and imogolite. The minerals components from Mt. Dieng were composed of allophane and imogolite, feldspar, kaolinite, metahalloisite, zeolite and quartz. For the Young Formation Merbabu was dominated by allophane and imogolite, whereas for the Old Formation one was composed of allophane, imogolite, kaolinite and K-feldspar. Sample from Mt. Lawu indicated that the X-ray diffractogram was not identified, this was likely due to the peak was covered by the higher peak from feldspar. Infrared spectral characteristics of the amorphous material indicated that the absorption bands of the first region appeared at a range of 3440-3510 cm^{-1}, the band due to stretching vibration of hydroxyl (OH) groups either as structural OH or as adsorbed water. The absorption bands of HOH from adsorbed water appeared at range of 1639-1655 cm^{-1}. The maximum adsorption bands were observed appeared at range of 910-972 cm^{-1} are due to stretching vibration of Si-O-Al. The absorption bands of Si-O or Al-O appeared at range of 471-570 cm^{-1} and 1033-1030 cm^{-1}, respectively.

Key words: Andisol, allophane, imogolite, X-RD, Infrared Spectra.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of groundwater quality and its suitability for agriculture use in Minufiya governorate, Egypt

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Abstract

This study was conducted to evaluate factors regulating groundwater quality in an area with agriculture as main use. For these purposes, fourteen groundwater samples were collected from different locations of Minufiya Governorate, Egypt. Minufiya governorate is located in the south-west corner of Nile Delta, 80 km north of Cairo, and its groundwater resources are developed for water supply and irrigation purposes. The groundwater samples were analyzed for various water quality parameters such as pH, electric conductivity, soluble cations (Na^{+}, K^{+}, Ca^{+2} and Mg^{+2}), soluble anions (Cl^{-}, HCO_3^{-}, CO_3^{-2} and SO_4^{-2}), macronutrients (NO_3, NH_4, total P, total K), and micronutrients (Fe, Mn, Zn and Cu). Chemical index like sodium percent (% Na), sodium adsorption ratio (SAR), residual sodium carbonated (RSC) and Kelley's ratio (KR) were calculated. Based on the analytical results, the abundance major ions are as follows: $HCO_3^{-} > Cl^{-} > SO_4^{-2} > CO_3^{-2}$ and $Na^{+} > Mg^{+2} > Ca^{+2} > K^{+}$. Also, the examined samples for its content of macro and micro nutrients can be arranged as $K > NO_3$-N > NH_4-N > P and Fe > Cu or Mn >Zn respectively. The studied water samples have pH values ranged between 6.88 and 7.89. The analytical results indicated that, 14.28%, 57.15%, 64.29%, 92.86% of ground water samples classified as good order based on EC, RSC, % Na and KR parameters, respectively. On the other hand, 100% of groundwater samples are excellent for irrigation purposes based on SAR, while 50% of samples are marginally for irrigation dependable on their nitrate content. The dominant hydro-chemical facies of groundwater is Ca-Mg-HCO_3 and Na-Cl-SO_4 type. Assessment of water samples from various methods indicated that groundwater in study area is chemically suitable for agricultural uses without any harmful effect on soil or plant.

Key words: Groundwater, chemical characters, irrigation water, evaluation, classification.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Investigation of a novel soil analysis method in agricultural areas of Çarşamba plain for fertilizer recommendation

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Abstract

In this study, a novel soil analysis method for fertilization recommendation is developed and validated with 164 soil samples taken from Çarşamba plain, Turkey for determination of potassium as a plant nutrient. In conventional soil analysis methods, available potassium nutrient is determined by ammonium acetate extraction with flame photometer. In this study an alternative to existing method is proposed by developing extraction solutions suitable for interference dynamics of ion selective electrodes in a flow injection setup. Flow injection analysis system was optimized and K ion concentration of 164 soil samples taken from Çarşamba plain was determined with potentiometrically. For the same soil samples, K ion concentration is determined with ammonium acetate extraction using flame photometer in parallel. Fertilization recommendations for potassium are calibrated on ammonium acetate extraction based measurements. In order to evaluate available K nutrient analysis results from new generation soil analysis method in fertilization recommendation process, a correlation model is required for relating new generation method results to conventional method results. An artificial neural network based soft sensor system is developed for this task. Potentiometric K ion measurement of soil sample in flow injection analysis system is presented as input to soft sensor system. Soft sensor predicts available K in soil sample based on artificial neural network model which can be used in fertilizer recommendation. Prediction performance of soft sensor is validated with experimental data and fitted with high correlation coefficient (R^2= 0.902). Experimental studies have shown that K determined by potentiometric measurements can be used in fertilization recommendations in Çarşamba plain by using soft sensor approach.

Key words: Soil analysis, fertilization recommendation, soft sensor, artificial neural network.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Kinetic adsorption of ammonium into some loess soils of Northern Iran

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Abstract

The study of adsorption kinetics is very useful for understanding the mechanisms that are involved. In order to predict the mechanism involved during the present sorption process and the potential rate controlling steps such as mass transport, pore diffusion and chemical reaction processes, several kinetic models were used to fit the experimental data, namely, zero-order, first-order, pseudo-second-order, simplified Elovich, parabolic diffusion and power function models. At the present study, an ammonium adsorption kinetic experiment was conducted using solution containing 100 mg/l of ammonium chloride at the times of 0.25 to 384 h. Kinetic equations for ammonium adsorption were evaluated by comparing coefficients of determination (r^2) and standard errors of estimate (SE) for each equation, which were determined by least square regression analysis. The results of adsorption kinetic study showed that ammonium is adsorbed fast within the first hours, but with elapsing the time, it will be slow. The most ammonium adsorption was in Kordkoy soil and the lowest one was observed in the Houttan soil 2. The rates of ammonium adsorption in all soils could be best described by the pseudo second order, power function and simplified Elovich equations.

Key words: Adsorption, ammonium, kinetic.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Swelling clays and salt-affected soils : demixtion of Na / Ca clays as the rationale for discouraging the use of sodium adsorption ratio (SAR)

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Abstract

Sodium adsorption ratio SAR defined as SAR = (Na)/√(Ca + Mg)/2, where concentrations of cations in solution are expressed in meq/L has long been considered as correlated to exchangeable sodium percentage (ESP) on clay minerals or soil exchange complex, and as the key concept to explain swelling of clay minerals and the difficulties of reclaiming salt-affected soils. Though its basis is empirical, it was alleged to be theoretically justified on the basis of ion exchange, derived from the Gapon convention. However, it has long been challenged on the basis of both field observations and experimental evidence : it fails to account for the fact that calcium and magnesium do not play the same role, while potassium is absent from the formula ; calcium concentration must be « corrected » when calcite is present etc. There exist specific ion effects. Experimental measurements of the decrease of permeability when solutions are diluted led Quirk & Schofield (1955) to define the concept of critical threshold, and to show that potassium and magnesium play an intermediate role between sodium and calcium. This threshold is simply determined by the concentration of calcium, irrespective of the value of SAR or ESP. Indeed, demixtion of Ca-Na clay minerals during ion exchange, a phenomenon well known since Glaeser & Mering (1954), implies that there exists an interaction between adjacent sites. This undermines the theoretical basis of SAR : the derivation of SAR from ion exchange equilibria implies to use an equilibrium constant. This parameter is no more constant if demixtion occurs. The results obtained are positive : demixtion leads to expulsion of sodium from inner exchange surfaces and its replacement by calcium, according to the « three crystals pore » proposed by Quirk (2003). Sodium can then be more easily leached, as permeability is maintained by clusters of Ca-sites. Calcium concentration in solution appears thus as the simpler parameter to guide salt-affected soils reclamation when swelling clays are present.

Key words: SAR, sodium, calcium, clay, swelling, ESP, demixtion, sodium adsorption ratio.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of the attachment mechanism of potassium in soils. Application to the montmorillonites bionic Na-Ca

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Abstract

Fifty cycles of wetting and drying (WD) were carried out on biionic montmorillonites Na-Ca samples saturated with potassium. And container various proportions with calcium. They made it possible to highlight that the penetration of potassium in interlayer's spaces, to replace calcium or sodium, is accompanied by a collapse of the layers which confers a stable structure to them and consequently, most part of potassium brought passes in a nonexchangeable state. This retrogradation of potassium, was confirmed by the analysis by X-rays diffraction, indeed, the study of swelling to water by the measurement of d001 showed that the interlayer's distances from studied clays evolve with the number of cycles WD, they pass from 11,8 Å, for montmorillonites Na-Ca, which didn't undergo cycles WD to 10,2 Å when they undergo 50 cycles. That corresponds to dehydrated montmorillonite. The study of the reversibility of this evolution shows that it is reversible because if submitted the clay Na-Ca to a series of alternative WD and saturated by potassium, even after a high number of cycles (WD), by solutions of calcium chloride concentrated, most quantity of potassium can be extracted.

Key words: Fixation of potassium, montmorillonite bionic Na-Ca, demotion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of different fertilization on the dissolved organic carbon, nitrogen and phosphorus accumulation in acid and limed soils

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Abstract

Soil quality has become an important issue in soil science. Dissolved organic carbon (DOC) is believed to play an important role in soil processes and in the C, N and P balances, their supplies to plants in all types of soils. It is much more sensitive to soil management than is soil organic matter as a whole, and can be used as a key indicator of soil natural functions. This study aimed to assess the different organic fertilizers influence to DOC and N, P accumulation. The study was caried out on the moraine loam soil at the Vezaiciai Branch of Lithuanian Research Centre for Agriculture and Forestry in 2012. In the field trial were two soil backgrounds: acid and limed was used for incorporating the organic fertilizers (farmyard manure (60 t ha $^{-1}$) and alternative organic fertilizers. DOC was analyzed using ion chromatograph SKALAR. It was revealed that the different organic fertilizers and liming combination had a significant effect on DOC amount in soil. The highest amount of DOC (0.241 g kg^{-1}) was obtained in the limed soil fertilized with farmyard manure. The most unfavorable status of DOC was determined in the unlimed, unfertilized soil. Significant increase of soil organic carbon (SOC) content demonstrate the positive role of organic fertilizers in SOC conservation The limed soil with farmyard manure had a higher nitrogen (1.43g kg^{-1}) and phosphorus (0.84 g kg^{-1}) content compared to the other treatments. In conclusion, amendment of organic fertilizers showed the essential positive effect, induces an increase in DOC content in the topsoil. This immediate increase is generally attributed to the presence of soluble materials in the amendments. Application of organic fertilizers in acid and limed soil increases the nutrient stocks and ensures soil chemical indicators at the optimal level for more plant growth. Thus may provide a mechanism as well as prediction opportunities for soil conservation, sustainability, and protection against degradation

Key words: SOC, DOC, N, P, organic fertilisers, liming.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Role of forest canopy on proton budget of the selectively logged peat forest in central Kalimantan, Indonesia

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Abstract

Forest canopy plays an important role on nutritional forest floors and soils. Litterfall and throughfall are main sources of soil nutrients on the ombrogenous peatland forest. This paper will describe monitoring results of ion budgets on the selectively logged peat swamp forest in Central Kalimantan, Indonesia, with emphasizing the role of the forest canopy in filtering rainfall that subsequently affects the proton budget. In order to highlight the role of the forest canopy, the proton budget is compared to the budget on the fire-damaged peat swamp forest. Annual rainfall on the study sites is in average 2.800 mm. Proton input from rainfall reaches 0.14 $kmol_c\ ha^{-1}\ a^{-1}$, and from throughfall 0.12 $kmol_c\ ha^{-1}\ a^{-1}$. When NH_4^+ ion (sources of potential acidity) incorporated into calculation of the proton input, the total proton input from rainfall and throughfall is 0.54 and 0.45 $kmol_c\ ha^{-1}a^{-1}$, respectively. This result implies that the forest canopy of the selectively logged peat swamp forest is as a proton sink or a proton buffer. The proton buffer of the forest canopy obtained in this study is much less than obtained elsewhere, for example on Japanese cedar forest ecosystem the proton buffer reaching 1 $kmol_c\ ha^{-1}\ a^{-1}$. Retention of HCO_3^- ion by the forest canopy is one of important mechanisms in buffering proton. It implies that the forest canopy is of importance for balances of $HCO_3^-|CO_2$ in the atmosphere-plant-soil system.

Key words: Forest canopy, proton budget, selectively logged peat swamp forest.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The use of soil methods in archeology in Mikulcice

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Abstract

Currently, Mikulcice is one of the most significant archaeological sites not only in the Czech Republic but also in Central Europe. One of the auxiliary sciences of archeology is pedoarcheology. This paper presents the results of pedoarcheologic research in the area of Mikulčice - Valy. The aim was to assess the usefulness pedoarcheologic methods to distinguish filling of cultural pits. On the basis of the results of laboratory analyzes, the paper aims to differentiate individual sections of the settlement, which should arise from different amounts of phosphorus, carbon, humus and humus quality. The test pit S1 MAP was 130 cm deep. However, the first 30 cm was made up of rock walls of the palace. Another 30 to 70 cm consisted of sandy dark colored sediments that were homogeneous throughout this part. At 80 cm, there is a sudden change of almost all of the monitored characteristics. Granularity is changed, clay content increases and the amount of sand decreases. At this depth, there is also an increase of the amount of phosphorus, Cox, humus and total carbon. There is also a large amount of carbon and bones. This is probably the beginning of the waste pit.In the case of the S2 MAP test pit, it is also considered as the waste pit. The total depth of the pit was 100 cm. Waste pit ranged from 10 cm to 60 cm. This pit comes from the Great Moravian period. It has been surprisingly found that two distinct peaks of phosphorus content were present in the layer forming the filling of the waste pit (10 - 60 cm). The same trend was detected at other characteristics. This may indicate a certain discontinuity of occupying this place. Period of intense utilization was substituted by period of less intense settlement, which was immediately followed by more intensive use of the surrounding. Below the waste layer, from about 60 cm to the bottom of the probe, there is sandy aluvial soil. It is interesting that there is a alternation of gain and loss of sand. This phenomenon is probably due to the activities of the Morava River floodplain. The increased sand content refer to running water which was more powerful and therefore there were floods of greater intensity.

Key words: Soil methods, archaeology, Cox, phosphorus, pedoarcheologic

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of grain size on the chemical composition of soil

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Abstract

In 2012, pedologic samples were taken from 5 plots with the incidence of water erosion. Selected areas were apparently damaged by erosion at first sight. On each plot, three soil pits in total were uncovered. The first soil pit was uncovered in the upper side where the least disruption of water erosion was assumed. The second soil pit was uncovered in the central part of the plot where the highest degree of soil damage due to water erosion was assumed. The last soil pit of each plot was uncovered at the bottom of the plot. Accumulation of soil washed down from the higher parts of the land was assumed there. In this manuscript, we bring you a brief overview of the changes of chemical elements content and granularity of the plot. Particles less than 0.01 mm in size were used for the evaluation of grain size. In the Czech Republic, these particles are commonly used for grain size classification. Chemical elements were measured using a handheld XRF analyzer. For this paper, following elements were selected: Si, P, Ca, Mn, Mg, S, Ti, Fe, Hg. This paper deals with the effect of erosion on the changes of the chemical soil composition. The samples of topsoil from the upper part of the land and samples from the lower part of the land were compared. The results show the bottom part of the land contains increased amount of chemical elements often up to 50%. For example, P has increased from 0.0348% to 0.06968%, in the case of Ca from 0.68984% to 0.79112%, Mn from 0.06278% to 0.22236%, Mg from 0.77456 % to 0.80426%, S from 0.0219% to 0.08122%, Ti from 0.26006% to 0.30882%, Fe from 1.87544% to 2.32032% and Hg has increased from 0,00106% to 0.00122%. In the topsoil, the strongest correlation between elements and granularity was observed at the following elements: Mg (r = 0.92), S (r = 0.97) and Fe (r = 0.69). Therefore, it is evident that water erosion has the effect on altering the soil chemical composition in the cumulative part of the slope. Heavy metals or rare earth metals were not detected in the case of these five sites of interest. However in other areas, this may look different.

Key words: Grain size, chemical elements, XRF analyzer, erosion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of sorption characteristics of Zn (II) onto natural and physically modified zeolites

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Abstract

The purpose of this study was to characterize the zinc (Zn) sorption properties of the natural and physically modified zeolites for agricultural and environmental treatments. Experiments were carried out using batch method as a function of solution pH, contact time, adsorbent dosage, and temperature. All these factors affected Zn^{2+} ion removal from aqueous solution. The sorption efficiencies in the optimised conditions for natural and physically modified zeolites were found to be 95.9 and 99.7% respectively for the Zn ion concentration of 100 mg L^{-1}, respectively. Equilibrium modelling data were evaluated using linear Langmiur, Freundlich and Dubinin-Redushckevich (D-R) isotherms. Maximum Zn sorptions (q_{max}) for natural and physically modified zeolites were found to be 20.87 mgg^{-1} and 15.75 mgg^{-1}, respectively. Thermodynamic parameters, gibbs free energy change (ΔG^o), enthalpy change (ΔH^o) and entropy change (ΔS^o), were calculated at different temperatures. From the obtained results, it could be concluded that the natural zeolite is more effective than physically modified zeolites in terms of maximum Zn ion sorption. Therefore, natural zeolite could be used for the adsorption of Zn ions in agriculture and environmental treatments.

Key words: Zinc, zeolite, sorption, thermodynamic parameters.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Comparison of methods for sampling and extrapolation of data about the soil acidity for the purpose of chemical amelioration of acid soils

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Abstract

It is presented a model for sampling, analyzing, interpretation and extrapolation of data for the soil acidity in arable areas with acid soils. Studied soils are Luvisols, with differentiated in terms of clay content, profile. The depth of meliorated layer is 0,50m, and the depth to which is performed sampling is 0,75m. Samples are collected in a square grid from the total area of the sections. Analytical samples represent an average from randomized single samples to avoid random errors. The sampling points are indicated by coordinates. Soil acidity is interpreted by the content of mobile exchangeable forms of Al^{3+}, H^{+} and Mn^{2+}, as well as by the content of exchangeable bases Ca^{2+} and Mg^{2+}. The ameliorant rates, expressed as CaO, are determined according to a balanced method, in which the main burden is the amount of CaO required to neutralize the acid equivalent of mobile exchangeable Al^{3+}, H^{+} and Mn^{2+}. The ratio (Ca^{2+} + Mg^{2+} / Ca^{2+} + Mg^{2+} + Al^{3+} + H^{+} + Mn^{2+}) is interpreted as an integrated indicator through which it is estimated the acid-alkaline balance of the soil and the degree of its lime requirement. Extrapolated are data for sampling points from a three equal in depth layers. The extrapolation of the data for each parameter defining the structure of soil acidity is characterized by the application of kriging and nearest neighbor methods. It has been found that the spatial extrapolation achieved by kriging method, is less suitable for the purpose of chemical amelioration, as compared to the nearest neighbor method, since it leads to a technological difficulties in mechanized application of differential rates of the chemical ameliorants. The nearest neighbor method is applicable to extrapolation of final results of the study, as on extrapolation are subjected areas in which the application of chemical amelioration should be excluded, and areas where have to be applied different rates of lime.

Key words: Soil, acidity, lime rate, kriging, nearest neighbor.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of total, dissolved and humified carbon in peat soil under renaturalization

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Abstract

Ecosystems of peat bogs are one of the larger organic carbon reserves. Perennial grasses are believed to be able to reduce organic matter (OM) decomposition, since they partly restore OM by leaving a great content of root and stubble. Some researchers recommended establishing long-term grasslands, which, if properly managed, could produce a high herbage yield, however OM transformation depends on the composition of individual swards and their management. Natural and agricultural ecosystems not only play an important role in the conversion of atmospheric CO_2 into soil organic matter (SOM), but also in the sequestration of soil organic carbon (SOC). According M.Strack and Y.C.A. Zuback (2013) peatlands play an important role in the global carbon cycle storing an estimated 469 to 486 Gt of carbon, emitting approximately 10% of all global methane (CH_4) emissions and acting as large sources of particulate and dissolved organic carbon to downstream ecosystems. Study was carried out on a peat bog (*Terric Histosol*) with the removed and non-removed peat layer at the former Radviliškis Experimental Station of the Lithuanian Institute of Agriculture. Soil samples for chemical analyses were taken from peat bog soil from 0–10, 10–20 and 20–30 cm layer in 3 replicates in 2012. Chemical analyses were carried out at the Chemical Research Laboratory of Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry. SOC content was determined bv the Tvurin dichromate – oxidation method modified by Nikitin (1999), labile carbon by Continuous Flow Analyzer SKALAR, humified C – in 0,1 NaOH. The differently used peat soil has unequal content of SOM: soil with non-removed peat layer had higher amount of SOM (70 – 82 %) compared to peat bog soil with removed peat layer (70 – 11 %). The soil with non-removed peat bog layer of unused peat bog soil and forest soil with removed peat layer had more labile carbon compared to the other treatments. Renaturalization is still observed after the usage of the peat soil and there are variations in their chemical compositions. The carbon accumulation and sustainability potential was established in the soil with non-removed peat layer in which the fertilized perennial grass was cultivated till the termination of the experiment. This work will assess as a carbon sink, the quality of organic matter, properties of labile carbon compounds. Experimental data relevant to environmental and agronomic point of view, studies would be a great contribution to the environment and soil chemical research and development in the international context.

Key words: Terric Histosol, renaturalization, sustainability, peat soil, carbon, soil quality

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

How the sorption of benzene in soils contaminated with aromatic hydrocarbons is affected by the presence of biofuels

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Abstract

Although the remediation of soils contaminated by aromatic hydrocarbons has been thoroughly studied, it is not yet known how the presence of biofuels impacts the efficiency of remediation of these volatile contaminants. Sorption isotherms are important and effective parameters for evaluating the applicability of cost-effective remediation technologies such as bioventing and enhanced bioremediation. The present work focuses on the adsorption of benzene on two common Portuguese soils (granite and limestone) previously contaminated with two different biofuels: butanol and biodiesel, with the objective of assessing the partition of benzene between the three phases (solid, liquid and gas) of the soil when they have been previously contaminated by different biofuels with two different concentrations (0.23 mg/kg and 1.16 mg/kg). Contaminated soil samples were kept at a constant temperature of 25ºC between successive additions of benzene with concentrations (determined daily using a GC-FID) varying from 0.5 µg/L to 275.6 µg/L. Mass balances allowed to calculate benzene concentrations in the liquid and in the solid phases of the soils from the determined gas phase concentrations. Different mathematical models, such as Freundlich, Langmuir and polynomials, were adjusted to the experimental data yielding high coefficients of determination. Experimental data combined with predictions from theoretical models lead to an increased knowledge on soil sorption of benzene that evidenced dissimilar behaviors depending on the type and concentrations of the biofuel and mainly on the soil type. (Acknowledgements: This work was supported by FEDER funds through the Operational Program for Competitiveness Factors - COMPETE and National Funds through FCT - Foundation for Science and Technology via the project PTDC/AAG-TEC/4403/2012 (ISIS)).

Key words: Sorption, soils, benzene, biofuels

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Origin, distribution and transformation of authigenic carbonates in loessic soils

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Abstract

Processes of authigenic carbonates formation are part of terrestrial biogeochemical cycle of carbon, which starts with co-accumulation of oxalic acid and Ca in Ca- oxalates. After plant decay are these biominerals slowly tranformed under the influence of microbial processes into authigenic carbonates (calcites), depending also on soil condition. The formation of authigenic calcites runs over in soil system where is rather high Ca and Mg concentration, presence of oxalomorphic plants and sufficient oxalotrophic stability of microorganisms. In addition to Ca- oxalates, Ca and Mg ions necessary for carbonate formation comes also from air (precipitation, dust), mineral weathering, subsurface water flow and decaying organic matter. The distribution pattern of authigenic calcites with depth, the size and shape of individual forms of calcites on loessic soils of SW Slovakia, as it is resulted from micromorphological study indicate that through the historical development of that soils as landscape units, soil water regime has played decisive role at vertical redistribution of forms (size, shape) of authigenic calcites. To this witness the depth of variation of needle calcite zones and horizons of micritic calcites occurence depending on soil types (leaching). Needle calcite zones which approach closest to the soil surface, gradually coalescence to the horizons of micritic calcites at the depth. Micritic calcites are without, or with microsparitic domains. Our study concurrently support the ideas of their inorganic origin depending on evaporitic soil regime. This formations have its own historic dynamics on which depends also the preservation of calcaric nature of soils.

Key words: Authigenic carbonates, Ca- oxalate - carbonate pathway, needle shaped calcites , micritic calcites, loessic soils, micromorphological aspects

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fractionation of boron and its relationship with soil properties in Eastern littoral soils of Caspian Sea

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Abstract

The various forms of boron in the eastern littoral soils of the Caspian sea in Golestan province were investigated. The dominant forms of boron in these soils were in order Hot water extractable boron > residual boron > Non specific absorb boron (NSA-B) > Mn hydroxyl oxy boron (MOH-B) > Amorph Fe-Al boron (AMO-B). The hot water extractable boron had a positive correlation with specific absorb boron (SPA-B) (α=0.01), and NSA-B had a positive correlation with MOH-B and SPA-B (α=0.01). SPA-B had a significant positive correlation with pH in (α=0.01), and had a significant positive correlation with clay percentage in (α=0.05).

Key words: Boron fractionation, soil properties, hot water extractable boron.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Research of the applicability of Mehlich-3 multinutrient extraction method in Thrace region soils

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Abstract

This research was carried out to extract available soil macro (K, P, Ca, Mg) and micro (Fe, Cu, Zn, Mn, B) nutrients by using single extraction solution (multinutrient extract solution) and analysis by ICP –OES equipment and determination of correlation coefficient between this method and routine other laboratory analysis methods. Total of 107 acidic and 123 neutral and alkaline soils were sampled from Thrace region. Soil available macro (P, K, Ca, Mg, S) and micro (Fe, Cu, Zn, Mn, B) nutrients were determined by ICP-OES after extractions of samples by Mehlich-III and other routine extraction methods. According to correlation test results of classical macro and micro nutrients extraction methods used in soil analysis laboratory and Mehlich-3 extraction method, high and very high correlation is determined for B and Mn in acidic soils and for other nutrients (K, Ca, Mg, S, Fe, Cu, Zn), except B, Mn and P, in neutral and alkaline soils. Regardless of soil reaction, correlation test results indicated intermediate correlation for B and P except Mn.

Key words: Soil analysis, Mehlich-3, extraction method.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Geochemistry of alluvial and desert aquifers in agricultural soils of South Egypt

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Abstract

Geochemistry study of groundwater at South Egypt where intensive agricultural activity takes place was carried out with the use of GIS to elucidate the factors regulating quality of alluvial and desert aquifers. To achieve the goal of study, 118 groundwater samples were taken from the distributed irrigation wells. The obtained results showed that salinity of the groundwater in the desert fringes of the study area was higher than in alluvium area. None of the studied wells was of first grade quality with respect to salinity. The ECw is low closer to the Nile River, and it increase as one moves into desert. In some reasons the values of ECw in some wells near the Nile are high as a result of decreasing deep of wells, and absence of drainage projects in these areas led to the leakage of drainage water to these wells which led to the increasing salinity of these wells. Water of most wells are moderately alkaline, as p^H values were between 8 – 8.5. More than 50% of the wells can be considered suitable for irrigation according to SARw (less than 10) and RSC (less than 1.25). Concentration of soluble cations and anions in most of the groundwater samples followed the order $Na^+ > Ca^{2+} > Mg^{2+} > K^+$ for cations, and $Cl^- > HCO_3^- > SO_4^{2-}$ for anions. Nitrate (NO_3^-) concentration of the groundwater samples in the study area ranged from 0 to 274.9 mg l^{-1}. In most wells, nitrate concentration was higher than the permissible concentration limits for drinking water and for livestock and poultry. The concentrations of Fe, Zn, Pb, and Cu in all wells were lower than the permissible concentration limits for irrigation water. Only, in about 5% and 22% of wells, Ni and Mn concentrations were higher than the permissible concentration limits for irrigation water, respectively.

Key words: Geochemistry, groundwater, GIS, Qena Governorate, Egypt.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Role of potassium bearing minerals in desorption of reserved potassium in some soils of Northern Iraq

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Abstract

A laboratory study was conducted to successive extraction of reserved potassium by using conc. HCl under reflux for 13 surface and sub-surface soil samples representing three chosen pedons of soil series (472 ECC Bashika, 463 EKC Rabeaa and 461 ECC Talafar) locations of Nineveh Province in northern of Iraq, Aim is to investigate role of clay minerals on release of reserved potassium from soils. Results showed that dominated clay minerals were (smectite > illite > kaolinite > chlorite) for both 472 ECC and 461 ECC soil series and were (illite > smectite > kaolinite > chlorite) for 463 EKC soil series. Also results appeared that exchangeable K^+ released values were (2483-4575) mg kg^{-1} at 461 ECC and 463 EKC soil series respectively, non-exchangeable phase ranged from (752-1390) mg kg^{-1} at 461 ECC and 472 ECC soil series respectively. Soil fertility was evaluated according to its K^+ mica release referring for high K^+ release content with range between (3324-5516) mg kg^{-1} at 461 ECC and 463 EKC soil series, but rate of K^+ released was very law according to parabolic diffusion model with range from (195-359) mg kg^{-1} at latter soil series respectively. Results reflect effect of clay minerals on potassium release as amount and rates in arid and semi-arid regions.

Key words: Calcareous soils, Iraq, K^+ kinetics, potassium, release.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of the nature and content of water-soluble organic compounds in soils of the North-East of the European part of Russia

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Abstract

Water-soluble low-molecular organic compounds perform essential ecological functions, participating in the global circulation of substances and processes of soil formation. The study of these substances is a complex task due to their small concentrations and chemical lability. Elemental composition of water-soluble organic compounds in soils of the North-East of the European part of Russia is understudied. The use of such physical-chemical methods as gas chromatography and chromato-mass-spectrometry allows to improve the existing information about this group of compounds and to identify patterns of their location in space. Qualitative analysis of particular organic substances was conducted by two methods, identifying compounds without changing their chemical composition and identifying their trimethylsilyl derivatives. Soil sampling for qualitative and quantitative determination of organic compounds was done by the A. Mueller scheme with some changes. Sample preparation included such stages as extraction of acids, sorption concentration, drying at 40 °C, derivatization, then gas chromatography and chromato-mass-spectrometric analyses. This method of sample preparation increases the detection sensitivity of compounds compared with detecting them in the form of ethers (Mueller et al, 2002). All the identified substances belong to the three classes of compounds, alcohols, carbohydrates, and organic acids (aromatic and aliphatic oxyacid). By the gas chromatography method, we made a quantitative analysis of the compounds which were diagnosed as trimethylsilyl derivatives. Carbon weight fraction of the identified compounds in water extracts from Stagnic Albeluvisols soils (WRB, 2006) is 1-25 % in terms of carbon of water-soluble soil organic compounds. Carbohydrates make about 50 % of all the compounds identified, acids - 30÷45, alcohols - 5÷11 %.

Key words: Water-soluble low-molecular organic compounds, soil, gas chromatography, chromato-mass-spectrometry, trimethylsilyl derivatives

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil phosphorus fractions in Harran Plain

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Abstract

The fate of fertilizer P in soil during crop production has to be determined to evaluate the long-term economic value and sustainability of fertilizer practices. Total soil P (TP) and soil-test P (STP) are affected by long-term P application but relationships between these measurements need to be established for crop productions to improve P management guidelines. This research was conducted to evaluate soil P fractions in Harran Plain. Around 550 points were determined in the research area of 40 X 50 km by using grid system (based on 1X2 km cells). 1100 soil samples were taken from two depths (0-30 and 30-60 cm). Soil samples were analyzed for STP (Olsen P) and TP. In the paper, the relationship between STP and TP will be discussed.

Key words: Total P, bioavailable P, P minerals, soil test P, P fractions.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The role of pyrogenic and cryogenic processes in 137Cs migration in frozen soils

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Abstract

During last years, the frequency of wildfires in the territory of Yakutia has significantly increased because of thunderstorms and unauthorized controlled fires. Nowadays, many sites of burnt forest, which were formed in different years, are often found near cities and villages. Here we show the results of radio-ecological studies performed on burnt territories of the Central Yakutian plain that differed in forest types and geocryological conditions. The results of this study have shown that the increased concentration of ^{137}Cs was observed in the surface layer (0-4 cm) of the soil. Thus, in all studied soils profile sections the greater amount of ^{137}Cs (80 – 88 % of its total amount in a profile) was concentrated in the upper 4-cm layer of soil. However, it was still detectable until the depth of 8-9 cm. In condition of ubiquitous pollution of the territories with ^{137}Cs, forest fires, in general, reduce its levels in the environment. However, besides fire, permafrost activities (thermokarst, thermal abrasion etc.), which occur after a forest fire on ice-reach frozen soils, also contribute to this process. Thus, forest fires greatly affect redistribution of ^{137}C in soils of the Central Yakutian plain. Moreover, the influence of cryogenic processes on redistribution of the radionuclide in soil during the post-fire period depends on volume content of ice in frozen soil.

Key words: Frozen soil, pyrogenic and cryogenic processes, ^{137}Cs migration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Boron adsorption onto benchmark soils of New Zealand and its relationship with selected soil properties

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Abstract

Boron (B) availability from soil solution to plant depends on adsorption which in turn depending on several soil factors; pH, mineralogy, Fe and Al oxides in soil. To evaluate B adsorption selected soils were run for B adsorption in bench and dynamics of B adsorption with change in solution pH. Results showed increasing trend of B adsorption as soil solution concentration increased, with Allophanic and Ultic red Soils showing maximum B adsorption. Adsorptions in all soils were described both by Langmuir and Freundlich isotherms. Significant relationship was found in Langmuir model maximum adsorption 'b' and amorphous Fe contents in selected soils. Responding to solution pH, results showed that as pH proceeds from 2 to 9, adsorption increased gradually, followed by gradual decrease with further increase in pH. The experimental data and model predication used here can be used to manage bioavailability of B on studies soils.

Key words: Boron adsorption, New Zealand soil, soil pH, langmuir isotherm, freundlich isotherm

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The adsorption of heavy metals in the soil, depending on the size of soil particles

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Abstract

The parameters of adsorption of Cu^{2+}, Pb^{2+}, and Zn^{2+} cations by soils and their particle size fractions were studied. The adsorption of metals by soils and the strength of their fixation on the surface of soil particles under both mono- and poly-element contamination decreased with the decreasing proportion of fine fractions in the soil. The aim of this work was to study the effect of the particle-size distribution and the clay and physical clay soil chemistry physical clay fractions on the adsorption of copper, lead, and zinc by chernozems. The objects of study included the upper humus horizons of different chernozems of the Rostov oblast. To study the ion-exchange adsorption of the Cu^{2+}, Pb^{2+}, and Zn^{2+} cations, the soil in the natural ionic form was disaggregated using a pestle with a rubber head and sieved through a 1mm sieve. The soil samples were treated with solutions of Cu^{2+}, Pb^{2+}, and Zn^{2+} nitrates and acetates at the separate and simultaneous presence of heavy metals (HMs). In the solutions with the simultaneous presence of HMs, their molar concentrations were similar. The concentrations of the initial solutions varied in the range from 0.05 to 1 mM/l. The soil:solution ratio was 1:10. The contents of HMs in the filtrates were determined by atomic absorption spectrophotometry. The contents of adsorbed HM cations were calculated from the difference between the metal concentrations in the initial and equilibrium solutions. The increase in the degree of dispersion of the particle-size fractions in similar soils resulted not only in an increase in the content of adsorbed HMs but also in an enhancement of their fixation on the surface of the fine particles. Therefore, the adsorption capacity of the Lower Don soils for Cu^{2+}, Pb^{2+}, and Zn^{2+} decreased in the following sequence: clay loamy ordinary chernozem ~ clay loamy southern chernozem > loamy southern chernozem > loamy sandy southern chernozem. The parameters of the HM adsorption by the same particle-size fractions isolated from the different soils decreased in the following sequence: clay loamy chernozem > loamy chernozem > loamy sandy chernozem. This was related to the qualitative differences in the mineralogy and chemistry of the separated fractions and the significant effect of their composition and properties on the parameters of the HMs adsorption.

Key words: Metals cations, contamination, chernozem, the ion-exchange adsorption.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of olive mill wastewater at different rates in olive field: Effects on the chemical and microbial properties of soil

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Abstract

The fertilization effects of the direct application of olive mill wastewater (OMW) were extensively investigated in agricultural soils. This practice has been extended in the Mediterranean region particularly where olive grove soils presented very low levels of organic matter and are exposed to progressive degradation processes. The high fertilization value attached to OMW is attributed to its richness in water and nutrient resources. This study aimed to investigate the valorisation of this waste biomass as a potential soil conditioner and fertilizer in agriculture. OMW was assayed at three doses (50, 100, and 200 m^3 ha^{-1} $year^{-1}$) over three and six successive years in olive fields. The findings revealed that the pH of the soil decreased but electrical conductivity and organic matter, total nitrogen, sodium, and potassium soil contents increased in proportion with OMW concentration and frequency of application. While no variations were observed in phosphorus content, slow increases were recorded in calcium and magnesium soil contents. Soil polyphenolic content increased progressively in relation to OMW levels in all the investigated layers. However, no significant difference was noted in lowest treatment rate compared to the control field. In the soil upper-layers (0-40 cm), five phenolic compounds were identified over six consecutive years of OMW-spraying. For all treatments, microbial counts (aerobic bacteria and fungi) increased with OMW quantities and spraying frequency compared to the control.

Key words: Olive mill wastewater (OMW), soil layers, spreading, physico-chemical properties, microbial counts.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of humic acid and different organic manures on pristine point of zero charge (PPZC)

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Abstract

A study on the distribution of the electric charges, by the influence of humic acid, vermicompost, oil cake and cow dung compost in agricultural and forest soil was made by the potentiometric titration method of net electric charge measurement. Two different type of soil samples Haplaquept (forest soil) and fluvaquent (agricultural soil) bore net negative charge at their native pH, but variability in the magnitude of this charge was attributed to the effect of Al-blocked exchanged sites or contribution from strongly acidic organic functional groups. The titration curves at different ionic strengths crossed the common point of intersection, the pristine point of zero charge (PPZC), or the pH at which the net electric charge is zero. PPZC of forest soil is lower compare to agricultural soil, was attributed to the higher amount of organic carbon and exchangeable Al. Kaolinite (1:1) and bentionite (2:1) bears significant pH dependent positive charges between pH range 3 to 8 for kaolinite and 3 to 7 for bentionite. Surface properties of both soil and clay change drastically when 1 to 2 % humic acid and organic compost applied to the research site. It was observed that PPZC values reduces when humic acid and other three organic compost incubated with kaolinite clay (1:1) but PPZC reduction maximum when clay incubate with humic acid. Among these organic compost, vermicompost play minor role on the pH dependent surface charge properties. On the other hand in case of expanding (2:1) type bentionite clay, pH dependent surface charge properties are slightly altered compare to 1:1 type kaolinite clay. PPZC values increases when humic acid incubated with 2:1 type bentionite clay. Oil cake fails to change the surface properties of bentionite. Among three organic composts oil cake influences more on the PPZC value of agricultural soil; on the other hand vermicompost influences more on the pH dependent surface charge properties of forest soil.

Key words: Distribution of electric charge, pristine point of zero charge, humic acid and compost.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Stable isotopes: General principles and applications in ecology

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Abstract

Stable isotopes are a powerful research tool in environmental sciences. They are unique tracers of fundamental biogeochemical processes and are frequently used in ecological studies since they provide valuable information for identification of sources and sinks in different compartments of ecosystems (e.g. origin of water in the soil), reconstruction of ancient civilization diet and palaeoclimate (e.g. tree rings, sediments and ice cores), characterization of trophic relationships, determination of carbon and nitrogen turnover rates in soils, ecosystem gas exchange etc. Most commonly used in ecological and environmental research are stable isotopes of carbon, nitrogen, sulphur, oxygen and hydrogen. These are typically measured by a technique called stable isotope mass spectrometry (IRMS) coupled to a peripheral (e.g. elemental analyser) that converts a sample quantitatively to a suitable gaseous compound (typically CO_2, N_2, or H_2) that the mass spectrometer can then analyse. An important aspect of understanding stable isotope theory are isotope effects (equilibrium and kinetic isotope fractionations) that result from differences in physical properties of stable isotopes.The purpose of the lecture is to provide an introductory course in stable isotopes that addresses some fundamentals of stable isotope biogeochemistry, what stable isotopes are, what are common applications in ecological sciences, and outlines general principles of bulk - stable isotope analytical method.

Key words: Stable isotopes, stable isotope mass spectrometry, ecology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Selenium in soils of Moldova

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Abstract

Selenium (Se) is an essential trace element for both animals and human beings, although it is considered to be conditionally required for plants. As compared with other biogenic trace elements Se occurrence in the environment of Moldova is poorly understood. The objective of this study was to establish Se content and distribution in soils of this country. To solve this problem soil and plant samples were gathered in 139 large soil areas from different regions of Moldova. Se content in samples was detected using fluorometric method. It was established that Se concentration in soils ranged from 100 to 668 $\mu g\ kg^{-1}$ dry weight with the mean value 246±73 $\mu g\ kg^{-1}$. Determined local maximum of Se (1933 $\mu g\ kg^{-1}$) was due to anthropogenic impact and wasn't used in statistical analysis. Se concentrations in different soil types were at the mean ($\mu g\ kg^{-1}$) 232±56 in Cambisols (3 areas), 241±85 in Humic Luvisols (18 areas), 245±63 in Luvic Chernozems (15 areas), 277±97 in Haplic Chernozems (14 areas), 236±60 in Xeric Chernozems (70 areas), and 262±109 in Humic Gleysols (15 areas). Mainly, Se content in soils was optimal (more than 175 $\mu g\ kg^{-1}$), however there were soil areas with Se deficiency (lower than 125 $\mu g\ kg^{-1}$). Maximum of Se in soils was observed at the depth of 0.4–0.7 meters and then it decreased on going to parent rock. Se content typically increased with increasing of soil clay particles. The average Se content was 200 $\mu g\ kg^{-1}$ in sandy, 240–242 $\mu g\ kg^{-1}$ in loamy, and 261 $\mu g\ kg^{-1}$ in argillaceous soils. Se washout from terraces and watershed slopes as well as Se accumulation in relief depressions was shown. It caused an increased Se content in Humic Gleysols (up to 668 $\mu g\ kg^{-1}$). As compared to other trace element content in soils Se position was presented according to the following relationship (mg kg^{-1}): $n{\cdot}10^{4}$ Fe > $n{\cdot}10^{2}$ Mn > $n{\cdot}10^{1}$ Zn > $n{\cdot}10^{1}$ Cu > $n{\cdot}10^{-1}$ Cd > $n{\cdot}10^{-1}$ Se. These elements are able to cause antagonism for Se uptake by plants. High Se concentrations in local water reservors (0.2–6.1 $\mu g\ L^{-1}$, mean 1.8 $\mu g\ L^{-1}$) indicated the substantial presence of soluble Se forms, which were available to plant assimilation. Actually, agricultural crops grown on Xeric Chernozems accumulated the following Se levels ($\mu g\ kg^{-1}$): sorghum – 147, sunflower – 125, maize – 117, clover – 111, alfalfa – 110, oat – 107, barley – 106, wheat – 106. Thus, geochemical conditions of Moldova are favorable for Se bioaccumulation by plants.

Key words: Selenium, soil, plant, bioaccumulation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Simultaneous extraction and potentiometric determination of potassium and nitrate in soil by using ion selective electrodes

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Abstract

Rapid and simultaneous determination of nitrate (NO_3^-) and potassium (K^+) ions in soil samples using ion selective electrodes (ISE) was investigated. The compatibility of ISEs with soil extraction solution is a challenging subject as various effects such as pH, ionic strength and interferences have to be considered as well as efficiency of the extraction solution. In this study, 30 agricultural soil samples of different properties were extracted with 0.01 $mol.L^{-1}$ $Al_2(SO_4)_3$ and the extracts were simultaneously measured by NO_3-ISE and K-ISE in a flow system. The results were compared with ion chromatography (IC) as the reference method, and the regression analysis between IC and ISE results was yielded high correlation (R^2 = 0.986 and R^2 = 0.951 for K^+ and NO_3^-, respectively). It was concluded that, ion selective electrodes can be used with 0.01 $mol.L^{-1}$ $Al_2(SO_4)_3$ extraction solution for rapid and simultaneous determination of nitrate and potassium in soil samples.

Key words: Ion selective electrodes (ISE), soil analysis, nitrate, potassium.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Modeling of soluble salts in deficit irrigation for sugar beet and sugar cane in province of Khuzistan, Iran

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Abstract

Decreasing irrigation water will decrease crop yield and increase both salinity and crop water stress. Because of salt accumulation, we have further decrease of crop yield. In this work we used SaltMod to study the yield reduction and salt accumulation in the root zone profile and below the root zone for sugar beet and sugar cane in the central Khuzistan province in southwest of Iran. After leaching excess salts and bringing the ECe of salt affected soils to 4 dS/m, changes of above salinity parameters were studied after 20 years of irrigation. Using the farmers' responses option, SaltMod reduces the area of cultivated crops in order to facilitate leaching. If the salinity of root zone at field capacity (FC) predicted by SaltMod is divided by two, the salinity of the saturated extract is obtained which are all below 4 dS/m. We also showed deficit irrigation to the amount of 10%and 40% for the two crops named above will reduce the yield of sugar beet to 81% and 48% and the yield of sugar cane to 22% and 6%. Therefore, it was concluded that growing sugar beets in Khuzistan is more desirable than growing sugar cane.

Key words: M Field capacity (FC), leaching, SaltMod, water stress.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Understanding the humic acid interaction with calcium, barium, and strontium ions in soil: A spectroscopic investigation

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Abstract

Humic substances have a major role in controlling the mobility and bioavailability of metallic ions in soils and natural waters. The alkaline earth metals, calcium, barium, and strontium, are broadly abundant in the crust of the earth, and Ca^{2+} ions are known to be important in the formation of structural aggregates in soils. Yet, direct spectroscopic evidence of how Ca, Ba, and Sr ions interact with soil organic matter, is minimal. To develop a deeper understanding of the interaction of the alkaline earth cations in soil, we studied the complexation behavior of strontium, barium and calcium by humic acid (HA) using solid-state ^{13}C CP-MAS NMR, FTIR and extended x-ray absorption fine structure (EXAFS) spectroscopy. A HA sample was extracted from an agricultural mollisol (pH 6, 32.5% clay content, 3.7% organic carbon) located in southwestern Minnesota, USA, by the standard NaOH method. The HA sample was treated with chloride salts of Ca, Sr or Ba, then freeze-dried prior to spectroscopic measurements. The FTIR spectra, obtained using pressed KBr disks, and the ^{13}C NMR spectra revealed spectral differences, stemming mainly from deprotonation reactions of the carboxylic and phenolic groups of the HA. The association of Ca, Ba, and Sr ions with the HA caused a marked FTIR shift of the carboxylate C-O stretching band ,with the Ba shift being the most pronounced (HA 1604.7; HA-Ca 1595.1; HA-Sr 1597 ; HA-Ba 1579.6), which seems to imply that Ba is the strongest bound element . An NMR shift of the carbonyl peak at 171.8 ppm was also observed to 174.5 for Ca, 173.7 for Sr, and 174.4 for Ba confirming that these cations are behaving differently towards soil HA. The EXAFS spectra indicated back-scattering from oxygen atoms, in the first shell, for Ca, Sr, and Ba. Our data confirm that (1) the carboxylates and phenolates are the prevailing functional groups involved in the interactions between the extracted HA and alkali metal cations, (2) barium forms the strongest complex compared to strontium and calcium.

Key words: Calcium, Strontium, Barium, Humic acid, EXAFS, FTIR, 13C NMR.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of *Olea europea* L. and *Ficus Carrica* L. fine root activity on the K biodisponibility and clay mineralogy of the rhizosphere

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Abstract

The objective of this study was to compare the effect of fine root activity of *Olea europea* L. and *Ficus Carrica* L. on soil in its immediate vicinity. The study was conducted on two stations in Northern Algeria: Guendoul and Bouira. *Olea europea* L. and *Ficus Carrica* L. roots significantly altered some chemical properties of rhizosphere soil. Increases of soil carbon (47.6 and 21.6 %), KNH4+ (21 and 7%) and $KHNO_3$ (15 and 12%) were observed in the *Olea europea* L. and *Ficus Carrica* L rhizospheric soil of Bouira and Guendoul respectively. Bulk soil and rhizospheric soil clay mineralogy were similar. Interstatified illite-smectite, smectite-illite and illite were predominant in clay fraction. Chlorite and kaolinite are less represented. The decomposition of XRD diffractograms of two soil clay fractions using the Decomp program revealed that *Olea europea* L. roots promote K^+ storage in interlayer position. Indeed, the lower abscissa position of the gravity center (cg)of the X-ray patterns, the peak displacement of clays populations PCI, I/S, S/I toward illite peak position indicates an increase of "Illite like" layer content in the vicinity of *Olea europea* L. roots. *Olea europea* L. roots appeared to have more influence on the rhizosphere soil than *Ficus Carrica* L. roots probably because of its higher root biomass and the greater activity of the tree in winter (Contrary to *Ficus Carrica* L., *Olea europea* L. keep their leaves in winter). The two species underground activity seems to be well reflected in their respective rhizosphere.

Key words: Clay minerals, olive tree, fig tree, rhizosphere, potassium.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Elevation kinetics of non-exchangeable potassium release and correlation with soil characteristics

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Abstract

Sustainable management of soil potassium ignored, while the environmental impact of nitrogen and phosphorus fertilizer applied as broadly as they are seen as the main problem. The rate of non-exchangeable K+ release from soil minerals can significantly influence K+ fertility of soils. The objectives of this study were (i) to determine the kinetics of non-exchangeable K+ release from some calcareous soils and (ii) Soil properties associated with the release of non-exchange potassium. The kinetics of nonexchangeable potassium (NEK) release was studied using calcium chloride extracts 0.01 M in the range of 0-2017 ha. The results of kinetic studies was investigated by the kinetics model such as first order, zero order equation, power function equation, simple Elovich equation and parabolic diffusion equation. The results showed that the zero-and first-order equation failed to explain the kinetics of K release from soil, due to the high estimated standard error of the mean 26.4, 2.09 and a low correlation coefficient, 0.76, 0.54, respectively. Also the parabolic diffusion equation, due to the high standard error, was not able to explain The kinetics of nonexchangeable potassium (NEK) release, despite the high coefficient. The power function equations with coefficient 0.94 and standard error 11.99 and Elovich equation with coefficient 0.94 and standard error 9.64 to reasonably match the data received. Comparison of kinetic data with a power function equation and simple Elovich The kinetics of nonexchangeable potassium (NEK) release from soils is controlled by the diffusion process. Investigation of correlation coefficients power function equations and simple Elovich with soil properties showed that among all physiochemical characteristics measured except salinity and sand percentage are significant at the 5% level by correlation coefficients with a power function equation. The equation simple Elovich except salinity and cation exchangeble capacity and other characteristics of the correlation coefficient was significant at the 5% level. In contrast, the zero-order equation, the correlation coefficient between any of the soil properties, there was no significant correlation coefficient of the equation.

Key words: Non-exchangeable K+, kinetics, release, correlation coefficients.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of organic fertilizers on different forms of phosphorus and corn yield in Moghan region

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Abstract

Use of phosphorus fertilizers in alkaline calcareous soils is very low, due to the major problems of low efficiency, stabilization and accumulation of phosphorus**,** in the soil. Awareness of the different forms of phosphorus and their interaction with organic and chemical fertilizers are necessary for the management of soil phosphorus. The purpose of this study was to investigate the effect of different treatments: (50 kg superphosphate (T_1), 100 kg superphosphate (T_2), 50 kg superphosphate + 5 tone organic manures (T_3), 50 kg superphosphate + 10 tone organic manures (T_4), 100 kg superphosphate + 5 tone organic manures (T_5), 100 kg superphosphate + 10 tone organic manures (T_6), 5 tone organic manures (T_7), 10 tone organic manures (T_8) on the changes in the different forms of phosphorus , NaCl+NaOH-P, citrate bicarbonate (CB-P), citrate bicarbonate dithionate (CBD-P), and HCl (HCl–P)., at planting, middle of the growing season and harvest time and also on corn yield with correlation coefficients in different soil with different forms of phosphorus. This study was a completely randomized block design with three replications. The results showed significant differences between control and treatments with manure application was observed at 5% level. treatment (T6) have the highest yield, with an average of 5393.7 kg/h and The lowest yield owned treatment (T2), with an average 4253 kg/h. Also, the results showed that the correlation value of the stabilized phosphorus with calcium carbonates in all treatments except the treatments T1, T2, and Absorbable phosphorus were significant. Study of the correlation coefficient between soil properties and different forms of phosphorus showed a significant correlation at 5% level between the percentage of clay, lime, phosphorous, calcium phosphate and calcium carbonate were observed. While the correlation between the other characteristics and different forms of phosphorus was non-significant. organic fertilizers due to enhanced elements absorption by reducing ph and Increased solubility of deposited elements.

Key words: Phosphorus fractions, superphosphate, manures.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of soil properties in phosphorus sorption

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Abstract

Phosphorus sorption by soils depends on a series of soil properties, most important of which are pH, clay and organic matter (OM) content, cation exchange capacity (CEC), amorphous Fe, Al and Mn oxides, as well as $CaCO_3$. The aim of this work was to evaluate the soil properties that affect P sorption in 10 soils of Thessaly, Greece. We chose soils that differed considerably in pH, and we conducted batch sorption tests with initial added element concentrations C_0 = 0 - 100 mg L^{-1} at 1-to-10 soil-to-solution ratio. We measured three sorption indices: The experimental sorption at 100 mg L^{-1} (q_{100}), the maximum sorption according to Langmuir (q_{max}) and the distribution coefficient, K_d (equal to q/C). We also measured important soil physico-chemical properties, as well as the phosphorus saturation index with ammonium oxalate, as %PSI = P/(Fe+Al). Moreover, the three P sorption indices were correlated with the measured soil properties. We found that q_{max}.was significantly correlated with CEC (R^2=0.561 at p<0.05), and this indicates that P sorption increases with the increase in soil colloids content. Also, pH affected P sorption significantly, probably due to its relation with $CaCO_3$ (the correlation of q_{100} vs. pH had R^2=0.707 at p<0.01). Contrary to the expected, the sorption indices were correlated significantly but inversely proportionally with Fe, Al and Mn oxides (R^2=0.551 at p<0.05, taking into account the sum of all oxides in mmol kg^{-1} soil), and this indicates that P sorption was rather affected by $CaCO_3$ rather than the oxides. The correlation between P sorption and %PSI was not significant, while the P extractions with Mehlich-3 and ammonium oxalate had a significant and negative correlation with P sorption, meaning that the higher the initial P concentrations in soil, the lower the maximum P sorption capacity.

Key words: Phosphorus, sorption maximum, phosphorus saturation index.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Geochemical characteristics of the red soil and parent carbonate rocks from SW Bulgaria

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Abstract

The presented study investigates the geochemical behavior of the system parent rock - top soil, from two locations in the SW part of Bulgaria. They are situated at altitude between 700 and 1000 meters and with different aspects (N and NE). The climate conditions are characterized with low rainfall and increased solar radiation. The investigated soil cover has been determined as Chromic Cambisols and Rendzic Leptosols. The parent rocks are represented by different types of marbles. In the western location they are white (calcite dominated) marble, grey (deformed) marble and impure (enriched in silica minerals) marble. Eastern location is built up by dolomite marble, marble breccia and grey (calcite dominated) marble. To achieve the aims of the study, several soil profiles, as well as the parent rocks, were described, sampled and analyzed. The major and trace elements are determined by multi element AES-ICP and RFA analyses. The soils from the both locations showed similar pH values and organic matter: slightly alkaline pH (7.3 to 8.9 for the west one and 7.8 to 8.8 – for the east one) and organic matter up to 4%, for the east one, and up to 5% - for the west one. Related to the carbonate parent rocks clear decalcification trend, accumulation of major rock forming (Al, Si, Fe, K, Na, Ti, P, Mn) and trace (Pb, Zn, As, V, Cr, Ni, Cu, Co, Y, etc.) elements in the soils were observed. The Ca/Mg ratio is in the interval 1-2. The heavy metals (Pb, Zn, Cu, Cr, As) content slightly increases in the soil but retain below Threshold Limit Values (TLV), for agricultural and nonagricultural soils, due to low content in the parent carbonate rocks. The calculated concentration coefficient significantly varies, depending of the parent rock's composition: it is higher in the system red soil/white marble and lower in red soil/impure marble. However, in the range of each soil profile the concentration coefficient remains almost the same. The data obtained suggest direct relation between microclimate conditions, parent rocks and their weathering products with supplement human activity. (Acknowledgements: The authors are grateful for financial support to the project DDVU-02-20/2010, from Bulgarian Science Fund.)

Key words: Red soils, soil geochemistry, rock geochemistry.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Acid-base properties of humic acids isolated from different sources

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Abstract

Potentiometric titration was used for obtaining detailed information on the acid-base properties of humic acids. The studied humic acids were isolated from different four sources i.e. alluvial soil (HAs), farmyard manure (HAf), compost (HAc) and poudrette (HAp). The isolated humic acids were purified and performed. Back titration using 0.1M HCl as the titrant and direct titration using 0.1 M NaOH as the titrant of humic acid solutions (2 mg/ml) at the ionic strength of 0.1 were executed. Moreover, total acidity and functional groups of humic acids were estimated. The studied humic acids were similar in their acid-base properties: i) the data of direct and back titration curves which limited the position and composition of dissociation or ionization of functional groups of the studied humic acids were more similar, ii) total functional groups of HA determined from back and direct potentiometric titration was ranged between 5.40-6.54 and 4.20-5.00 mmolc/g HA, respectively, iii) total functional groups of humic acids determined using potentiometric titration were varied from those determined using normal titration methods, where total functional groups at normal titration methods ranged between 11.32 and 19.58 mmolc/g HA, and iv) humic acid extracted from poudrette has the highest value of total acidity followed by compost, farmyard manure, while the soil came late.

Key words: Potentiometric titration, acid-base properties, humic acids, functional groups.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of pyrolysis temperature on chemical and physical properties of sewage sludge biochar

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Abstract

Pyrolysis of sewage sludge to biochar is an effective way to sludge management, besides mitigation of CO_2 input to atmosphere and positive effects on soil properties. The aim of this study was to evaluate the effects of pyrolysis temperatures from 300 °C to 700 °C, on physical and chemical properties of a secondary aerobically digested urban sewage sludge biochar. Biochar yield significantly decreased with increasing pyrolysis temperature, whereas gas yield increased with rising temperature. Biochar pH and EC had rising trend with increasing temperature. Biochar produced at low temperature had higher concentration of nitrogen and total organic carbon (TOC) but lower C/N, P, K and Na content. Iron, Zn, Cu, Mn, Ni, Cr and Pb concentrations increased with temperature. Lower DTPA extractable concentration of Fe, Zn, Cu, Mn, Ni, and Pb was found in biochars compared to sewage sludge. Particle density was greater in biochars produced at high temperatures. Biochar production decreased bulk density, although it had no significant difference between temperatures. Pyrolysis decreased sewage sludge water repellency and the lowest repellency rating was found for produced biochar at 700 °C.

Key words: Pyrolysis, sewage sludge biochar, nutrients, bulk density, water repellency.

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International Soil Science Congress

EURASIAN SOIL
Congress 2014
Antalya, TURKEY

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SOIL EROSİON & CONSERVATION

Land is our future, Let's protect it against desertification

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Abstract

Along with the rapid increase of the world population, the need for food and fresh water resources are gaining more and more importance every day. Loss of productivity due to excessive and misuse of productive lands as well as climate change and drought makes it even more difficult for food security and to meet the demand for clean water with each passing day. For a sustainable ecosystem, ensuring the sustainable management of land resources is of great importance. And this would be through integrated watershed management, protection and rehabilitation. Conservation, improving and increasing the productivity of the land, cooperation to combat drought and desertification, enhancing inter-agency coordination, sharing and dissemination of best practices are a necessity. These issues are not only important for future generations, but seen as a necessity for today's world to live in peace and tranquility.

Key words: Desertification, land degradation, sustainable management.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of the suspended sediment load in semi-arid area by sediment rating curve approach, wadi Ouahrane basin, Algeria

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Abstract

In this paper, we show a methodology for an assessment of the suspended sediment yield in the wadi Ouahrane basin (270 Km² of northwewt Algeria). We use discharge–sediment load relationships to explore the variability of water discharge and sediment load. The wadi Ouahrane basin was controlled by a gauging station (Ouled Fares) to measure discharge and sediment transport (sediment concentration), over a period of 40 years (1973 – 2012). The relations between daily mean sediment discharge and daily mean water discharge were analyzed to develop sediment rating curves (SRC). Sediment transport was evaluated using the model obtained at this level. The mean annual sediment yield during the 40 years of the study period was 762 $T.km^{-2}$. This drainage basin had high rainfall and runoff, the hydric erosion was very important. Sediment transport in winter remains the highest (60%), significantly more than other seasons.

Key words: Sediment transport, model, sediment rating curve, assessment, semi-arid, basin, Algeria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of soil erosion with MPSIAC and EPM methods using Arc-GIS package, case study: Chalderan watershed in northwest of Iran

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Abstract

Soil erosion reduced soil fertility, crops and also gradually causes loss of agricultural lands. If the soil exposed to erosion, first adverse effects will occur on water and plants. So being aware of the extent of erosion and its spatial changes will help planners to protect the soil, one of the critical resources for agriculture. Because the proper management of soil in a watershed required identification of sediment production power of the basin, to identify the exact causes of soil degradation we need accurate baseline information. The purpose of this study was to evaluate the spatial changes of erosion in Chalderan watershed in northwest of Iran, with two methods, MPSIAC and EPM, with use of Arc-GIS package. Comparing results of these methods showed that MPSIAC is closer to reality and according to the quantitative analyses by using MPSIAC and EPM methods, forty percent and fifteen percent of the basin has low erosion, respectively.

Key words: Soil erosion, MPSIAC, EPM, Arc-GIS.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil erosion protection potential of young Lycium plantation

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Abstract

Soil erosion is removal of soil and rock particles by water, wind, ice and gravity. It is widely recognized as a global soil threat. Soils impacted by different forms of erosion cover large areas around the world. While landscape, soil and climate conditions trigger soil erosion processes, the vegetation cover reduces the soil erosion risk. About 60 % of the area of agricultural land in Bulgaria is under erosion risk, which necessitates implementation of series of measures for soil erosion control. The aim of this study is to determine the erosion protection potential and the loss of soil nutrients of young *Lycium Barbarum* plantation. Field experiments have been set up under unirrigated conditions at the experimental field for soil erosion studies of the N. Poushkarov Institute of Soil Science, Agrotechnology and Plant Protection near Suhodol. The local soils are Chromic Luvisols, moderately eroded. The altitude is 750 m and the slope gradient is 8^0. The experiment consists of four field plots for soil erosion studies, three of which planted with Lycium barbarum and a reference one with bare soil. The plants have been planted at a distance of 2 m between adjacent rows and 1 m between each two plants within the row. The size of each field plot is 32 m^2 (4 m width and 8 m length). The plots are equipped with containers for collecting the surface runoff caused by erosive rainfall events. Biometrics, including the root-striking of the plants, their growth in height, foliage cover (projection) and blossom, was studied from May 13^{th} to October 21^{st}. The data reported cover the results from the studies during the first vegetation period after planting in the Spring of 2013. During the year four erosive rainfalls were observed with a total amount of 79.2 mm, resulting to a total amount of the soil loss of 465 kg/ha from a planted plot and 551 kg/ha from bear soil. The total surface runoff is 114 m^3/ha from planted plot and 153.1 m^3/ha from bare soil. The total losses of $N\text{-}NO_3^-$ are 0.569 kg/ha from plated plots and 0.718 kg/ha from bare soils and the losses of $N\text{-}NH_4^+$ are respectively 0.055 and 0.117 kg/ha. The results from biometrics showed that 96 % of the plants were found to have stroked roots and 73 % blossom. The results reported here show that *Lycium Barbarum* plantation manifests soil protection effect from the first year after planting, since the surface runoff from the planted field plots is 74.4% of that from the reference plot with bear soil, and the respective portions of the soil and nutrient losses are 84 % and 0.79 %. The research throughout the following years will give further information about the soil erosion protection potential of young Lycium plantation.

Key words: Shrubs, soil erosion, protection, plantation, research.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Investigating the effects of erosion control efforts on improving soil properties in areas damaged by dam and road building

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Abstract

Lately, serious ecological and socio-economical changes have been taking place in the Watershed of the Coruh River due to Coruh Dam Projects implemented by the General Directorate of State Hydraulic Affairs. Some negative effects of land degradation on natural resources of the Watershed have being observed during the construction of one of these projects, the Deriner Dam and building of new roads. However, there is not much scientific research on the degree of land degradation and success of precautions taken against it. In this study, erosion control and tree planting efforts to stop soil erosion and to improve soil properties in damaged areas as a result of building new roads, a part of the construction of the Deriner Dam, were investigated. In accordance with this purpose, soil samples were taken from three different areas; two of which are erosion control areas with terraces built and acacia and yellow pine seedlings planted and the one is an undisturbed (control) area with natural forests. In order to represent the whole study area, total of 60 disturbed soil samples were taken both from terraces and from sloping area left between terraces built for erosion control purposes in damaged areas. In addition, for comparison, 15 soil samples were taken from the undamaged natural forest area that has not affected by the road construction. Collected soil samples were analyzed for a total of six soil parameters including soil texture, pH, organic matter, total nitrogen, total lime, and electrical conductivity. By running variance analyses on these soil parameters, we tried to determine whether there are any improvements (rehabilitation) in soil properties of damaged areas with the help of ongoing erosion control and planting efforts. After evaluating statistical analyses run on the soils data, there were significant differences found for soil properties at terraces and between terraces in erosion control and reforestation areas. Moreover, it was determined that the reforestation efforts have resulted in improvements of soil properties at some degree but when they are compared to the soils of the undisturbed natural forest, it is clear that the degree of improvement is not sufficient yet. However, it can be stated that the areas planted with acacia seedlings have better soil properties than the areas planted with yellow pine seedlings.

Key words: Land degradation, soil erosion, erosion control and reforestation efforts, improvement of soil properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Characterization of erodibility using soil strength and stress-strain indices for soils in selected sites in Enugu State, Nigeria

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Abstract

In this study, initial soil strength indices (q_u) and stress-strain characteristics namely failure strain (ε_f); area under the stress-strain curve up to failure (I_s) and stress-strain modulus between no load and failure (E_s) were investigated as potential indicators for characterizing the erosion resistance of two compacted soils namely sandy clay loam (SCL) and clay loam (CL) in some selected sites in Enugu State, Nigeria. The unconfined compressive strength (used in obtaining strength indices) and stress-strain measurements were obtained as a function of moisture content in percentage (mc %) and dry density (γ_d). Test were conducted over a range of 8% to 30% moisture content and 1.0g/cm^3 to 2.0g/cm^3 dry density at applied loads of 20, 40, 80, 160 and 320kPa. Based on the results, it was found out that initial soil strength alone was not a good indicator of erosion resistance. For instance in the comparison of exponents of mc% and γ_d for jet index or erosion resistance index (J_i) and the strength measurements, q_u and E_s agree in signs for mc%, but are opposite in signs for γ_d. Therefore there is an inconsistency in exponents making it difficult to develop a relationship between the strength parameters and J_i for this data set. In contrast, the exponents of mc% and γ_d for J_i and ε_f and I_s are opposite in signs, there is potential for an inverse relationship. The measured stress-strain characteristics however, appeared to have potential in providing useful information on erosion resistance. The models developed for the prediction of the extent or the susceptibility of soils to erosion and subjected to sensitivity test on some selected sites as shown in table 8 achieved over 90% efficiency in their functions.

Key words: Characterization, erodibility, soil strength, stress-strain, indices, soils, selected sites, Enugu State, Nigeria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil erosion and conservation in two geomorphic and recreational environments

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Abstract

Erosion in recreational areas is often triggered by vegetation removal as a result of activities like walking, horse-riding, camping, motor vehicle use, mountain bike riding, and development of visitor facilities. Sandy soils in two geomorphic settings were investigated for potential differences in erosion patterns and conservation practices. On a coastal sand dune (100% coarse sand) leading to a popular beach, fencing provided regulated access via five rill-eroded, metre-wide paths over slopes ranging from 6.5 to 10 degrees and slope lengths from 35 to 45 m. Conservation measures on back-dune paths included repeated spreading of off-site clay-based fill and/or road metal, later replaced by concreting. On the seaward-face paths where potential erosion rates were estimated to be >10 times those on adjacent areas, a below-surface board-and-chain system was replaced by low maintenance solid-surface plastic pavers. Relic cliff-top dunes in a different area were traversed by a 26-km walking track with non-vegetated and unfenced pathway segments 1-3m wide. Soil texture was dominated by coarse sands (coarse:fine:silt of 79:19:2) which were eroded by wind, water and mass downslope transfer from walker's footfalls. Despite gentle slopes (<5 degrees), combined erosion processes resulted in hollowing of pathways below adjacent surfaces to depths of up to 65cm. Where path surfaces became uncomfortable for walkers, or gullies up to 80cm deep developed, visitors widened paths by trampling adjacent vegetation. This study found that costly installations on eroded pathways are feasible for well-frequented, beach-fringing dunes, but not for lengthy walking tracks with long gentle slopes extending for kilometres; and erosion patterns and conservation measures on sandy soils differ in contrasting geomorphic and recreational environments.

Key words: Sands, erosion, recreation pathways, conservation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Aggregate stability as an indicator of soil crusting, soil erodibility and sediment characteristics for interrill erosion

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Abstract

Crusting and erosion of cultivated soils result from aggregate breakdown and the detachment of soil fragments by rain, and the susceptibility of soil to these processes is often inferred from measurements of aggregate stability. Here, theories of aggregate breakdown are reviewed and four main mechanisms (i.e. slaking, breakdown by differential swelling, mechanical breakdown by raindrop impact and physic–chemical dispersion) are defined. Their relative importance depends on the nature of the rain, as well as on the soil's physical and chemical properties. The relations between aggregate breakdown, crusting and water erosion are analysed, and existing methods for the assessment of aggregate stability are reviewed. A unified framework for the measurement of aggregate stability is proposed to assess a soil's susceptibility to crusting and erosion. It combines three treatments having various wetting conditions and energies (fast wetting, slow wetting, and stirring after pre-wetting) and measures the resulting fragment size distribution after each treatment. It is designed to compare different soils, or different climatic conditions for a given soil, not to compare time-dependent changes in that soil.

Key words: Aggregate stability, crusting, erosion, methodology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of classification and estimation models for soil loss in soil disturbance of engineering construction

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Abstract

Growing interest in the research of soil loss caused by human activities has attracted attention over the world especially for the developing countries. However, existent soil erosion estimation models focused on natural than artificial conditions, and particularly the models used to estimate the soil erosion rate to the latter involves a number of uncertainties, which require further attention. To develop scientific models, it is necessary to extract the characteristics of soil bodies that formed in different engineering construction programs. This contribution reports the results of an investigation of classifications in various artificial programs around China. Some indexes, such as slope gradient, slope length, soil layer depth, vegetation coverage were measured for accumulation masses and excavation faces, which were caused in the process of construction. Soil samples were also collected from different sites representative of different types of programs and located in different areas of China. Measurements of soil density, soil water content and soil particle size were made on these samples. Four classifications were given and related experiments, including artificial simulation rainfall, field and indoor wind tunnel simulation, and natural rainfall and wind erosion monitoring, were taken to calculate the amount of soil loss in different types. On the basis of analyzing, the crucial parameters to contribute soil loss were selected and the models using for calculating different types soil erosion were put forward.

Key words: Soil erosion induced by human, soil disturbance, engineering construction, erosion modeling, parameter selection

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Morphological aspects of postpyrogenic soils dynamics

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Abstract

Soils, affected by catastrophic wildfires in 2010, were investigated in pine woods of Togljatty city, Samara region with the special reference to soil morphology and profile development rates. Pyrogenic soils characterizes by formation of specific charcoal horizon with increased portion of postfire organic matter. The postfire soils investigated were identified as Sod sandy textured soils with weak features of eluviation. Profiles of mature soils consist of AY-AC-C layers, while the postfire soil has AYpir layer instead of humus horizon. The black carbon content were higher in postfire plots that in mature one, but in opposite there was not any natural under composed remnants on forest floor in fire disturbed soils. Not revegetated soil shows the evidences of organic matter illuviation during the first and second years of postfire succession. One year later after wildfires essential changes in layer morphology, surface erosion and transportation of a burned material and an dark colored material illuviation down on a profile were quite expressed. At the beginning of research (2010) there were thick black horizons on a soil surface whereas in the summer of 2011 they were presented by only thin layer on a surface. It testifies that an erosion processes influenced on soils since the soil surface was affected by precipitation after disappearance of the litter. All dark colored material was moved to relief depressions by water streams that led to increase of the dark colored solum thickness there. In some places there are features of mechanical turbation of soil profiles. Investigation conducted shows that there are essential postfire changes in soil morphology after the intensive and catastrophic wildfires effect. Some micromophological aspects of soil restoration are discussed in presentation as well. This study was a contribution to the Russian foundation for basic research, project for young scientists No.14-04-32132.

Key words: Soils, wildfires, organic matter, postfire soil development, ecology and conservation biology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of organic conditioner applications on soil loss under simulated rainfall conditions

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Abstract

This study was conducted to determine effects of farmyard manure, rice husk and municipal waste compost on soil loss occurred by runoff in two different soil groups under greenhouse conditions. Soils classified as Lithic Ustorthent and Typic Calciustept located in Minöz Basin of Samsun province were used in the study. Organic conditioners were applied to the degraded soils of basin (sieved from 8 mm) according to dry weight basis at four different doses (0, 2, 4 and 6 %) in the simulation experiment conducted under greenhouse conditions. Experiment was planned in a randomized plot design as factorial arrangement with two replications. After 12-week incubation period, 15 % slope was given to erosion pans and artificial rainfall with the intensity of 55 mm h^{-1} and 70 mm h^{-1} was applied for one hour and soil loss values occurred by runoff were measured. At the end of the experiment, it was determined that organic conditioners applied to the soils reduced losses. Municipal waste compost was determined to be more effective than rice husk compost and farmyard manure in reducing soil losses occurred from runoff pans. Effectiveness of organic conditioners showed differences depending on application doses and the lowest losses were obtained at maximum dose applications. As a result of the study, by using rice husk compost, municipal waste compost and similarly organic conditioners in the agricultural fields both reduced soil losses occurred by degradation and negative impacts revealed in terms of human health and environment pollution and thus contributed significantly to the country economy were concluded.

Key words: Erosion, rainfall simulation, organic conditioner.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Using of spectral and geomorphometric data for water erosion mapping in El Ksiba Region in the central high atlas mountains of Morocco

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Abstract

In semi-arid zones where vegetation is generally less covering, bare lands occupy the major part of space and are easily detectable by land observation sensors, thus significantly influencing the satellite signal because of the variation of their colors and their brilliancies. By exploiting the correlation between the spectral signature of the surface and the state of its degradation, many spectral indices have been elaborated by using data acquired by different. Furthermore, geomorphometric variables derived from the Digital Elevation Model contribute in understanding the hydrological behavior of the ground toward hydric erosion. The aim of this work is to identify and map the degradation risks in the mountainous region of Moroccan central High Atlas. This approach will contribute in the elaboration of a decision help support system to take the necessary intervention measures for the protection of risk areas and for the preservation of land and vegetation. For this purpose, we have exploited geomorphometric variables derived from a Digital Elevation Model. Among other things, we have considered spectral variables such as indices that describe the form of land spectra as well as indices of vegetation that were calculated from a satellite image acquired by the sensor of Landsat-5Thematic Mapper (TM). Before the processing and extracting of information, the image has been corrected from the perturbing effects and it has been geo-referenced for an adequate integration in a geographic information system for multi-criteria analyses (MCA).

Key words: Water erosion, geomorphometric variables, spectral indices, Multi-Criteria Analyses, central High Atlas Mountains of Morocco

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of rainfall, soil textural composition and surface cover on erosional losses on abandoned farmlands in the rainforest zone, Southern Nigeria

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Abstract

A deeper knowledge of soil erosion process on abandoned farmland of varying ages would be useful in the prediction of runoff and sediment production for assessing nutrient loss risks and planning nutrient conservation strategies during natural fallow. This study was conducted to examine the influence of rainfall, soil textural composition and surface cover on erosional losses on abandoned farmlands in the rainforest zone, southern Nigeria. Four 40m^2 runoff plots were installed to collect runoff and sediment loss from the months of June to September in 2012 rainy season. Soil textural information showed that the 10yr-old, 3yr-old and farmland were sandy loam, while the 5yr-old fallow was silt loam. Stepwise regression identified rainfall and sand content as the causes of runoff on the 10yr-old fallow, while rainfall and crown cover determined sediment loss; on the 5yr-old fallow, runoff was caused by rainfall and silt content; on the 3yr-old fallow, rainfall was responsible for the erosional losses, while on the farmland, rainfall and sand content were identified. The study revealed that rainfall was the major rainfall parameter controlling soil erosion on the fallow plots, and that greater percentage of the rainwater was absorbed by the coarse textured and more permeable soils of the 10yr-old and 3yr-old fallows, while the fine and poor permeable soil of the 5yr-old fallow generated the most runoff. The study concluded that surface feature and cover helped to minimize the erosional force of rainwater. To reduce soil erosional losses, fallow soils should be mulched.

Key words: Erosional losses, soil surface feature, surface cover, abandoned farmlands.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The role of the conservation agriculture technology in reducing soil erosion in the central region of Azerbaijan

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Abstract

The research shows that the current situation of the soil fertility is not satisfactory in Azerbaijan. Salinization of the land areas, especially in central regions and agricultural territories, exposure to erosion as well as soil compaction due to the use of heavy agricultural machineries have increased enormously. Application of relevant agrotechnical, meliorative and agro-meliorative measures is necessary to ensure the protection of soils from erosion. Prevention of soil fertility and reduction of erosion are also possible through application of the Conservation Agriculture (CA) technologies. Conservation agriculture should be considered not only as a technical method, but also as an approach for environmental protection. Mainly the following technologies are applied by us in the conservation agriculture: (i) laser leveling of soil surface, (ii) bed planting method, (iii) crop residue retention on the field, (iv) minimum or zero tillage, and (v) application of crop rotation system. CA is a long-term process which has a year-by-year impact on the soil fertility. As a result of the 3-year research conducted by AIM on CA application, it was found that this approach has the following important advantages: year-by-year reduction of soil erosion, decrease of fuel and labour force costs, increase of the efficiency of water use. The experiment activities were carried out in farmer household in Agjabedi region which locates in central part of Azerbaijan during 2010-2012 through application of bed planting method and retention of crop residues on the soil in experiment and control field. Analyses of soil samples from the experiment areas and control fields during 2010-2012 show that agrochemical properties of soils, particularly the amount of humus increased in the experiment area compared to the conventional in the control fields. As a result of the research, it was determined that retention of crop residues on the soil through application of bed planting method has provided an opportunity to increase productivity of the crop, to reduce production costs and to increase physical, chemical and biological characteristics of soils.

Key words: Soil erosion, conservation, conservation agriculture, soil fertility, salinization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of soil erodibility state under different land use and land cover in Madendere watershed

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Abstract

The soil erodibility factor (K-factor) is a quantitative description of the inherent erodibility of a particular soil; it is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Therefore, this indicator also shows potential erosion risk case for that area. The primary objective of this study is to determine effect of different land use and land cover on soil erodibility values in Maden Dere Watershed by applying GIS and RS. To determine land use and land cover of the study area, Geoeye satellite image was used. Four main land use and land cover that are forest, orchard, pasture, and cultivated land were determined and their distribution are 38.6 %, 35.5%, 12.8% and 9.5%, respectively. 71 soil samples were collected from surface (0-20 cm) for each land use and land cover. According to statistical analysis, it was found that there were significantly differences between land use/land cover and K factor. The highest mean value belongs to forest land cover flowed by pasture, orchard and cultivated land. This means that top soils of forest are very sensitive to erosion, in other words, forest soils are under high potential erosion risk.

Key words: Soil erodibility, land use-land cover, Madendere watershed.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The study and analysis of the factors of resource degradation in soil and water on the tray of Mostaganem

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Abstract

The tray of Mostaganem represents a case of most affected ecosystem in Algeria by degradation of its soil and water resources. It is a sandy coastal area covering over 78 100 hectares, characterized by a significant wind activity and thus a strong erosive power. Additionally to this erosive effect, the plateau is under strong urban concentration and economic activities: agriculture, industry and port, which threaten as much its resources, that it's basic ecological balance. This work is a contribution to the diagnosis of the state of degradation of the plateau of Mostaganem subject to various agricultural and industrial constraints that affected its natural soil and water resources. One important result of this approach is that the degradation of Mostaganem plateau exists in several forms at the same time it remains undervalued because it has not benefited enough attention from scientists or even socio-economic operators. She half-opened, however, an investigation way of primary importance on ecological and environmental impacts of rapid development conducted in the region, in the medium and long term.

Key words: Tray of Mostaganem, degradation, soil, water, natural resources.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimation of erodibility factor (k) using the universals soil loss equation and the geometric mean particle diameter

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Abstract

Among different land degradation processes, soil erosion is particularly a serious threat to soil and water conservation in Iran. Soil erodibility factor (susceptibility of soil to be lost to erosion) is one of the universal soil loss equation. Soil erodibility or K factor is one of the most important factors necessary for the determination of soil loss or sediment yields for inter-rill and rill erosion. Soil erodibility is a complex property and is thought of as the ease with which soil is detached by splash during rainfall or by surface flow, or both. This factor (K) in the RUSLE accounts for the influence of soil properties on soil loss during storm events on upland areas. The K values are usually estimated using the soil erodibility nomograph method, which uses % silt plus very fine sand (0.002 mm-0.1 mm), % sand (0.1 mm-2 mm), % organic matter and soil structure and permeability classes to calculate K. In this study, soil erodibility factor was calculated using with the Wischmeier equation and based of geometric mean particle diameter. The results showed that the K-factor values are estimated based on the geometric mean particle diameter, the average is higher than the amount determined by the Wischmeier equation. Results were compared. The differences based on t-test at the level of 0.001 were significant. Ultimately, erodibility maps obtained from both methods are obtained by extrapolation method.

Key words: Soil K factor, USLE, geometric mean diameter.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessing the relation of splash erosion with rainfall intensity

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Abstract

The splash raindrops cause the dispersion and decomposition of soil particles when raindrops hit the ground and accelerate the process of water erosion. The intensity and the amount of soil decomposition depend on kinetic energy which, in turn, is influenced by rainfall intensity. Most of the scientists and soil specialists believe that true perception of erosion caused by splash raindrop puts an end to the useless efforts to fight erosion and opens a horizon to solve this problem regarding controlling soil biology against the splash. Therefore the amount of displaced soil particles depends on the type of soil and diameter of raindrops and rainfall intensity. To find out the relationship between the amount of splash erosion and rainfall intensity at meteorology stations, sprinkling cups designed for this purpose were installed at these stations. The displaced sands at given time base were measured. The rainfall intensity at the above time base was taken from related graphs and the kinetic energy of rain was calculated. The total amount of displace sands in each phase with the degree of intensity during each phase take in to account and relate correlative equations was formulated. Results showed that equation between rainfall intensity and splash rate in Marivan station was more significant and in Saghez station no significant. Other features of rain such as statistical descriptions have been investigated.

Key words: Soil erosion and conservation, splash erosion, rainfall intensity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Transformation of polydispere organization of solid phase in eroded chernozems in the Preural Region

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Abstract

Retrospective monitoring has been performed into polydisperse organization of solid phase of variously eroded typical and alkalized chernozems. Typical chernozems form on slope of the southern exposure adjoining the Chermasan river high-water bed. Its bottom bound steepness increases from 1-2 to 8°. The erosion rate increases likewise. 35 years later thickness of non-eroded soil decreased on the average by 4 cm, of weakly eroded one by 4-6 cm, moderately eroded – by 6-9 cm, whereas thickness of severely eroded soil remained on the same level. Humus content changed in full correspondence with the change of humus-accumulative horizons' thickness and decreased from 0.2% in non-eroded soil to 1% in slightly and 2% in moderately eroded soil. Humus content is the lowest in severely eroded soil but compared to 1977 the change is insignificant. By 2011 cumulative nitrogen and phosphorus content likewise decreased. Their general tendency to decrease with erosion degree persisted. Nitrogen content in humus in slightly, moderately, and non-eroded soil remained on average level whereas in severely eroded soil it reached high content level. The fact that severely eroded soil condition does not worsen with time may be due to translocation of thin disperse soil fractions with water flows occurring on the slope. It is also demonstrated by a considerable decrease within the period of 35 years of clay (<0.01 mm) and silt (<0.001) in size composition of eroded soils. The greater erosion severityd the less quantity of these fractions are lost (tilt by 5.1, 4.1, and 2.4 of clay by 1.9, 1.7 and 1.3 respectively). In non-eroded soil tilt quantity did not noticeably change, clay quantity decreased by 17%. Washing-out and removal of fine disperse fractions in the slope soils resulted in lightening of eroded soils texture by 1-2 grade. Thus, non-eroded medium clayey soil transformed into light clayey, slightly eroded heavy loamy soil into light loamy, moderately eroded light clayey soil into medium loamy, severely eroded heavy loamy soil into medium loamy. Alkalized chernozems developed on the slope of the same inclination with south-east exposition. Unlike the previous slope, this one does not have a through exit to the bottomland and in its lower part there is a road with high ground fill (built before 1977). This sort of dam led to a somewhat different development of erosion processes. In the upper part of the slope, where in 1977 there were non-eroded and slightly eroded soils, thickness of humus accumulative horizons decreased by 10-14 cm, while in the third part of the slope thickness of moderately eroded soil increased by 4-7 cm. This process was accompanied by the reduction of humus content and clay in previously non-eroded soils and their rise in moderately eroded ones. Humus and tilt contents in severely eroded soil remained at the same level but clay quantity rose. This resulted in some increase in the content of cumulative nitrogen and phosphorus as well as increased nitrogen content. Soil solution in the lower part of this slope became substantially alkalized while the one in the upper part was acidized. Thus, on the slopes with free run-off fine disperse fractions can shift. As a result, size composition becomes 1-2 grades lighter. With the available linear obstacles in the lower part of the slope the quantity of fine-disperse fractions in severely eroded soils increase.

Key words: Soil erosion, chernozems, transformation, fine disperse fraction.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Change of fluctuations of soil properties in kashtanozem in extremely uniform conditions under agricultural impacts

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Abstract

Reliable quantitative information about changes of soils is necessary for development of projects for soil protection, engineering, etc. Changes of soils are inevitable process under climate change and intensive agricultural and other usages that in many cases leads to deterioration of soils properties. These changes occur simultaneously at different levels of soil organization and soil cover. We have proposed considering three principal categories of the spatial changeability of soil properties using the concept of nesting: heterogeneity for significant changes in soil-forming factors, variability for their insignificant changes, and fluctuation for leveled soil-forming factors. We study these categories of soil changeability at the example of Kashtanozem (chestnut soils), that are the most widespread soils at Kulunda steppe situated at the south of Western Siberia. In this paper we quantitatively analyse soil fluctuations. Data were the result of soil investigation in the limits of not long (6 meters) trenches of soil pedons under different usage (virgin soil, unirrigated arable soil and irrigated arable soil). Statistical comparison of soil properties at different impacts was done by comparison of statistical characteristics and probabilistic distributions (pdf) of soil properties. Pdf with high p-values was considered as probabilistic model of soil property as whole in the soil volume in space in soil horizons. Analysis of pdf regularities gives clear and stable information about difference of soil properties under agricultural impacts. Information divergences quantify these regularities. Analysis of soil fluctuation shows that they change dramatically under agricultural impact. Analysis of entropy value highlighted the main tendency – the tendency of outstanding decreasing quantity of various microconditions of soil in top horizon and growth of it in the bottom of soil profile. It is necessary to recognize that fluctuations of soil properties, their profile distribution depend on conditions and soil formation factors, and in fact, are a genetic sign of the soil.

Key words: Soil properties, fluctuations, agricultural impact, probabilistic distribution, micro-conditions.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil degradation caused by water erosion and its economical aspects

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Abstract

Intensively farmed arable land in areas prone to water erosion contributes significantly to the change in soil properties. Erosion is demonstrated by changes in physical and chemical properties of the soil, by reducing the soil profile depth, by distribution of fine soil particles into the lower part of the slope and by increasing the skeletal soil in transport zones. The paper is focused on the evaluation of erosion processes using Universal soil lost equation, setting long-term loss of soil erosion and the impact of this degradation process on the quality of agricultural land. Comparison of different results is presented in the model sites in areas with intensive crop production, operating on large land blocks. A comparison of soil properties according to data from the 70s of the 20th century and after their revaluation in 2013 was performed. The results show significant deterioration in soil quality, resulting in a reduction in the price of land parcels. Erosion thus have serious consequences not only ecological but also economical, that may be specifically enumerated by reducing the value of the soil. The knowledge gained by the investigation of model sites was used for the evaluation of potential price reductions of soils in the Czech Republic due to soil erosion.

Key words: Soil erosion, soil degradation, price of soil, loss of soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Statistic and probability characteristics of rain factor R in Slovak Republic

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Abstract

Because soil erosion which is caused by rain is also an important phenomenon in the Slovak Republic, higher emphasis is impute to research of water erosion caused by rain and that is why we proceeded to calculate the rain factor R. Based on data which were provided by the Slovak Hydrometeorological Insitute for 6 selected meteorological stations in Slovakia, we accomplished to the calculation of rain factor R. For the calculation we used the methodology by Wischmeier-Smith (1978) and results we comparing with the methodology of Hudson (KE> 1) and with already published values of the Research Institute of Soil Science and Conservation. We also created a line exceeded of probability from the calculated data, which gives us detailed information on the occurrence of the calculated R values 1 time per 100, 20, 10, 5, 2 and 1 year. On the basis of calculated data we created a distribution of R factor values for individual months of the growing season and found out that the highest percentage fall on the summer months June, July, August and by contrast the lowest to April and October, so i tis necessary to impute emphasis to soil erosion control especially in summer months. Comparing the methodology of Hudson (KE> 1) and methodology of Wischemeier-Smith, we found out that the Hudson methodology gives almost 2 times lower value of R-factor than with using the methodology of Wischmeier-Smith.

Key words: Erosion, erosive effective rainfall, R-factor, Wischmeier-Smith, probability.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

$CaCl_2$ activation and reaction mechanism of the yellow river sediment

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Abstract

This paper is to explore the way of improving the Yellow River sediment pozzolanic activity and stability, which aims at propelling the application in stabilized earth concrete of the Yellow River sediment, so as to achieve its large-scale utilization and alleviate its massive deposition in downstream river channel of the Yellow River. The influence of ratio and dosage of $CaCl_2$ and $CaCl_2$+$Na_2O{\cdot}nSiO_2$ on the activation of the Yellow River sediment was discussed. Reaction mechanism of $CaCl_2$ with sediment was preliminarily explored through X-ray Diffraction (XRD) and Fourier Transform Infrared Reflectance (FTIR). The results show that Pozzolanic Activity Index (PAI) and reactive rate of 4% $CaCl_2$ activated sediment are 1.2 and 3.9 times of the original respectively. When the sediment is activated by compound activator ($Na_2O{\cdot}nSiO_2/CaCl_2$ =1/1) of 6 wt. %, the PAI is 0.63, increasing 24%. XRD and FTIR analysis indicates that $CaCl_2$ promotes the hydrolyzetion of albite, which explains the increased amount of soluble Si^{4+}.

Key words: The yellow river sediment, pozzolanic activity index, hydrolyzetion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Work of soil and risks of agricultural erosion : Case of the itinerary technical cereal on tray of Mostaganem, Northwest Algeria

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Abstract

With a semi-arid Mediterranean climate and viticulture vocation, the tray of Mostaganem (North-West of Algeria) has become a region of great crops. Subject to increased mechanization and inappropriate tillage practices, farm lands are exposed to erosion that seriously weighs the physical and socio-economic contexts. An itinerary technique (cereal) is chosen to study along the slope, surface and deep structural changes of soil, moisture and the fine particles (<2 µm). Thus, consideration of the surface shows a strong soil erodibility partly linked to the action of implements and a rain erosivity accentuated by lack of vegetation in the rainy season. Crop profiles observations show the small depth of tillage affecting mostly superior horizon. Average horizon, moister, rich in fines particles and barely reached by tools impedes any move to lower horizon which is very compact without variability. With this kind of technical itinerary, fine elements losses estimated to (3 t/ha/year) result closely from the characteristics of the physical environment but also the conditions of its exploitation. In case of more important spatial-temporal units extrapolation, the consequences will be even more harmful if improvement actions are not undertaken.

Key words: Erosivity, erodability, structural state, technical itinerary, cereal, tray of Mostaganem, soil work.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Development of a lanthanide based particle tracer for soil erosions applications

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Abstract

Soil erosion is a global problem, which affects much of the world's agricultural land. Loss of the soil resource from a field system not only reduces the productivity of that area, but can also result in pollution of watercourses surrounding the site. Sediments from an agricultural origin generally contain high levels of nutrients, in particular phosphates, which result in eutrophication leading to algal blooms and other contaminants such as pesticides, pathogens and toxic metals. Tracing of sediments from source areas into rivers and coastal waters provides a tool for understanding the complex sediment and contaminant delivery relationship, and the effect humans have upon it. Particle tracers may be deployed at sites of soil erosion and can be designed to mimic the properties of soils and sediments of interest. Current methods include the use of magnetic particles (Zhang *et al* 2004) and coloured gravels (Tieseen *et al* 2007) both of which have been used in the study of tillage erosion, but are limited in general to field boundaries. However, a simple, cost effective tracer that mimics transport of the indigenous soil or sediment, is non-toxic and has high detection sensitivity when very diluted is yet to be developed. Presented here is an applied particle tracer based upon lanthanide chelate doped silica sol-gel particles. The spectroscopic properties of lanthanide chelates allow for the detection of the tracer at low levels, even against the high background often present in environmental samples. Using a modified Stöber synthesis method, monodispered silica particles have been developed within the fine silt range (63-250 µm).The incorporation of a novel lanthanide chelate complex, $Ln^{3+}TTA_3.2PO$, where the TTA is the conjugate base of 2-thenoyltrifluoroacetone and 2PO represents 2-pyridinol-1-oxide, has yielded particles which exhibit similar properties to sediment particles during preliminary laboratory experiments. These particles are stable, displaying high levels of fluorescence and proposed to be non-toxic within soils, aqueous solutions and sediments, and as such are ideal candidates for use within sediment to fate tracing studies.

Key words: Tracer, soil erosion, lanthanide, silica sol gel.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Research progress on soil erosion of pisha sandstone area in Loess Plateau

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Abstract

Pisha sandstone, generally refers to large area Mesozoic sedimentary rock that being exposed in Ordos Plateau, north of Loess Plateau, China. The pisha sandstone is characterized by as hard as stone when it is dry, easily changes into mud when wet, and weathering denudation is strong. The area has a very high erosion rate and poor vegetation; it is main source areas of Yellow River silt and coarse sand. This paper reviews the research progress about the erosion patterns of pisha sandstone areas, the effect of the lithologic characters of pisha sandstone on its erosion, the natural vegetation distribution status of hillslope-gullyslope system and its influences on soil erosion, the soil and water conservation measures carrying out are presented such as grazing prohibition, returning cropland to forest, building check dam etc. Then some suggestion on research contents of soil erosion in the pisha sandstone area is addressed. And a novel controlling and improving scheme is put forward, in this scheme, the effect of sediment reduction different allocation system of soil conservation measures has been analyzed.

Key words: Pisha sandstone, soil erosion patterns, lithologic characters, vegetation distribution, hillslope-gullyslope system.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Reservoir sediment prediction in Duhok dam using artificial neural network and conventional methods

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Abstract

Estimating soil erosion and sediment yield in watershed can play an important role for study dams and reservoirs. Because of complicated and non-linear process of sediment load and the lack of data in hydrological stations, it is difficult to measure exact sediment yield. However, the classic methods usually cannot handle the problem as well. In this study, Artificial Neural Network (ANN) as a non-linear black box model is used for modeling sediment yield in the dam of Duhok, located in Duhok, Kurdistan region, Iraq. The ANN is becoming a strong tool for providing environmental engineers and hydrological process with sufficient details for design purposes and management practices. Observed time series of water discharge at current and previous time steps are used as input to a three-layered back-propagation feed-forward neural network model and the output will be the estimated sediment yield. The best architecture of the ANN method is obtained by try and error. The obtained results are compared with the results of two conventional methods (i.e., linear regression model and rating curve method) by using coefficient of determination (R^2) and model efficiency factor (E) in order to approve the efficiency and ability of the proposed method. Results indicated the ANN model performed better than conventional methods.

Key words: Artificial neural network, linear regression, curve number, sediment load.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of cover crops on soil erosion over olive orchards

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Abstract

Olive orchards are usually located over sloppy sites and exposed to water erosion most of the time. A research was conducted over such an olive orchard (in Kilitbahir Village of Eceabat Town of Çanakkale) with six different plant covers (horse bean, field pea, vetch, vetch + wheat, field pea + wheat and control) in 3 replications over 18 plots. A total of 54 rainfall simulations were performed to investigate the effects of cover crops on soil erosion. In each simulation the time to runoff, runoff, maximum runoff, runoff coefficient, sediment concentration, sediment peak and total soil loss were measured. While the differences in time to runoff values of the plots were significant ($p=0.012$), the differences between runoff, maximum runoff and runoff coefficient of the plots were insignificant. Sediment concentration, sediment peak and total soil loss values of the plots also significantly varied. The highest sediment concentration (55.15 g/lt) and sediment peak (81.37 g/lt) were observed in control plot and lowest sediment concentration (5.86 g/lt) and sediment peak (17.46 g/lt) were seen in field pea + wheat plot. Sediment concentration and peak values of the other plots were in between them. Total soil loss of the control plot was almost 12 times higher than the loss in field pea + wheat plot. Further long-term studies can be conducted to better understand the effects of cover crops on erosion process.

Key words: Cover crop, rainfall simulation, *Olea europaea* L., erosion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The anthropogenic sodium sulfate minerals as an intensification factor of wind erodibility of the soils in Segzi plain at the east of Esfahan, Iran

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Abstract

The soil control against wind erosion in Segzi is very important because of strategic location of this area that it is nearby some industrial estates. The soils with a soil moisture regime of aridic and a soil temperature regime of thermic, were classified as Gypsic haplosalids subgroups according to Soil Taxonomy. The soil subgroups of the soils have changed to Gypsic Aquisalids after leaching with agriculture surplus water in winter. The natural system of (Nacl, $CaSO_4.2H_2O$) in the soils has changed to secondary system of ($Na_2SO_4.10H_2O$, $CaCl_2$) after soil leaching for salt melioration in winter. In this research using chemical and physical analyses, micro morphology and Thermal analyses were resulted that the major factor in wind erosion of the soils is secondary sodium sulfate evaporates as thenardite and so mirabilite in Segzi. And so for control of wind erosion proposed to return to primary salt system adding $CaCl_2$ in soil system as first step of soil salinity melioration.

Key words: Gypsic Haplosalids, Gypsic Aquisalids, secondary sodium sulfate, wind erosion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Runoff characteristics of improved tillage vs. conventional tillage under simulated rainfall

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Abstract

Runoff from agricultural fields can be harnessed for improving dryland crop production in semi-arid areas. This paper presents results of a study based on a simulated rainfall where runoff characteristics from an improved tillage were compared to the conventional tillage (CT). The improved tillage, called the in-field rainwater harvesting (IRWH), is a special no-till crop production practice that promotes runoff from a crusted runoff strip into basins where the water infiltrates beyond evaporation but is available for crop use. Runoff characteristics such as time to runoff, total run off, runoff coefficients and runoff rate were compared. IRWH significantly shortened time to runoff by 48% compared to CT plots. IRWH increased final runoff rate and runoff coefficients compared with CT treatments. Results based on runoff characteristics indicated the advantages of IRWH over CT and that IRWH could harvest runoff water that could meet 1% of maize irrigation water requirements under the experimental conditions.

Key words: Dryland crop production, rainwater harvesting, simulated rainfall, tillage.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Monitoring the effect of conservation practices on the erosion rates in some small watersheds in Eastern Romania

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Abstract

It is known that the successful implementation of control measures to preserve soil quality on slope agricultural lands depends largely on the designer's ability to select a control strategy for a specific site, considerable simpler and less costly. The paper refers to several small watersheds with agricultural use, representative for Eastern hilly area of Romania, where different types of soil conservation measures have been applied. The study included monitoring of some factors to highlight the role of soil conservation practices in reducing water erosion process. In this respect, it was studied the dynamics of the climatic, pedological, relief, vegetation, hydrology and erosion parameters. Runoff and erosion rates for individual storms were studied both at the plot and microbazin level by performing measurements on standard runoff plots, respectively in the network flow sections. Also, RUSLE model and Geographic Information System were used to simulate spatial distribution of erosion and sedimentation processes. Significant interactions and feedbacks were found to occur between soil characteristics and vegetation, which influenced both runoff and erosion responses. Monitoring allowed more direct linkages to be made between management practices and their impacts on runoff and soil erosion.

Key words: Soil erosion, runoff plots, conservation practices.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of organic and inorganic amendments on soil erodibility

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Abstract

The objective of the present investigation was to find out the effect of incorporating of various organic and inorganic matter sources such as lime (L), zeolit (Z), polyacrylamide (PAM) and biosolid (BS) on the ınstability index. A bulk surface (0–20 cm depth) soil sample was taken from Samsun, in northern part of Turkey. Some soil properties were determined as follows; fine in texture, moderate in organic matter content, low in pH and free of alkaline problem. The soil samples were treated with the inorganic and organic materials at four different levels including the control treatments in a randomized factorial block design. The soil samples were incubated for ten weeks. After the incubation period, corn was grown in all pots. The results can be summarized as organic and inorganic matter treatment increased structure stability and decreased soil erodibility. Effectiveness of the treatments varied depending on the types and levels of organic and inorganic materials

Key words: Erosion, structure stability, lime, zeolit, polyacrylamide, biosolid.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Sediment yield in Ankara Haymana - Soğulca, İkizce, Kızılkoyun and Nallıhan – Bozyaka reservoir catchments

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Abstract

This study has been carried out between 2006-2011 in order to determine the sediment yield of the reservoir catchments namely Ankara – Haymana – Soğulca, Kızılkoyun, and İkizce and Nallıhan –Bozyaka. As the results of the bathymetric measurements, the sediment yields were found as 42.079,5 tons/year for Soğulca catchment, 1.767 tons/year for Kızılkoyun catchment, 7.720 tons/year for İkizce catchment and 16.670 tons/year for Bozyaka catchment. Among the empirical methods, USLE has been used to determine the potential soil loss amount, the results were as 167.347 tons/year for Soğulca catchment, 20.779 tons/year for Kızılkoyun catchment, 48.670 7.720 tons/year for İkizce catchment and 108.308 tons/year for Bozyaka catchment. Some of the SDR equations were also used, the best results for İkizce and Bozyaka catchments were obtained by Boyce method. On the other hand, a SDR test equation was developed for these four catchments and the results from this equation showed a deviation between -1,5 % and 6,4 % for these catchments. The best result from EİEİ equation was obtained for İkizce catchment with 8.141 tons/year. No relation was obtained for other three catchments.

Key words: Bathymetry, sediment, USLE, SDR, Soğulca, İkizce, Kızılkoyun, Bozyaka.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of suitable methods for stabilization of coastal dunes in Samsun-Bafra

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Abstract

This study was aimed to prevent harmful sandy movements which occur by the effect of wind, for arable land in sandy land of 20 km coastal zone of Alacam-Bafra District of Samsun. Main titles of study are living and lifeless fences and subtitles are hydroseeding, traditional planting and afforestration. Mat; made by reed plant was used as lifeless fence which exist in natural vegetation and wild oleaster used as living fence. At the end of the study; development and living rates of trees, wind properties as climatic parameters and soil losses were determined. As a result; comparing living fence with lifeless fence, lifeless fence application was more effective to inhibit the new material movement to the new plots. Removal and depositions were decreased for the subtitles by lifeless fence. Depositions to the plots are in the following order; 1 kg/da/5year for control, 0 kg/da/5year for hydroseeding, 0 kg/da/5year for traditional planting, 5 kg/da/5year for afforestration, 2 kg/da/5year for afforestration+ hydroseeding, 10 kg/da/5year for afforestration+ traditional planting. Removal and depositions of new material to the plots continued for living fence. Long-term average wind directions are in the following order; %54 south-southwest, %31 north-northeast and %15 north-northwest. As a result; lifeless fence is the most suitable application for the temporary stabilization in Bafra district. Also we recommended that afforestration+hydroseeding application as the minimum values for both losses and depositions by durable stabilization in subtitles.

Key words: Sand dune stabilization, wind fence, afforestration, SPVAACE, hydroseeding.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Different pasture amelioration methods effects on soil and water conservation in natural pasture area of minoz creek basin

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Abstract

In this study, effects of four different pasture amelioration methods on sediment and water losses in natural pasture soil of Minöz Creek Basin were investigated. Experiment was conducted with six treatments; control under uncontrolled grazing (C), control under controlled grazing (CG), fertilizing (F), spread seeding (SS), cultivation or aeration (A) and spread seeding+fertilizing (SSF) on sandy loam textural soil (Lithic Ustorthent). In the study, erosive rainfall between 2008 and 2011 were evaluated and their effects on sediment and water losses were investigated. The rainfall values of the study area are 517,40 (mm) in 2008 for the lowest and 710,30 (mm) in 2011 for the highest. According to the results, it was determined the lowest sediment value is 10,2 (kg/ha) for SS and the highest value is 18,6 (kg/ha) for CG application. According to the water losses, the lowest value is 20,5 (mm) for F and the highest value is 70,6 (mm) for SSF application. Consequently, results of this study showed that the most effective amelioration methods are SS application for decreasing the sediment movement and F application for decreasing water losses.

Key words: Pasture amelioration, sandy loam soil, sediment and water losses, erosive rainfall.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Depleting soils

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Abstract

The 2004 Nobel Peace Prize Laureate Wangari Maathai addressed the Kenyan soldiers on one occasion and said: "[You] are trained to protect the borders of the country. [You] hold your gun, what are you protecting? The whole country [soil] is disappearing with the wind and the water. When you look at the rivers and they are brown, that is your country disappearing." Soil does far more than providing food, fiber and fuel. It filters water; sustains ecosystems; and, stores carbon – a vital phenomenon in slowing global climate change. Soils are under threat around the world. Erosion is a major concern. In some countries, soil is lost almost 100 times faster than the rate of its formation. Soils are also being degraded irreversibly because of building activities, pollution and acidification. Incessant construction activities along with unsustainable mining operations and energy-related undertakings in recent years accelerated the degradation of soil in Turkey. Highway travellers can witness the mindless plunder all over the land. One travels smoothly on newly constructed highways while observing piles of leftover destruction everywhere: heaps of broken asphalt from previous roads; newly excavated topsoil dumped into adjacent streams; eroded hillsides; quarries on the horizon. In the age of global climate change, these so-called development efforts sound incomprehensible since such anthropogenic activities are responsible for the change. It has long been proven scientifically that climate change increases the potential erosion rates and reduces soil quality. This fact alone requires each country to adopt and implement sound conservation practices to protect their natural environment and hence social stability and security.

Key words: Soil, degradation, erosion, global climate change.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Improving physical quality of a clay loam soil selected from semiarid region using polyacrylamide

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Abstract

In semiarid regions, physical quality of fine-textured soils is generally poor due to low rate of organic matter and consequently weak stability of aggregates. A greenhouse experiment was conducted to evaluate the effects of anionic polyacrylamide (PAM) on some physical quality indices and also their time variability in a clay loam soil selected from a semiarid region. These indices were mean weight diameter (MWD) of aggregates, dispersion clay (DC), saturated hydraulic conductivity (K_s), and total porosity (n). The rates of PAM including 0 (control), 0.125, and 0.25 g kg^{-1} of air dry soil were mixed with the soil and uniformly packed into plastic pans, and incubated in a greenhouse at 0.7 - 0.8 field capacity moisture content (0.123-0.14 g g^{-1}) and temperature of 22 ± 4 ºC for 6 months. MWD, DC, K_s, and n were measured for the soil taken from the 10-15 cm layer of pans at 30, 90, and 180 days. The results showed that although beneficial effects of PAM on soil physical quality reduced with time, however, both low and high used rates of PAM significantly increased means of MWD by 83 and 127 % and n by 8.75 and 7.75 %, respectively compared with the control even 6 months after the start of the experiment. Also, both low and high used rates of PAM significantly decreased mean of DC by 31 and 43 % and increased mean of K_s by 11.5 and 14.5 %, respectively relative to the control. By considering the application cost of PAM, it can be suggested that in semiarid regions, 0.125 g PAM kg^{-1} of air dry soil is suitable application rate for improving physical quality of fine-textured soils.

Key words: Fine-textured soil, incubation time, polyacrylamide, physical quality parameters.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Applying a 'regional' focus to the 'universal' principles of erosion and sediment control

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Abstract

Australia is an old continent with a patchwork of mostly erodible and low-nutrient soils and climatic zones varying from alpine, tropical and desert. Erosion and sediment controls (ESC) have been used for many years to limit soil loss and mitigate soil impacts. In the last two decades ESC guidelines have evolved significantly though still based on universally accepted principles. These guidelines however, have primarily been developed from experiences gained from coastal city soils and weather conditions rather than those conditions typically found across the country. This paper provides a brief historical account of ESC in USA, Europe, Australia and specifically Queensland, explains some of the problems in adapting ESC and drainage controls along a 2000 km transect from Queensland coast to the arid centre, and explores the opportunities and difficulties for regionalisation in terms of technical parameters, cost / benefits and institutional drivers for five Queensland regions. It concludes that effective and cost efficient ESC outcomes will only be achieved when guidelines adequately reflect the local conditions in which they are applied. The same is likely to apply elsewhere, e.g. Turkey.

Key words: Erosion, sediment, control, soil, regional.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of slope steepness with toposequent on erosion factor (A study case of Cikeruh catchment area, West Java, Indonesia)

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Abstract

The research was conducted with the aim to know the effect of slope steepness on organic carbon and soil erodibility as erosion factor. This research was conducted from September to December 2011 in the Raharja and Cinanjung Village, Tanjungsari, Sumedang District, West Java, Indonesia. The study was carried out using physiographic free survey method, which is a survey based on land physiographic appearance. Soil sampling was carried out into transect on the similarity slope without calculating the point of observation range. Soil sampling was carried onto three classes of slope as follow: 8 – 15 %, 15 –25 % and 25 – 40 %. Each was consisted of three slope position i.e. top slope, middle slope and down slope and four sample of soil were taken from each of them, hence it resulted 36 points of observation. The results of this study indicate that gradient of slope have some significant contribution in every sample. Middle slope with gradient 26-40% has the highest potential erosion occurrence. It has organic C content (0.84%) and the highest erodibility value (0.1092)

Key words: Slope steepness, erosion, erodibility.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Role of wind erosion in dust-salt masses migration, soil salinization and degradation (in the coastal area of Azerbaijan)

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Abstract

In a global, including regional climate change, considering the impact of drought, desertification and land degradation, there is a need for detailed study of the role of deflationary process (obtaining quantitative and qualitative data) in the respective natural-anthropogenic conditions in the region of study. It is important to identify the dust and salts amounts taken away by winds, define dust salt accumulation areas and develop actions to counter these processes. In the studied region, all types of soils subject to potential deflation. To solve these problems, studies are carried out in the coastal zone with a variety of landscapes, saline soils, having a number of patterns spreading beyond the region of study. The studies are carried to establish the degree of deflation of soils, to identify areas of their expansion, to identify sources of eolian dust and salt migration. Summarizing the results of studies of soil deflation, it is shown that 18% of soil subject to wind erosion of varying degrees. The source areas of eolian dust-salt mass migration are established as well as their accumulation areas. Salinization of meadow gray saline and alkaline soils is high, thick residue in their upper horizon constitutes 1.42-1.50 % and 0.63 %, respectively. Mean total removal of salts from saline soils with the average 10% plant cover varies from 171 to 320 ton per km^2 per year, or 1.7 - 3.2 t / ha per year.That means the deflation rate is at 0.17 - 0.32 mm per year, which estimates the annual removal by wind of the dust-salt mass from across the region. The acquired data of eolian removal of dust salt mass per unit area are functional. These are averages for soil salinity of mainly hydromorphic, chloride-sulfate type. Loose constitution of the upper salt accumulation horizon (evaporite horizon) contributes to removal of dust-salt mass by wind. The thickness of evaporite layer reaches 2-2.5 cm. According to the value of the full aqueous extract the solid residue in the upper horizons of the crust-plump saline soil constitutes 8.7 %, and in the eolian mound near shrubs - more than 7.0%. Eolian dust-salt mass migration in the zone of active anthropogenic influence deterioratesthe geochemical environment.

Key words: Wind erosion, land degradation, saline soil, deflation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Transporting capacity of small depth flows as the prerequisite of eroded soil formation

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Abstract

The objective of this work – by the example of sod-podzolic soil of different degree of wash off quantitatively assess the ability of small depth flows at the system level "flow-soil" to transfer certain mass of soil material. The results of model experiments used for verification of theoretical equation of sediment transport. Determination of quantities transfer and deposition of sod-podzolic soil of different degree of wash off spend on a large erosive tray. The tray had artificial channel (length 5 m, width 0.1 m, bump height of roughness of the bottom – 0.35 mm), which was set different velocity of the water flow and streams of water artificially loaded soil in dry or pre-humid condition. The range of velocities varied from 0.27 to 0.67 m/s. The flow depth – 8-13 mm. In the experiments yielded the following indicators: the average velocity (V, m/s) and water turbidity, the radius (r_i, m) of the transported and deposited in the stream bed of aggregates and other. These indicators are used for verification of the theoretical equation transporting capacity (β, kg/m^3):

$$\beta = \frac{C}{(gH)^{1/\gamma}}\left(V^2 - V_k^2\right)^{1/\gamma}, \qquad (1)$$

where g is the acceleration of free fall, m/s^2; H is flow depth, m; C and $1/\gamma$ are empirical indicators. Calculation of V_k was held by the equation:

$$V_k = \sqrt{\frac{\frac{4}{3}\left(\frac{\rho_i}{\rho_w} - 1\right)gr_i + \frac{f_i}{r_i\rho_w}}{K_d}}, \qquad (2)$$

where ρ_i is density of the soil solid phase, kg/m^3; ρ_w is water density, kg/m^3; f_i is coefficient of surface strength for transported or deposited aggregates, N/m; K_d is lift coefficient (c-vortex). On the basis of the obtained experimental data was found the following regularities. The average diameter transported flow aggregates increases with the velocity of water flow, and the diameter of the aggregates, deposited in the stream bed decreases with increasing velocity. It is established, that it depends not only on the flow velocity, but also on the extent washed of soil, humus content and water resistance of aggregates. The obtained experimental data will allow to making the conclusion on the applicability of the model's transporting capacity flow in relation to the soil material. Comparison of the experimentally obtained values of portable soil material and calculated the dependence (1) showed that the average error modulo amounted to 18.6%, and the correlation coefficient – 0.80.

Key words: Soil erosion, modeling, transporting capacity, aggregate composition, soil, flow.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Joint impact of degradation processes on organic soils in western part of Ukraine (Kamin-Kashyrsky District)

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Abstract

The deflation processes frequently appear on the light mineral and drained organic soils in the north-western part of Volyn region in Ukraine every year and have tendency to increase in time and space. The territory of Kamin-Kashyrsky (*further: K-K.*) district is located in the area of Polissya (Forest Zone) and it is of some interest to us as being characterized by diversity of soil types dominated with drained organic bogs, peat and meadow-peat soils with different types of degradation threats. The aim of investigation to detect a joint risk of main degradation processes that have been spread in this region over the last decade under uncharacteristic conditions for this area: continuous droughts, periods of high wind velocities, increased human impact on the already partially regraded soils with a risk of the radioactive contamination. Different government reports have been studied and photos with fixed degradation processes described with different specialists. The results revealed intersection between fire activity in burning turfs during the year and amount of material blown away by wind erosion. Mineral soils of light granulometric composition with varying stages of podzolization and gleyification have formed deflated send-dust material that is capable to damage and simultaneously impose dry particles from the surface of organic soils into the airflow. The way to restore these territories with valuable nature soil complexes is their reclamation. It should be performed on degraded lands with unproductive by its genetic nature and strongly transformed soil, namely friable sand soil with a capacity of organic horizon less than 20 cm; mistakenly drained transition peat soils; bog with a capacity of peat horizon less than 20 cm with underlay of loose gleyed (lightened) sand, burnt and processed peat; moderate and strongly structured plots (with the presence of gravel, boulders, wood, etc. more than 10% in volume); strongly shrub and debris cluttered soils; secondary bogged soils, floodplain lands of long spring flooding; radioactively contaminated soils (highly saline, ferrisol and calcareous, highly acidic, heavily eroded, worn peat moors, etc.). All superficially dried organic soils, sandy soils and those of sandy granulometric composition located on terrain elevations of about 120-180 m above sea level are prone to the effects of wind erosion and need a vegetation cover.

Key words: Degradation, organic soil, joint risk, erosion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The new volumetric approach for field measurements of rill erosion

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Abstract

Erosion on the agricultural soils in the Czech Republic threats seriously their production and nonproduction functions. Erosion have devastating effect on fertile topsoil of the agricultural soils, reduces the thickness of the soil profile and nutrients and humus content, deteriorate physical, chemical and biological properties of soil. At the Brno University of Technology was designed and realized facility "the soil erosion bridge", which allows the soil surface profile measurement and quantifies the volume of erosion rills, which can occur after heavy rainfall. The main objective was to develop a method for volumetric quantification of erosion rills during heavy rainfall season. Using new equipment the soil surface profile was measured directly in the field during 4 years (2007–2010). New equipment consists of three parts. The first equipment is a square frame with an inside dimension of 4 m^2. The second equipment is removable profile, which serves for movement of the soil erosion bridge. The third equipment is the soil erosion bridge. The soil erosion bridge serves to volumetric quantification of rill erosion. The more effective way of data processing was developed. It was developed a software, by which it is possible the automatically transfer the rill surface profile to digital form. In the South Moravian Region in the Czech Republic was selected case study area with typical very steep sloped relief with the loess soil. The measurement was carried out on the research plots with a slope of more than 10%. More than 1300 cross sections of the soil surface profile were measured using the new type of soil erosion bridge. From these profiles it was possible to calculate the volume of the eroded soil from the research plots. The results were always in excess of 100 t ha^{-1} rok^{-1}. This is a value many times higher than the tolerated limit of soil loss in Czech Republic. Thanks to this new equipment, it is possible to quantify the soil loss from the plot threatened of water erosion. The advantage of this equipment is its using during the vegetable season when the soil surface is overgrown with vegetation and crops are higher growth.

Key words: Soil erosion bridge, soil loss, volumetric quantification, rill erosion, field measurement.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Slope effects on crust formation in agricultural land in Northern Iraq

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Abstract

A field study was conducted in an undulated agricultural land dependent on natural precipitation in Northern Iraq. The area were characterized by the presence of the soil crust phenomenon, which leads to increase water runoff and soil loss from sloping lands, in addition to its negative effects on seedling emergence. The objective of this study was to evaluate the rainfall quantity and slope degree effects on crust formation, and to determine the relationship between them and crust strength and thickness. A Catena was chosen with a length of 150 meters and a slope of 3-6%. Three pedons were chosen at the top, middle and bottom of the Catena, described morphological features according to Soil Survey Staff 1999. Soil samples from horizons of each pedon have been taken for laboratory analyzes. The crust thickness and resistance to penetration, bulk density, practical size analysis and the soil moisture content calculations were done in two different stages. First at the beginning of the rainy season, and second at the end of the season. The results observed that there are an increase in crust thickness and strength, with an increasing in rainfall and decreasing of slope degree. Crust thickness and crust penetration resistance in the middle of the slope was 3.75 mm and 2.78 kg cm^{-2} compared with 3.50 mm and 2.10 kg cm^{-2} at the top, and 2.80 mm 1.40 kg cm^{-2} at the bottom, respectively. Also an increasing in the crust density at the topsoil, and the proportions of clay and silt were found in the crust compared with the underneath soil, without any change in soil texture.

Key words: Catena, crust formation, crust strength, crust thickness, Iraq.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of erosion mechanism meeting water of Pisha Sandstone

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Abstract

The rock and soil erosion in Pisha sandstone area of Zhungeer Qi Inner Mongolia was very serious; the main reason is that once meeting water, the Pisha Sandstone as solid as rocks would turn into mud. In this paper, the intrinsic cause for the erosion of Pisha Sandstone has been tentatively analyzed in the light of minerals, chemical compositions and grain size distribution.

Key words: Pisha sandstone, minerals, chemical composition, erosion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Impact of irrigation erosion on fertility of irrigated dark chestnut soil and productivity of vegetables in Southern Kazakhstan

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Abstract

Issues of protection of irrigated soils from erosion are becoming more relevant. Irrigation erosion is one of the forms of water erosion and it is common in almost all irrigated areas of south and south-east of Kazakhstan. Under the influence of irrigation flushing in soil profile of eroded soils occurs the decline of humus horizons, loss of plant nutrients, reduction of stocks of productive moisture and nutrients, deterioration of water-physical, chemical and biological properties of soils. As a result of flushing, annually soils lose fertile soil layer and a significant part of the yield (20-30%). In this regard, the development of measures to combat soil irrigation erosion, and fertility reproduction have great scientific and practical significance. Study of the influence of irrigation erosion on change of humus horizon capacity, reduction of nutrients and finally reduction of productivity of vegetable crops was conducted on irrigated dark chestnut soils located in the south-east of Kazakhstan. Preliminary results of conducted soil studies have shown that irrigation erosion changes chemical properties of soil in different parts of irrigated field, enhancing the increase at the end of the furrow. As water flow rate increases, the content of water-stable aggregates in plowing and subsurface layers decreases, when the value of bulk density increases, the content of exchangeable bases reduces. Reduction of the content of mobile forms of nutrients in flush zone occurs in irrigation, and increase in accumulation zone. Soil observations conducted in drip irrigation method of vegetable crops on irrigated dark chestnut soils, showed that character of behavior of water-stable aggregates is almost the same, and there is a slight degradation of soil aggregates. Drops in sprinkling are the main reason for separating particles under the influence of successive blows of drops, and in fine disperse irrigation the dynamics of changing water-stable aggregates more than 0.25 mm is observed. From the above mentioned, it can be said that irrigated dark chestnut soils are subject to erosion processes in various degrees. Therefore, it is needed to develop anti-erosion and water-saving irrigation technologies.

Key words: Soil, soil fertility, irrigation erosion, nutrient reserves, irrigation flush.

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International Soil Science Congress

EURASIAN SOIL
Congress 2014
Antalya, TURKEY

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SOIL FERTILITY

9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Conservation agriculture role on the humidity and organic matter of the semi-arid grounds soil

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Abstract

The uncertain rainfed agriculture in semi-arid and need annual water negatively affects the production and grain yield. These characteristics are an obstacle to rapid changes in varietals' lines or culture systems to cope with climate changes. Soil loss is very advanced by the various phenomena of erosion. These phenomena are exacerbated by production systems (monoculture cereal and fallow) and the methods and tools used tillage (plowing and backcrosses). The wait for the rains to begin the initial work of soil is necessary. This situation leads them to significantly reduce the period of crop growth, already reduced in recent years because of climate change, including drought and global warming. The performance impacts of direct seeding techniques are discussed successively, through the results of tests conducted in the region. We proceed to the study of soil parameters such as moisture and organic matter and the parameters of crop yield (wheat grain yield). The simplified work studies on cereal crops are beginning to draw tracks and paths for further research and understanding of why not to integrate this system on the farm more respectful vis-a-vis natural resources.

Key words: Conservation agriculture, humidity, organic matter, semi-arid grounds.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of organic matter (manure, straw, green fertilizer) on the mineralization of organic carbon in a salty soil

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Abstract

The salinity and sodicity give to the soil unfavorable physical, chemical and biological properties that affect the growth of plants. This work aimed to test the possibility of using organic amendments such as manure, straw and green fertilizer to improve, under controlled conditions (temperature, humidity), some biological properties, and consequently well value soils under disadvantageous effect of salts. Samples of a salty soil from the salty plain of Elmadher (Batna, Algeria) were used for this study, and a calcimagnisic soil was sampled from the El Hadaiek, Skikda, Algeria, as a reference. The salty soil is characterized by EC (1/5) of 3.62 dS / m, pH = 8.62, a rate of 2.21% of organic carbon and 0.14% of nitrogen. Using the respirometric technique, five treatments were performed; salty soil, salty soil + manure, salty soil + straw, salty soil + green fertilizer and reference soil alone (calcimagnisic). The amount of CO_2 released during 7 weeks of incubation was evaluated; and the total microbial biomass at the beginning and at the end of incubation was calculated, the pH and EC were measured. After 39 days of incubation, the amount of CO_2 accumulated was 151.4 C-CO_2 mgkg^{-1} soil for the salty soil against 329.6 mgkg^{-1} soil for calcimagnesic soil. This shows a lower biological activity under the salty soil. The salty condition seems more asphyxiating and inhibits the C mineralization process and, consequently, reduced the soil microbial biomass. Indeed, the cumulative curve examination reveals that the release of the cumulated CO_2 is higher in the case of the salty soil enriched with manure. The lowest CO_2 production was reported in the salty soil alone. The amount of CO_2 released after 39 days, is 485.4, 329.6, 299.3, 156.4 and 151.4 C-CO_2 mgkg^{-1} soil respectively for Salty soil + Manure, No salty Soil (calcimagnesic soil), Salty soil + Straw, Salty Soil + Green Fertilizer, and the salty soil system. It shows a strong influence of organic matter on the total biomass. Indeed, in the Salty Soil + Manure treatment, the density of micro-organisms is high compared to other treatments. The decrease in electrical conductivity is also remarkable in this treatment after 39 days of incubation. The small amounts of CO_2 released in the salty soil alone system indicates the direct action of salinity on microbial activity, but probably in indirect action by limiting the diffusion of oxygen due to a strong dispersing of ESP (Percent Sodium Exchangeable). Indeed, our results show that the addition of organic matter to a salty soil significantly increases the production of CO_2 released during the incubation period. This confirms the role of organic matter in the neutralization of the saltiness. However, the effect of organic amendments is different; the positive action of the manure is due to its richness in elements readily biodegradable and a low C/N ratio indicating better biological activity.

Key words: Salty soil, EC, organic matter, manure, green fertiliser, straw, carbon mineralization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of oil palm press biochar and or/cowdung incubation on selected soil properties and yield of lettuce on tropical Haplic Acrisol

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Abstract

Agricultural waste can be processed under pressure into a byproduct called biochar. One common agricultural waste produced in Ghana is oil palm press. Biochar has the potential to be used as a soil amendment but its impact on soil fertility and crop yield has not received adequate attention in Ghana and especially in the coastal savannah agro ecological zone. An incubation study was conducted at the School of Agriculture Research and Teaching Farm, University of Cape Coast to assess the effect of biochar prepared from oil palm press on selected soil properties and yield of lettuce. The oil palm press was pyrolysed between 350 – 400 ^{0}C using a lucia biomass pyrolytic stove. Coastal savannah Haplic Acrisol was amended with the Biochar solely or in combination with cowdung manure. Sole application of biochar at different rates (0 t/ha, 3t/ha, 5t/ha and 10t/ha) or in combination with cowdung (0.42t/ha, 0.82t/ha and 1.67t/ha) were incorporated into pots and lettuce seedlings transplanted into pots after 2 weeks at the nursery. Each treatment was replicated three times in a completely randomised design. The biomass yield of lettuce grown in each treatment for a period of 5 weeks was determined and selected soil properties were also evaluated. Both sole and combined applications of biochar significantly increased total soil organic C, soil pH, NO_3^--N and total dry matter yield of lettuce compared to control treatment. Meanwhile, the sole application of cowdung significantly increased $NH4^+$-N concentrations compared with other treatments. This finding will be translated to field studies so an inform decision can be taken for its recommendation to farmers in the tropical coastal savannah zone to use cow dung in combination with biochar for farming since cowdung is also readily available especially at the university farms.

Key words: Biochar, oil palm press, haplic acrisol, soil fertility.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of integrated nutrient management on growth, yield and quality of short grain aromatic rice varieties (*Oryza sativa* L.) for Chhattisgarh plains

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Abstract

A field experiment was conducted to evaluate the effect of integrated nutrient management on soil quality and its management. It was carried out at Research cum Instructional Farm, I.G.K.V., Raipur (C.G.) during *kharif* 2012, with the objective to study the response of integrated nutrient management on short grain aromatic rice varieties for optimization of yield and quality. The experiment was laid out in split plot design with three replications having four varieties namely (V_1) Dubraj, (V_2) Badshah Bhog, (V_3) Vishnu Bhog and (V_4) Bisni in main plot and six nutrient management treatments *i.e.* (N_1) 60:40:30 Kg N:P_2O_5:K_2O ha^{-1} (Inorganic), (N_2) 80:50:40 Kg N:P_2O_5:K_2O ha^{-1}(Inorganic), (N_3) 60:40:30 Kg N:P_2O_5:K_2O ha^{-1} (50%Inorganic+50%Organic), (N_4) 80:50:40 Kg N: P_2O_5: K_2O ha^{-1}(50%Inorganic+ 50% Organic), (N_5) 60:30:60 Kg N: P_2O_5: K_2O ha^{-1} (Organic – FYM) and (N_6) 80:40:80 Kg N:P_2O_5:K_2O ha^{-1} (Organic – FYM) in sub- plots. The result indicated that the treatments significantly influenced the Total uptake of nitrogen and phosphorus was recorded in the variety *Dubraj*,while *Badshah Bhog* recorded the highest potassium uptake. Whereas among the nutrient management options application of 80:50:40 Kg N: P_2O_5: K_2O ha^{-1} (50%Inorganic+50% Organic) recorded highest nitrogen, phosphorus and potassium uptake. In fertility status of soil, the application of 80:40:80 Kg N:P_2O_5:K_2O ha^{-1} (Organic – FYM) recorded highest available nitrogen, phosphorus and potassium after rice harvest.

Key words: Integrated nutrient management, plant nutrition and fertilization, organic manures and inorganic manures, soil quality, soil fertility.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ecological problems and nitrogen balance in vegetable crops growing

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Abstract

Nitrogen balance, based on long-term field experiments, is the main tool for optimisation of the fertiliser application under specific soil and environmental conditions. The purpose of this study is to focus on the nitrogen balance and some ecological problems in agricultural system. The impact of precipitation, irrigation water and fertilizer application on main soil characteristics, N-uptake by plant production and N-output by drainage water are estimated in this investigation. The study is carried out on Fluvisol (near Plovdiv) in Southern Bulgaria. Ecological assessment of nitrogen fertilizer application has been made of data from field experiments with different vegetable crops (eggplant, green beans and carrots) over the period 2009-2011. The experimental design includes control (N_0) and three treatments with nitrogen application –N_{80}, N_{160} and N_{240} on the background of $P_{80}K_{80}$ kg.ha^{-1}. The field plots are equipped with modification of Ebermayer type of lysimeters, which collect drainage water from 100 cm depth of soil profile. According the received data it was observed that compensation between the amounts of N input and output was achieved in two variants (N_{80}, N_{160}) for eggplant and carrots. The data showed that the including a green beans in this study is not suitable because it is difficult to control nitrogen balance in the plant-soil system. Reducing the nitrogen input to the amount applied by precipitation and irrigation water is the most ecological-friendly technological decision and very important factor for environment protection.

Key words: Agricultural system, fertilization, nitrogen balance, nitrogen leaching, vegetables, environment protection.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fertility of calcareous chernozem of the Rostov region under different tillage systems

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Abstract

This paper discloses the study of changes of physical and chemical properties of soil under no tillage, minimum tillage and the traditional tillage (plowing). In grain composition the soil is classified by N.A. Kachinskiy as a clay loam with different methods of treatment with contents of physical clay - 48.87-59.58%.The mass ratio of the solid particles of various size does not undergo radical changes under the influence of treatments but the particles vary within the category. With no tillage treatment the contents of silt fraction decreases down the profile, under minimum-slightly increases. Density of plowing horizon was classified on the scale of N.A. Kachinskiy as compacted tilth and varied from 1.28 to 1.20g/cm^3 depending on the method of the soil treatment. In A horizon when using resource-saving treatments there is a slight increase in the density of the soil, and with plowing the indicator increased by 0.24 g/cm^3. It was found that the content of humus in plowing horizon under no tillage is 4.01%, minimum tillage - 4.51%, traditional tillage - 3.43%. In areas with resource-saving technologies the calcareous chernozem was characterized as low-humus, and at plowing-as slightly humus. A high level of humus stock in a meter long soil depth is marked out at all areas. In terms of influence of treatment methods on this indicator we can get the following range: minimum > traditional > no tillage. Analysis of the depth-wise distribution of mineral nitrogen distribution in calcareous chernozem with different tillage systems identified the following trends: in humus horizons ammonium nitrogen is prevalent, and at the bottom of profile -nitrate nitrogen; with energy-saving technologies of soil treatment stands out the depth of accumulation of mineral nitrogen (ammonium + nitrate) - 35-50cm. Thus, the physical and chemical properties of calcareous chernozem depend on the method of basic treatment. Continuous use of the surface treatment (minimum and no tillage) hinders the loss of soil humus that contributes to the growth of content of humus and mineral nitrogen as compared to traditional plowing. Therefore the proper soil treatment plays an important role in controlling its humus status and fertility in general.

Key words: Fertility, chernozem, methods of soil treatments, physical and chemical properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of the environmental status of soils with kinetic model of biological growth and rate of growth of agricultural crops

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Abstract

It required solving any theoretical problem for creating a common method of assessment of the environmental status of soils. Tool for assessment of the environmental status of soils is the kinetic model of biological growth in this paper. The kinetic model of biological growth describes plant growth and development according to time and the initial concentration of the lead component of the substrate. Differentiation of growth equation allows finding intervals with different kinetic characteristics. Investigation is devoted to testing of the model on the example of his own experimental data on growth rates depending on the time of crop growth at a fixed concentration of pollutants and nutrients in the soil. It is shown that the dependence of the growth of crops on the time at fixed concentrations of nutrients and pollutants in the soil adequately described by the model. Match is found between the intervals with the same kinetic characteristics of growth response curve and the flow intervals phenological phases obtained in the field.

Key words: Kinetic model of biological growth, assessment of the environmental status of soils, plant growth and development, rate of growth.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Alleviating the infertility of an acid sulfate soil by using ground magnesium limestone with or without calcium silicate

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Abstract

Each year rice consumption increase throughout the world and improving rice production in problematic granary areas is the most suitable solution to increase rice production. Such granary areas are often found in acid sulfate soils of Peninsular Malaysia. These soils are compacted mineral soils, low in pH (< 3.5) and contain high amount of aluminum (Al) and as such, it would inhibit crop root growth. The objective of this study was to alleviate the infertility of acid sulfate soil by using ground magnesium limestone (GML) with or without calcium silicate (CS). The soil obtained from Merbok Kedah (Peninsular Malaysia) were treated with 2 rates (2 and 4 t ha^{-1}) of GML and 4 rates (0, 1, 2 and 3 t ha^{-1}) CS and subjected to 120 days of submergence condition. The soil pH prior to submergence was 2.90 and it showed that for 4GML, the soil treated with addition of 2CS and 3CS is significantly higher than 0CS and 1CS value of 5.33, 5.53, 4.13 and 4.23, respectively. Application of the amendments reduced the exchangeable Al by 77.23% to 96.24% from 4.26 $cmol_c$ kg^{-1} (prior submergence) below the critical level of 2 $cmol_c$ kg^{-1}. In 2GML, addition of 2CS significantly increased Si content from 52.06 to 99.02 mg kg^{-1} Si while in 4GML, addition of 1CS and 2CS significantly increased Si content compared to that of 0CS and 3CS. Soil treated without CS, show that Si content increased from 21.21 mg kg^{-1} (prior submergence) to 52.06 mg kg^{-1} and 74.40 mg kg^{-1} in 2 and 4GML respectively, plausible due to the dissolution of Si from the acid sulfate soil. Addition of the amendments increased Ca content significantly above the critical level of 2 $cmol_c$ kg^{-1} for rice. Hydrolysis of CO_3^- from GML produce hydroxyls (OH^-) ion neutralize Al by forming inert gibbsite, $Al(OH)_3$. This in return, raises the soil pH and reduces Al toxicity of the acid sulfate soil. GML ($CaMg(CO3)_2$), is known to supply Ca and Mg while calcium silicate ($CaSiO_3$) supply Si that can be taken up by crop. The silicate anion is known to be reactive in neutralizing H^+. Thus, silicate anions from CS may neutralize acid sulfate soils, hence raises the soil pH significantly in treatments with addition of calcium silicate compared to without calcium silicate. Therefore, addition of GML with CS shows an ameliorative effect on acid sulfate soil.

Key words: Aluminum toxicity, soil acidity, ameliorative effect, silicon, calcium.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Growing of fenugreek (*Trigonella foenum-graecum* L.) in dependence on water regime and inoculation with nitrogen fixing bacteria Rhizobium

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Abstract

Fenugreek (Trigonella foenum-graecum L.) is an annual legume crop. It is widely cultivated in India, China, Egypt, Ethiopia, Morocco, Turkey, etc. Fenugreek plants and seeds are used in foods as a spice but are medicine plants, too. In Bulgaria this crop is known only as a kind of spice. Fenugreek is a dryland crop but it well responds to a minimum application of irrigation. Fenugreek plants were grown in the condition of pot trial. The effect of inoculation with nitrogen fixing bacteria *Rhizobium* spp was tested in an experiment with Leached Smolnitza (Pellic Vertisol) (FAO, 1997) from Bojurishte (Sofia district) at 60% and 40% Water Holding Capacity of the soil. Fenugreek seeds were inoculated with three *Rhizobium* spp strains. Different strains showed different virulence in the conditions of the trial. *Rhizobium* strain №333 had the highest efficiency. Results showed that fenugreek inoculation led to increased plant yield at two water regimes. The seed yield was highest at the variant with 60% WHC and No333 strain inoculation. The crude protein content in seeds was higher in plants grown at 60% Water Holding Capacity than in plants grown at 40% WHC. The content of macroelements (P, K, Ca, Mg) of seeds did not show significant differences. The best variant of growing fenugreek inoculated with strain No 333 *Rhizobium* spp at 60% Water Holding Capacity of the soil could be recommended for future experiments.

Key words: Fenugreek, *Rhizobium*, soil moisture, yield.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimates of carbon storage in the below ground NPP of agriculture lands of Southeast Anatolia region

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Abstract

Net primary production is one of the most important ecosystems parameters, carbon cycle and biochemical cycle. Net primary production is strongly affected by falls annually precipitation amounts and pattern with annual- temperature. In this study 200 samples were collected in the agricultural lands and grassland and NPP and carbon amounts calculated in the soil of the Southeast Anatolia Region. The highest values of NPP and carbon amounts were observed in the north and the lowest values - in the south. The lowest values of NPP were observed in the barley and the highest values in the corn (Zea mays). Total NPP amount was calculated 31.98 Tg or 14.94 Tg C and mean NPP density was 4.21 t ha^{-1} or 1.91 t C ha^{-1}. Above-below ground NPP and carbon amount of the grassland were calculated 155.05 g m^{-2} yr^{-1} or 70.48 g C m^{-2} yr^{-1}, and NPP and carbon amount of the corn were calculated 2320.76 g m^{-2} yr^{-1} or 1054.98 g C m^{-2} yr^{-1}. The grassland has been subjected to grazing by livestock for all year. The live stocks are mainly sheep, goats, horses and cattle which grazing freely all years round. To compare all data were used SPSS 10.0 and data were investigated by $p<0.01$ significant level.

Key words: Terrestrial net primary production, above-below ground biomass amounts (NPP), above-below ground carbon amounts, Southeast Anatolia Region.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes in some soil fertility properties by industrial agricultural waste amendment

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Abstract

In this research, the effect of industrial agricultural waste amendment, cotton gin wastes (CGW), on some fertility properties of clayey textured soil (Typic Xerofluvent) were investigated. Cotton gin waste was applied to soil as a fresh material, (dry weight basis 1000, 2000 and 4000 kg da^{-1}), and pot experiments were carried out according to the completely randomized experimental design with 5 replicates in greenhouse conditions. This study is consisted of two different stages including 14 months totally. The first stage which is consists of 6 months incubation period (1^{st} sample period). Second stage which is consists of other 6 months plus 8 weeks bean (*Phaseolus vulgaris L.*) vegetation period (2^{nd} sample period). End of the first 6 months, soil samples were collected and the effects of CGW on some soil properties determined. End of the second 6 months, bean plants grown as an indicator crop in greenhouse conditions and after 8 weeks the plants were harvested and analyzed. The effects of CGW on N, P, K, Ca, Mg, and Na concentrations with OM, pH, EC values and macro plant nutrients content (N, P, K, Ca, Mg) in clayey textured soil were different level and way in both stages. The effect of CGW on dry matter yield in the bean plant was not significant. At the end of the experiment, it is determined that some soil properties, especially EC and OM level, and total N, available P, K and Mg content of soil improved by the application of cotton gin waste.

Key words: Cotton gin waste, fertility, organic matter, soil, waste.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of the some soil fertility status of Rhizomatous Iris (*Iris* Spp.) plant grown in flora of Turkey

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Abstract

This study was carried out to determine fertility status of soils in which rhizomatous irises are naturally growing in flora of Turkey. For this purpose 150 soil samples were taken from 47 regions between 2006 and 2009. For this objective salinity, pH, $CaCO_3$, organic matter, available phosphorus and potassium of soil samples were detected. According to the results of study electrical conductivity values were between 50 to 2290 µmhos cm^{-1} and the soil pH was found to be between 5,15 to 8,60. Soil samples were mostly different calcareous content and highly organic matter. The available phosphorus values were found 3 - 135 mg kg^{-1} and potassium 55 - 1450 mg kg^{-1}.

Key words: Iris, flora of Turkey, soil, fertility status.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mathematical models for soil fertility of Azerbaijan

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Abstract

The previous studies show that for creating soil fertility models, many researchers prefer to use unequivocal regression analysis. This is primarily due to the fact that (i) as opposed to analysis of variance, the regression analyzes require more simple statistical calculations, and (ii) as opposed to factorial and correlative analyzes, the regression equation may create the possibility of a physical explanation of the investigated process. Despite these advantages, our research and numerous observations have revealed some of the following difficulties of using regression analysis: ◆ Regression and or mathematical models, although combine the basic features of physical processes, but not completely cover the process due to the limited number of experimental measurements. This, in turn, in many cases gives an incomplete picture of the actual trend of the process, and ultimately the model may not be able to capture the impact of all used factors. ◆ Although there is enough material for a regression analysis, the constructed model does not fully reflect the interaction of the relevant internal physical process. ◆ One of the features of the regression models in the studies refers to the case when the parameters are in the multicollinear relationships. In this case, despite the correct methodology for conducting experiments and statistical approaches, the final model is characterized by lower regression coefficients that can be the result of the above mentioned errors. ◆ With significant nonlinear impact of parameters on the results, the constructed regression models may give result to misinterpretation. ◆ Implementation of the regression models is limited due to the above mentioned reasons and as well as methods of model building. We have proposed a new mathematical model, which has a complex relationship with soil and environmental parameters. This fact alone indicates that in the soil-ecological system the considered factors independently on others have an additive effect on the results. On the other hand, model of the yields has no direct linear dependence on the parameters of the soil- ecological system, which indicates the importance of participation of nonlinear elements in the models. A new mathematical model has a more general nature than the regression models, and hence it has some advantages, and gives a result close to the measured data. Proposed technique combines both the modern scientific and technological progress, and the idea of dimension theory and factor analysis, and sufficiently covers the nature of ongoing processes in the soils.

Key words: Mathematical modeling, soil fertility, optimization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of soil properties derived from different parent rocks on teak biomass characteristics in Southwest Nigeria

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Abstract

Understanding the soil characteristics that influence teak production in soil derived from different parent rocks is imperative in sustaining teak cultivation. In the southwestern ecological zone of Nigeria, teak (*Tectona grandis*) is widely grown in large-scale as a way of meeting the high wood demand and soil conservation. A study was carried out to assess the effect of teak biomass characteristics on soil nutrient derived from basement and sedimentary rock formations. Systematic line transect was employed to establish 36 sample plots of 900m^2 across Ilaro and Olokemeji plantations underlain by sedimentary and basement complex rocks respectively. In each plot, soil samples (topsoil and subsoil) and teak biomass were collected. The Pearson's result showed that at Ilaro and Olokemeji plantation, none of the topsoil and micronutrient properties showed any significant relationship with teak biomass parameters. It showed that at Ilaro, subsoil N, OC, pH, EC and CEC had positive and significant association with bole height; and subsoil silt showed positive and significant association with tree height and volume. For micronutrient, only subsoil Zn and Fe had significant relations with volume and total height at Ilaro, while at Olokemeji, only subsoil Fe showed positive and significant association with bole height. The stepwise regression analysis at Ilaro indicated that subsoil organic carbon and subsoil silt exerted significant effects on bole height, total height and volume, while at Olokemeji only topsoil hydraulic conductivity exercised significant effect on total height. It also identified subsoil Fe to influence bole height at Olokemeji plantation, whereas at Ilaro plantation, subsoil Fe and subsoil Zn were identified to influence total height and volume respectively. The study revealed that at Ilaro plantation soil, the contents of K, Mn and Zn were principally influenced by tree height and volume while at Olokemeji plantation, the contents of K, Mn and Zn were also principally influenced by tree height and volume, while basal area influenced N content. The study concluded that tree height, volume and basal area influenced the proportion of nutrient in the studied plantation soils.

Key words: Teak biomass characteristics, soil nutrient, parent material, teak plantation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Bio-diagnostics of the irrigated soils under fodder crops in the arid subtropical region of Azerbaijan

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Abstract

In the conditions of the intensive anthropogenic influence on the irrigated Gleyic Calsisols soils of Azerbaijan dry subtropics, first of all, soil biological indices undergo sizable changes. In this connection, in the modern soil formation, particular attention is given to the study of biological processes of matter transformation and possibilities of its further use for biodiagnosis of the ecological state and trend of soil formation. This necessitated developing effective agrotechnical measures with the use of uninterrupted and interrupted sowings of fodder crops. In order to determine the trend of processes of soil formation, as bio-diagnostic soil indices microbiological and biochemical indices were used as they are considered the most sensible soil indices to the changes of soil and ecological conditions and fertility. The purpose of the research is to study biogenic transformations of mobile forms of the mineral fraction and humus of irragri Gleyic Calsisols soils under fodder crops subject to species of plants and types of their sowings, numbers of microorganisms, particular physiological groups, soil enzymatic activity, respiration and cellulose decomposing capacity. The scheme of the experiment: (1) winter barley – corn; (2) winter rye – corn; (3) lucerne ; (4) sainfoin; (5) corn; (6) winter barley-corn + soya + sorghum + amaranth – barley + vetch; (7) winter rye + vetch + rape – corn + soya + sorghum + amaranth- barley + vetch. According to the results, during the year, in the variant with winter sowing rye + vetch + rape and the main sowing corn + soya + sorghum + amaranth, uninterrupted summer barley, which provides the uninterrupted field use, the air-dry mass of stubble and root remains is accumulated in every hectare up to109-112 centner per hectare. But in the variant 2 the air-dry mass of stubble and root remains is accumulated 63.67-70.2 centner per hectare. The long-term researches showed that in the uninterrupted variant 7 under different fodder crops in the layer of 0-25 cm, the total number of microorganisms changed within 5234.1-5847.92, non-spore-forming bacteria-4457-4325, spore-forming bacteria-892-1049, Actinomycetes - 1601-1793, microscopic fungi - 5.83 - 6.35 thous./ha. The research results revealed strong seasonal variation of invertase. In spring the highest invertase activity is observed in variant 7 - 16.86-23.9 mg of glucose. It was established that the sowing of variant 7 are most effective: salt sum is decreasing from 0.34 to 0.17 %, the content of the absorbed Ca is increasing from 69 to 79%, the content of Mg and Na is decreasing up to 5.8-7.9% and 1-1.9%, the content of calcium carbonate increased (5.9-8.1%).

Key words: Soil, bio-diagnostics**,** microorganisms**,** invertase.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of fertilizer treatments on early performance of two bottomland oak species in an alkaline soil

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Abstract

Many acres of once productive Missouri farmland along the Missouri River are being planted to bottomland hardwoods. However, on many of these sites, once trees become established, most show symptoms of chlorotis due to high soil pH levels (> 7.5). Six treatments including: 1) $FeSO_4$ plus water degradable S; 2) Fe chelate; 3) Fe chelate plus NH_4NO_3; 4) NH_4NO_3 alone; 5) NH_4NO_3 plus $FeSO_4$; and 6) control containing combinations of iron, sulfur, and nitrogen were tested for their effectiveness in ameliorating soil conditions to stimulate nutrient uptake and growth of two-year-old planted pin oak (*Quercus palustris*) and swamp white oak (*Q. bicolor)*. Some chlorosis was still present after two years of treatment. After two years, treatments with S had significantly (P>0.05) lower pH. Neither Fe nor N treatments affected pH. For leaf nutrient and growth analyses, tree species were not analyzed separately. Treatments with S had lower foliar P, K, and Ca concentrations for all years, but these concentrations were not affected by Fe or N. Deer browsing continued to be a major problem to maintaining height growth. Treatments containing S had smaller basal diameters and lower tree heights than treatments with S. Height loss or height decline, which may have been associated with deer browsing, was greater in treatments with S. Sulfur containg fertilizers were effective in lowering soil pH, but the depression of pH by sulfur containing fertilizers may not necessarily coincide with favorable seedling response. Nutrients other than iron are likely involved in the seedling chlorosis. Prescription for nutrient management on bottomland sites such as these will need to be developed for tree plantings to become healthy mast producing forests.

Key words: Chlorosis, Fe chelate, bottomland oak species, alkaline soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of drought stress on the growth of the *Stipa barbata*

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Abstract

Stipa barbata is known to survive under diverse soil and water conditions. In order to test its potential of aridity tolerance ability, the effect of aridity stress on the growth of the *Stipa barbata* was studied by growing plants in arid soils. The experiment was conducted in a greenhouse, with a factorial arrangement in a completely randomized design using 5 replications. Aridity levels of field capacity irrigation (as control), -6 and -10 bars were applied. The root weight, root length and chlorophyll concentration parameters in -6 bars aridity level were more than control aridity level. The water content was highest in FC aridity treatment. Our results suggest that in the soils that have -6 to -10 bars water content, *Stipa barbata* could be used for soil rehabilitation.

Key words: *Stipa barbata*, drought, growth.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Establishing a soil reference system for fertility assessment and monitoring at plot level in the highlands of Mindanao, Philippines

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Abstract

The study objective was to develop a methodology and build a soil reference system to provide scientific guide on soil fertility assessment and monitoring for land use planning in the highlands of Mindanao, Philippines. Specifically, this had aimed to: (1) determine the basic nutrients for soil fertility assessment and monitoring of representative plots in two locations within defined toposequences by soil composite samples analyses, (2) find out the crop yield in plots where soil composite samples were taken, and (3) calibrate soil analyses results with crop yields. The first step of the study had adopted the geomorphopedological approach by laying out toposequences to establish the relationships between rock, relief, soil, land cover and farmers' management strategies. Conducted in crop production areas of Miarayon Village, along the volcanic footslope of Mt. Kalatungan, Bukidnon, the elevation range of the toposequence is 1,900 to 1,300 m asl. Production areas in the upper part (Salsalan) are located at about 1,600 to 1,400 m as land in the lower part (Mambuaw) at 1,400 to 1,300 masl. A total of 24 plots (12 in each location) which were predominantly planted to carrots, corn and potatoes were investigated. Soils are "Andic" Cambisol in open and convex positions and "Andic" Umbrisol in concave positions and in toeslopes. Chemical parameters analyzed were pH water, Total Organic Carbon (TOC), Total Nitrogen (TN), CN ratios, available P, available Ca, Mg, K and Na. The pH values ranged from 4.9 to 5.9. TOC and TN content were medium to high (4.7 to 9.6% and 0.3 to 0.79% respectively) with C:N ratios that ranged from 15 to 11. Available K (0.23 to 1.13 $cmol_{(+)}$/kg) and Mg (0.25 to 2.14 $cmol_{(+)}$/kg) were above the threshold limits while Ca (1.9 to 11.25 $cmol_{(+)}$/kg) was low to medium. Although available Na (0.04 to 0.13 $cmol_{(+)}$/kg) was generally low. Soil had high P retention, thus available P was limiting (<1 mg/100g). Crop yields were higher than the average Bukidnon values. Average carrot yield in Mambuaw was 2.4 tha^{-1} greater than in Salsalan. Average corn yield in Salsalan was higher than in Mambuaw by 0.29 tha^{-1} only. Average potato yield in Salsalan was superior to Mambuaw by 8.97 tha^{-1}. The relationship between carrot yield with soil pH and nutrient levels was undefined. The relationships between corn yields and available Ca, Mg and K were positive, while for Na was negative. For pH, TOC and TN, their relationship with corn yield was uncertain. Potato yield was strongly associated to pH and nutrient levels except for available Na.

Key words: Mindanao Philippines, "Andic" Cambisol, "Andic" Umbrisol, soil reference system, soil fertility assessment, crop yield measurement

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of Q/I parameter on limiting soil potassium critical levels of some soil order in Iraq

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Abstract

This study was conducted to determine potassium critical level for calcareous soil in Kurdistan region for this purpose 16 soil sample were taken from different soil orders (Mullisols, Vertisols, Aridisols, inceptisols and Entisols). The K^+ critical level were determined depending on extracted K^+ with NH_4AOc, potassium activity ratio (AR^K) and potential buffering capacity (PBC^K) , using Graphic and statistical methods. The results indicated that the best parameter for determining K^+ critical level is potential buffering capacity. The critical level of potassium depending on PBK was 71.9 cmolc Kg^{-1} $(mol\ L^{-1})^{0.5}$.

Key words: Potassium activity ratio, critical level, potential buffering capacity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil and crop management effects on soil organic carbon

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Abstract

At present the major environmental problem is the carbon dioxide (CO_2) axis climate change. Climate changes basically stems from human activities. In recent years there has been a severe drought in Mediterranean ecosystem. Most people cannot predict the exact cause of the drought. Even the scientific community is not sure about effect of soil-crop management on atmospheric CO_2 increase and climate change. In order to get high yield and production farmers are using high inputs such as chemical fertilizers, pesticides, tillage, irrigation and improved seed. Last 15 years effect of crop and soil management on soil organic carbon has been studied. Under the high temperatures and less water conditions and burning of straw after harvest for the next crop, reduce soil organic carbon (SOC) and elevated CO_2 concentrations and climate change is expected to increase as well. Soil can be a sink for atmospheric carbon, thus reducing the net CO_2 emissions normally associated with agricultural ecosystems, and mitigating the 'greenhouse effect'. Atmospheric CO_2 can be fixed to soil thought photosynthesis. Since plant root and mycorrhizal fungi are demanding more carbon, plants are capturing more atmospheric CO_2 and accumulated in plant tissue. Carbon sequestration and saving carbon in the aggregate has recently been the burgeoning topic in soil science with an increasing interest on the effect of mycorrhizal hyphae (glomaline as the by-product), together with humic substances enhancing aggregate stability. Arbuscular mycorrhizal fungi (AMF) are obligate symbioses of nearly %95 of plants species. The effects of mycorrhizal colonization on nutrient uptake and root growth were studied extensively. However recently it has been indicated that mycrrhizae hyphae may have significant effect on soil aggregate size and development. Mycorrhizae fungi are the major component of soil microbial biomass, and AMF hyphae produce glomalin, a recalcitrant glycoproteinaceous substance highly correlated with soil aggregate water stability as well. Long term mycorrhiza inoculation or indigenous mycorrhizae management also has effect on aggregate development. And also under long term field experiment there is a relationship between SOC content and yield increases.

Key words: Carbon sequestration, mychorriza, soil management.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Dependancies on soil properties in assessing the productivity of vegetable crops

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Abstract

In the Republic of Uzbekistan practical work on soil evaluation showed that in the transition to new intensive farming systems, efficient use per hectare of arable land, widespread adoption of rent and farm land use created the need for soil evaluation methods that take into account regional natural, economic and business conditions. The purpose of the research is to develop methods of bonitation of irrigated foothill alignment employed under vegetable crops and searching for correlative relationships between the most important agronomic properties of soils on one hand and major vegetable crop yields on the other hand. As a result of experiments to establish a correlation between soil properties and yield of basic vegetable crops were calculated correlation coefficients between different groups of vegetables and most important from an agronomic point of view of soil properties. So we calculated the coefficients in texture - 0,81-0,92, humus reserves - 0,96-0,98, the degree of salinity - 0,57-0.71 at the depth of the gley horizon - 0.88 - 0.95, the amount of phosphorus in the layer - 0-50 cm 0.92-0.95, the amount of potassium in the 0-50 cm layer – 0.92-0.98 on gypsum soils – 0.68-0.76. Established correlation allowed developing a scale of assessing soil quality in texture and calculating bonitation coefficients on the individual properties of soils. Slightly saline soils in relation to unsalted potato crop is reduced by 15-20% , 15-25% of cabbage, tomato 20-30% , 25-30% of onions on medium saline soils, respectively, 35-40, 40-60, 50 - 60%. In the Republic of Uzbekistan there has been developed a technique of regional soil bonitation under vegetable crops, which reflects the natural conditions and soil properties.

Key words: Soil properties, vegetable crops, evaluation, correlative relationship, irrigated soils, assessment, ground, irrigation, mechanical structure, cropland, salinification, humus, phosphorus, potassium, vegetables, cabbage, onion (bow), potatoes, tomato, crop, nature, agronomics, technique

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Copper content and distribution in vineyard soils of central Serbia

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Abstract

The present study investigated the copper content of vineyard soils as affected by the long-term use of copper-based fungicides. The soil samples were taken from individual vineyards located in the central region of Serbia, from two depths: 0-30 and 30-60 cm. At the same time, at each site, control samples were taken from a nearby forest in order to determine the background concentrations. The pseudototal (Cu_T) and available (Cu_{EDTA}) copper content was analysed in 60 soil samples in total, 46 of which represented vineyard soils and 14 control samples. The maximum value of copper was 200.1 mg/kg of pseudototal and 82,1 mg/kg of available copper. Comparison of the copper content in vineyards to the background concentrations of the control samples, clearly proved anthropogenic influence. Out of 46 vineyard soil samples analyzed one half (22 of them) had the Cu_T concentration above the critical level of 60 mg/kg. Eleven samples had the pseudototal content over the MAC of 100 mg/kg. Anthropogenic influence also was confirmed on the basis of copper availability and copper distribution along the soil profile. Available content of over 50 mg/kg was found in 8 out of 46 samples of vineyard soils analyzed. According to the percentage contribution of available Cu_{EDTA} to pseudototal Cu_T, half of the samples were above 36%, which is potentially phytotoxic. The concentration of copper was the highest in the surface layer in the vineyard soil samples. A check of the background Cu levels has shown that the distribution of Cu_T and Cu_{EDTA} is completely uniform throughout the soil profile. Data from some of the plots analyzed indicate that the process of erosion is under way at the site. The soil on lower-lying terrain has been found to be more exposed to copper pollution than the soil of higher terrain. Since copper at the studied sites is very persistent and accumulates in a short period of time, focus should be placed on the preventive measures of reducing the use of copper-based fungicides to an optimal level.

Key words: Copper, soil, vineyards.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Rhizosphere-based phosphorus management for rice in acidic inceptisols

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Abstract

Phosphorus (P) limitation and low P-use efficiency (PUE) in acidic soils are well known. In recent years, rhizosphere-based P management approaches are increasingly recognized as efficient methods for enhancing PUE in acidic soils. In a field experiment, three rhizosphere based P application methods were compared against the commonly used farmers' P management practice {(basal application of single super phosphate (SSP faremrs' practice @ 60 kg P_2O_5 ha^{-1})} in terms of yield attributing parameters and grain yield of rice (variety: Shahsarang) grown in an acidic inceptisols. Three rhizosphere based P application methods were: (1) phosphate solubilizing biofertilizer (PSB @ 4 kg biofertilizer material ha^{-1}; strain MZS1-012) + rock phosphate (RP@30 kg P_2O_5 ha^{-1}), (2) root dip in SSP-soil slurry (SSP-root-dip; 112.5 mg P_2O_5 kg^{-1} soil and 10 h incubation), and (3) SSP-root-dip+PSB+RP. The SSP farmers' practice, The SSP-root-dip and SSP-root-dip+PSB+RP treatments were comparable in terms of effective tiller numbers and were significantly higher than that in PSB+RP treatment. The root volume of rice at 60 days after transplanting and the harvest index were the highest in SSP-root-dip+PSB+RP treatment plots. The higher grain yield of rice and their per cent increase over control plot was in order of SSP framers' practice (52.9%) > SSP-root-dip+PSB+RP (49.0%) > SSP-root-dip (47.8%) > PSB+RP (32.5%). The SSP farmers' practice and SSP-root-dip+PSB+RP treatments plots were comparable on grain and straw P uptake, PUE and P recovery efficiency (PRE). The PUE and PRE in SSP farmers' practice and SSP-root-dip+PSB+RP treatments were significantly higher compared to that in other treatment plots. Besides, the input cost involved in SSP-root-dip+PSB+RP treatments was one fourth of the cost of SSP farmers' practice. In conclusion, SSP-root-dip+PSB+RP treatment was found to be one of the efficient rhizosphere based P management approaches for enhancing rice productivity in acidic soils of North East India.

Key words: Phosphate solubilising bacteria, rock phosphate, SSP-root-dip-soil slurry, phosphorus use efficiency, phosphorus recovery efficiency.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The influence of forest gaps on some properties of humus in a managed beech

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Abstract

The present research focuses on the effect of artificial gaps on some properties of humus in managed beech dominated stand in Hyrcanean forest, Northern Iran 8 year after its formation. In this study, sixteen gaps were sampled in site and these gaps classified into four classes (small, medium, large and very large) with four replications for each. Humus sampling was carried out at the centre and at the cardinal points within in each gap as well as in the adjacent closed stand, separately, as composite samples. The variables of organic carbon, P, K, pH and total N were measured for each sample. The results showed that the gap size had significant effect only on total N (%) and organic carbon (%) in beech stand. The amount of potassium clearly differed among three positions in beech forest. The adjacent stand had higher significantly potassium than center and edge of gaps. There was significant difference between center and edge of gaps only in terms of potassium. Comparison of humus properties between gaps and its adjacent stand revealed that the mean amount of potassium in adjacent stand was higher than gaps and there is no different between them regarding to other humus properties. According to the results, it can be concluded that there is relative similar condition among gaps and closed adjacent stands in terms of humus properties eight years after logging in the beech stand.

Key words: Gap, beech, humus, Hyrcanian forests

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes of microbial community structure on aggregate size by long-term fertilized in Korean paddy soil

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Abstract

Microbial-based indicators of soil quality are believed to be more dynamic than those based on physical and chemical properties. We analysed microbial communities structure associated with different aggregate size fractions in Korean paddy soils that applied long-term fertilization for 43 years with no fertilizer, NPK, NPK+Compost and Compost, respectively. The amount of total phospholipids fatty acids (TPLFA) associated with macroaggregate (4,000-2,000 and 2,000-250 μm), microaggregate (250-50 μm) by calculating FAME profiles were markedly increased by fertilization, and the compost was especially more effective on increasing these microorganisms. The ratio of gram positive bacteria to gram negative bacteria was markedly increased by compost application compared with chemical fertilization. However, The significant of difference in microbial community structure associated with different aggregate size fractions was not observed between Compost and NPK+Compost treatments. These results demonstrated that the combined application of chemical fertilizer and compost would be more effective on improving aggregation without deteriorating microbial community structure than compost application only.

Key words: Microbial community structure, long-term, paddy soil, aggregate size.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fertilization systems impact on crop rotation productivity and heavy metals content in shallow sod-podzolic loamy soil and winter rye grain

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Abstract

Field study of organic, mineral and complex fertilization systems was fulfilled on experimental plots of the Perm Agricultural Scientific Research Institute in 1993-2010 years. Average yields in fifth rotation varied from 2831 to 3859 FU as influenced by fertilization systems. All studied systems provided yields raising compared with control treatment (no fertilizers). Essential advantage of complex fertilization systems, guaranteed humus, mobile phosphorus and potassium content raise, was determined. The maximum yields, but minimum crop returns were obtained from combination of manure total rate 160 $t.ha^{-1}$ within rotation and equivalent mineral fertilizers application (fertilizers rates are defined according the nutrients quantity in FYM). The highest net returns were gained after mineral fertilizers application. Mineral fertilizers and FYM may be the sources of heavy metals soil contamination. The essential pollution by heavy metals of agricultural product and soil was not noted in given studies after long-term (about forty years) manure and mineral fertilization.

Key words: Fertilization system, FYM, crop rotation productivity, heavy metals content.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Establishment of recommendation fertilization guide of vegetable crops in Algeria

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Abstract

The goal of fertilization is to meet the nutritional needs of plants by completing the supply of soil nutrients in an economically profitable and environmentally friendly. Achieving on-farm optimum economic crop yields of marketable quality with minimum adverse environmental impact requires close attention to fertilization guide. The recommendations seek to do this by ensuring that the available supply of plant nutrients in soil is judiciously supplemented by additions of nutrients in fertilizers. The objective is that crops must have an adequate supply of nutrients, and many crops show large and very profitable increases in yield from the correct use of fertilizers to supply nutrients. The main objective of this work is to establishing a reference guide of fertilization of vegetable crops and cereal in Algeria. To meet this objective, we have processes in two steps: 1) Establishment of theoretical fertilizer recommendation from international guide of crop fertilization; 2) Validation of these developed theoretical fertilizer recommendation by trials in the fields. Sixteen fertilization guides of vegetable crops from the Canadian provinces (5 guides), USA (10 guides) and countries of northern Europe England (1 guide). Generally, the rating of these recommendation is ranging from poor soil to soil exceedingly rich; however, the numbers of fertility classes are very different. Indeed, Quebec Ontario, Minnesota, Wisconsin New England, Maryland and Kentucky and Florida guides are subdivided into 5 fertility classes, ranging from poor soil to soil exceedingly rich. The recommendation of New Brunswick and Manitoba contain six classes. The recommendation of Michigan, Nova Scotia and England contain 10 and 7 fertility classes respectively. The recommendation fertilizer of New York and New Jersey have 3classes. Unlike the systems of fertilization recommendation mentioned above, the recommendation fertilizer of Pennsylvania is based on continuous models of P, K and contains 34 classes for P and 22 classes K. Then we standardized the P soil analysis with conversion equations (Olsen method) and units of measurement (kg/ha, mg/kg…).Following this procedure we transformed discontinued systems of fertility classes in to continuous models to facilitate comparison between the different fertilization recommendation models in one hand, in other hand to obtain critical value (CV).Finally, we used statistics of the conditional expectation in order to generate the theoretical recommendation fertilization guide of fertilization with *7 fertility classes* (VL, L, M, MH, OP, H and VH). The next step was calibrating soil tests against yield responses to applied nutrient in field experiments. A database (not published data) from agriculture and agri-food Canada, were used. Production of pumpkin responded positively and significantly to P or K soil fertility levels, increases being observed with P more often than with K. According to the Cate-Nelson methods, the critical value of Olsen-P in the top 20 cm of soil was about 25 mg/kg: at values of greater than or equal to 25 mg/kg, crops achieved about 80% of their maximal yield in the absence of fertilizer application. The CV of K in soil for this crop was about 140 mg/kg. The CV found was very close to this generated by the theoretical method for recommendation of fertilization guide. Finally, we used the procedure of Cope and Rouse in both sides of the CV in order to make subdivisions of different groups of soil fertility. One calibrates the soil-test value against yield response to tile nutrient to predict fertilizer requirement.

Key words: Fertilization recommendation, NPK-fertilization, critical value, vegetable crops.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of bioorganic ameliorants on humus contents of periodically flooded rice soils

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Abstract

It's a well known fact that soil humus is a major source of nitrogen and other plant nutrients. Humus concentration in soil is mainly regulated by changing of the quantity of incoming organic mass and physico- chemical and biological properties of soil. In this regard, main purpose of the work is to investigate the influence of application of various doses of prepations "Green- Eco" and "Edagum" on indicators of humus status of periodically flooded low productive rice- swamp soils. The obtained results showed that tested bioorganic ameliorants had statistically significant positive effect on concentration of total humus. Data on humus balance is proving this. The greatest increase in total humus concentration is observed in option of application of 50 kg ha^{-1} of «Green-Eco", positive balance was +10.7 %. Increasing of the dose two and three times, on the contrary, reduced humus concentration, respectively to 10.7 % and 7.1 %. Opposite effect on total humus concentration was observed in application of different doses of "Edaguma". So, the application of low- dose (50 L ha^{-1}) of this bioorganic ameliorant had no effect on total humus concentration, and it was the same as in the control variant. Humus concentration increased by 7.1% in application of 100 l/ha and by 10.7% in application of 150 l/ha of Edagum. The most important characteristics of easy degradable organic matter are the content of nitrogen and ratio of C:N, affecting the rate of decomposition of labile organic matter. In our experience, different doses of biomeliorant had different impact on these indicators. Thus, nitrogen concentration of humus in application of «Green- Eco" at a dose of 50 kg ha^{-1} decreased compared with the control (5.5%) to 5.2%, i.e. humus became richer in carbon which is good for effective soil fertility. In increasing dose of bioorganic ameliorant to 100 and 150 kg ha^{-1}, nitrogen concentration in humus in both variants has increased to 6.7%. C: N ratio in application of 50 kg ha^{-1} of Green- Eco was equal to 11.6 versus 10.8 in the control variant, i.e. humus became more satiated with carbon, and in other two options, this figure was lower than in the control- 8.7 and 8.8 respectively. Thus, a positive effect on concentration of total humus, and its quality has application of less dose (50 kg ha^{-1}) of "Green-Eco", which is important for the farmers from the economic point of view. Application of different doses of "Edaguma" into studied soil also had different impact on concentration of nitrogen in humus and correlation C:N. Since nitrogen content of humus in all test options increased compared with the control, i.e. humus became more saturated with nitrogen than carbon. Naturally, in all variants the ratio of C:N also changed, it reduced and became lower than in the control group. In conclusion we can say that the most optimal positive effect on total humus concentration and on its qualitative composition is are dose «Green- Eco" 50 kg ha^{-1} and dose "Edaguma" 100 L ha^{-1}.

Key words: Biological ameliorants, humus, humus quality, nitrogen, C:N ratio.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Migration of organic substances in rice-swamp soils and scientific bases of stabilizing their humus status

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Abstract

Research aim is to examine the degree of intensity of migration of organic substances, to determine basic losses of humus in periodically flooded rice soils and develop a scientific basis of stabilizing their humus status. The obtained results on studying humus migration showed, that for one growing season from 1 ha in layer with capacity 0-20 cm, migrates 4.56 ± 1.3 kg/ha of water-soluble humus, in 0 - 50 cm 11.9 ± 1.7, and in layer with capacity 85 cm as a result of hydro-statistic pressure of groundwater, which is particular for almost all irrigated areas, especially for rice plots, and there is a sharp decrease in intensity of migration (4.9 ± 1.3 kg/ha). Study of seasonal dynamics of humus under rice showed that humates and fulvates of alkali metals are easy soluble in water and in presence of downward flow of water can easily move deeper into the soil profile. In this regard, by fall in soils under rice there is a sharp decrease of total humus. The same pattern is typical for total nitrogen. In rice-alfalfa crop rotation with two fields of alfalfa (green mass is separated) there is the original level of humus content. Soil under wheat has the richest active components in organic matter. Concentration of C_{trans} in it was 0.88% carbon. Minimum amount of it is determined in rice soil and is equal to 0.03% of carbon. Level of humus content of studied soils is 1.51 ÷ 1.96%. This level of humus can be conditionally assumed as optimal for rice-marsh soils in Akdala irrigation area. Solubility of humus under rice is higher, which by the end of the season has increased almost twice, and under alfalfa of 1st and 2nd year, this figure decreased by the end of the season. Research has established that there is a constant transformation of organic residues, depending on soil biological activity. Deficit of biomass balance under rice is 99.3 c/ha, wheat 66.8, and alfalfa 41.6 c /ha, which is 2 times lower than under the previous crops. Humification coefficients of stubble and root residues of alfalfa (0.24 ± 0.02) and rice (0.26 ± 0.016) are distinguished with statistical stability and can be used to assess current state of soil surface of rice-marsh soils. Carbon balance calculation shows that in decomposition of residues of alfalfa, the balance is stable, while in decomposition of root and stubble residues of rice – it is negative. Based on the above mentioned, to maintain a stable balance of humus, it is necessary to apply specific agrotechnical methods, including mandatory use of organic fertilizers, crop rotation with alfalfa and leaving crops' straw, etc. The research results showed that the distribution of humus in rice-swamp soil is a subject to normal function. Among the studied factors of soil humus status, in rice-swamp soils, rice yield has a maximum quantitative dependence on total humus concentration and its nitrogen concentration.

Key words: Rice soils, total and water soluble humus, humus migration rate, rate of decomposition, soil fertility.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Chemical and enzymatic status of the soil in a Hungarian long-term experiment

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Abstract

The activity of humans could cause global dangers to soils. One of these is the decline of organic matter content. To stop or turn back this negative process, organic matter e.g. manures, treated non-hazardous organic wastes have to use in the agriculture. The continuously formed sewage sludge seems to be a good material if it contains high quantity of nutrients while the organic and inorganic toxic materials and elements are present in low quantity in it. There are several experiments studying the effect of sewage sludge composts on the properties of the soil and plant but we have got little information about the long-term effects of sewage sludge compost treatment. In our small plot experiment we have treated the acidic sandy soil with 0, 9, 18 and 27 t ha^{-1} sewage sludge compost in every third year since 2003. The applied compost is made from sewage sludge, straw, rhyolite and bentonite therefor it contains organic and inorganic colloids important for sandy soil. The long-term application is suitable to determine the real positive or negative effects of sewage sludge application. After 10 years of sewage sludge compost application we have found positive changes in the 0-30 cm soil layer: pH, nutrient and organic matter content of the soil has increased. The invertase and catalase activities also increased which indicate the better biological status of treated soil.

Key words: Sewage sludge compost, soil chemistry, invertase, catalase.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Critical level of boron and its relationship to relative yield of shoot dry matter, leaf and grain in wheat in eastern littoral soils of Caspian Sea

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Abstract

This research has been studied in northwest and southwest of Gorgan River in eastern littoral soils of Caspian Sea. The boron concentration in plant samples has range between 24.65 to 141.73 mg kg^{-1}. B concentration in plants had positive correlation with soil pH and soil EC (α=0.01). The B critical level of relative yield of shoot dry matter was 3 mg kg^{-1} and for relative uptake of shoot dry matter was 4 mg kg^{-1}. B critical level of relative yield of grain was 3 mg kg^{-1}. In these samples 95% of soils were upper than critical level of boron.

Key words: Boron concentration, B critical level, relative yield, relative uptake.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of pistachio nut hull compost on soil fertility: A comparative study with manure

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Abstract

The usage of agricultural wastes as soil amendments is an economically feasible and environmentally friendly way of improving soil fertility. In this research composted pistachio nut industry waste (mainly pistachio nut hull or mesocarp) (PC) and farmyard manure (FM) were incorporated into two different calcareous soils differing in texture and carbonates content to test effects of these organic materials on soil fertility parameters. An incubation experiment in the laboratory was set up in 2 (soil) x 2 (compost) x 5 (rates) full factorial experimental design in triplicates. Equivalents of 0, 50, 100, 150, and 200 Mg ha^{-1} of composts were mixed thoroughly with 2 kg of air – dry soil and incubated at 25±1 ^{o}C for one month. After incubation the routine soil fertility parameters were analyzed. PC and FM have differently affected the investigated soil parameters. The incorporation of both PC and AM reduced the pHs of the soils whereas the treatments increased available phosphorus and DTPA extractable Zn concentration in soils. It can be concluded that despite the usefulness of FM, the PC has advantages over FM on not containing any weed seeds and ease of decomposition rate due to lower C:N ratio. Consequently, the result of our study indicated that PC could be an ideal organic fertilizer for enhancing micronutrient availabilities in the region.

Key words: Pistachio nut hull or mesocarp, organic waste, animal manure, organic amendments, plant nutrients.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil fertility status under three agricultural productions in Ravni Kotari, Croatia

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Abstract

Topsoil spatial and/or temporal monitoring such as survey LUCAS has been established in EU countries in order to monitor soil degradation processes: acidification, alkalization, salinization, pollution, organic carbon and available P and K status. In those surveys the effect of fertilization or tillage system on soil fertility changes is not provided directly. Preliminary examination of the effect on soil fertility of different agrochemicals was conducted in this study. On the basis of those results the monitoring methodology was constructed. Preliminary study consisted of the fertility status comparison at three production systems with soil fertility status from 5 years ago. Soil reaction, content of total carbonate and active lime, exchangeable cations (potassium, magnesium and calcium), extractable phosphorus and humus in arable soil layer were compared. First production was 20-year wine grapes production with past 5 years of organic production (ORG), second production was 20-year crop production, mainly cabbage, corn and beans, fertilized with low mineral NPK fertilizer and manure (LMO) and third production was 20-year wine grapes production fertilized with high mineral NPK fertilizer and manure (HMO). First two production systems were on Anthrosol from Gleysol developed on Quaternary lake sediments, and third production was on Anthrosol from Pseudogley developed on Pleistocene sandy clay substrata. All three locations were placed in flat terrains in Ravni Kotari region, Croatia, under a Mediterranean climate. Application of organic fertilizer and dolomite caused potassium accumulation, while phosphorus, humus and Ca contents and pH remained stabile. Application of mineral fertilizers in high doses caused accumulation of phosphorus and potassium, while soil reaction, total carbonates and exchangeable calcium were stable. There were symptoms of micronutrients deficiency probably induced by high soil P and K levels. Application of mineral fertilizer in low doses was the best for soil fertility status because potassium and phosphorus content were slightly increased but still low while naturally high content of humus and high soil reaction were preserved. Preliminary study was the starting point for establishing 20-year-long monitoring that will be performed on all three production systems. Main treats that will be monitored are acidification, alkalization, salinization, organic matter and available P and K status. Soil parameters, sampling time intervals, sampling method and methods of data analysis were specified. The purpose of monitoring soil properties change will be to propose the guidelines for optimal long-term agricultural management of natural resources.

Key words: Dolomite, manure, mineral fertilizer, monitoring, soil fertility change.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

An investigation of climate trends and Soil fertility at horticultural experience station of Kamalabad of Karaj/Iran after fourteen years

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Abstract

The objective of this study was to describe the climate trends and the variation in physico-chemical properties of four selected soil series (soil series 1 : Xeric Torriorthents, fine-loamy, mixed (calcareous) thermic; soil series 2 : Xeric haplocalcids, fine-loamy, mixed, thermic; soil series 3:Xerifluventic haplocalcids, fine-loamy, mixed, thermic; soil series 4 : Xeric haplocampids, fine, mixed, thermic) at different soil depths (0-30, 30-60, 60-90 and 90-120 cm depths) of horticultural experience station of Kamalabad of Karaj/Iran after fourteen years (1998-2012). According to our results, average temperature, total precipitation and total evapotranspiration from1998 (13.91°C) to 2012 (15.33°C) increased. Univariate analysis of variance of soil physico-chemical properties indicated that year had significant effect of all studied soil parameters at the two different sampling times (1998 and 2012).; however, the effect was dependent on the studied soil series and soil depth of horticultural experience station of Kamalabad of Karaj. The results showed that after 14 years, all soil samples were containing higher amount of soil total nitrogen (except of soil series 1 at soil depth of 30-60 and 60-90 cm). Also results showed that the soil series 1 and 4 at all studied soil depths contained higher amount of soil available potassium in 2012 as compared to 1998. The highest value of available phosphor was observed in soil series 2 at soil depth 0-30 cm in 2012. Fourteen years after the first soil sampling, the highest values of soil-pH (in soil series 1 at soil depth 90-120 cm), amount of silt { in soil series 1 at all soil depths (except of soil depth 0-30 cm)} and also amount of clay in soil series 2 at soil depth 60-90 cm were observed in 2012 as compared to 1998. But contrary, the highest values of Ec in soil series 3 at soil depth of 90-120), SP and OC in soil series 4 at soil depth 0-30cm, TNV in soil series 2 at soil depths 60-90 and 90-120cm and amount of sand in soil series 1 at soil depth 90-120 cm in 1998 as compared to 2012. Comparison of plant samples of apricot varieties, which grown at soil series 3 (Xerifluventic haplocalcids, fine-loamy, mixed, thermic) of horticultural experience station of Kamalabad of Karaj in 1998 and 2012 revealed significant changes leaf-K, leaf-B, leaf-Cu, fruit-pH, total soluble solids of fruit, titrable acidity of fruit, fruit-P, fruit-K, fruit-Ca and fruit-Mg during 14-year period. The concentration of leaf-K, leaf-Cu, fruit-P, fruit-k, total soluble solids of fruit and titrable acidity of fruit increased over time.

Key words: Climate trends, Soil fertility, horticultural station, Karaj, Iran

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of using different percent of vermicomposts on some of chemical properties of calcareous soil

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Abstract

To study the effect of using different percent of vermicomposts on some of chemical properties of calcareous soil an experiment with nine treatments was conducted using a complete block design and tree replications. Nine different vermicomposts including, vermicomposted rice hull cow manure, azolla residues and cow manure. Mixed with soil at the rates of zero (blank), 10 and 20% w/w were used. The results of analysis of variance showed that there are significant differences between all tested chemical factors in different rates. The highest and lowest electrical conductivity were respectively, 20% of cow manure vermicompost and 10% azolla residues vermicompost. The highest pH of treatments was observed in treatment with 10% cow manure vermicompost, and lowest pH observed in treatment with 20% vermicompost of azolla residues. The highest concentration of N was measured in treatment with 20% vermicompost of azolla residues and the control treatment had the lowest concentration of this element. The highest P concentration in treatment 20% vermicompost of rice hull cow manure was observed and the lowest this element was observed in control treatment. The highest concentration of K, Fe, and Cu were measured for vermicomposts in the treatment with 20% vermicompost of cow manure. The treatment of 20% vermicompost of azolla residueshad highest concentration of Mn and Cu elements, and the lowest concentration of these elements were observed in control treatment. The highest of organic carbon was observed in 20% vermicompost of azolla residues.

Key words: Vermicompost, chemical properties, soil calcareous.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Lunar planting calendar impacts on growth of fenugreek seeds in sandy soils

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Abstract

This study was conducted at the University of Mosul, College of Agriculture and Forestry, Department of Soil Science and Water Resources, the agricultural season 2011-2012 AD to study the effect of appointments lunar in some indicators of growth and winning plant fenugreek (Trigonella foenum - graecum L.) in nine dates of the lunar month is (1, 4, 8, 11, 15, 18, 22, 25 and 29 thereof) in 3 iterations shall be our 27 pilot unit, within a randomized complete block design RCBD, measured by plant height (cm / plant), wet weight of the plant (gr pot $^{-1}$), dry weight (gr pot^{-1}), four months after the lunar from planting seeds, harvested plants in the dates correspond to the days Lunar planted where (as the plant to full maturity). Appointments Lunar gave the best values when the moon was close to full moon (full moon) in sandy soil.

Key words: Moon, fenugreek, sandy soil

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Impact of the development the animal husbandry on the condition humus in soils of Perm Krai

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Abstract

The adopted a program developing agricultural production (2020) in Russia provides for its the further development with a priority direction animal husbandry. Industrialization of agrocomplexes and farms, wide application of fertilizers and pesticides allowed increase in the productivity agrocenoses, but worsened their ecological and safety of received production. Transition to intensive technologies in agriculture showed their active influence not only on agrocenosis, but also on the equilibrium of the entire system. Regulation of the balance of humus in the soil and extended its reproduction can be done in two ways: a) an increase in revenues in the soil organic matter (organic fertilizers, afterreap and root residues), b) the reduction of organic matter mineralization using agricultural methods. Perm Krai is located in the Western Predurale and defined by the coordinates 56°06′-61°39′ north latitude and 51°47′-59°03′ east longitude. From the north to south the area kray extends for 600 km, from east to west in the southern part of the region – 200 km, and in the northern – 500 km. On the Krai territory secreted 6 naturally-farming districts. Earlier, the authors have conducted of agroecological assessment on the humus condition in the soils of the Perm Krai in these districts. The purpose of research is to determine the effectiveness of use of wastes animal husbandry to ensure the sufficient balance of the humus in the soil. Degree of development of territory of the region is different, that is expressed in of agricultural area and stooks cattle. Amount of agricultural lands per 1 head of cattle varies from 4.0 to 8.9 ha, at norm 2 ha. With such development of cattle breeding in the Perm Krai and the use of wastes industry has note very low saturation 1 hectares of agricultural land the organic matter (0.65-1.42 t/ha). Thus, it was found that for increasing saturation 1 hectare of ploughland and 1 hectares of agricultural land is necessary to increase the number of animal husbandry, a minimum of 2 times, and increase the use of of wastes animal husbandry only cattle will enhance the saturation of one hectare of ploughland to 3-5 t/ha.

Key words: Humus, organic matter, soil, animal husbandry

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimation of nutritional status of potato (*SolanumTuberosum L.*) plant by soil and leaf analysis grown in the different regions of Erzurum (Centre, Pasinler and Oltu town) Turkey

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Abstract

This study conducted to determine the fertility potential of potato grown soils in Erzurum region (City center, Pasinler, Oltu). For this purpose total 74 representative soils and leaf were sampled and analyzed. Texture classes of in City center, Pasinler and Oltu soils of Erzurum agriculture soils, were sandy caly, clay and clay loam respectively. Soil reaction (pH) Of Erzurum and Pasinler soil samples were slightly alkaline and neutral pH, Oltu soil samples has a slghtly alkaline reaction. Organic matter (OM) content of City center soil samples is usually very low, however lime content of Pasinler and oltu were higher than city center soils which have low content of lime however Oltu soil samples have low OM and Pasinler soil has high OM. Salt content of Oltu Pasinler and City center soil were found have medium, light and average level. Total soil N content and plant available nutrient concentrations (P, Ca, Mg and K) of soil samples, were in adequate level. Plant available Fe and Cu were in suffecient level and Pb and Cd were not toxic level in plant and soil samples. Plant available Mn is low soil samples of Erzurum, plant available Zn and B levels were low in soil samples of Pasinler plain. Plant available P content is under sufficient value in plant leaves samples. As a result, Phosphorus (P), boron (B), manganese (Mn) and zinc (Zn) were insufficient level of potato plant leaves which was grown in Erzurum center, Pasinler and Oltu region. The results indicated that growers should be in an attempt of conservation and improvement of current fertility status of the soils.

Key words: Potato, critical nutrient levels, leaf analysis, soil analysis, fertility potential.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of nutritional status of Kars – Selim town agriculture soils

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Abstract

This study conducted to determine the fertility potential of Kars town soils of Kars city. For this purpose total 48 representative soils were sampled and analyzed. Texture classes of Selim agriculture soils were clay. Soil reactions (pH) were slightly neutral reaction. Organic matter contents of soil samples were usually moderate level. Lime contents of soils were very low. Salt contents of soils were light level.Total soil N content and plant available nutrient concentrations, P, Ca, Mg and K of soil samples were in adequate level. Plant available Fe and Cu contents were insufficient level and Pb, Ni, Mo and Cd were not toxic level in soil samples. Plant available Mn, B and Fe were low in soil samples. As a result, B, Mn and Fe were insufficient level of Selim town agriculture soil samples. The results indicated that growers should be in an attempt of conservation and improvement of current fertility status of the soils.

Key words: Soil, test, fertility, nutrition

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study on presence of phosphate solubilizing bacteria from wheat and barley fields of Marvdasht Province, Iran and evaluation of their product using HPLC

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Abstract

Indeed phosphorus is one of the most important elements for growth of plants in the fields. On the other hand phosphate solubilizing bacteria (PSB) mobilize insoluble inorganic phosphates from their mineral matrix to the soil solution, making them available to the plant roots and it could affect the yield. From last decade's presence of these microorganisms have been reported by many scientists from different environmental niches. Hence the aim of this study was screening of the PSB from barley and wheat fields in order to identify and characterize the isolates. Therefore, 100 soil samples have been collected from wheat and barley fields at different villages including: Falonak, Ramjerd, Zargaron, kohsabz and Ghasemabad in Marvdasht province, Iran. Then, based on serial dilution method, the phosphate solubilizing bacteria were isolated from soil samples on NRIP medium and the isolates with clear zone were characterized using phenotypic and molecular tests and the culture filtrate were analyzed using HPLC. In addition, the frequency of occurrence for isolated microorganisms evaluated using SPSS software. In the present study the results obtained from molecular identification indicated that the isolates were belong to Entrobacteriaceae family including: *Alcaligenesfaecalis* strain IAM 12369, *Klebsiella pneumonia* subsp. Ozaenae strain ATCC 11296, *Raoultellaplanticola* strain ATCC 33531, *Entrobacterkobei* strain CIP 105566 *Entrobacterludwigii* Strain EN -119, *Entrobacterkobei* strain CIP 105566, *Glaciecolaagarilytica* strain NO2 and *Klebsiellavariicola* strain F2R9. On the other hand the HPLC analysis, in accordance with the obtained pick indicated that, totally 4 products from barley farms and 3 from wheat farms have been detected, which, based on production time two compounds are same. The results obtained from statistical analysis indicated that, there is no significant difference between wheat and barley samples. Although there are no differences between the fields it could be concluded that it is because of the identical place of sampling. In addition, the molecular identification indicated that most of the bacteria were belong to the Enterobacteriaceae family and these bacteria with their metabolite had a good effect on quality of wheat and barley fields in this geographical area.

Key words: Phosphate solubilizing bacteria, Enterobacteriacea, NRIP medium, HPLC.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Carbon and nitrogen turnover in the anthropogenic ecosystems of the semi-desert

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Abstract

In the natural and anthropogenic ecosystems of semi-desert landscapes the peculiarities of carbon and nitrogen turnover and deposition in soil and litter was studied. Such studies are important for understanding the functioning and the development of anthropogenic ecosystems in conditions of extensive management (without human interference in the soil fertility sustaining). Our investigations were carried out in the northern part of Caspian Lowland (Volgograd region, Russia, 49°25'46°46'). Natural ecosystems in this region are presented by desert (micro hills with solonetz soils) and steppe (micro- and meso-depressions with meadow-chestnut soils) types. The goals of the work were to compare the rates of decomposition of organic matter, which enter the soil surface in natural and anthropogenic ecosystems developed on soils of solonetz complexes. We studied the rate of decomposition (i) of dry parts of grass in desert and steppe natural ecosystems, (ii) of fallen leaves in 60-year plantations of oak (*Quercus robur*), (iii) excrements of sheep in natural associations intensively used as pastures during several decades. Another important question was to compare the stocks of nitrogen and carbon conserved on the soil surface and in soils in various ecosystems. The conclusions of the work are the following. Annual deposition of carbon and nitrogen on the surface of anthropogenic ecosystems decreased compared to natural steppe and desert biocenoses. In the oak plantations it occurred due to less amounts of the fall entered, although the rate of decomposition was lower here than in natural biocenoses, and in pastures – due to less amounts of the entered organic material and higher rate of its decomposition. Compared to the virgin soils, in 5-40 cm layer of humus horizon in the oak plantation and in 0-40 cm layer in the pasture ecosystem the storages of carbon and nitrogen decreased. The content and the stocks of these elements increased in forest ecosystem in the 0-5 cm layer. In general natural ecosystems accumulate more carbon and nitrogen in soil and litter than anthropogenic ones created instead on the same places.

Key words: Semi-desert soils, organic matter decomposition, carbon and nitrogen cycle.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes in selected soil properties affected by long-term organic and chemical fertilization practices in Mediterranean Turkey

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Abstract

In order to study the effects of long-term fertilization treatments on soil fertility, we examined various soil chemical and biochemical parameters as well as plant yield and mycorrhizal colonization rates in a 13 years field experiment established in Adana Province, Mediterranean Turkey in 1996. Treatments included chemical fertilization, farmyard manure, plant compost and mycorrhiza-inoculated plant compost. The crop rotation was wheat (*Triticum aestivum L.*) and corn (*Zea mays L.*). A series of soil chemical (pH, organic carbon, plant available nitrogen and phosphorus), and biochemical markers [phospholipid and neutral lipid fatty acid (PLFA and NLFA) profiles, soil ergosterol content and glomalin related soil protein (GRSP)] as well as mycorrhizal colonization were assessed in the soil samples collected in May, August and October 2009. No significant difference was observed in soil organic C and available N in relation to long-term fertilization treatments but available P significantly responded to different treatments in different seasons (between 11.5-33.8 $mg.kg^{-1}$ in spring, 10.4-28.6 $mg.kg^{-1}$ in summer and 10.5-33.2 $mg.kg^{-1}$ in autumn). However, the compost treatment inoculated with mycorrhizal fungi exhibited higher root colonization (77.3%) over control (16.3%), chemical fertilization (10.0%), farmyard manure (19.3%) and plant compost (20.0%). No statistically significant change was observed in ergosterol content under different treatments and between different seasons. Effect of long-term organic treatments on soil PLFA structure was statistically prominent but only bacterial PLFAs were responsive to seasonality. Organic fertilization increased GRSP (mean annual ranging from 0.91 to 2.46 $mg.g^{-1}$ total GRSP) but long-term annual mycorrhizal inoculation had no significant effect on the soil GRSP pool.

Key words: Organic fertilization, soil fungi, arbuscular mycorrhiza, ergosterol, glomalin, phospholipid fatty acids.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of organic fertilizers on improvement of soil microbiological functioning under saline conditions of arid regions: Impact on carbon and nitrogen mineralization

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Abstract

The study was conducted on representative and contrasting soils of arid region. It focuses on the compared influence of two organic fertilizers: Poultry manure (PM) and Bovine manure (BM) on improving the microbial functioning of non Saline (SS) and Saline (SSS) soils, in particular, the process of mineralization of Nitrogen and Carbon. The microbiological activity was estimated by respirometric test (CO_2 emissions) and the extraction of two forms of mineral nitrogen (NH_4^+, NO_3^-). Thus, after 56 days of incubation under controlled conditions (28 degrees and 80 per cent of the field capacity), the two types of manures showed that the mineralization activity varies according to type of soil and the organic substrate itself. However, the highest cumulative quantities of CO_2 , $N\text{-}NH_4^+$ and $N\text{-}NO_3^-$ obtained at the end of incubation were recorded in non saline soil treated with poultry manure with 1173.4 , 4.26 and 8.40 mg/100 g of dry soil respectively. The reduction rates of release of CO_2 and of nitrification under saline conditions were 21 and 36, 78 % respectively. The influence of organic substratum on the microbial density shows a stimulating effect on all microbial groups studied. The whole of results gotten show the interest of two types of manures for improvement of the microbiological functioning of arid soils.

Key words: Salinity, organic matter, microorganisms, mineralization, nitrogen, carbon, arid regions.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

CO_2 volatilization kinetics from some organic fertilizers added to calcareous soil in Northern Iraq

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Abstract

A field experiment was conducted to determine CO_2 volatilization due to addition organic fertilizer to a field of college of agriculture and forestry, Mosul university classified as Aridiols within a great group of calico-camborthids, with urea, poultry, cattle and sheep manure added as 1%. Statistical analysis was carried out by using Randomized complete block design (RCBD). Results referred to CO_2 volatilization during 39 days passed within two phases, first was rapid till 10days while second phase was slow till experiment duration. Also results showed an arrangement of volatilization as follows urea > sheep > cattle > poultry. Rate coefficient of volatilization according to first order model were (533 , 273 ,228 and 143) $x10^{-4}$ day^{-1} and (144, 1143, 1014, and ac780) $x10^{-4}$ mg kg^{-1} $day^{-1/2}$ according to parabolic diffusion model for sheep, cattle, poultry and urea manures respectively.

Key words: CO_2 volatilization, organic fertilizers, calcareous soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The financial feasibility of hazelnut husk and sewage sludge based vermicompost production

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Abstract

Recycling the waste such as hazelnut husk, sewage sludge etc. has been one of the issues into the agenda of many countries. Therefore the purpose of the study is examining the feasibility of the vermicompost production. Technical data about composting hazelnut husk and sewage sludge gathered from past research. The time series data such as production, export, import and price of vermicompost collected from TURKSTAT, FAO and related institutions. Autoregressive integrating moving average model (ARIMA) and smoothing methods such as double exponential model and winter model were used in forecasting process. We followed net present value and internal rate of return were used to evaluate the financial feasibility for the facility having one ton vermicompost production capacity per day. Research results showed that the profitability of vermicompost production facility was high, while the likelihood of loss was less. Vermicompost production facility with approximately 130 thousands of US dollars initial investment provided net present value of 1.28 million of US dollars during the economic life. The internal rate of vermicompost production facility was 23%. Research results also revealed that production cost of vermicompost was $0.2 per kilogram. Since vermicompost production facility investment with high profitability and low level of risk was good investment alternatives with low level of competitive, the study suggested to investors who has good backgrounding about sector paid attention to marketing system and market observation about organic input market.

Key words: Vermicompost production, financial feasibility, waste recycling.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biomineral fertilizers – Basis of ecological land cultivation

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Abstract

Research aim: to justify scientific basis, develop biotechnological mechanisms of improvement and reproduction of fertility using biomineral fertilizers based on zeolite. Research methods: physical, chemical, microbiological modeling on mineral modified zeolite and soil columns. Field and vegetation experiments on dark chestnut soils of northern and south-eastern Kazakhstan. Research objects: dark chestnut soils of the North Kazakhstan (near Astana), south-east of Kazakhstan close to Almaty, natural zeolites, modified zeolites (MZ), Chankanay deposit in Kazakhstan. Physico-chemical principles of preparation of biomineral fertilizers: series of experimental works based on the possibility of substantial increase of the volume of zeolite sorption by organic and biological agents. Optimum standards of chemical breeding and storage have been developed for each of them. These developments lay in the subject of "know-how" in research works and are based on new techniques of zeolite raw material processing. All of them are based on fundamental laws of mass exchange and conservation of energy medium. In experimental and production studies and test of the effectiveness of biomineral fertilizers was obtained high yield of potato tubers, rice, wheat, and soya. In all options of using biomineral fertilizers, yield increase was -36-140% compared to the control.

Key words: Soil fertility, humus, zeolite, modified zeolite, macronutrients, micronutrients, humic and microbial preparations, effective microorganisms.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of vermicomposting organic wastes on their physical properties

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Abstract

To study effect of vermicomposting organic wastes on their physical properties an experiment with ten treatments was conducted using a complete block design with tree replication. Ten treatments including vermicomposted and non vermicomposted of rice hull chicken manure, cow manure, azolla residues, rice hull cow manure and chicken manure were used. The results showed that bulk densities and ash contents increased in vermicomposting process. In vermicompost of rice hull cow manure bulk density was most increase. Water holding capacity (Fc) and (Sp) organic wastes decreased during vermicomposting process. Highest reduce of Sp in cow manure vermicompost and the lowest reduce in azolla residues was observed. Highest and the lowest reduce of Fc were measured for treatments with vermicomposts of rice hull cow manure and azolla residues respectively. The highest reduce of humidity 4 hours after drainage was measured in azolla residues vermicompost and chicken manure vermicompost had the lowest reduce of humidity 4 hours after drainage.

Key words: Vermicompost, organic waste, physical properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Relations between phosphorous and potassium in some calcareous soils of Neinava Province, Iraq

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Abstract

Ten soil samples were collected depend on the soil properties and reliefs from the line (Mosul –Tel Abta) 80 km West Mosul city which is a productive area for wheat growth. To study the availability and the relations between Phosphorous and Potassium nutrients, a neubauer technique was carried to know the uptake of these nutrients by an indicator barley plant. The results showed that availability of P and K had significant correlations with clay and clay + silt contents, and had negative correlations with lime, pH and sand content. The growth of plants depend on the availability of these nutrients in soil, and the uptake of P correlated with the uptake of K. It was concluded that the availability of P were under the critical level by the Olsen method. So we need more P fertilization in this region to get a good yield of the wheat while the K availability was efficient in many soil samples for growing wheat and Barley.

Key words: Phosphorus, potassium, soil properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effective methods of improving soil fertility and productivity of cotton in Southern Kazakhstan

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Abstract

Long-term use of irrigated gray soils in production resulted in reduction of total humus concentration by 40-50 %, and these soils have lost plant nutrition elements. Irrigated gray soils due to highly salinized groundwater are susceptible to secondary salinization, which significantly affects the growth and development of cotton. In this regard, development of scientific principles and practical measures to optimize soil fertility and increase the productivity of irrigated gray soils acquire special importance and priority. The purpose of the study is to examine the effectiveness of different types of fertilizers and growth stimulator on cotton. During field studies the following methods such as stationary, laboratory analysis and other methods have been used. Field researches on secondary saline irrigated light gray soils have been conducted in Maktaral district of South Kazakhstan region. Upland cotton variety "Maktaaral 4007" was grown. The study was conducted on efficacy of using various types of nitrogenous fertilizers on the background of phosphate and potash fertilizers and humic liquid fertilizer "Edagum CM" as a bio-stimulator of growth and development. Phosphate and potash fertilizers were applied into the soil prior to planting cotton, and nitrogen fertilizers - in fertilizer during budding. Liquid fertilizer "Edagum CM" was used for seed treatment and spraying of cotton plants during germination and budding. Studied fertilizers influenced on the growth and development of cotton plants, as well as on the yield of raw cotton. On control variant without fertilizers application, yield of raw cotton was 16.6 kg ha^{-1}. Application of recommended dose of phosphorus-potassium fertilizers and ammonium nitrate provided increase of cotton to 4.3 t ha^{1}. Application of calcium nitrate and urea - ammonia mix as fertilizer on the background of phosphorus-potassium fertilizer provides the same increase as in the use of ammonium nitrate in the range of 4.4-4.5 kg ha^{-1}. The highest yield of raw cotton was at variant with liquid fertilizer humic "Edagum CM" based on peat - 22.8 kg ha^{-1}, the increase was 6.2 t ha^{-1}. Analysis of the experimental data showed that secondary saline light gray soils showed the effectiveness of nitrogen fertilizer and humic preparation "Edagum CM" that enhance the improvement of nutrient status of soil and provide a reliable yield increase of raw cotton.

Key words: Irrigated light gray soil, soil fertility, cotton, salinization, fertilizers.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Some soil fertility attributes as a function of long-term fertilization systems

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Abstract

Long-term field experiments, originally established for studying the possibilities of production intensification in agriculture, became reliable indicators of production sustainability in the last decades. In a 50 year-old Hungarian field experiment with crop rotation of potato, maize, winter wheat and with different treatments of sole farmyard manure (FYM) doses, or equivalent NPK fertilizers, and their combinations, were analyzed with special regard to the long-term influence of these treatments on soil fertility. FYM treatments resulted in 10% higher soil organic carbon (SOC) content than that of equivalent NPK fertilizer doses. The lowest soil reactions developed both without fertilization and with the highest NPK doses. FYM and equivalent NPK fertilizers had a similar influence on the potassium content of the soil, while an increase in the phosphorus content could be observed in the case of mineral fertilization. Zinc and Boron contents were positively affected by increasing FYM treatments, however mineral fertilization did not show a clear correlation. The yield-increasing capacity of FYM doses was only 82%, as compared to the equivalent amount of mineral NPK. On the unfertilized plots, fairly high (presumably of atmogenic origin) N-uptake (48 $kg.ha^{-1}$) could be measured. The average N-utilization of FYM doses was 10% lower than that of the equivalent mineral fertilizer doses. FYM treatments resulted in much higher values (48%) of soil aggregate stability. Mineral fertilization had higher yield increasing capacity without significant decrease of soil fertility parameters, however FYM treatments were more beneficial on most of the soil fertility attributes which have an important role in maintenance of long-term soil fertility. Therefore it is suggested to strive using both of these fertilization systems in soil nutrient supply.

Key words: Soil organic carbon and nutrient content, soil reaction, crop yield, N-utilization, soil aggregate stability

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Interaction effects of corn residue and nitrogen on barley yield and organic carbon of soil

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Abstract

In order to investigation of the effects of different levels of corn residue and nitrogen application on winter barley yield and soil organic carbon this experiment was done in research field of Islamic Azad University, Shahr-e-Rey, Tehran, Iran. Experimental design was split plot based on complete randomized blocks with 3 replications. 2 levels of nitrogen (75 and 150 kg/ha) were as main plot and different corn residue (0, 25 and 50 percentage) as sub plot. The results showed that the highest grain yield of barley (8500 kg/ha) was in 50% corn residue + application of 150kg/ha. Application of 150 kg/ha nitrogen and 50% corn residue lead to a meaningful increasing in organic carbon of soil compare with control conditions (0.1% to 0.7% respectively).

Key words: Crop residue, organic carbon, corn, barley.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of soil properties on yield and quality of tobacco plant in Akhisar region of Turkey

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Abstract

The research was carried out in Akhisar environs where tobacco was very popular in the period of 2004-2005. In this study, 9 fields were selected which are known to show differences in terms of the quality and efficiency in the villages called Hacıosmanlar Arabacıbozköy, Dereköy, Mecidiye and Süleymanlı. In order to find out the differences caused by the efficiency, the some properties of soils were examined and agronomical and morphological measurements were done by observing the growth and the development until the end of vegetation. The relationships between yield and quality of tobacco and some soil properties were determined by correlation tests. After two years of the study, total reducing sugar, total nitrogen, and raw ash were measured as 0.126 %-1.410 %, 7.81 %-33.71 %, 0.45 %- 3.24 %, respectively. It was found no correlation between the yield and some morphological properties, whereas, it was obtained very important realtionship among the lenght of the plant, the number of the leaves and the width of the leaves. The yield and total reducing sugar were decreased by increasing bulk density as an important soil property. On the other side raw ash content of tobacco increased. It is recommended that low raw ash and high sugar content are required for tobacco quality. With this content, The yield and quality of tobacco can increase with taken some necessary measurement for decreasing bulk density. There was a positive relationship between total N content of tobacco and the lenght of the plant, the number of the leaves and the width of the leaves. The nicotin content of tobacco increased with increasing available Mg, Na and Cu content in soil. On the other side, the raw ash content in tobacco decreased with increasing total salt and available Fe, Zn and Mn in soil. It was determined that there was a positif relationship between salt in soil and reducing sugar in soil which is another quality factor for tobacco. In the research, some results were reached as mentioned above. However, further studies must be carried out in the next years to determine relationships between soil properties and yield and quality of tobacco. It can be possible to improve yield and quality of tobacco with using these relations for producers.

Key words: Tobacco, soil properties, quality, yield, Akhisar.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of composts on agrochemical properties of soils of Zarafshan valley, salted with magnesium carbonates and yield-capacity of corn

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Abstract

Peculiar characteristics of soils of Zarafshan valley are salinity with carbonates. To improve of soil reclamation is recommended introduction large amount of manure or other organic fertilizers in these soils. But currently there is no possibility to collect so many organic fertilizers in Uzbekistan. That is why, we searched other ways production of organic fertilizers for improve of soil fertility. In the experiment was studied the influence of composts, prepared from tobacco wastes and manure on agrochemical properties of soils of Zarafshan valley, salted with magnesium carbonates and yield-capacity of corn. Through production of compost from these industrial wastes can be decided once two problems that exist in Uzbekistan. These include: problems of environmental contamination with wastes and problems ensuring with organic fertilizers in farmland soils. Introduction of composts in the doze of 30 t/ha separately and on the background of mineral fertilizers-NPK increased the humus content, total NPK and mobile nutritious substances in soil. It is proved that composts, prepared from tobacco wastes with their effect on the yield-capacity and quality of corn production can successfully substitute manure. Composts positively influence on the balance of nutritious substances in the system of soil–corn.

Key words: agrochemical properties, corn.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Current ecological and agromeliorative condition of irrigated soils in Ukraine and ways of managing their fertility

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Abstract

In Ukraine , which a large area is located in areas of unstable and insufficient moisture , food and resource supply is largely dependent on the availability, condition and use of irrigated lands. Irrigation is a significant factor of soil transformation, changes the main factors of soil formation and inherent in the original soil natural relationship with the environment, determines the subsequent evolution of the soil cover. Irrigated lands in Ukraine are concentrated mainly in the steppe climatic zone. The total area of irrigated lands is 2.1 million hectares, actually 0.5 - 0.7 million hectares are being watered annually. Purpose - to characterize the current ecological and agromeliorative condition of irrigated soils in Ukraine and ways to manage their fertility. During long-term research the basic directions of the evolution of soils under irrigation have been established: cultivation of soils, increasing their natural and effective fertility by using suitable for irrigation water; development of degradation processes by using limited suitable or unsuitable for irrigation water and low farming culture. Basic complex characteristic of irrigated land, which determines the possibility, technological features and prospects for their further use is ecological and agromeliorative soil condition (measured by hydrogeological, soil - ameliorative, ecological - toxicological and agronomic criteria). Generally, in Ukraine about 20% of the total irrigated lands have good ecological and agromeliorative condition, satisfactory - about 65% and not satisfactory - about 15%. Areas with not satisfactory condition are lands which are used unsuitable for irrigation water, soils strongly or medium saline and / or solonetzic and waterlogged. By satisfactory conditions are the lands, which have a low level of salinity and solonetzicity, are irrigated limited suitability for irrigation waters and are in automorphic - hydromorphic conditions. In all other cases, ecological and agromeliorative soil condition is defined as good. For a more accurate assessment of ecological and agromeliorative soil condition is created a series of electronic maps of irrigated lands. Fertility management of irrigated lands is aimed at models formation of sustainable, environmentally safe and cost-effective land use and should be based on the legislative, regulatory, legal, regulatory and methodological, informational, technological, scientific, financial security, using international experience of environmental activities.

Key words: Soil, irrigation water quality, processes, reclamation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fertility and productivity of soils in the Czech Republic

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Abstract

Soil as a principal production factor in agriculture has a number of specifics that require some detailed understanding of relation that exist between the production and soil characteristics, environment and food quality. Because of highly heterogeneous soil and climatic conditions, it is almost impossible to describe them accurately. For the identification of main relations, the systems of soil categorization are developed that contain the main specific features of individual groups of soils. Categorization of soil-climatic conditions provides sufficiently accurate definition of the soil productivity level for individual commodities and the need for production inputs. Crop yields and soil inputs were assigned to individual crops by the use of statistical methods based on the main parameters: soil texture, level of fertilization, weather and climate history, soil depth, slope, stoniness, exposure, technological way of tillage and other specific habitat-related conditions that are defined by the categorization of soil-climatic characteristics using so-called valued soil-ecological units (BPEJ). The level of individual yields and costs is attached to each of the main crops that are arranged according to their suitability to individual habitat-related conditions. Production costs are derived from the soil inputs according to operational surveys, applied processes and machinery costs. The system can also predict crop yields with respect to changing weather conditions on a statistically significant level. This paper presents results of the system and other possible use of related data for farms.

Key words: Soil fertility, soil productivity, soil valuation, soil classification.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Performance evaluation of FAO agro-hydrological model for yield production, soil water and solute balance under environmental stresses (Case study winter wheat)

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Abstract

In this research a model was developed and evaluated for simulation of yield production, soil water and solute balance based on FAO agro-hydrological model. Performance of Model was evaluated by using field data for winter wheat under water and salt stresses. An experiment was conducted in an experimental farm of Birjand University, to study the effects of three salinities of irrigation water (S1, S2, S3 respectively 1.4, 4.5 and 9.6 dS/m) with four irrigation depth levels corresponding to 50%, 75%, 100% and 125% crop water requirement for two varieties of winter wheat (Roshan and Ghods), with three replications and basin irrigation method for 1384-85 period. The developed model predicted soil water and solute balance with proper accuracy. The average relative errors of model to predicted soil water depletion in root zone and electrical conductivity of soil saturation extract were 7.1% and 2.8%, respectively. For yield production, the model predicted grain yield for three fractions of applied water, 0.75, 1 and 1.25, were predicted with proper accuracy, but under high water stress (applied water fraction equal 0.5), predicted grain yield by the model was improper and indicated over estimate with considerable relative error. Based on predicted yield results, under high water stress, yield reduction coefficients due to water stress, k_y, were inoperative.

Key words: Evapotranspiration**,** water stress, salt stress, simulation model.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The experience of purposeful management of soil fertility and mineral nutrition optimization of grain and leguminous crops in the conditions of rainfed agriculture of the Northern Kazakhstan

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Abstract

The soils of the Northern Kazakhstan are characterized by relatively favorable physical and chemical properties, high content of available potassium but differ considerably in the humus content and total forms of nutrients as well as moisture conditions. In dry steppe zone 200 -330 mm precipitation falls for crop year. In comparison, from 350 mm and above it falls in steppe. Humus content in dark chestnut soils makes up 3-5%, in ordinary humus it is more than 6%. The low level of intensification of agriculture has led to the decline, as an effective and potential fertility of soil which needs in refurbishment. About 70 % of soils are characterized by very low and low phosphorus content. Restore and replenish its content in the soil can be possible only with application of fertilizer. However, there is a question: how and how much fertilizer should be applied in each case? The question is extremely important and complex. Issues concerning food diagnosis and soil fertility management are not practiced. The results of years research in solving the problem of diagnosis and optimization of the conditions of phosphorus and nitrogen nutrition of grain and leguminous crops in the Northern Kazakhstan are considered in this article. The estimation is given to the most widely used in the practice methods for determining doses of fertilizers on the basis of empirical data from field experiments (the best average dose) and balance method of calculating doses. Neither of these conditions in the Northern Kazakhstan has given satisfactory results. It is developed and proposed a new approach to the assessment of the phosphate status of soils and determination of crops' needs in phosphorus fertilizers taking into account the specifics of the zonal and the main factors determining their effectiveness, the initial state of the soil and crop to the individual requirements of P2O5 content in the soil. It is revealed a close correlation between the content of P2O5 in the soil and crop productivity, which allowed determining the optimal parameters of its content in the soil and providing a method for achieving an optimal level. Proposed a new approach to the diagnosis and optimization of nutrition allows accurately determine the element deficiency in the soil and purposefully manage soil fertility, creating an optimal diet and formation of potentially possible harvest, using optimization formula below Dr.kg/ha=(P optimal-P actual)*10. The methodological approach to crops evaluation and diagnosis of nitrogen nutrition conditions are offered. It is given the established diagnostic criteria for optimal performance and security crops with nitrogen. The new method of determining the needs and calculate doses of nitrogen fertilizer to the individual requirements of crops and 4 main factors determining their effectiveness are presented. The mathematical model for predicting the effectiveness of fertilizers is given. The developed technique allows controlling the nitrogen regime of soils, optimizing supply faiths and ensuring high efficiency and environmentally safety fertilizers. It is found that each crop imposes specific requirements for content and nutrients in soil.

Key words: Rainfed agriculture, humus, physical and chemical properties, fertilizer, food diagnosis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Implementation of precision agriculture technology at Russian State Agrarian University – Moscow Timiryazev Agricultural Academy

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Abstract

Information on implementation of Precision Agriculture Technology in the Research Centre for Precision Agriculture at the Russian State Agrarian University- the Moscow Timiryazev Agricultural Academy is presented. The following main elements of the Precision Agriculture Technology are implemented in the Research Centre for Precision Agriculture: seeding (planting) the crops with navigation systems, e.g. Autopilot; precise fertilizing and applying the chemical plant protection means (herbicides) with special scanners and sensors in correlation with current stage of crops and weeds presence and dissemination; crop yield assessment in connection with field maps.

Key words: Precision agriculture, GPS system, autopilot, soil fertility variability, differential fertilizing and applying herbicides, yield mapping.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes of soil chemical properties and its relationships to microbial activity in irrigated and non irrigated olive groves in South Peloponnese, Greece

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Abstract

The implementation of olive cultivation techniques in Greece has not been systematically tested under the prevailing Mediterranean conditions. A LIFE+ project was initiated (oLIVE-CLIMA; LIFE 11/ENV/000942) aiming to introduce new management practices in olive tree crops that lead to increased carbon dioxide uptake by plants as well as carbon sequestration from the atmosphere and reverse the trend of soil organic matter decline, erosion and desertification. This paper presents data on soil organic matter and microbial activity from a soil campaign in a pilot region in Greece, and particularly in the area of Chora, prefecture of Messinia, South west Peloponnese. The soil campaign took place during the period December 2012-February 2013. Twelve soil parcels of olive groves were selected (6 irrigated and 6 rainfed) and in each soil parcel six composite soil samples were taken from 0-10 cm depth at equal intervals along a straight line of the trunk of the tree to the middle of the distance from the nearest tree of the next tree series. The first three samples were under olive tree canopy. An additional composite sample was taken at depth of 10-40 cm. Soil samples were analyzed for soil physicochemical and biological properties. In this study results for main soil chemical properties, as well as soil basal microbial respiration (BR), microbial biomass C (MB-C) from the region of Messinia, are presented. The results showed considerable differences in TOC, BR and MB-C associated with the sampling position and soil depth. The higher TOC, BR and MB-C values, in most cases, were determined in samples taken from points under the canopy, but not close to the tree trunk compared to the sampling points outside the canopy. This indicates the positive effect of rhizosphere and the favorable soil moisture conditions under tree canopy on soil microbial activities. TOC, BR and MB-C values were considerably lower in soil depth of 10-40cm compared with 0-10 cm in both irrigated and rainfed soil parcels. Moreover BR and MB-C was higher in irrigated soil parcels compared with rainfed ones suggesting that the periodic irrigation significantly enhances the soil microbial activity. There were no considerable differences in TOC while significant relationships were obtained between BR and MB-C values and main soil chemical properties revealed that microorganisms and their activity is influenced by changes in soil chemical properties. For this the TOC and potential activity of microbial community can contribute in the soil nutrient and irrigation management guidelines in order to exploit the utilization of productive soils in the region under studied.

Key words: Soil, chemical properties, microbial activity, olive groves

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes of soil properties and seed germination indexes after application of green walnut husk in soil

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Abstract

The aim of this research was to investigate the effects of green walnut husks on some soil properties and seed germination. Green walnut husks have been obtained from Ezine-Çanakkale. They have been air dried and ground. Green walnut husks were mixed with clay soil at the rates of 0, 2 and 4% (w/w) in 1 L jars. Water content of soil+walnut husk samples were adjusted to approximately 50% of field capacity and samples were incubated at 25C^{o} for 11 weeks at incubator. Mean weight diameters of soil aggregates increased with 2% walnut husk application. Extractable iron contents of samples increased from 5.1 ppm to 7.1 ppm after 4% green walnut husks applications. Soil pH, EC and total carbon significantly increased with green walnut husks applications. Germination study was conducted for cress *(Lepidium sativum* L), lettuce (Lactuca sativa) and purslane (*Portulaca oleracea*). Green walnut husks +soil mixtures were placed in petri dishes. Seeds were sown in these mixtures and petri dishes were placed in incubator at 25C^{o}. Germination indexes and percentages have been deteremined.

Key words: Green walnut husks, cress, lettuce, purslane, mean weight diameter, total carbon.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Irrigation with saline water impacts soil and cereal crops yields in Tunisian south

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Abstract

Salinization is one of the main degradation processes endangering the soils in Tunisian arid land. That is characterized by its arid climate, with a total rainfall of less than 150 mm annually. Water resources, when available, are saline. To the aim to examine the possibility and the sustainability of extension of cereal crop in the southern marginal area, this study was carried out in order to test the effect irrigation with saline water in soil and cereal crops yields of 3 local accessions and 3 improved durum wheat cultivars also 3 introduced and 3 improved barley cultivars at two locations in Mednine area (33" 29'52 N; 10" 38'10 E) and the Tozeur area (33" 58'19N; 8" 12'59 E) in an Oasian ecosystem, during three years. In Mednine area, the assay was irrigated with saline ground water (EC=9dS/m). In Tozeur area, we have two essays, one was irrigated with the oasis water (EC=3dS/m) and the other with drainage water (EC=9.2dS/m). The same genotypes were grown by farmers, in their fields, and using their saline ground water (9dS/m <EC<14dS/m) during one growing season. Dry matter production and yield parameters were evaluated under salinity stress. Beyond that, we are interested, by evaluation of physical and chemical properties of soils, and provide the evolution of soils irrigated with saline water from September 2009 to January 2014. The results indicated that durum wheat and barley can be economically profitable when grown in these marginal areas using brackish water. The estimated grain yield can reach up to 3t/ha, above the overall national average yield. The study of the dynamics of soil salinization showed no risk of salt accumulation in sandy soils of this region, suggesting the sustainability system of cereal production irrigated with saline water.

Key words: Soil, salinization, water, salinity, cereal, evaluation, yield, arid land.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes in the physical and chemical absorbing power and nutritive regime of replantosol formed on loess in the foothills of Ile Alatau

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Abstract

Long-term researches of soil-formation process on reclamate freshly exposed loess are conducted by soil permanent study area of Agriculture University which is situated in chestnut soils zone in the foothills of Ile Alatau. Soil permanent study area consists of 72 concreted plots measuring 2 m^2. They were filled with loess to a depth of 60 cm in the spring of 1991. Quantity of long studied variants is 7, one of them has natural undisturbed profile of dark chestnut soil. There is also a variant with loess filled in 1971. Different doses of ameliorants were applied and phyto-improvers were seeded on variants, which were filled from 1991. In 1994-1995 test sowing were made and from 1996 it was left as neglected field. According to the research of 1991-2012 years, it was established, that calcium cation is predominant in composition of absorbed bases. Its content of total cations has increased from 66% to 82% after 18 years (1991 -2009) of pedogenenic process. The highest rates of exchange capacity and calcium content in absorbed bases are set on variants Natural Kastanozem, Loess, since 1971, Phytocontrol, Vermicompost, 27 ton ha^{-1}. This confirms the dominant role of the time factor and the reclamation of syngenetic pedogenenic process. Gradual increase of the exchange capacity (from 13.55 to 20.18 meq 100 g^{-1}) in time was established for explored variants. pH on loess in the 0-point of pedogenenic process was 8.2, and it was 7.8 after 21 years of pedogenenic process. The highest content of hydrolyzable nitrogen, after variant Natural Kastanozem (57.9 mg kg^{-1}) is established on variants: Loess since 1971r. (38 years) – 44.9 mg kg^{-1}; Vermicompost, 27 ton ha^{-1} (18 years) – 43.0 mg kg^{-1}; Dung, 60 ton ha^{-1} (18 years) and Phytocontrol (18 years) – 41.6 mg kg^{-1}. The same variants (10-12 years) – 30.8-39.2 mg kg^{-1}. The same variants (3 years) – 16.8 mg kg^{-1}. Then and there, the content of hydrolyzable nitrogen in replantosols depends on the duration of pedogenenic process and types of bioreclamation. Content of labile phosphorus in replantosol does not particularly depend on pedogenenic process and varies from 13.0 to 19.6 mg kg^{-1}. Maximum content of exchange and water-soluble potassium is observed in the upper horizon of r replantosols, it gradually decreases with depth. Exchangeable potassium content was low in the initial 3 years with fluctuations within 204,1-217,1 mg kg^{-1}. For 10-12 years and 18 years, their number stabilizes at 384-403.8 mg kg^{-1}. Content of mobile nutrients for 2009 shows that the best conditions for plant nutrition is observed on variants Loess since 1971, Vermicompost, 27 ton ha^{-1}.

Key words: Physical and chemical absorbing power, nutrient status, soil formation, reclamation, loess, replantosols, vermicompost.

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International Soil Science Congress

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Transformation of organic carbon and properties of light-chestnut soils in the Kenkiyak field under the influence of oil pollution

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Abstract

Research aim: evaluation of current soil ecological state of soils contaminated with oil in the Kenkiyak field in the Aktobe region. Research methods: comparative- environmental, mapping, field, laboratory- analytical and other methods of research. Ecological condition of soil surface of the territory of oilfield is very complicated and in general unfavorable. On the area of active oil field the spots of petrochemical pollution, salinity caused by wastewater and layer waters is observed. Intake of bituminous substances by soil causes changes of total content of organic carbon. In transformed soil carbon the content of carbon in comparison with the background rapidly increased in technogenic layer and in buried upper profile. The study of morphological and physical properties of soils showed a change of natural morphological profile: the increase of weight bulk density took place, bulk density structure has increased, soil has become impervious to air and water. Organic carbon content in technogenic layers is 3.63 %, in buried horizon it is 8.74 %, and in illuvial horizon -14.74 %. At a depth of 100 cm, it decreased to 10.24 %, and only in the second meter layer of 160 cm it reduced to 3.99 %. Thus, carbon profile of contaminated soils has significantly changed. Long term development of the field has influenced the increase of organic matter content. At the same time in the subsurface soil layers there is organic carbon accumulation. During first time degradation of bituminous substances does not occur. In arid climates self-purification of oil contaminated soils is slow, that is due to their low natural fertility and salinization. In addition, oil falling on the soil surface and soaking heavily pollutes soil and surface water and groundwater, filling them with aggressive and biologically hazardous fluids components. As a result, the fertile soil layer does not restore for a long time.

Key words: Bituminous substances, organic carbon, bulk density, degradation, self-cleaning.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Marine sediment contamination along the coast south of the city of Sfax (Tunisia)

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Abstract

SIAPE is located in the southern area of Sfax in Tunisia. It produces huge amounts of liquid waste which are not processed and are discharged directly into the same drainage outlet of the treatment, reaching therefore the sea. The most important channel discharges are those derived from the production of acid phosphoric acid and to a lesser extent water wash unwanted gases during the production of triple super phosphate (TSP) trioxide and heavy metals (Fe, Hg, Cd, Co). Marine sediment constitutes a trap for many inorganic and organic pollutants and could be a useful indicator of the state of pollution. In our study, we have made a series of seasonal sample of marine sediment. The distribution of chemicals, heavy metals and fluorine has been addressed as a spatial mapping during October 2010 to assess the behavior and movement of these elements in the environment. Our results suggest that the spatial distribution of heavy metals in sediment accumulation depends on the distance from the rejection station and this for the majority of metals (Zinc, Chrome and fluoride). The accumulation of theses metals in the sediment denotes maximum values localized in more than 4 km of the point of discharge stations. This could be due to the hydrodynamics and the behavior of the metal with respect to the receiving environment. Moreover, the most contaminated areas are located far enough from the rejection station. This leads us to consider another possible source for these pollutants like ports. It would be interesting to extend the study area in order to know the origin, distribution and the impact of contamination across the Gulf of Gabes (Tunisia) and to look at environmental contamination by other metals present in the area (vanadium, nickel...)

Key words: Soil pollution, heavy metals, fluoride, sediment

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

A kinetic approach on remediating PTEs in sewaged soils using novel biotechnology

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Abstract

In a completely randomized field experiment, a novel biotechnology was sequentially experienced to remediated potential toxic elements (PTEs) in a sewaged soil ecosystem. The technology was applied in two stages, first bioremediation with a biochemical remediative amendment composed of probentonite (Bentonite, rock phosphate, *Thiobacillus* sp. and phosphate dissolving bacteria) and second was phytoremediation with canola, Indian mustard or black nightshade hyperaccumulator plants in association with mycorrhyzea (AM). Results indicated that the application of this novel biotechnology reduced the zinc equivalent value in the experimented sewaged soil from initially 630 to a safe level less than 200. The effect of canola hyperaccumulator plant in general far exceeded that of the two other trailed plants; however, the differences between their competences were not that elevated. Inoculation with either mycorrhyzea or *Thiobacillus* sp. significantly improved PTEs uptake by the tested hyperaccumulator plants. From a kinetic prospective, the application of the combined novel biotechnology exhibited exclusive remediative action compared to the application of any of the single remediative amendments in minimizing Zn equivalent value to a safe level. The different mechanisms that took place during the bioremediation process of in the studied sewaged soil were discussed.

Key words: Bioremediation, mycorrhyzea, Zn equivalent, kinetic models, PTEs, sewaged soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Thallium binding in soils impacted by smelting activity

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Abstract

The study focused on Tl contamination of soils in the area historically affected by Zn smelting near Olkusz (southern Poland). Significant differences in Tl concentrations and chemical fractionation were observed between forest and grassland soil profiles, indicating the effect of land use on Tl behavior. Our findings proved the ability of forest soils to concentrate high amounts of Tl (if present in smelter emissions), particularly within the organic layers. A comparison of Tl concentrations in the upper (O or A) and the bottom horizons (C) of forest and grassland soils clearly demonstrated both strong contamination and vertical mobility of Tl. The results of the sequential extraction procedure indicated the important role of soil organic matter in Tl mobilization, probably as a result of long-term alteration/dissolution of smelter-derived particles followed with Tl release; up to ~20% of total Tl amount was associated with the exchangeable/acid-extractable fraction in forest soils. The Tl concentrations detected in grassland soils were up to an order of magnitude lower than for forest soils. Taking into account the dominant bonding of Tl to the residual fraction, Tl associated with grassland soils poses lower environmental hazard with respect to the potential mobilization or uptake by plants. Nevertheless, further research with emphasis to environmental stability of Tl-bearing phases (oxides, sulfides, silicates) is needed for complex understanding of Tl behavior in such polluted (agro)systems.

Key words: Thallium, soil, contamination, smelter.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The study of nitrate contamination in spinach vegetation farms in Iran

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Abstract

In the recent years, in order to enhance agriculture products, the producers, in Iran, have tended to use increasingly chemical fertilizers, in particular, nitrogen rather than taking advantage of state of the art knowledge. The purpose of present study is to examine the nitrate amount in the two highly use plants, i.e. spinach at the vegetable farms of Dezful city. The sampling of the farms at third zone of Dezful was conducted randomly through three consecutive pickings from first, middle and last rows during morning. The samples was dried in an oven at 70°C and powdered by a mill. Next, a spectrophotometer device read their nitrates. In order to compare the mean and standard deviation, the nitrate concentration in the tested samples in the three zones was studied by employing Duncan test at 5% level using spss 18. The results showed that the highest nitrate amounts in the tested samples of the three farms were 2128 mg/kg of fresh weight in the Spinach. Thus, there was no significant difference. The amount of 51.85 % of the Spinach were exceeded the standard limit. (1000 mg/kg of fresh weight).

Key words: Vegetation farms, spinach, nitrate contamination.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Studying the nitrate contamination in Parsley farms in Iran

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Abstract

The accumulation of nitrate in the agriculture products, especially vegetables, water and foods is one of those factors that exposes the people health and hygiene in particular the neonates to the risk. The purpose of present study is to examine the nitrate amount in the highly use plants, i.e. parsley at the vegetable farms of Dezful city. The sampling of the farms at third zone of Dezful was conducted randomly through three consecutive pickings from first, middle and last rows during morning. The samples was dried in an oven at 70°C and powdered by a mill. Next, a spectrophotometer device read their nitrates. In order to compare the mean and standard deviation, the nitrate concentration in the tested samples in the three zones was studied by employing Duncan test at 5% level using SPSS 18 package. The results showed that the highest nitrate amounts in the tested samples of the three farms were 10295 mg/kg of fresh weight in the parsley. Thus, there was no significant difference. All the parsley samples were beyond standard limit (500 mg/kg of fresh weight).

Key words: Nitrate, spectrophotometery, Parsley, Dezful.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Quantification and contribution of nitrogen inputs in the soil on groundwater contamination by nitrates: Valley of High-Cheliff (North Algerian)

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Abstract

Nitrogen (N_2) is an essential nutrient for plants. However, when the application of nitrogen exceeds the needs of the plant and the denitrification capacity, nitrogen can migrate to groundwater, usually in the form of nitrates. The transfer of nitrates in soil results from a large number of interdependent factors: climatic, agrological, and agronomic. The Conditions of interaction of these factors can lead to situations more or less favorable to leaching of nitrates. Thus, according to some studies in agronomy, high levels of nitrate pollution observed result from an increase in the mineralization capacity of soils under the cumulative effect of intensive farming practices. Many European countries and some U.S. states are already based on the nitrate test for establishing the optimum nitrogen doses. In agricultural areas, the use of large amounts of mineral fertilizers and the increased volume of animal waste as a result of development of breeding cause nitrogen excess surplus capacity utilization by the vegetation, it is driven into groundwater and causes an increase in nitrate concentrations. Other factors are at the origin of the presence of nitrate in large quantities in groundwater. With a total annual volume of agricultural production of around 1.5 million tons, agriculture is certainly the pole par excellence of the Hight-Cheliff. The main crops are arboriculture and gardening. Potatoes, covered nearly half (48%) of the total volume of agricultural production, it is a major consumer of Nitrogen fertilizers. For the purpose of estimate the amount of leachable nitrogen, nitrogen balance was drawn up, see all the inputs and outputs of nitrogen were almost calculated. The objective of our work is to study the importance of soil conditions on the nitrogen balance in the region of High-Cheliff occupying a considerable area and having a semi-arid climate. We will build on the results soil analysis and calculation of nitrogen and the influence of some soil conditions on input and output of the nitrogen balance. The present study shows, in a second step, the spatial evolution of nitrate through a map prepared by ordinary kriging for the year 2011 during high waters. It appears, from this map, the most affected areas are those for which the level of intensification of nitrogen fertilization (gardening zones) is strongest in the most permeable soils located on the borders of the valley and in the western part.

Key words: Soil characteristics, agriculture, fertilizers, nitrate pollution, groundwater, ordinary kriging, semi-arid climate, Algeria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Domestic sewage and its availability of some heavy metals in soil depths

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Abstract

This study was conducted with the objective of reviewing the impact of the application of raw and treated sewage on the trend of changes of iron in different soil depths. An experiment was performed three times to this end in the form of a CRD (Completely Randomized Design) with three treatments including tap water, treated sewage, and raw sewage. Soil sampling was done as composites at the soil depths of 0-30 and 30-60 cm. The available iron was determined in soil by DTPA method. The data experimented was analyzed at two probability levels of 1 and 5 percent by SPSS statistical software to determine the level of significance, and the Duncan test was used to compare the averages. The results from the statistical analysis showed that the use of raw and treated domestic sewage has stimulated an increasing trend in available iron concentration.

Key words: Available iron concentration, domestic sewage, soil depths, completely randomized design (CRD).

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ecological monitoring of soils in industrial areas in Bulgaria

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Abstract

The Ecological status of the Bulgarian soils according to content of toxic substances (Pb, Cu, Zn, Co, Ni, Cr, Cd, As, Hg) is analyzed in the context of the framework of the National Monitoring network. The distance between points in this network in too large (16 x 16 km) so it's not found local pollution in industrial areas. That's why the individual scientific studies by monitoring networks with points at a short distance, showed that the polluted soils in Bulgaria with content of heavy metals and metalloids above the maximum allowable concentrations are 43 660 ha. This represents 0.7% of the agricultural areas of the country. Of these 7 985 ha are polluted. The pollution is associated with increased concentrations of lead, cadmium, copper, zinc, reaching up to 5 times the maximum allowable concentrations. The present study shows information about heavy metal pollution of soils in two anthropogenic polluted regions - municipality Kuklen and the municipality Chelopech and Chavdar. In the area of the municipality Kuklen is located metal extraction plant, and in the municipalities of Chelopech and Chavdar mining company operating. The summarized data for soil diversity, according to limit concentrations of harmful substances and updated maps both monitored regions enable for the development of plans to implement the ameliorative activities for improvement soil quality.

Key words: Heavy metal, pollution, monitoring, limit concentration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of gasgeochemical state of soils, grounds and surface atmosphere during land use engineering for construction

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Abstract

During town-building reserved areas with unfavourable properties particularly river valleys and overflow land are frequently used. During the land use engineering soils are being covered with man-made technogenic grounds. Grounds can contain construction garbage and household organic residues. Increased methane concentration in soils and grounds causes risk of fire and explosion situation. At the same time sanitary-hygienic danger of atmospheric pollution occurs. The high methane and carbon dioxide content in the atmosphere is dangerous for human health. Also these gases' emission causes increase greenhouse gases' content in the atmosphere and influences on the global climate changes. Assessment of gas geochemical state of soils, grounds and surface atmosphere before construction start and technogenic grounds after land use engineering. Objects of research are the alluvial soils and technogenic grounds in the widest part of Moskva river's valley. The registered low rates of methanogenesis before construction start are 0.02-0.03 $ng.g^{-1}.h^{-1}$ in automorphic and sedihydromorphic soils, 0.13 $ng.g^{-1}.h^{-1}$ in hydromorphic soils. Methanogenesis is provided for corresponding oxidation (on the average from 4-6 $ng.g^{-1}.h^{-1}$ to 19 $ng.g^{-1}.h^{-1}$). Methane concentration in atmosphere varies from 0.4 to 3.0 ppm. Carbon dioxide concentration in soils is 375.0 ppm, gas emission is 16.4 $mg.m^{-2}.h^{-1}$, concentrarion in surface atmosphere is less than 157.3 ppm. After land use engineering processes bacterial methanogenesis and oxidation increased. Unfavourable physical and mechanical properties, processes of organic remains' decomposition in technogenic grounds caused increase of methanogenesis rates optionally to 0.62 $mg.m^{-2}.h^{-1}$. In this case high rates of methanogenesis aren't provided for corresponding oxidation in technogenic grounds so it causes methane accumulation in ground stratums on the average from 5.4 ppm to 2872 and 3080 ppm. These are potential dangerous concentrations as per fire and explosion hazard criterions (according to Russian standart). Methane concentration in surface atmosphere increases on the average to 2.6 ppm. Methane accumulation in the atmosphere to 35 and 65 ppm is above points with potential dangerous methane concentration in grounds, it approaches to liminal concentration of sanitary-hygienic criterions. As a result of methane oxidation processes and decaying organic remains carbon dioxide is produced and accumulated in soils and grounds on the average to 3000 ppm. Its concentration in atmosphere is 1.7 times smaller (1681 ppm), this is 0.4 max. permissible concentration (MPC). It's fact that 0.2 MPC (800 ppm) carbon dioxide concentration causes unfavourable human and animal health conditions. In natural soils high rate of methanogenesis is provided for corresponding bacterial oxidation, it prevents methane accumulation in soils and the atmosphere. In technogenic grounds high rate of methanogenesis isn't provided for corresponding methane oxidation, and it causes accumulation methane in soils, grounds and the atmosphere.

Key words: Greenhouse gases, methanogenesis, methane oxidation

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes of potentially toxic elements after regular sewage sludge compost treatments

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Abstract

Due to the increasing sewage installation – it has increased by 3,5-fold in the last decade according to the Central Statistical Office of Hungary - the amount of sewage sludge is also increasing. We have to solve the environmentally sound disposal of the sludge. Results of many experiments showed that sewage sludge and sewage sludge compost can be recycled as nutrient supply. Using municipal sewage sludge compost in the soil could cause the occurrence of toxic elements and accumulation problem. The small plot experiment with sewage sludge compost was established in the spring of 2003. The compost contains 40% sewage sludge, 25% straw, 30% rhyolite, 5% betonite. The small-plot experiment was re-treated in the fall of 2006, 2009 and 2012. There are 12 treatments in five blocks, where 0, 9, 18 and 27 t ha^{-1} sewage sludge compost was applied and then ploughed into the soil. Triticale as autumn cereal, corn and pea as spring crops were sown in crop rotation. Soil samples were collected from 0-30 cm layers after harvest. In this paper, test results of potential toxic elements (As, Cr, Cu and Zn) content of soil samples from the years 2009-2012 are presented. Based on the results of the four-year period presented, the element concentrations measured in the soil did not exceed the limits of the 50/2001. (IV.3.) Government Statute. Our aim is to maintain this unique long-term experiment for studying the composted sewage sludge as a nutrient and organic matter source, applied it similarly to the farmyard manure in every third year.

Key words: Sewage sludge, co-composting, potentially toxic elements.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of precursor concentration on nitrate removal by nanoscale zerovalent iron stabilized on sand

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Abstract

In many parts of Iran, surface and groundwaters are polluted with nitrate ion (NO_3^-). Nitrate is released to water resources mainly by agricultural and industrial activities and intensive animal husbandry. High concentration of nitrate in water is harmful to humans, animals and plants. As an effective method for nitrate decontamination, chemical reduction of nitrate has been done by zero-valent iron nanoparticles stabilized on sand (quartz). Intending to best results, the natural sand with grain size of 0.1 to 0.3 mm was used. $NaBH_4$ method was applied to stabilize iron nanoparticles on quartz. Characterization of nanoparticles was done using various techniques (SEM, XRD). Some solutions were provided at different levels of nitrate, afterwards nitrate concentration reduction in presence of nano Fe0-established on sand with precursor concentration was evaluated. (The equivalent ratio of 2.5, 5 gr of $FeSO_4.7H_2O$ to 1gr of sand). In order to measure nitrate, ultraviolet–visible spectroscopy was applied at 220 nm. The results indicate the maximum efficiency of nanoscale iron particles with ferrous sulfate concentration of 2.5 g. The method causes the sand particles to stabilize iron nanoparticles by providing the right Fe^0Nps, level, preventing their aggregation and thereby increase the reactivity of zero-valent iron nanoparticles on sand in comparison to Fe^0.

Key words: Pollution, nitrate, nanoparticle iron (Fe^0), sand, stabilization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

A review on phytoremediation and the roles of soil beneficial bacteria in increasing phytoremediation's efficiency

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Abstract

Soil pollution has a side effect on the quality of food production and finally on human food chain and on other parts of environment as well. Soil ability for remediation of these pollutants such as heavy metals less has been noticed in the past. Most of the conventional remedial technologies are expensive and inhibit the soil fertility; this subsequently causes negative impacts on the ecosystem. Phytoremediation is a cost effective, environmental friendly for decreasing soil pollutants concentration. The heavy metals at elevated levels in the environment lead to impair the metabolic activities and result in reduced plant growth. Hence the alternate ways to reduce the toxicity of heavy metals to the plants is using the rhizosphere microbes. Due to the rhizosphere, microorganisms have exceptional ability to promote the growth of host plant by various mechanisms such as the production of phytohormones, siderophore and solubilization of minerals, the reaction between metals, microbes and plants are considered. A lot of research on the Phytoremediation and the Roles of Soil Beneficial Bacteria in Increasing Phytoremediation's Efficiency has been done in Iran and around the world, which is mentioned in this article.

Key words: Phytoremediation, heavy metals, Rhizosphere bacteria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Detoxication of irrigated soils contaminated by nickel in southern Kazakhstan

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Abstract

Currently, a significant negative factor in reduction of soil fertility is the factor of soil contamination with heavy metals, pesticides and other pollutants. Our research results show the increase of heavy metals concentration in irrigated soils in particular Pb, Ni and Cu. In addition, deterioration of environmental, soil and reclamation conditions of irrigated areas has also led to reduction of soil protection features in terms of Pb and Ni. River water – the irrigation sources become more contaminated. Currently, the majority of irrigated areas in the south of the country are characterized by a regular increase of Pb and Ni concentration from irrigation to ground water. In this regard, the main objective of research work is to develop a method of detoxication) of irrigated soils contaminated by Ni. Experiments on developing of detoxication method of soils contaminated by nickel have been performed in Shieli rice area by conducting field vegetation experiment. Coal sorbent obtained by means of rice husk cracking was used as a detoxicant for conducting experiment. The obtained data showed that a small dose of coal absorbent 0.4 g/vessel in comparison with the control, enhances nickel intake by rice plants, especially by corn and root to 24-25 %. And the following two tested doses 4.0 and 8.0 g per vessel, on the contrary, contributed to the decline of nickel intake by rice plants, and as the dose increases, the effect of soil detoxification increases. Coal sorbent depending on the applied dose reduces the flow of nickel in the most valuable part of rice - corn to 12.6-27.1 %. A similar pattern is typical for other organs of rice - straw and roots. Therefore, we suggest to use coal sorbent in periodically flooded rice soils, depending on the degree of pollution to reduce the intake of nickel by rice plants. Using this data, the regression equation (y =-2.06x2 +7.79 x +15.85) has been done which clearly describes (R2 = 0.7482) the dependence of intake of nickel in the most valuable part of rice - wheat from coal sorbent dose. This equation can be used to determine the appropriate dose of coal sorbent when concentration of nickel content in soil is known.

Key words: Soil pollution, heavy metals, detoxification.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of soil pollution damage from the Persian Golf war

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Abstract

Much of land in southern and western parts of Iran affected adversely by pollutants produced by 700 burning Oil wells of Kuwait and thousand well and oils and gas station in Iran Iraq war 1976-1991. Research has indicated deposition at about 3.5 ton per hectare of atmospheric pollutant over approximately 500.000 km^2 of Iranian territory various reports of international agencies indicated the widespread distribution of nitrogen oxides, sulfur oxides, per oxides, forma formaldehyde, methane and heavy metals. These were deposited on natural resource of Iran and other countries. Paraffin compounds, aromatic hydrocarbons and other elemental and organic contaminates, damaged natural resources, animals and environment, results indicated the widespread occurrence of atmospheric congested oil-related pollution across the impacted areas and confirmed the inflection of damage to natural resources of forest, rangelands, soils and water, wetlands and plants swamps, and livestock poultry and aquatic organisms.

Key words: Soil pollution, evaluation, Persian Gulf, Kuwait war.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of Pb isotopes to track the sources and routes of metal uptake in the earthworm *Eisenia fetida*

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Abstract

The aim of this work is to determine the important routes of metal uptake in earthworms to enable a better understanding of the primary source of metal uptake in the environment. Earthworms can take up chemicals from pore water and soil both by ingestion and through contact with their skin. However, it is unclear which pathway is the most important for metal uptake. An experiment was designed in which both soil chemistry and foods were artificially manipulated, producing different pools of soil lead (Pb) with different isotope compositions at a range of Pb concentrations. Earthworms (*Eisenia fetida*) were exposed to different lead concentrations through the addition of 500 mg/kg lead acetate to soil and 500 mg/kg lead nitrate to food (manure), with distinctly different isotopic compositions. Earthworms were also exposed to combinations of soil only and soil plus food in order to quantify the proportions of Pb taken up from each component. After acid digestion of the earthworm tissues, the Pb isotope composition of the accumulated lead in the earthworms was measured using a Thermo-fisher, iCAPQ, ICP-MS for $^{208}Pb/^{206}Pb$ and $^{207}Pb/^{206}Pb$ ratios measured relative to NIST SRM 981, allowing us to determine the pathway of lead uptake. Mixing calculations have been used to deconvolute the lead isotope signatures and identify the amount of lead taken up by the earthworms from the different soil pools. Differences in bioaccumulation factors and the relative amounts of lead accumulated from different pools changes as a function of concentration in the different pools. Earthworms were shown to uptake more lead from food, but when the concentration of lead in food was high they selectively avoided this and absorbed lead from the soil source. Our findings suggest that major pathway of lead uptake in earthworm species is heavily influenced by their ecology.

Key words: Earthworms, metals, uptake, lead, isotopic.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Remediation of the degraded lands in water erosion circumstance

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Abstract

Steppe, semi-desert and desert ecosystems are characterized by high degree of vulnerability, extreme sensibility to adverse environment conditions and low potentials for self-healing processes. Conditions, when a uniform vegetative cover is not steady with low precipitation contribute to activation of water erosion processes. The aim of this research is a study of protection means and remediation methods of the degraded lands under water erosion processes and reinforcing of ecological sustainability of abovementioned zones. In many cases to limit an invasion of polluted lands and confine waste collection areas, they are bordered by embankment (safety berm). The absence of uniform vegetation and presence of unconsolidated ground on this area, bring to condition when water erosion processes are appeared and activated. Self-healing of sward on embankment's slopes depends on complexes of factors, like: exhibits of slopes, mechanical properties, chemical content of soils, microrelief and etc. Restoration of destroyed soil surface and vegetation cover inside embankment is connected with some difficulties, as embankment consists with man-caused substrates, which have clay alluviums in structure. During this study multi-stage biological reclamation method was carried out. Depending on exhibit of embankment's slopes, physical and chemical properties of soils, rates of sward, etc., we define duration and type of reclamation method. Complex measures, as fixture of embankment slopes, creation of sustainable vegetative cover by adding meliorants, organic and mineral fertilizers, selection of suitable type of plants are held during research. Research results revealed several options for the restoration method, usable for degraded lands. They can generalize as usage a complex of erosion control measures, enhancement soil-forming processes and improvement physical and chemical properties of degraded lands.

Key words: Degraded lands, soil erosion, reclamation, soil fertility, phyto-meliorants.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fractions of heavy metals in the soil after the application of municipal sewage sludge, peat and furnace ash

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Abstract

The aim of the study was to evaluate the effect of the addition of various materials, i.e. municipal sewage sludge, furnace ash and peat, as well as various doses of ash-sludge and ash-peat mixtures, on some physico-chemical properties of the soil: pH, hydrolytic acidity, sorption complex capacity, organic C content, the content of P, K and Mg available forms, total content of heavy metals and their forms soluble in 1 mol · dm^{-3} HCl solution, and their speciation as well. Municipal sewage sludge and of ash-sludge and ash-peat mixtures use in the experiment caused the greatest increase in sorption capacity, in content of phosphorus, potassium and magnesium and resulted in a gradual increase in the content of studied heavy metals. The addition of ash and applied mixtures to the soil caused a change in soil reaction (the pH increase). The ash was characterized by a low content of heavy metals. After peat and its mixtures with ash application decreased content of heavy metals was observed, and when the peat was used alone could be seen the greatest increase in the organic C content in the substrate. Distribution of heavy metals in the fractions separated in different combinations show large variations, depending on the tested metal and the studied variant. Chromium, zinc, lead and cadmium have been stored mainly in the residual fraction (F_5), and most of the copper and nickel have been specifically bound with organic matter (F_4). It has been found that the alkaline materials application to the soil decreased the solubility of most heavy metals, which results in a limitation of their uptake by plants. Chromium and copper were an exception, which solubility increased with the alkalinity of the substrate. An exception was chromium and copper, which solubility increased with the alkalinity of the substrate.

Key words: Municipal sewage sludge, peat, furnace ash, soil, heavy metals, speciation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Particulate pollution in the southern sector of Sfax city -Tunisia: Monitoring and impact on the soil

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Abstract

The spatio-temporal follow-up of particulate fallout from some polluted sources situated in the southern suburbs of Sfax city, as a case in points the phosphate fertilizers producing factory (SIAPE), Lead smelter and SIOSETEX soap factories, shows that the daily flow of aerosols is lower than the French-German standards (AFNOR- TALUFT). The spatio- temporal variability of collected particulate deposits depends on the distance of collection sites from the polluting source, the frequency of exposure to the SIAPE chimney and the air flow characteristics. The analysis of the particulate fallout shows neutral to alkaline pH tendency and an electrical conductivity increasing while going away from the polluted area. This seems in relation to the alkaline character of the elements which dominate the effect of acidic components. Dusts deposited on the soil of different collection sites seem to be contaminated with metal elements. Our results show that Cd levels of studied soil exceed the Chinese standard (0.68mg/kg DM), while lead concentrations remain below the standard at 30.2 mg / kg DM. The use of numerical approaches (Enrichment level, Enrichment factor) shows the possible involvement of SIAPE and lead smelter factories in the contamination of soils by metals.

Key words: Particulate, aerosol, soil, cadmium, lead, contamination.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Pollution of irrigation soils and cultural plants with heavy metals in the basin of the river Kvirila due to mining industry (West Georgia)

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Abstract

At present, global environmental pollution is one of the world's major problems. Emission of chemical elements is often an unforeseen phenomenon, and soils, water reservoirs and hydrologic network can get polluted with industrial waste, while some other sources of pollution are unforeseen discharges in case of emergencies, emission of aerosols into the atmosphere, etc. Since the startup of Chiatura manganese ore deposit treatment (this amounts to 130 years now) to 2005, 230 734 009 mio tons of raw ore have been extracted and 110 713 614 mio tons of marketable products have been realized. Manganese ore is mostly extracted by open cast mining. As the ore is dressed at the plant, the river Kvirila permanently gets polluted with manganese ore admixtures. The content of manganese ore in the river Kvirila is 10-12%. The data of the field studies and analytical data prove that the soil and cultural plants, besides manganese ore, get polluted with different heavy metals, such as nickel, arsenic, etc. Accumulation of large amounts of heavy metals in the hydrosphere and soil and inclusion of heavy metals in the biological chain may have major harmful effect on the people's health in the region and biosphere.

Key words: Heavy metals, soils, hydrosphere, mining industry.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial distribution and ecological risk of heavy metals in surface sediments associated Manwan Dam in Lancang River

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Abstract

Bulk heavy metals (As, Cd, Cr, Cu, Mn, Ni, Pb, Zn and Al) and grain sizes in sediments collected at upstream and downstream of Manwan Dam were studied to demonstrate the spatial distribution of heavy metals in the sediments and to assess their risk. Correlation analysis and cluster analysis showed that high toxic heavy metals of Cd, As, Pb were significantly positively correlated and could be clustered into one group. The risk assessment demonstrated that the pollution of Cd and As were more serious than other heavy metals. Except Cr and Ni, all the heavy metals increased rapidly with the closer distance to the dam. The high concentration of Cr was found in the section far away from the dam. Fine-grained sediments with higher risk level were found in the section near the upstream of dam, while coarse-grained ones with lower risk level were found in the section far away from the downstream of dam. The sections in tributary were lower in risk than those in the main stream. Heavy metal concentrations in the mainstream sediments were influenced by dam construction and those in tributary were influenced by both dam construction and human activities in locality. Unusual high concentrations of Cd, As, and Pb in both sections implied that more pollution prevention measures are needed in the Manwan Dam in order to prevent increased heavy metal pollutions in the Lancang River.

Key words: Manwan dam, heavy metals, spatial distribution, ecological risk

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The perspectives for the typical sampling of soil samples with bioassay on the example of the development of chemical industry

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Abstract

To identify patterns of anthropogenic impacts on soil contamination it is not always possible to find the control over the uncontaminated (background) site as contaminated and background areas often vary in a range of other environmental factors (moisture regime, soil disturbance, etc.). On the territories of settlements this heterogeneity is most noticeable and is associated not only with the chemical transformation of natural soils of varying degrees of disturbance, but also with the functional zoning of the urban area. Therefore, to justify the sampling in urban areas a special study is required. In October 2013, a soil bioassay was carried out using garden cress on a garden plot within the boundaries of Sterlitamak city at the intersection of Gagdanskava and Babushkina streets with the area of 50 × 100 m at different distances from the road. The city territory is contaminated with a large number of organic and inorganic compounds, which makes integral evaluation of soil toxicity necessary. The following indicators were used: the percentage of emerged seeds, the average length of sprouts, length above- and belowground parts of seedlings, seedling dry weight. The results obtained (48 experiments) show that the dimensional indices of seedling overwhelmingly correlated with each other. No significant influence of the distance from the road on soil phytotoxicity was found out, but within the investigated area a plot with an increased toxicity was identified, which appears to be a consequence of storage of pesticides in this location. The results obtained can be used in determining the reference soils for subsequent mapping of soil toxicity within territory of Sterlitamak city. Since the structure of soil in different functional areas of cities varies considerably, significant differences in soil phytotoxicity can be detected at a distance of several meters. Sampling is recommended in areas currently or previously used for growing agricultural products. In other functional areas it is viable to allocate phytocenoses with spontaneous vegetation, performing in this case a controlling functon (Seifert et al, 2000).

Key words: Soil bioassay, garden cress, agrotehnogenic area.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Chelant washing of metal polluted garden soils: can remediated soil be used as a plant substrate

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Abstract
Soil contamination is becoming a major problem, caused by the large amounts of man made pollutants and chemicals that are being anchored into agricultural and urban soils everyday. Potentially toxic metals (PTM) are one of the main causes of concern as they are persistent in soils and are difficult to remove. In Europe alone there are estimated approximately 240,000 contaminated sites in need of immediate remedial treatment and in almost 40% of these sites, toxic metals are the most important contaminants. In the United States, PTMs are present in 77% of the Superfund sites (National Priority List), in 72% of the Department of Defense Sites and in 55% of the Department of Energy sites. We demonstrated in a pilot-scale experiment, the feasibility of EDTA-based washing technology for soils contaminated with potentially toxic metals. Acid precipitation coupled to initial alkaline toxic metal removal and an electrochemical advanced oxidation process were used for average recovery of >75% of EDTA per batch and total recycle of water in a closed process loop. No waste-water was generated, solid wastes were efficiently bitumen-stabilized before disposal. We applied multi-level approach to access the quality, toxicity and functioning of Pb, Zn and Cd contaminated / remediated soil from vegetable garden in Meza Valley, Slovenia. Contaminated / remediated soil was placed into experimental plots equipped with lyzimeters. Soil properties were assessed by standard pedological analysis, fractionation and leachability of toxic metals by sequential extraction and TCLP and metal bioaccessibility by UBM tests. Soil respiration and enzyme activities were measured as indicators of soil functioning. Remediation reduced the metal burden for 80, 28 and 72% for Pb, Zn and Cd respectively with limited impact on soil pedology. Toxic metals associated with labile soil fractions were largely removed. No shifts between labile and residual fractions, during seven months of experiment were observed. Initial metal leaching measured through lyzimeters eventually sized entirely. However, remediation significantly diminished potential soil enzyme activity and no trends were observed for remediated soil to recover its biological properties. Furthermore we studied plant performance on contaminated / remediated soil, and safety of crops produced. Selected cultivars were rotated within 16 months. Pb, Zn, Cd and micronutrient plant uptake was measured by AAS and their phytoaccessibility by DTPA method. Plant fitness was assessed by chlorophyll fluorescence and gas exchange measurements and evaluation of root colonization with mycorrhizal fungi. Remediation reduced Pb and Cd concentrations in roots, green parts and fruits in most of the plants. Phytoaccumulation of Zn was reduced in approximately one half of the cultivars. Soil Mn was diminished for 4 times, phytoaccessibiliy of micronutrients Cu, Fe and Mn for 54, 26 and 79%, respectively and plant yield for up to 10-times (*Spinacia oleracea*). Photosynthetic parameters of plants grown on original and remediated soil were similar except for reduction in *Spinacia olearecea*. Frequency of mycorrhizal colonization in roots of *Pisum sativum* was reduced five times, no significant changes were found in *Allium cepa* roots. Soil washing successfully removed labile forms of Pb, Zn and Cd and thus lowered the human and environmental hazard of remediated soil; however remediation also extracted the trace elements essential for soil biota. Conjointly with lowered water potential soil health was not completely restored. Remediation reduced plant uptake of Pb bellow concentration stipulated by legislation. Measures to reduce plant accumulation of other toxic metals and to revitalize remediated soil are needed.

Key words: Toxic metals, soil remediation, quality of remediated soil, safe food production

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Remediation of cadmium contaminated vertisol mediated by Prosopis charcoal and Coir pith

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Abstract

Metal contamination of soil due to industrial and agricultural activities is increasingly becoming a global problem, thereby affecting animal and human life, thus rendering soil unsuitable for agricultural purposes. Remediation of cadmium (Cd) contaminated soil (vertisol) using agricultural by products as source of organic amendments, Coir pith- a by-product of the coir industry and prosopis charcoal- prepared by burning Prosopis plant wood (*Prosopis juliflora* L.) was investigated. The alleviation potential of Prosopis charcoal and Coir pith on the negative effects of Cd in soil was evaluated in pot culture experiments with *Vigna radiata* as the test plant, a Cd accumulator. Cadmium addition to soil resulted in accumulation of Cd in all plant parts of *V. radiata* predominantly in roots. The influence of Cd in the presence and absence of organic amendments on the various biological and chemical parameters of the soil, on the levels of Cd accumulation and on the growth attributes of *V. radiata* has been assessed. Organic amendments, apart from causing a significant reduction in the soil bioavailable Cd and its level of accumulation in *V. radiata* have effected an increase in the micro and macro nutrients contents of the soil and in plant parts. Among the organic amendments, Prosopis charcoal was found to be more effective in reducing the bioavailable levels of Cd in the soil artificially spiked with Cd in graded concentrations of 0, 5, 10, 20, 40, 60, 80 and 100 µg g^{-1} and its accumulation in *V. radiata,* thus resulting in an increase in the root, leaf and grain biomass. Coir pith, however, was effective in increasing the total mycorrhizal colonization of roots and second in reducing Cd levels in plants. Therefore, Prosopis charcoal was considered best for stabilization of Cd in soil.

Key words: Cadmium, organic amendments, Prosopis charcoal, coir pith, *Vigna radiata*, accumulation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Peculiarities of the action of selenium in the presence of cadmium

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Abstract

The trace element selenium (Se) is an essential component of the antioxidant defense. Agrochemists work with Se showed its ability to increase crop resistance to adverse environmental factors - drought, lack of moisture, salinity and other stresses. The aim of this research was to study the effect of selenium on the growth, development and productivity of cereals (spring barley "Sonnet" and spring wheat "Zlata") under conditions of soil contamination by heavy metals (cadmium). Under the treatment of Cd (10 mg/kg) and processing plants via leaves selenium in booting phase significant morphological changes in the formation of barley did not happen. High dose of selenium led to increase of this element in barley grain (~ 1000mkg/kg) and reduction in weight of the straw (when the length of the stalk is increased) and corn. However, the use of selenium has led to a significant increase of the total content of nitrogen in the plants. Using of cadmium concentration does not cause plant material adverse change. The content of cadmium increased compared to control (15%) both in the straw and in the grains. However, the content of nitrogen decreased in the versions with cadmium. Thus, in their joint action occurred leveling indicators for biomass and characterization of nitrogen in the straw and grain. Significant changes compared to control not installed, excluding amounts of these elements. Plants-accumulators (or in the case of additional contribution of selenium) can accumulate large amounts of selenium 10 - 100 mg Se/kg, due to the fact that they synthesize mainly non-protein selenium-amino acids. In this case, it is obviously occurs because the protein content of nitrogen is reduced, and the total is increased. These forms accumulate in vacuoles, which allow preserving the activity of enzymes and supporting the sustainability of such plants to toxic concentrations of heavy metals. In this case, the activity of enzymes, particularly involved in oxidative processes, contributed to the increase of stability conditions of the plants in the presence of cadmium.

Key words: Selenium, an antioxidant effect, cereals, barley, Cd, crop structure

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Comparative analysis of content of radionuclides in chernozems under different types of the land use

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Abstract

The results of comparative analysis of radionuclides (^{226}Ra, ^{232}Th, ^{40}K, ^{137}Cs) are presented. The consistent patterns of their activity distribution (the content) in the profile of chernozems exploiting in agriculture and their analogues under forest (field-protective forest) and long-term fallow are shown. Clay and loess are parent rocks in these soils. The soil samples were selected in Volgograd, Rostov and Orenburg regions and Republic of Bashkortostan. Most of the soils characterized by a maximum content of radionuclides in the upper part of the profile, the minimum is in the middle of.The content of radionuclides in the soil profile depends on their original content in the parent rock (the more radionuclides in the parent rock, the more of them in the humus horizon). Under agricultural use of soil with fertilizers, this pattern may not be observed. 137Cs is observed significantly more than arable land in the humus horizons of soils under forest and long-term fallow. This may be associated with features of the biological cycle. In the soils under arable permanent estrangement of agricultural biomass leads to decrease of ^{137}Cs. There is the same pattern for ^{226}Ra, but less pronounced (except soil long-term fallow).The differences in the content of ^{40}K in the soils of different lands were hardly observed. In most cases the content of ^{232}Th in soils under arable land and long-term fallow is more than a field-protective forest.

Key words: Radionuclides, chernozem, types of land use

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Herbicide degradation under different herbigation management strategies

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Abstract

Soil and water contamination by agricultural pollutants such as herbicides is one of the most important environmental challenges. This problem is even escalated more due to applying new technologies such as herbigation that are more efficient than conventional spraying methods. Thus, applying accurate and efficient management strategies for herbigation, to reduce soil and groundwater resources contamination is necessary. Selecting less devastative management strategies for herbigation requires information on degradation and persistence of herbicides in soil. Metribuzin is one of most popular herbicides which applied with irrigation water for different crops. To investigate the degradation and persistence of Metribuzin applied with herbigation in soil, during 2012, field trials were carried out under different herbigation management strategies. Metribuzin was applied at 0.75 kg /ha while applying four application methods, namely conventional spraying, herbigation via the first irrigation, herbigation via the second irrigation and applying Metribuzin through both the first and second irrigations each at half a dose of a single application rate. Using multi-stage sampling, dispersion and disintegration of Metribuzin were determined at different soil depths. The results show that Metribuzin degradation patterns in different herbigation management strategies changes with time after application and soil depth. Minimum degradation of Metribuzin found at herbigation via the second irrigation, unlikely conventional spraying cause to highest degradation. Because in conventional spraying, applied herbicide remain on the soil surface for a long time before first irrigation thus it is more available for photo degradation and microbial degradation. While application via the second irrigation cause to rapid movement of Metribuzin to deeper layers of soil, thus this herbicide will be unavailable for photo degradation and microbial degradation.

Key words: Herbigation, metribuzin, degradation, soil depth.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Heavy metal content and its spatial variability in the soils of the area of the gold mine in Gadabay Region, Azerbaijan

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Abstract

The contamination of soils and rivers due to oil production, agricultural pollutants and mining is a growing problem for several regions in Azerbaijan. One of the main heavy metal pollution sources is Gold and Copper Mine in Gadabay region, west mountainous part of Azerbaijan where mining dates back to over a century. This Mine is the biggest one in the Caucasus and well-known with its exploitation history by German Siemens Brothers from time of Tsar Russia. The study deals with the concentrations of heavy metals in the soils and their spatial variability in the area of the Mine. The analyses results of soil samples found out a clear difference between the concentrations of soil heavy metals for the separate parts of the Mine. Heavy metal concentrations in all soil samples collected from the Mine site are in the order of Mn>Zn>Cu>Cr>Ni>Co>Pb>As>Se>Cd>Hg. The mean values of some heavy metals such as Cu, Cr, Co in the Tailings Management Facility are higher than the Mine site while concentrations of Mn and Zn are lower. Meanwhile the heavy metal concentration of some soil samples exceeds levels in government standards. The elements with the highest concentrations are mainly Ni, Co, As and Zn. Moreover, soil properties were studied and soil map of the Mine site was compiled via GIS.

Key words: Mining, heavy metals, soil contamination, soil properties, GIS mapping.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Recultivation of technologically disturbed lands – One of the methods of carbon sequestration

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Abstract

The soil surface in the Republic of Kazakhstan is exposed to technogenic effects, in the results of which the centuries-old soil-plant cover is disturbed. In the south of the Republic the soil surface is disturbed due to mining of non-ore resources. Careers, dumps and hollows which have various sizes and shapes are formed. Natural recovery of soil surface depends on the productivity of the surrounding undisturbed landscapes, in scarcity and poor vegetation self-restoration of land cover is long. Remediation works were carried out on lands disturbed during the extraction of loess-like rocks for construction materials. Thus, during reclamation of loess-like loams the bio-agrotechnological methods were used. Legume-cereal crops and their grass mixtures were used. The agro-technical method included plowing of loess-like loams, conducting plot experiments, putting on them the fertile layer of common gray soils of different capacity, application of organic and mineral fertilizers and irrigation. The results showed that after 4 years of reclamation the lands could be used for growing grain crops. In remediation of loamy rocks it is not necessary to put a fertile layer. They provide an excellent yield of agricultural crops in conditions of biological re-cultivation and irrigation. Biotechnical methods of reclamation of dumps of phosphorite deposits, which are composed of coarsely fragmented dolomite rocks and shale of various genesis showed positive results with the use of wood chips and bentonite clay in order to preserve moisture. The use of pit-hole method of planting of germinated seedlings of narrow-leaved Elaeagnus and Halimodendron was the most effective and economical. They have a great capacity of seeding, drought-tolerant, undemanding to fertility of the substrate. On dumping waste rock dump was carried out randomly and a comb like hills and ridges of the relief were formed, between them the seeds germinate. Disturbed lands, deprived of soil-plant cover in their biotechnological methods of re-cultivation effectively reduce the carbon emissions.

Key words: Remediation, biotechnology, blade, loam, legume-cereal grass mixture.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of Gyttja on plant growth and nickel contents of lettuce (*Lactuca* Sativa) in nickel contaminated soils

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Abstract

In this study, the effects of Gyttja on some yield criteria and nickel contents of lettuce (*Lactuca sativa*) grown in Ni contaminated two different soils (Inceptisol and Entisol) were investigated. The study was conducted with the application of three levels of gyttja (0, 5 and 10%) into two different soils (Inceptisol and Entisol) contaminated with three levels of Ni (0, 40 and 80 mg/kg) in a factorial experimental design with three replications. As a basic fertilization, 300 mg/kg N and 90 mg/kg P_2O_5 were applied into each pot. At the end of the study, the highest mean values for plant length (15.83 cm), leaf number (16.3) and plant fresh weight (106.7 g) were obtained in the 10% gyttja without Ni application in Inceptisol. The relations among soil orders, yield criteria and Ni contents were determined.

Key words: Lettuce, nickel, yield criteria, Inceptisol, Entisol.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of mercury mobility on microbial activities of soil treated using different amendments

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Abstract

Heavy metals pollution of soil is an increasing problem worldwide especially in industrialized areas. Mercury (Hg) is an extremely toxic pollutant that poses global environmental and human health risk. The accumulation of Hg on soils is mainly due to several anthrophogenic activities (Selin, 2009). The presence of soil organic matter plays an important role on mercury mobility since it is bound to soil organic matter but also it can be tied to thiol groups of sulphur. Recently, it has been observed that sulphur on soils stimulate the sorption of mercury on humus fraction reducing its mobility. The objective of this work was: (1) to evaluate the mobility of mercury in Chernozem and Cambisol soils; (2) to compare the effect of amendments rich in organic and inorganic sulphur forms on the mercury mobility; (3) how the mercury mobility can affect to soil microbial activity in both soils amended with sulphur. Different sulphur forms were applied by the addition to soils of three amendments treatments: digestate from biogas station, ash from biomass combustion and $(NH_4)_2SO_4$. Soil Hg content was reached by an addition of $HgCl_2$ solution. During the experiment, soil samples were regularly collected to determine the mobile mercury content as well as enzymatic activities such as dehydrogenase and hydrolytic enzymes. Chernozem soil showed a reduced content on mercury after 1 days of incubation while in the case of Cambisol soil it was reached after 21 days. However, the application of different amendments to Cambisol soil provoked a reduction of mercury content after 1 day, especially in presence of digestate. The microbial activity was positively stimulated by addition of digestate, in both Chernozem and Cambisol soils, by the increase of soil enzymes activities detected except phosphatase and urease activities. In conclusion, application of digestate can reduce the mercury mobility and/or toxicity as confirmed *via* an assessment of the soil microbial activities.

Key words: Amendments, mercury mobility, microbial activity, soil pollution, sulphur.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Vertical and horizontal distribution of heavy metals in a transect in sodic urban soils of Çankırı, Turkey

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Abstract

Heavy metal contents of urban soils should be monitored to avoid their potential health impact on city residents and tourists. Sodic urban soils generally exist in East side of Cankırı along the highway crossing the city center. These soils have a high potential impact on water and air quality in residential areas due to their well known properties of low water infiltrability and poor soil structure. We evaluated vertical and horizontal distribution of common heavy metals concentrations in these urban soils. We determined 10 sampling sites on a 6-km transect along the highway crossing the city in NE to SW direction. Each sampling site was sampled by five different soil depths (0-2.5, 2.5-7.5, 7.5-12.5, 12.5-17.5, and 17.5-30.0 cm). The concentrations of heavy metals in soil samples were measured using Inductively Coupled Plasma. The rank of heavy metal concentrations where Fe> Mg> Mn> Ni> Cr> Zn> Cu> Ca> Co> Pb> Na>K>Cd>Hg. Concentrations of Mg and Fe were higher than their regulatory values. Concentrations of Mg, Cr, Mn, Fe, Ni and Co gradually decreased from NE to SW, values of Hg was far greater in the NE half of the study area than SW half, concentrations of Cd and Pb showed patchy distribution by vertical and horizontal distance, and greater Zn concentrations occurred at both ends of the transect compared to values closer to city center. No obvious relation was detected between pH and concentration of any of studied heavy metals. In general, horizontal variations of heavy metals were greater compared to their vertical variations. That concentration of Mg was far greater than that of Ca was attributed to the parent materials of the soils, which contains considerable amount of serpentine.

Key words: Sodic urban soils, heavy metals, serpentine, Çankırı, public health.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Efficient use of alfalfa and barley in phytoremediation technology to remove oil pollutants from soil

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Abstract

This study was Carried out at the College of Agriculture - the University of Baghdad, to investigate the efficiency of two different crops alfalfa (P1) and barley(P2) and the control (without) (P_0) in reducing the proportion of hydrocarbon oil in the soil, and two levels of NPK 100(F1) and 50(F2) kg $N\text{-}P_2O_5\text{-}K_2O$. ha^{-1} use of fertilizer. Diesel engine oil was added to the soil at levels 0, 20, 40 and 60 g kg^{-1} soil. in containers of 25 kg in August under farm conditions After three months in October the soil was cultivated with alfalfa and barley crop, using factorial experiment, with in complete randomized design (CRD) with three replications, Two levels of NPK (100 and 50 kg ha^{-1}) fertilizer was added using NPK fertilizer. The results obtained from this study was a significant decrease in the concentration of residual diesel engines oil in soil caused by the treatment alfalfa (P1) and barley (P2) to the values of 25.53 and 27.12 g kg^{-1}, respectively comparing with the control (P0) which was to 33.82 g kg^{-1}.

Key words: Alfalfa, barley, diesel engine, NPK.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial distribution of lead and copper concentrations in the Zanjan industrial region, Iran

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Abstract

Heavy metals are found naturally in all soils, but soil contamination due to human activities is increasing day by day. The area around the mines and metals processing plants are at the risk of severe pollution because of the activities of exploration and mining and also fumes and wastes resulting from such processing processes. This research was conducted to evaluate the soil pollution by lead and copper, on the outskirts of Zanjan, a city in northwest of IRAN. In this study, 100 samples of surface soil (0-30 cm) were sampled in a grid form in an area of approximately 36,000 hectares, from the vicinity of polluting factories to the surrounding farm lands. The total amount of lead and copper of samples were measured after digestion method using atomic absorption set. The results of the analysis showed a strong spatial dependence for both elements and the amplitude dependence for copper and lead is 4800 and 3400, respectively. Mapping of elements using kriging method in Arc-GIS package showed that, the concentration of lead in most areas especially eastern half and central part of Zanjan, is above the high risk threshold (50 ppm) and concentration of copper, except for a small part of the north east region, in all areas exceeded the limits (50 ppm) and on the threshold of toxicity as far its concentration in the central region of Zanjan has reached its maximum amount. Therefore it is necessary to eliminate contamination of the surrounding farm lands using modern methods such as leaching and Phytoremediation and also construct mining and processing facilities as well as heavy metals compliance with relevant standards to prevent from further pollution.

Key words: Heavy metals, kriging, mapping, soil pollution, spatial distribution, Zanjan industrial region.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Lowering of agricultural production due to land degradation and soil pollution and its reflection on achieving food security

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Abstract

This study focused on the environmental pollution and degradation of natural resources and their impact on agricultural production as a kind where the land and water resources are the backbone of agricultural development in Arab world as the most important natural resources that must be exploited guide and protect them of human activity in the Arab world adversely affect the outcome of pollution and land degradation, and most of the Arab world lies in the arid semi-arid lands and is a significant danger of desertification and desert encroachment and degradation of agricultural lands, pastures and forests. The low productivity of soils due to degradation of the most important environmental problems in the Arab world and the varied manifestations of this deterioration, which includes Anhsarlgate vegetation, overgrazing, poor water use and the illegal cutting of forest and desert creep and the formation of sand dunes as well as salinity and soil hardening.

Key words: Agricultural production, degradation, food security, pollution, soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of atmospheric emissions of nitrogen compounds on the biochemical parameters of soils of European Russia

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Abstract

Since the 1980s of the twentieth century, the nitrogen oxides have been becoming priority pollutants of air, which is associated with intensive industrial and transport emissions NO_x, and NH_3 and N_2O emissions from agricultural lands. The aim of the study - to assess the impact of anthropogenic emissions of nitrogen oxides on soil biogeochemical parameters in areas with different land use. Results; (i).The assessment of nitrogen deposition of wet deposition showed that in the Moscow region of mineral nitrogen deposition ranged from 5-15 kg N ha^{-1} per year and in the Kostroma region 2-7 kg N ha^{-1} per year. In the wet deposition in the Moscow region dominated nitrate - 50 to 60% of the total mineral nitrogen pool, while in the Kostroma region were only 20-30%. (ii). The study of mineral nitrogen compounds in the soils revealed that in the sod-podzolic soils the concentration were 5-23 mg N/kg in the Moscow region and 2-20 mg N kg^{-1} in the Kostroma region. In the investigated areas concentration of ammonium forms varied between 4-11 mg N kg^{-1}in the Moscow region and 0.6 - 5 mg N kg^{-1} in the Kostroma region. Contents of nitrate in forest soils ranged from 0 to 13 mg N kg^{-1} in the Moscow region and from 0 to 5 mg N kg^{-1} in the Kostroma region. Mineral nitrogen pool in soils mainly represented the ammonium form due to the specific biogeochemical processes of wood ecosystems. In some soils have the prevalence of nitrates, it can be either an adaptation of forest ecosystems to the conditions of nitrogen limitation, any influence of anthropogenic emission. In Moscow, the maximum values (>10 mg N kg^{-1}) content of nitrates in the soil marked for sites located near agricultural fields and areas of impact of forest fires. For Kostroma forests visible linkages between increasing concentrations of nitrate in the soil and anthropogenic objects were not observed.

Key words: Ammonium form, nitrates, biochemical parameters of soils, nitrogen deposition.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Removal of metals and arsenic from aqueous solution using Fe- and Mn-oxide nano-composite

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Abstract

Treatment of As(Ⅲ) can be a challenging task due to its high mobility and small affinity to mineral surfaces and that pre-oxidation step to As(V) is necessary for enhancing removal efficiency. In this study, Fe-Mn oxide was synthesized through chemical precipitation in solutions with varying concentrations of $FeCl_3.4H_2O$ and $MnCl_2.4H_2O$ for oxidative adsorption of As(Ⅲ) in aqueous solution. The synthesized Fe-Mn oxide mineral possessed oxidation property rendered from manganese dioxide phases and adsorption capacity from iron oxide phases. The Fe-Mn oxide was characterized for surface area, morphology, composition, and magnetic property and bench scale laboratory experiments were carried out to investigate potential utility of the mineral in treating As(III) under the mineral dose of 1 g/L and 1 mg/L As(III). The results of kinetic experiments revealed the oxidation of As(III) occurred in a very short period of time (less than 30 min), followed by adsorption to iron oxide phase, with its removal efficiency being the highest for the mineral synthesized under 1:0.25 Fe:Mn condition. The maximum adsorption capacity determined from isotherm experiments was found to be 200 mg/g. The removal of As(V) remained relatively constant in pH 3-6 at around 60 % removal but dramatically decreased when pH was raised to 10. The ionic strength in the range of 0.001-0.1 M $NaNO_3$ and the presence of competing anion (0.1-1 mM PO_4^{3-}) had little effect on the As(III) removal. The overall results of this study demonstrated the potential utility of the Fe-Mn oxide for treatment of As(III) in field applications for high removal capacity and magnetic property that enables better separation of reacted material after the treatment process.

Key words: Arsenite, Fe-Mn oxide, oxidation, adsorption, synthetic material.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mineralogy, geochemistry and microorganism biodiversity of anthroposoils and the application of selected autochthonous species of microorganisms in bioleaching processes of contaminated substrates (ashy soils)

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Abstract

Soils and buried coal-combustion ashes on the model contaminated site contain high concentrations of arsenic that is present mainly in the finest fraction of the studied samples. Amorphous aluminosilicate glasses represent dominant component of solid samples and are a major As-binding phase. Arsenic is incorporated in aggregates of nanoparticles composed by Al, Si, Ca, Fe. In case of static and dynamic leaching with aqueous solutions, arsenic extractability from solid matrix is relatively low (approximately 4,8%). Significantly higher proportion of As was released by fungal bioleaching using Aspergillus niger (17-39%). For the study of bioleaching processes, species diversity of contaminated soils with focus on microscopic filamentous fungi and bacteria was defined. Identified species of microscopic fungi of soil substrates were *Alternaria* sp., *Aspergillus niger*, *Cladosporium* sp., *Mucor* sp., *Mycocladus* sp., *Paecilomyces* sp., *Penicillium* sp., *Rhizopus stolonifer* var. stolonifer, several species of the genus *Trichoderma* and bacterial strains of the genus *Pseudomonas*, *Rhodococcus*, *Bacillus* and *Streptomyces*.

Key words: Contamination, arsenic, mineralogy, microorganisms, bioleaching, remediation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Phytoextraction of sun flower and maize on the Pb contaminated soils exposing to EDTA and DTPA: An example of Yahyalı region of Kayseri in Turkey

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Abstract

Phytoextraction is proposed as an effective method to remove dangerous elements like heavy metals from contaminated soil using high biomass plants. The aim of this study is to determine the effect of EDTA and DTPA applications with increasing concentrations (0, 4, 8 mmol kg^{-1}) on the phytoextraction of maize (*Zea mays*) and sunflower (*Helianthus annuus*) grown in Pb contaminated soil. It is also aimed to determine the quantity of Pb on the surface of soil and the cleaned part of contaminated soil from Pb. Experiment soil was provided from the Pb-Zn carbonate mines which are located near Kayseri, Yahyalı in Turkey. Plants were grown in controlled greenhouse conditions during 10 weeks. EDTA (ethylenediaminetetraacetic acid) and DTPA (diethylenetriaminepentaacetic acid) were applied to contaminated soil 2 weeks before harvest. At the end of the experiment, total and extractable Pb concentrations of soil and plant have been determined for the purpose of determining the contents of Pb in the sample soil and plants. As a result of EDTA and DTPA applications with increasing doses to the soil which is contained total Pb of 448.64 mg kg^{-1}, the increase of Pb concentration on the bodies of maize and sunflower has been observed. The surge of Pb accumulation in these plants was associated with the surge of Pb level in the soil solution due to the addition of chelates to the soil. It was observed that maize and sunflower was not affected by Pb concentration of high level. Soil pH, EDTA and DTPA were found to have an important influence on the potential capacity of plants to absorb Pb and extractable Pb from soil.

Key words: EDTA, DTPA, lead, maize *(Zea mays)*, phytoextraction, sunflower *(Helianhus annuus)*

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The complex of mathematical models of micromycete sprouting in anthropogenically impacted soils

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Abstract

Soil microscopic fungi (micromycetes) represent a group of microorganisms, which generally benefit soil fertility. Some species take part in cellulose, humus, minerals, biostimulators, toxins and other matters transformations in soil. Many authors believe that the rate of micromycetes fruiting and alteration in population in anthropogenically impacted soils is closely related to microbiota alteration caused by pollutants. Thus, the study of micromycetes colonies growing patterns and their mathematical modeling, as well as changes of the model parameters under anthropogenic impact, is of significant importance. The studies carried out over the years resulted in mathematical models of propagule sprouting and showed the effect of crude oil pollution of soil on the model parameters. The colonies radius alteration patterns in anthropogenically impacted soil were studied. It has been shown that the diffusion processes might be one of the reasons of the radius alteration rate deviation from the linear growth law, as well as formation of ring structures in colonies. The created mathematical models and their changes under the crude oil pollution demonstrate a significant capacity increase in environmental niche regarding opportunistic fungi. This evidence clearly indicates that there has been a significant shift in the structure of the soil fungi compounds in contaminated soil towards dramatic increase in opportunistic fungi. The computational experiments performed using derived mathematical models and their comparison with natural/real experiments provided good correlation between the calculations and experimental data.

Key words: Anthropogenically impacted soil, micromycetes, a mathematical model.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Antimony- and arsenic-bearing secondary mineral phases and their fates in contaminated soils at the abandoned Sb deposit (Slovakia)

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Abstract

Publication summarized results from geochemical and mineralogical studies of soils affected by mining activity at the abandoned Sb deposit in eastern Slovakia. Soils are contaminated mainly by Sb (up to 5757 ppm), As (up to 2484 ppm), Pb (up to 683 ppm) and Zn (up to 407 ppm). Antimony, As and Pb occurs in soils mainly as a part of secondary mineral phases which are products of sulphide oxidation. Pyrite, arsenopyrite, stibnite and sulfosalts (fullopite) is the main source of metalloids and metals in soils. Secondary mineral phases from Poproč soils have significantly heterogenic chemical composition from high Fe and low Sb content to high Sb and low Fe content, and in some cases increased concentrations of Ca and Pb (more than 5 wt. %) in high Sb phases. As a product of sulphide oxidation, formed mainly in the process of precipitation from soil solutions, minerals goethite *α-FeO(OH)* with increased concentrations of Sb (up to 3.14 wt. %) and As (up to 1.29 wt. %) and tripuhyite $FeSbO_4$ with increased content of As (up to 1.14) were positively identified (EMPA, μXRD). Secondary phases with dominant Sb content were identified as valentinite/senarmontite Sb_2O_3, cervantite α-Sb_2O_4 and pyrochlore group mineral "stibiconite" (EMPA). High Sb phases with increased concentrations of Ca (up to 6.48 wt. %) or Pb (up to 20.78 wt. %) were identified as mineral "stibiconite" (EMPA). Presence of these stable secondary minerals can control the mobility of Sb, As and Pb in soils. Mobility of all observed elements in different solvent agents (distilled water, NH_4NO_3, EDTA, AcOH) is very low.

Key words: Antimony, arsenic, tripuhyite, contaminated soil

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Bioavailability of heavy metals (Cu and Zn) after amelioration of contaminated soil

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Abstract

The soil in the region of Zlatitza (Western Bulgaria) is long term contaminated and hygienically loaded by heavy metals (especially by Cu) resulting from the activities of the nearby copper producing smelter. Important factor which further increases the mobility and bioavailability of heavy metals in the soil is its acidity (pH_{H2O} = 4.0). In this way, in the region are formed areas without any vegetation. The objective of this experiment was to investigate the impact of different soil amendments on the bioavailable forms of heavy metals (Cu and Zn) measured in three soil extractants - 0,01M $CaCl_2$, 1M NH_4NO_3 and EDTA. In a pot experiment the polluted soil was ameliorated with three kinds of ameliorative materials – CaO, peat and zeolite with three doses in 12 treatments. A mixture of grasses was used as a test crop and heavy metal concentrations in the biomass were analyzed. The mobility of Cu and Zn increases when the soil pH decreases. A strong negative correlation was found between the soil exchangeable Cu and Zn (in 0,01M $CaCl_2$ and 1M NH_4NO_3) and the soil pH, which is expressed with (R = -0.861 and -0.852 for Cu) and (R = -0.906 and -0.868 for Zn). A positive correlation was found between Zn concentrations in plants and Zn extracted with $CaCl_2$ (R = 0,730) and NH_4NO_3 (R = 0,702).

Key words: Soil pollution, soil remediation, heavy metals, bioavailability, correlation coefficients.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Trace elements (Zn, Cu, Cd and Pb) in soils in the Pannonian Basin in Serbia affected by land use

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Abstract

Agricultural activities can be one of the causes of increased concentration of trace elements in soils. Therefore, land use changes from natural to agricultural systems can affect transfer of trace elements in soil-plant-human chain and the environment. The aim of this research was to investigate the effects of land use conversion on soil total and available concentrations of Zn, Cu, Cd and Pb. The study was conducted in Vojvodina (Pannonian Basin), the main agricultural region of Serbia. Soil samples were taken from 0-30cm depth from forest, arable and pasture land. After DTPA or acid extractions (HNO_3), the concentrations of trace elements were measured using AAS (Shimadzu AA- 6300 / GFA-EX7). The concentrations of the total and DTPA extractable trace elements were on average: 34.64 / 2.53 mg kg^{-1} for Zn; 14.35 / 4.13 mg kg^{-1} for Cu; 0.14 / 0.0002 mg kg^{-1} for Cd; and 14.48 / 0.05 mg kg^{-1} for Pb, respectively. The concentrations of DTPA extractable trace elements correlated positively with organic matter but negatively with soil pH and $CaCO_3$. However, correlations between available and total concentrations of trace elements were week. Land use change from forest to agricultural land has had higher effect on the total than DTPA available concentrations of trace elements, indicated agricultural contribution to soil trace elements concentrations.

Key words: DTPA extractable trace elements, total trace elements concentration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of soil microbial activities by long-term mercury contamination

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Abstract

The suspended matter heavily contaminated by mine spoils from the Idrija mercury mining site (Slovenija), has been transported by the trans-boundary Soča-Isonzo river system for centuries. Therefore, it caused a diffuse Hg contamination of riverside banks soil, with variable concentrations reaching up 80 µg g^{-1}. Mercury is known as one of the most toxic elements for humans and for biological systems in any of its forms, but there is a lack of data about the long-term effects of this element on soil microbial biomass and soil biological activities. The aim of this work was to determine the Hg distribution in soils near the river banks, its chemical speciation and the effects on the soil biological activities in both natural and cultivated soils. By applying the Bloom et al. (2003) five steps selective sequential extraction procedure emerged that soil Hg is in a large part in the form of cinnabar (HgS) (72.9÷94.1%), whereas the presence of the most bioavailable forms (water soluble, acid soluble and organo-chelated) is generally low. Soil microbial biomass, estimated by the fumigation-extraction method, was not adversely affected by Hg contamination as many soil enzymatic activities (FDA hydrolysis, β-glucosidase, alkaline phosphatase) with the exception of arylsulphatase and acid phosphatase, which showed significant negative trends with total mercury and its fractions. Soil respiration and specific soil respiration (QCO2) did not show any clear trend with soil organic carbon and neither showed any significant decrease at high levels of Hg contamination, confirming the absence of a generalized microbial stress in our soils. Methanogenesis appeared not affected by either long-term Hg contamination or Hg acute additions. On the contrary, methane-oxidation was strongly depressed both in long-term contaminated soils and after acute addition of Hg up to 100 µg g^{-1}. The contrasting effects on microbial communities involved in methane synthesis and degradation may alter the flow of CH4 from the soil system. The result of this work shows that although some general soil microbial activities have not been altered by long-term Hg contamination other biological activities linked to specific microbial groups may be significantly depressed.

Key words: Mercury, Hg speciation, soil microbial biomass, soil biological activity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assisted bioremediation tests on three natural soils contaminated with benzene

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Abstract

Bioremediation is an attractive and useful method of remediation of soils contaminated with petroleum hydrocarbons because it is simple to maintain, applicable in large areas, is economic and enables the total destruction of the contaminant. But, often, autochthones microorganisms have no ability to degrade these compounds and the contaminated sites have inappropriate environmental conditions for microorganism's development. These problems can be overcome by assisted bioremediation (bioaugmentation and/or biostimulation). In this study we evaluated the assisted bioremediation (bioaugmentation and biostimulation) capacity on the rehabilitation of three natural soils (granite, limestone and schist) contaminated with benzene. Two different types of assisted bioremediation were used, without and with ventilation (bioventing). The bioaugmentation was held inoculating the soil with a consortium of microorganisms collected from the protection area of crude oil storage tanks in a refinery. In unventilated trials biostimulation was accomplished by the addition of a nutrient mineral media, whereas in bioventing oxygen was also added. The tests were carried out in stainless steel columns with 3,927 L volume, using samples of 2000 grams of moist soil contaminated with benzene (200 mg per kg of soil), at a controlled temperature of 25 ºC. The processes were monitored in discontinued mode through daily measurements of benzene concentration in the gas phase, by gas chromatography (GC-FID), and oxygen and carbon dioxide concentrations by respirometry. The results revealed that contaminated soils can be remediated using both technologies, nevertheless the bioventing showed faster rates. The respirometric analysis proved to be an adequate instrument for controlling the biological activity. (Acknowledgements: This work was supported by FEDER funds through the Operational Program for Competitiveness Factors - COMPETE and National Funds through FCT - Foundation for Science and Technology via the project PTDC/AAG-TEC/4403/2012 (ISIS)).

Key words: Bioremediation, bioventing, respirometry, soils, benzene.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Using the triad approach to urban soil samples quality assessment

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Abstract

Urban soils are highly complex and heterogeneous mixtures of many contributing materials and associated contaminants as a result of many different processes. This is especially true of soils in those urban areas of Russia that have been or still are centers of industrial activity. Such centers contain a legacy of anthropogenic chemicals deposited in the soil environment and these chemical substances may pose potential risks to urban soil degradation. The following Triad-based parameters were employed: *i)* chemical soil analyses (revealing the presence of potentially dangerous heavy metals), *ii)* ecological parameters (assessing changes in microorganism's community structure and functions, bioindication); *iii)* toxicological bioassays (utilizing classical endpoints such as survival and reproduction rates). We studied variables at 6 references sites of urban soil in Kirov, Russia (58°35'24"N 49°40'11"E) for two years. The assessment of heavy metal concentration (Pb2+, Ni2+, Cr3+, Cd2+), toxicity indices in acute tests using organisms from different trophic levels: producers (green algae and higher plant): consumers (crustaceans and protozoan). *(iii)* reducers (luminescent bacteria) as well as the bioindication indices using biodiversity parameters of bacteria and fungi communities (with detection the presence of dark-pigmented toxicant-resistant micromycetes) in the soil samples were obtained. We combined these three types of environmental variables using different combinations of standardization (conversion to a common unit) and weighting schemes to produce a single Environmental Risk Index (ERI). Results obtained that all potentially polluted sites (affected by vehicular traffic emissions) have shown high levels of ERI, suggesting a general change from reference conditions. The Triad based approach we used provides a sensitive index of urban soil condition that is easily interpreted. It may be suitable for measuring restoration success or the impact of any anthropogenic disturbance in a variety of ecosystem types. (Acknowledgement: *This work is supported by Russian Foundation for Basic Research /grants No 14-04-31293-mol_a and No 12-04-01230-a).*

Key words: Ecological risk assessment (ERA), transport, chemical pollution, heavy metals, bioindication, bioassay.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Agroecological and agrochemical status of technosols due to opencast mining in Bulgaria

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Abstract

The power industry as a major sector in the economy of Bulgaria is associated with the coal mining. The open coal mining damage the land and an environment as a whole in the industrial areas. These damages are refunded legally a certain way (Regulation 26, 2002). The reclaimed land in the coal mining area recovered first by filling of geological materials with suitable physicochemical properties and surface deposition with natural soil at least 40 cm. Sometimes due to deficiency natural soil materials, recultivation of soils is humus free with direct biological reclamation. The present study presents two mining areas, technogenetic areas constructed - by two methods of reclamation - humus and humus free direct. Evaluated is the availability of nitrogen, phosphorus and potassium as essential nutrients in Technosols of both the reclaimed areas. Compared are the contents of heavy metals in reclaimed Technosols reference to the maximum allowable concentrations normed by the Bulgarian legislation. This research concluded that the studied Technosols irrespective of the method of reclamation have significant deficiency of nutrients, along with the for some of them was found and a load with heavy metals.

Key words: Open cast mining, reclamation, Technosols, availability of nitrogen, phosphorus and potassium, maximum allowable concentrations of heavy metals.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The use of sewage sludge for the fertilization of three different species of energy crop

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Abstract

During a long-term field experiment, the effects of fertilization with sewage sludge on yield and chemical composition of three species of energy crop (*Miscanthus giganteus*, *Salix viminalis L.* – osier, *Sida hermaphrodita* – Virginia mallow) were examined. Sewage sludge from Skierniewice Municipal Wastewater Treatment Plant (Poland), was used in two doses (10 t_{dm} ha^{-1} and 20 t_{dm} ha^{-1}). In order to improve its properties, before application, sewage sludge was enriched with brown coal ash from Bełchatów Power Plant (Poland). The control groups did not include fertilization. The study presents results from years 2010 - 2012. Fertilization with sewage sludge had an impact on the increase of miscanthus and osier yield. There was no significant impact on the yield of Virginia mallow. In comparison with the control, increase of nutrient concentration in biomass of fertilized crops was observed. The amount of nutrients accumulated in above-ground parts of tested crops indicates a significant return to the soil with leaf fall and physiological runoff to the underground crop parts. Fertilization with sewage sludge improved physico-chemical soil properties. In fertilized soil the sorption complex capacity, organic carbon content and total nitrogen content increased. Increasing doses of sewage sludge did not influence the content of heavy metals in soil, only zinc content increased with sewage sludge dose. Differences in the uptake of heavy metals from soil was observed in case of the amount of yield, sewage sludge dose and concentration of heavy metals. Results allow to initially conclude that tested plants can be used for phytoremediation of heavy metals from soil contaminated by these elements.

Key words: Sewage sludge, miscanthus, osier, Virginia mallow, phytoremediation

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Tracing the metal dynamics in semi-arid soils near mine tailings using stable Cu and Pb isotopes

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Abstract

Wind-blown dust from mine tailings enriched in metals constitutes an important source of pollution for soils. Here, we studied the dynamics of Cu and Pb in eight soil profiles (Luvisols, Chernozems), located at various distances from the tailings dams near a closed Cu-Pb-(Zn)-Ag mine at Kombat (Namibia). Tailings, soils, and bedrocks were analysed for bulk Cu and Pb concentrations, for their chemical fractionation using the sequential extraction procedure, and the isotopic compositions of Cu and Pb. The tailings were mainly composed of carbonates, and contained up to 4790 mg Cu/kg and 1900 mg Pb/kg. Copper concentrations in uncontaminated soils were relatively low (21.9-54.1 mg/kg), whereas soils near the tailings exhibited significantly higher Cu levels (44.5-757 mg/kg). Similarly, Pb concentrations in uncontaminated and contaminated soils were in the range 18.6-34.6 and 38.5-815 mg/kg, respectively. The sequential extraction indicated that Cu occurs in soils in more "labile" forms; whereas, Pb is more tightly retained in the soils. The Cu and Pb distributions in the soils indicated their vertical migration in the profiles. The basement rocks yielded negative δ^{65}Cu values (-0.368 to -1.062‰) and highly variable ^{206}Pb/^{207}Pb values (1.158-1.124). The tailings materials, had positive δ^{65}Cu values (+0.144 to +0.820‰), and ^{206}Pb/^{207}Pb clustered around the value of 1.150. Whereas Luvisols were mostly characterized by an increase in Cu concentration, and changing δ^{65}Cu values as a function of depth; Chernozems mostly yielded uniform Cu concentrations and isotope compositions in all soil horizons, clearly contrasting with the isotopically lighter composition of the carbonate bedrocks. The isotope multitracing revealed that the Pb composition of the soils is a result of a simple mixing between end-members; whereas the Cu isotopic composition was affected by other biogeochemical processes.

Key words: Soil, mine tailing, lead, copper, pollution.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Data manipulation of correlations between soil properties and GHG emission

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Abstract

Apart from the water vapours, carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) are important greenhouse gases (GHG) contributing 60, 20 and 6% towards global warming, respectively (IPCC, 2007). Researches of greenhouse gases emission and climate change require relatively huge amount of data. The objective of the present study was to develop input correlations between attributes of soils and their GHG production potential. Generally, these data can be inducted from measuring devices directly or from different systems like geographical information systems and some other specific systems which are used for experimental data storage and management. A software development which store and manage these different data under one platform can be useful for research and development projects. In the present study, one physical data table was generated for data-manipulation and data storage using a web- developed platform. Data storage with four columns usage assures possibility for continuous refinement during the researching processes, because new variables could be determined after the entities identification process. One of the most important benefits from such development will be that researchers could be able to store and manage data from different systems under one platform using one physical data table.

Key words: Greenhouse gases (GHG), soil properties, data manipulation, non-relational database, four column data storage.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of optimal number of soil samples for detail reconstruction of initial field of Cs-137 contamination in Chernobyl affected areas

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Abstract

A Chernobyl-derived Cs-137 fallout became a reason of formation of non-uniform field of radionuclide contamination along vast territory of the Europe. It was assessed after detailed field investigation within few river basins located in areas with different level of Chernobyl contamination, that existing radioecological maps composed during last two decades are not enough detailed for evaluation of large-scale assessment of initial contamination field transformation by the lateral migration processes of the Chernobyl-derived Cs-137 . The only way for researcher to overcome of this problem is additional soil sampling for evaluation of Chernobyl-derived Cs-137 concentration in different locations within study catchment for following creation of detailed radioecological maps based on collected data. It is necessary to evaluate the optimal number of samples which should be taken in each sampling point for receiving statistically correct results of radionuclide concentration. Special investigation was undertaken in few catchments (S= 2-50 km2) of the Central Russia, located in areas with different levels of initial Chernobyl contamination, for evaluation the optimal number of samples, which should be taken in each sampling point for the determination of Cs-137 concentrations error not exceed 30 % on 95 % significance level. Results of investigation will be presented.

Key words: Cs-137, soil sampling, evaluation of contamination, small catchments, radioecological mapping.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The removal of fluorene from soil by soil washing with a non-ionic surfactant

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Abstract

Organic micro-pollutants are widespread in natural environment, often related to human activities. Heavily contaminated soils are frequent around industrial plants using petroleum or coal. Among these compounds, polycyclic aromatic hydrocarbons (PAHs) are a class of special interest. Some of these PAHs are on the U.S. Environmental Protection Agency (EPA) List of Priority Pollutants. They are highly toxic and carcinogenic substances, often produced by incomplete combustion of carbon compounds. Their solubility in pure water is low, typically less than 10^{-4} M and they are strongly adsorbed in soils, especially onto terrestrial colloids. Their adsorption onto soils strongly limits the efficiency of remediation techniques. There are several treatment Technologies used for the removal of PAHs. Soil washing, a treatment technology used for removing contaminants from polluted soils, is largely based on the use of aqueous surfactant solutions and exploits both the solubilization capabilities of micelles and the lowering of the interface tension between the washing liquid and the soil particles, thus facilitating the solutes desorption and their exit from the soil pores. Surfactant-enhanced remediation has been, in particular, proposed as a suitable approach for removal of hydrophobic organic pollutants and the performances of different amphiphiles have been reported. Among the proposed amphiphiles, non-ionic surfactants have been often employed on the basis of their high solubilization capabilities and low critical micelle concentrations, CMC (that is the amphiphilic concentration at which theaggregation of monomer occurs, giving rise to the formation of micelles), whereas anionic surfactants have been usually selected taking into account their lower adsorption on the soils. The aim of this study was to investigate the removal of fluorene (Flu) from a contaminated soil by soil washing using a non-ionic aliphatic surfactant, Brij 58. In order to determine the optimum soil washing condition different experimental conditions were examined Therefore, the influence of treatment time, surfactant concentration and soil/surfactant ratio on the soil washing efficiency was investigated. Results show that the maximum fluorene removal from soil by Brij 58 was obtained in 48 hours with a Brij 58 concenration of %1 and a soil/surfactant ratio of 1/5.

Key words: Polycyclic aromatic hydrocarbons (PAHs), soil washing, surfactant, soil remediation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Heavy metal contamination in a soil of an industrial area in Sfax in the South of Tunisia

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Abstract

The purpose of this study was to investigate heavy metal concentrations in soils of an industrial area in Sfax (South of Tunisia). This polluted soil is within the industry cluster of Sfax characterized by a high industrial density (The Industrial Society of Phosphoric Acid and Fertilizers, Paint industry, Lead foundry…). Soil samples were collected in the top 15 cm of the soil layer (P1) and in 15 to 30 cm depth (P2) from two zones: zone 1(Z1) distant at 2,5 km and zone 2 (Z2) distant at 5 km from the polluted source. Soil samples were collected over seasonal periods between January 2012 and December 2012. Heavy metals (Cd, Pb, Cu, Zn, Fe and Al) have been analyzed in the different samples. The results related to the heavy metal concentration over the experimental period showed a high seasonal variability for heavy metal content in soil and a strong dependence on depth and on the rainfall patter occurring in the study area. The maximum values of heavy metals were obtained in spring and summer in the top 15 cm of the soil layer coinciding with the lowest rainfall; while the lowest values were generally obtained during periods of high rainfall (autumn and winter) in depth 0 to 15 cm .In soil from zone 1, the soil Zn, Cu, Pb et Cd contents in the first layer (0-15 Cm) were of 91.0, 48.0, 33.0 and 11.5 mg / kg, respectively during summer season. On the other hand, the mean values of all the heavy metal concentrations were higher in the soil from zone 1, if compared to that of the zone 2. Overall, in both soils from both zones, metal concentrations extended the limit for healthy soil.

Key words: Heavy metal contamination, industrial city, atmospheric pollution, soil metal concentrations.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biochemical responses of *Olea europaea* L. cv. chemlali exposed to air and soil pollution near the industrial complex in Sfax, Tunisia

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Abstract

The present study was performed in the vicinity of the industrial complex in the south of Sfax, Tunisia, in order to evaluate the response of *Olea europaea* L. cv. chemlali, one of the most important commercially valuable crops in Tunisia, to the impact of complex air and soil pollution. Field experiments included sampling of leaves and roots from olive trees in contaminated soil and air, are compared with invidious cultivated in unpolluted areas. Results obtained in this investigation showed that air and sol pollution induced an increase in the rate of hydrogen peroxide (H_2O_2) production, electrolyte leakage, and lipid peroxidation in all plant parts, indicating oxidative stress. This redox stress affected leaf chlorophyll and carotenoid content. Additionally, the activities of proteins involved in reactive oxygen species (ROS) detoxification were affected. Air and soil pollution induced an increase in antioxidant enzymes activities such as ascorbate peroxidase (APX), superoxide dismutase (SOD) and catalase (CAT). Likewise, antioxidant molecules polyphenols, flavonoids and anthocyanin contents were strongly induced by pollution, consistent with the role of these potent antioxidants in scavenging ROS such as H_2O_2. These results demonstrated the harmful impacts of inductrial activity on antioxydative defense system of *Olea europaea* L. cv. Chemlali, extended in arid region in Tunisia.

Key words: Air pollution, olive tree, arid region, ascorbate, superoxide dismutase, catalase.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Neotyphodium-endophytes mediated tolerance to soil abiotic stresses

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Abstract

Soil salinity and drought and soil polluted with heavy metals are important environmental constraints affecting food chain for human and other macro- and micro-organisms. *Neotyphodium* endophytes are a group of asymptomatic fungi residing within the aerial parts of many cool-season grasses which increase their host tolerance to soil common abiotic stresses. To study endophyte infected (E+) hosts under abiotic stresses compared to endophyte-free (E-) counterparts in the model plant of tall fescue, *Festuca arundinacea*, naturally infected plants were collected from their habitats. The plants were clonally propagated and a part of their tillers were treated with a fungicide mixture containing propiconazole and tebuconazole to prepare endophyte-free plants with the same genotype to the primary source. Infected and non-infected clones were exposed to water deficiency or planted in saline soil or soil contaminated with heavy metals. Under drought and salinity, E+ plants exhibited higher survival rates, increase in root dry matter and a lower shoot-to-root ratio. Endophyte infected plants accumulated more potassium (K+) and had a greater K+:Na+ ratio in their shoots in response to soil salinity. Generally, higher content of Zn and lower content of Ni and Cd were found in E+ plants compared to E- counterparts in soils contaminated with Zn, Ni and Cd high concentrations. In some genotypes, fungal endophyte increased the plant capability to accumulate and tolerate high concentrations of heavy metals, a characteristic useful in polluted soils phytoremediation. Understanding the involved mechanisms of endophyte-mediated plant tolerance to limitations in soil productivity may extend the use of Neotyphodium-grass combinations for forage production, landscape designing and/or phytoremediation in soils affected by abiotic stress conditions.

Key words: Heavy metal, festuca, neotyphodium, phytoremediation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Agronomic benefits and environmental risks of applying nitrogenous fertilizers to sandy soils cultivated with watercress

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Abstract

Glasshouse vegetable trial was conducted for two seasons using watercress as a common salad leafy vegetable, with the aim of evaluating the agronomic benefits and environmental risks of applying different combinations of organic and inorganic N fertilizers to a sandy soil. The results showed that, all fertilizer application rates had the capacity to stimulate vigorous growth, nutritional status of watercress plants, and to increase N recovery and concentration by watercress plants compared to control. Over both seasons of this study, all these improvements in growth quality parameters of watercress plants were in most cases not significantly different at the higher fertilizer application rates of 280 and 420 kg ha^{-1}. This finding indicates that the plant response due to the increasing of fertilizer application rate is subject to diminishing returns. Where the diminished yield per unit of fertilizer N addition was clearly seen, beyond which further additions will not improve the yield. Results of this work showed that, major considerations in applying of inorganic N fertilizers alone on sandy soils cultivated with leafy vegetables are the increase in residual nitrate in soils, the increase in groundwater contamination potentials by nitrate, and the threat of nitrates build-up in plant tissues. Under conditions of this study, high application rates of inorganic nitrogen fertilizer (420 kg ha^{-1}) caused high levels of nitrate accumulation in watercress plants, and on being consumed by living beings, pose serious health hazards. In general at the rate of 280 kg ha^{-1} equal combined organic and inorganic fertilizers, no health problems could be foreseen to humans or animals from food chain movement of nitrates. Under the conditions of this study, incorporation of combined organic and inorganic fertilizers into sandy soil cultivated with leafy vegetables at the rate of 280 kg ha^{-1} nitrogen using drip irrigation system was the best management strategy practice to reach optimum agronomic benefits while minimizing environmental impacts.

Key words: Health hazards, leafy vegetables, nitrate pollution.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of stabilized zero valent iron nanoparticles for Pb (II) immobilization in sandy spiked soils

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Abstract

Lead (Pb) contaminations of soils are a great concern for the human life and the environments. Application of zero-valent iron nanoparticles (ZVINs) for Pb (II) removal from aqueous solution and in-situ immobilizations of Pb in soils can potentially be a promising approach. The most important factor in application of ZVINs is low durability and reactivity. This study was conducted to synthesize and characterize the acid ascorbic stabilized-ZVINs under aerobic condition and assess their performance on Pb immobilization for sandy Pb^{2+}-spiked soils. Batch experiments were performed in a solution to soil ratio of 10:1 using various concentration of Fe^{0} (0, 0.5, 1 and 2g L^{-1}) for Pb immobilization of soils spiked with 0, 50, 150 and 450 mg kg^{-1} Pb (II) for 120 minutes contact time. The synthesized zero-valent iron particles had the diameters lower than 50 nm. Results showed that the Pb (II) immobilization in soils was increased from 12.6% to 92.6% in the sandy soils as the ZVINs dosage was increased from 0.5 to 2 g L^{-1}, representatively. Moreover, Pb (II) immobilization decreased from 44 to 35% as the initial Pb (II) concentration of spiked soils increased from 50 to 450 mg kg^{-1}. Results herein demonstrated that the high durability and reactivity of the novel synthesized stabilized-ZVINs suggesting a considerable approach for immobilization of Pb for contaminated soils.

Key words: Immobilization, lead, spiked soils, zero-valent iron nanoparticles.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Impact of trifluralin herbicide on nitrification and autotrophic nitrifying bacteria

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Abstract

In vitro experiment for 2 month were conducted to know the impacts of Trifluralin herbicide as recommended dose, over dose and low dose on the inhibition of Nitrification in calcareous soils, result shows the hazardous impacts of this herbicide on the production of both NH_4-N and NO_3-N respectively, nitrification totally inhibited during the first week of incubation of herbicide application to be 90%, 80%, 70% for over, recommended and low doses respectively without N source application after 2 month, inhibition of NH_4-N production remain 60% with over dose and 75 ppm N fertilizer at the end of experiment , then decreased to 38% with over dose and 150 ppm N fertilizer, to be enhanced positively with 225 ppm at same period. While the production NO_3-N increased with increasing N application and the incubation duration with all doses of herbicide and inhibited only 9% with over dose and75 ppm N fertilizer to be enhanced with the rest of herbicide doses at the end of experiment.

Key words: Nitrification inhibition, trifluralin herbicide, nitrifying bacteria, ammonia, nitrate.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Technogenic impact of motorways on adjoined agrocenosis in the black soil zone of the Southern Russia

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Abstract

Wide areas of industrial crops in black soil zone are situated along large motorways. There is an unfavorable ecological situation here due to heavy metals entering the soil and plants. Goal of research: evaluation of the role of windbreaks in restraining of heavy metals entering the soil and plants in agrocoenosis located near large motorways. Farther from the motorway, beginning from a distance of 50 m the increase of potential stock of lead mobile forms in the soil is recorded, as for current stock it is recorded at a distance of 50 m and 100 m from the motorway. The excessive amount of lead in winter wheat grain was found at a distance of 10m, 50 m and 100m from the motorway Consequently, windbreaks as a land reclamation factor are not able to control it.

Key words: Black soil zone, heavy metals, agro-forestry.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of arbuscular mycorrhizal fungi on phosphorus uptake by tall fescue in a cadmium contaminated soil

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Abstract

Arbuscular Mycorrhizal Fungi (AMF) as soil inhabitant microorganisms help plant species uptake water and nutrients and make physiological changes to increase growth and productivity of host plants in stress environments. Heavy metal pollution of soil is a significant environmental problem which inhibits plant nutrients uptake and ceases normal plant growth. In this study, the symbiotic effect of AMF was examined on phosphorus uptake by tall fescue, as an essential nutrient that increases shoot and root biomass, in a soil contaminated with different concentrations of cadmium. A greenhouse pot experiment was conducted in which plants were grown in plastic pots (17×25 cm) containing silty-clay soil contaminated with five ratios of cadmium including 0, 5, 10,15and 20 mg Cd per kg of dry soil. Potted soil was also inoculated with *Glomusmosseae* mycorrhizal fungus (100 g standard inoculum per pot) in3 replicates before planting to compare with those remained un-inoculated. Tillers were separated from a natural collected tall fescue (*Festucaarundinacea*) genotype and five tillers with the same size were planted in each pot. Pots were arranged according to a completely randomized design and kept in a normal greenhouse and watered were needed during about three month of experiment. The results showed that cadmium contamination decreased phosphorus uptake in shoots and roots of tall fescue. The highest and lowest concentration of phosphorus was measured in soil containing 0 and 20 mgkg−1 of Cadmium, respectively in both shoots and roots of tall fescue. Colonization of roots by *Glomusmosseae* mycorrhizal fungus had also significant and positive effect on increased uptake of phosphorus in roots and shoots of tall fescue compared to un-inoculated treatments. It seems that AFM may mitigate toxic effects of heavy metals on the plants possibly through improving absorption of some nutrient macro elements.

Key words: Mycorrihzal fungi, *Glomusmosseae*, phosphorus, tall fescue, cadmium.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Remediation by enhanced natural attenuation techniques of crude oil contaminated soil in the Mbodo community, Port Harcourt, Nigeria

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Abstract

The study evaluates the soil properties response to crude oil pollution using remediation by the enhanced natural attenuation (RENA) technique. 600g of uncontaminated soil was collected from the top soil (0-15cm) depth around Agbada 1 Flow Station, Mbodo Community, Aluu, Port Harcourt City, Nigeria. This site was chosen because of the possibility of soil in the area to be polluted with crude oil in future. The soil sample was air-dried and carefully sieved with 2mm diameter mesh. 200g of the soil remained uncontaminated with crude oil and this is called sample A which was the control while the remaining 400g of soil was contaminated with 1ml of Bonny Light type of crude oil and left for a week. Thereafter, the contaminated soil (Sample B) was subdivided into two equal parts (200g) namely sample B1 and sample B2. Sample B2 was fertilized with 1g of NPK 15-15-15 fertilizer, while sample B1 remained contaminated but unfertilized. The experiment was left for another week in the laboratory under room temperature. Laboratory analysis was then carried out on the soil samples (A,B1 and B2) every week for a total period of four (4) weeks on the concentrations of soil pH, total organic carbon, nitrate, sulphate, available phosphorous, cadmium, chromium, sodium, lead, iron, potassium, total petroleum hydrocarbon (TPH), moisture content and water holding capacity. Descriptive statistics was used to explain the concentrations of the soil properties in response to crude oil contamination in both fertilized and unfertilized contaminated soil samples. A TPH concentration of 6820 mg/kg was achieved after spiking and tilling of contaminated soil. There was a reduction in the TPH level from 7150mg/kg on the first day of application of fertilizer to 2550 mg/kg after day 28 (4^{th} week). The water holding capacity and moisture content increased with time from 35.6% and 59.4% on the first day to 47.7% and 65.3% on the 28^{th} day respectively. Finally, Cd reduced with time after the application of fertilizer from 0.09 mg/kg to 0.04 mg/kg. The study recommended among others that there should be a periodic monitoring and management of oil spill sites in oil producing communities to sustainably manage soil for food production and prevent loss of biodiversity.

Key words: Remediation, natural attenuation, crude oil, Mbodo.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The heavy metal contamination of soils roadside area in Rostov-on-Don

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Abstract

The object of research is ordinary calcic chernozem along the highway between city Rostov-on-Don and Novocherkassk. Samples were taken from the layers 0-5 cm, 10-15 cm and at 5, 15, 50, 100, 200 and 290 meters from the highway. Determination of heavy metals was carried out by X-ray fluorescence method by Spectroscan "MAX-GV". The accumulation and distribution of priority pollutants in the profile of urban soils – V, Zn, Pb, Cu, Co, Ni, was investigated. The some additional parametres were determined in this soil samples: total humus content according the method by Tyurin, particle-size fraction by "pipette method" (preparation of soil for analysis by sodium pyrophosphate) and the pH of the aqueous suspension potentiometrically. The results of the two-year study showed that the maximum permissible concentration is observed in the three heavy metals: cobalt (3,1 MAC), copper (1 MAC) and lead (3 MACs). In Rostov-on-Don lithochemical anomalies of cobalt were observed in the northern part of the city. In the soils, tested for cobalt and nickel, the profile excess of the maximum allowable concentration (MAC) is absent. The excess of copper maximum permissible concentration singly, from which one can make the assumption that it accidentally (bringing household waste, construction waste, etc.). Accumulation of lead due to the work of internal combustion engines of motor transport, as the distance from the highway deep into the forest park lead content naturally decreases. Vanadium, nickel and zinc exceeded typical background concentrations. We can conclude that anthropogenic accumulation of these elements do not go beyond permissible concentrations. As measured by total score of soil contamination in the forest park area around the airport "Rostov- on-Don" classified as soils with an acceptable level of pollution. Coefficient of overall pollution of soils varies from 1.97 to 8.34. Calculation of correlation coefficients between the total content of heavy metals and soil characteristics (humus content and physical clay, pH) confirmed the existence of a close direct relationship between these parameters.

Key words: Pollution, urban soils, heave metals, chernozem.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Analysis of heavy metals proportion in soils for diagnostics of technogenic pollution risk

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Abstract

There analyzed the content of Ni, Co, Cu, Cr, Mn, Zn, Cd, Pb, As, Fe in soils and plants in the zone of influence of ferrous metallurgy and metalworking (Perm). Ratio of the contents of these elements in soils and plants were evaluated statistically in the indexes of availabilities. The nickel containing changed most strongly with distance from the source of contamination. Changing the nickel level in the soil is negatively correlated with level of Fe and Mn in soils, and positively with the Fe / Co, Fe / Cu and Fe/other elements relationship balance. This suggests that the main phase of the input polluters elements in the region are iron - nickel mineral particles. Coupled with a high iron level in the background soils nickel becomes an indicator on the degree of contamination. Level of technogenic Pb in soils and Ni in plants from conjugate sampling sites negatively correlated. The effect of increasing the nickel level in the soil to plants shows up only indirectly. With increasing content of Ni in the surface layer of the soil, the ratio of the content of Cd / Co and Mn content in plants also increases. We have thus shown that intense anthropogenic soil contamination may be accompanied by the formation of factor indicator reflecting the change in the chemical speciation of soils and plants.

Key words: Heavy metal proportion, technogenic soil and plant contamination, factor indicator formation..

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Concentration and spatial distribution of total and bioavailable heavy metals in top soils in Taham district of Zanjan province, Iran

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Abstract

Toxic elements like heavy metals are natural constituents of the earth's crust and a number of these elements are biologically essential at trace levels and play an important role in human health. Heavy metal contamination of soil is a widespread problem in Zanjan province located in North West Iran due to natural pedogeochemical background and anthropogenic sources. Taham district was selected for detail study and the objectives of the study were set to evaluate the total as well as bioavailable fraction of heavy metals in surficial soils within the studied area. 57 surficial soil samples were collected and analyzed for heavy metal contamination by Atomic Absorption Spectrometry (AAS). The obtained results when compared with WHO and EPA standards show a very high concentration of some toxic metals notably As, Pb and Cd. Bioavilable fraction of studied metals was also measured with formation of metal complex with Diethylene Tri Amine Penta Acid (DTPA) agent. To find the share of the anthropogenic sources in the contamination of soils, the Enrichment factor (Ef) and Geological accumulation index were measured and the distribution maps were drawn using Arc GIS (9.3). High concentrations of some toxic metals like As, Pb and Cd were found in isolated patches in North West, East and South West of the studied area originating both from pedogenic as well as anthropogenic sources. Soil contamination by metals was very high around industrial town and agricultural lands within the studied area. The most effective factors responsible for high concentrations of other elements like Cu, Co, Ni and Fe in soil were found to be pedogenic in nature.

Key words: Heavy metals, enrichment factor, geological accumulation index, Taham district, Zanjan, Iran.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Studies on different concentration of Lead (Pb) and sewage water on Pb uptake and growth of Radish (*Raphanus sativus*)

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Abstract

To investigate the accumulation of Lead (Pb) by Radish (*Raphanus sativus*) cultivars a study was carried out at Department of Soil and Environmental Sciences, Gomal University, Dera Ismail Khan (Pakistan) during year 2012. Two verities of Radish i.e. exotic and local were used. The treatments included sewage water and different concentrations of Pb @ 25, 100, 200 and 400 mg L^{-1}). The results of the study showed that both radish verities were non – significantly influenced by the application of Pb concentrations and sewage water except for root diameter which was significantly greater in the local cultivar (3.261 cm). The treatments of lead significantly reduced the growth and yield of the both the cultivars. While the Pb uptake by the root and leaf of radish plants was increased by the increasing the lead levels, with the highest value for root (19.008 mg kg^{-1}) and leaf (16.134 mg kg^{-1}) in the treatment receiving the highest concentration of Pb. The total biomass, fresh weight of root and root diameter was found significantly higher in the plants receiving sewage water as compared with the control and different levels of Pb. The lowest values for these were found in the treatment receiving Pb @ 400 mg L^{-1}.The interaction amongst the verities and treatments were found significantly different for various parameters. It may be concluded from the study that the use of sewage water and lead concentration showed higher buildup in the plant root and may lead to different types of health problems.

Key words: Lead (Pb), sewage water, radish cultivars, Pb uptake.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Use of synthetic clay for removal of diclofenac anti-inflammatory

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Abstract

Pharmaceutical substances are of great interest in the environmental context in recent years because they were developed to be biologically active and can have the same physicochemical behavior for the trans-membrane movement, be persistent, accumulate and present biological effects on organisms that were not foreseen on the aquatic and terrestrial ecosystems. The presence of certain drug products and their derivatives or metabolites has been widely established worldwide in particular in surface and groundwater, wastewater, mud of water purification plants used in land farming and in soils. Current knowledge of the risks of these substances on the natural environment are limited, but it is important to address the problem of drug residues that are now present at concentrations like many pesticides and some of which have already caused effects on wildlife. These threats make it imperative to improve our knowledge of disposal methods of pharmaceutical substances in wastewater. Several studies have shown that layered double hydroxides (LDHs) can be used for the trapping of organic and inorganic chemical pollutants, especially those having anionic or acid character, because of their very high anion exchange capacity. The LDHs are similar to the natural hydrotalcite $Mg_6Al_2(OH)_{16}(CO_3)\bullet 4H_2O$, in which magnesium cations are replaced by aluminum cations. The partial substitution of trivalent cations by divalent cations generates an excess of positive charge on the sheets which is compensated by anionic species intercalated into the interlayer space, with water molecules. The most common anions in the interlayer space of LDHs are carbonate due to their small size relative to their charge, which have a very high affinity for these matrices and, therefore, they are difficult to be exchanged. In this work, we were interested to study the possible use of LDH for the elimination of diclofenac anti-inflammatory non steroidal in aqueous solution by sorption on a hydrotalcite on Mg-Al-CO_3 and by its calcination product. This environmental use is very different from the slow release supporting of the LDH, because its sorption capacity for diclofenac should be assessed as much lower concentration as it could correspond with its presence in surface or ground waters. We conducted tests of sorption to determine the optimal conditions for sorption of diclofenac on these solids (kinetics, solution pH, initial concentration of diclofenac, the sorbent mass and temperature).

Key words: Calcined hydrotalcite, diclofenac, sorption capacity, desorption.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Characterization of fluor and cadmium accumulation in polluted soil in an industrial zone in Sfax city during two critical periods

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Abstract

In recent decades, pollution of the environment has become a problem which affects almost all of the country. The industrial society of phosphoric acid and fertilizers (SIAPE), located 5 miles in the south area of Sfax (Tunisia), is at present the main source of air pollution in Sfax. Our study deals with the effect of air pollution on soil characteristics especially the determination of fluorine and cadmium level in July and April. The relationship of these two elements with the physico-chemical parameters of the soil was investigated. Analyses of the different physicochemical and mineralogical parameters of the soil in comparison with those of the control soil have enabled us to see a considerable reduction in both cadmium and fluorine during the spring (April 2011) season over the summer one (July 2010). In addition, the study of the distribution of concentrations of cadmium and fluorine at the level of different horizons showed that these concentrations decrease as one moves away from the transmitting source and with the depth. Our data also show that an acid pH appears to favour an increase in pollutants at ground level, as well as their mobility. Similarly organic matter seems to play an important role in the complexation of these pollutants by adsorption on mineral and organic colloids. Furthermore, the results of analyses of the various correlations, argue in favour of complexation of fluoride and cadmium with various organic and inorganic molecules.

Key words: Atmospheric pollution, soil, fluoride, cadmium.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of sharp-interface seawater intrusion modeling for layered coastal aquifers

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Abstract

The flow processes of layered coastal aquifers have received significantly less attention than the more simplified single-layer case, despite that stratified aquifers are widespread. In this study, the results of sharp-interface models were compared with dispersive modeling and sand-tank experiments to evaluate its applicability in multi-layered aquifers. Both steady-state and transient conditions are considered. Our findings showed sharp-interface modeling matches reasonably well with the steady-state salinities of the sand-tank experiments, although significant differences are observed during transient phases. The results indicated that sharp-interface models over-predict the toe position which is consistent with previous studies. A comparison between sharp-interface and dispersive model leakage fluxes showed that the freshwater leakage flux in sharp-interface modeling matched well with fluxes from the dispersive model along the tank, but the amount of saltwater leakage flux was negligible in sharp-interface modeling comparing to freshwater flux. The applicability of sharp-interface modeling was completed with simulations that representing a layered coastal aquifer in real scale. A 30 m high aquifer with two partially high permeable layers at the height of 14 m in top and bottom and a thin 2 m aquitard between them was selected for this purpose. Different scenarios including different aquitard conductivity (K) and aquifer freshwater inflow have been introduced to the models. The simulations demonstrated that the sharp-interface modeling depending on appropriate vertical leakage assumption can satisfactory resemble real-world condition.

Key words: Seawater intrusion, sharp-interface modeling, dispersive modeling, sand tank experiment, vertical leakage, layered coastal aquifer

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Leaching experiments and fractionation of zinc and cadmium in a contaminated soil after application amendments

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Abstract

Contamination of soil by heavy metals may pose long term environmental and health implications. Movement of heavy metals in polluted soils may be affected by organic amendments. Leaching Column experiments were conducted to investigate the movement of cadmium (Cd) and zinc (Zn) as affected by the addition of organic (sheep manure, poultry manure) and inorganic (zeolite) amendments in research field of Agricultural faculty of Lorestan University in Iran. Each column was leached with distilled water for 40 days. At the end of soil column leaching, sequential extraction was preformed to determine concentration of Cd, Zn and Pb in chemical fractions in soils. Movement of heavy metals in two treatments, soil with 1.5% Sheep manure and soil with 1.5% poultry manure, in comparison with control soil separately increased. The mobility of Zn was usually greater than Cd and Pb. In the other hand, The mobility of Cd was reduced after an addition of inorganic amendments (zeolite), whereas sheep manure and poultry manure increased concentration of heavy metals in the drainage. Sequential extraction results showed that in amendment soils the major proportion of Zn and Pb was associated with residual (RES) and organic matter (OM) fractions and major proportion of Cd was associated with carbonate (CARB) fraction. Organic amendments significantly increased the leaching of heavy metals to groundwater, so accumulation of heavy metals in plants probably reduces.

Key words: Heavy metal, leaching, sequential extraction, zeolite.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimating soil dispersivity coefficient by Artificial Neural Network

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Abstract

Soil dispersivity coefficient (α) is a required input parameter in solute-transport models based on the Advection-Dispersion Equation (ADE). Soil dispersivity coefficient is typically difficult to model due to the complexity of this phenomenon. With respect to importance of this parameter, this paper presents the MLP-Artificial Neural Network (ANN) approach to predict the soil dispersivity coefficient. Fortraining and testing of MLP model, the experimental data which measured in the rectangular tank with 1550mm length, 100mm width and 600mm height, were used. The collected data related to sandy soil with five sizes of very coarse, coarse, medium, fine and very fine and five distances of 25, 50, 75, 100 and 125 cm. NaCl was used as persistent pollutants with five velocities. The measured data such as transport distance (L), bulk density (ρ_b), porosity (n), hydraulic conductivity (K), average diameter of particles (D_{50}), the pollutant velocity (V_c) were used as input data for predicting soil dispersivity coefficient (α). For comparison of results statistical criteria such as mean absolute error (MAE), root mean square error (RMSE) and correlation coefficient (R^2) were used. The ANN model was performed by different structures to minimize the prediction error and determine the optimum network configuration. The results show that the best architecture for the MLP model comprised of 6 neurons in the hidden layer with transfer function of secant hyperbolic. The best structure has the coefficient of determination = 0.987 and root mean square error =0.0004 in testing stage. The performance of the MLP neural network was good in predicting the soil dispersivity coefficient; therefore ANNcan be used successfully to predict this parameter.

Key words: Soil dispersivity coefficient, Artificial Neural Network (ANN), Multiple Linear Regression Method (MLR), soil, water.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Source identification of heavy metals in atmospheric dust using *Platanus orientalis* leaves as bioindicator

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Abstract

Studies on atmospheric dust have been limited by high cost of instrumental monitoring methods and also sampling difficulties. The use of organisms acting as bioaccumulators has recently been proposed. In this study, the leaves of *Platanus orientalis L.*, as a possible biomonitor of heavy metals in atmospheric dust, were evaluated to understand the probable sources of pollution in Isfahan, Iran. Concentration of Zn, Cu, Ni and Mn and Magnetic susceptibility (χ_{lf}) were determined in washed (WL) and unwashed leaves (UL), monthly sampled from May to Nov., 2012. By subtracting the amount of metal concentrations and χ_{lf} in UL and WL, the amount of these parameters in dust deposited on the leaves (UL-WL) were calculated. Enrichment factor analysis (EF), correlation coeficient, principal component analysis (PCA) and cluster analysis (CA) on the UL-WL data were employed to trace the heavy metals sources. Results showed that the metal concentration in UL and WL in primary sampling times was not statistically different. As time passed, this difference became more noticeable. Seasonal accumulation trends of elements concentration in UL-WL, referred to as accumulative biomonitors showing the accumulation of dust on the leaves are considerable and the contamination of plants by metal occurs mainly by retention of particulate matter. All the heavy metals are well correlated with χ_{lf}, indicating the potential of magnetic measurement as an inexpensive and less laborious method to estimate heavy metals. Cu and Zn exhibited very strong correlation with each other and the highest correlation with χ_{lf}, suggesting an anthropogenic nature of these two metals. High EF of Cu and Zn showed that anthropogenic sources contribute a substantial amount of these metals in dust deposited on leaves. Whereas, less EF for Mn and Ni shows that natural source and local polluted soils might be the main origins of these metals. PCA results showed 2 principal components. Factor 1 with significant loading for Cu and Zn and factor 2 for Mn and Ni. In an agreement with the PCA and correlation results, CA showed strong clusters for Zn and Cu and also for Mn and Ni. Zn seems to originate from vehicular emissions, oil combustion and wear and tear of vehicle tires. Cu seems to originate from industrial processes, traffic and combustion of fossil fuels. Polluted soils in the area appears to be the main natural source for Mn and Ni in dust, while anthropogenic activities could be considered as the second origin.

Key words: Tree leaves, heavy metals, magnetic susceptibility, enrichment factor, multivariate statistics

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence nanoparticles on seed germination and soil bionetwork

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Abstract

Manufactured or naturally occurring nanoparticles has been mooted as having great potential for numerous applications in environmental applications. But there is an uprising concern about their undesirable effects on living systems in soil. In a series of laboratory and greenhouse experiments we have tested the effects of two types of metal oxide nanoparticles (ZnO and Fe_2O_3), and a carbon based nanoparticles (fullerene, C_{60}) for their effects on germination of seeds (rice, wheat, greengram, cucumber), soil enzyme activities microbial groups, soil nutrient content, accumulation of nutrient in straw of wheat plant. The nanoparticles were incorporated in an Inceptisol and a Vertisol to give a final concentration of 0.066% (w/w) for ZnO and Fe_2O_3 nanoparticles and 0.013% (w/w) for fullerene (C_{60}) nanoparticles. Germination of seeds was variable, and much reduced at higher concentrations of nanoparticles. The toxicity of NPs is species specific and also size dependent. Among all crops, cucumber found to be most vulnerable and rice least affected by the phototoxicity effects of all nanoparticles. There were variable observations on population of microbial groups and enzyme activities in soils. The negative effect of nanoparticles is evident in the case of bacteria, but this effect seems specific to type of nanoparticles and type of microbial groups. For example, bacterial population was lower in soils treated with nanoparticles of ZnO than Fe_2O_3 or fullerene. Whereas, population of ammonia oxidizing bacteria found to be significantly ($p<0.005$) higher in case of ZnO or fullerene treated soils. With respect to enzyme activities also there have been both positive and negative effects of nanoparticles. Nanoparticles of Fe_2O_3 showed lower urease activity, whereas ZnO showed higher values. Except urease activity, the effect of ZnO found to be negative on several other enzyme activities in the soil. Nitrification activity was higher in Vertisol; ZnO and Fe_2O_3 NPs accelerate nitrification activity in Vertisol, whereas the negative impact of Fe_2O_3 NPs was observed in the Inceptisol. There were variable observations on available phosphorus and mineral nitrogen in soil of microbial groups and enzyme activities in soils as, In Inceptisol, NH_4-N content was increased by application of nanoparticles but available phosphorus content not affected by nanoparticles. Overall nitrogen content in wheat straw was not affected by either of nanoparticles as well as soil types, whereas the phosphorus content of wheat straw was higher in Inceptisol. ZnO NPs significantly enhance zinc content in wheat straw, whereas, Fe_2O_3 NPs enhance the accumulation of iron in wheat grown in Vertisol. The nanoparticles themselves or their dissolved ions may be toxic to the soil ecosystem but toxicity greatly varies with soil types. Overall, the study demonstrates the undesirable effects of metal oxide and carbon based nanomaterials on plants, which underscores the necessity for taking remedial measure in the disposal of wastes and sludge containing these nanoparticles.

Key words: Hematite, zinc oxides, fullerene, phytotoxicity, soil enzymes, soil ecology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biorestoration of textile effluent polluted soil through Vermistabilization – an earthworm aided microbial-geological system

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Abstract

Vermistabilization is a relatively new technology for the biorestoration of textile effluent polluted soil where a complex mechanical and biochemical transformation of toxic dyes/chemicals and sludge is achieved through earthworm aided microbial-geological system. In the present study an epigeic earthworm, *Eudrilus euginiae* is employed for the restoration of textile effluent polluted soil under laboratory condition. Efforts were taken to understand the impact of textile effluent on the growth and fecundity of earthworms for which categories of earthworms were maintained with calculated amounts of raw textile effluent, chemically and biologically treated effluents for a period of 8 weeks. The changes in the physical (sand percentage, Slit, Clay), chemical (pH, EC, C:N, Water Soluble Carbon, fertilizer quality) and biological (total bacterial count, faecal coliforms and moulds) properties of the soil were measured. The composting potential of earthworms was also evaluated through co-composting the sludge and polluted soil with agricultural wastes and poultry droppings. There was significantly high fecundity of earthworms in the soil treated with raw effluent than that of control and the treated effluents suggesting the use of these earthworms for bioremediation of textile effluent polluted soil. There was a significant decrease in the organic matter and increase in total N, available P and K in the soil were earthworms were allowed for co-composting with agricultural -waste. The results indicate that vermistabilization is converting the sludge into nutrient rich manure. An increase in the contents of all transition metals were observed but still, the contents are less than the international standards for compost which indicates that the compost can be used in the fields without any ill effects on the soil. Phytotoxicity evaluation of vermistabilized soil and polluted soil is under progress and the results are promising. The study provides a sound basis that vermistabilization can be a potential technology for detoxification and biorestoration of textile effluent polluted soil.

Key words: *Eudrilus euginiae,* vermistabilization, polluted soil, textile sludge, phytotoxicity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The features of accumulation of heavy metals in soils of Rostov-on-Don agglomeration

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Abstract

The accumulation and distribution of priority pollutants in the profile of urban soils – Zn, Pb, Cu, Co, Ni, added to the soils mainly together with motor transport exhaustion and due to work of industrial enterprises, was investigated. The researches were conducted in the territory of the large city agglomeration of the South of Russia – Rostov-on-Don agglomeration. Objects: ekranozems – the asphalted soils, chernozem ordinary carbonate covered with steppe vegetation (fallow) and under the trees (forest plantation). It should be noted that the content of research elements in the parent rock exceeds background values. It may indicate the cumulative effect of the accumulation of heavy metals, having effect even on the parent rock. But another explanation is possible: this fact shows the loess loams specific character. In Rostov-on-Don lithochemical anomalies of nickel and cobalt were observed in the northern part of the city. In the soils, tested for cobalt and nickel, the profile excess of the maximum allowable concentration (MAC) is absent. Depthwise distribution of cobalt is characterized by relative accumulation of this metal in B, BC or C horizons that proves cobalt capacity to migration inside the profile with formation of its maximum at a level of carbon-bearing barrier. Nickel tends to accumulation in the middle part of the profile. Copper pollution has been detected at MAC level for some horizons or rather higher. However, taking into account that the same high levels were observed in lower levels of some of the researched soils, it can be assumed that this was not the result of pollution, but the effect of the parent rock being enriched in copper. Increase of the Approxible permissible concentration (APC) for zinc is observed in all researched soils, however, it should be noted that the APC is higher than background value. The source of pollution — the chemical plant for production of paint and varnish coating, in particular, zinc oxide, up until recently located about a kilometer from the place of the cut making.

Key words: Pollution, urban soils, heave metals, ekranozems, chernozem.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of long-term fertilization on metal transition from soil to plant

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Abstract

The increase of pollutant concentrations in soil and in the food chain became very important in the past few decades. Metals of different toxicities (Cd, Cu, Mn, Pb, Zn) occur in soils as a result of weathering, industrial processes, fertilization and atmospheric deposition. Some of them can be absorbed by the plants due to their mobility. Badly adapted cultivation of the agricultural soils (declining pH-value, application of unsuitable fertilizers) can enhance the mobility of the metals and by the way increase their concentrations in agricultural products. Soil and plant samples were taken from a field experiment which was carried out at four different locations, 210, 260, 360, 620 m above sea level, in a Latin rectangle design, under different fertilization (N, P, NP, NPK) regime resulting in different metal loads, in Hesse, Germany. The objective of this study was to determine the influence of application of different rates of N, P, and K fertilizers on soil and plant metal concentrations and to test the relations between available metal concentrations in the soil and metal loads of the plants depending on the fertilization treatments and to estimate their influences on the transfer factors. First results designated that application of long-term, 16 years, chemical fertilizer resulted as an increment of the metal contents in the soils. However applications of N, P, NP, and NPK treatments increased soil Cd levels, no significant differences were found between NP and P fertilizer variations for pseudo total Cd concentrations. Multiple linear regression analysis showed that the combination of OM and CEC produced significant multiple linear regression models for plant Cu, Pb, and Zn uptake. The mineral long-term fertilization had a significant effect on microelements' content, causing even multidirectional changes. Soil pH and organic matter affected Cd and Mn bioavailability increased with decreasing of soil pH. In the case of correlation analysis it is confirmed that the higher the organic matter content the higher the heavy metal content, nevermore, the lower the pH the higher the metal content. Soil pH is negatively significant correlated with soil aqua regia, EDTA and NH_4NO_3 extractable metal contents.

Key words: Long-term fertilization, metal, soil, plant.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Phytoremediation of selected heavy metals from sewage sludge by endemic aquatic plants of Khuzestan North

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Abstract

Some aquatic plants can remove nutrients and heavy metals from media such as sewage sludge or contaminated sediments. The objective of this research was to investigate the ability of selected aquatic plants to decontaminate the urban sewage sludge from selected heavy metals in dry and hot region of south of Iran. Research was conducted in 2 separate experiments, a pot experiment and a field one. In the pot experiment 3 plant species (*Typha latifolia, Phragmites australis* and *Scirpus tabernaemontani*) were tested in sand culture irrigated with nutrient solutions containing 3 levels of Ni (20, 50 and 150 mg kg^{-1}) and Cd (10, 35 and 85 mg kg^{-1}) for 60 days. Results of the pot experiment showed significant effect of both the concentration of the heavy metals in the nutrient solution and the plant species on the concentration of Ni and Cd in both the shoots and roots of plants. All 3 plant species showed a higher metal concentration in the roots as compared to the shoots. Nickel and Cd concentration in plant tissues increased with increasing culture media concentration of these metals. The highest concentration of Ni and Cd in the roots and shoots were for Typha (71.6 and 35.8 mg kg^{-1}) and (34.6 and 12.5 mg kg^{-1}), respectively. Transfer factor (TF) and biological concentration factor (BCF) for Ni were 0.44, 0.32, 0.26 and 0.58, 0.48, 0.42 for 3 plant species at the highest concentration (150 mg kg^{-1}), respectively. The second experiment was conducted with *Typha latifolia,* and *Phragmites australis* in the field in plots (6m x 0.5m x0.8m) isolated with impermeable plastic sheets containing 200 kg of dried urban sludge diluted 4 times with tap water. Ability of the plant species to remove 6 heavy metals including Ni, Cd, Cu, Pb, Cr and Zn from the sludge was evaluated in a 90 days period with plant samples taken every 15 days. Results showed that the amount of heavy metals removal from the sludge was higher by the roots as compared to the shoots. At the end of 90 days the amount of heavy metals removed by the roots of *Typha latifolia* and *Phragmites australis* were 130.4 and 59.1 for Ni, 80.5 and 29.6 for Cd, 44.3 and 30.7 for Pb, 885.5 and 217.1 for Cu, 483 and 96.8 for Cr, and 956.6 and 417.6 for Zn, respectively. The amount of heavy metals removal by the plant species especially *Phragmites australis* was very high and this plant could be successfully used for phytoremediation of sewage sludge contaminated by heavy metals.

Key words: Sewage sludge, heavy metals, aquatic plants.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Distribution, toxic potential, and sources of polycyclic aromatic hydrocarbons (PAHs) in soil around the international airport in Delhi, India

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Abstract

PAH contamination due to jet turbine exhaust in the peripheral soils of the International Airport in Delhi, India was determined. Densely populated residential areas surrounding the airport come directly under both the landing and take-off flight paths. Twelve priority polycyclic aromatic hydrocarbons (PAHs) were analyzed in the <2mm surface soil fraction. Identification and quantification of PAHs was done by high performance liquid chromatography (HPLC). The sum of 12 PAHs ranged from 2.39 to 7.53 μg g^{-1} with a mean concentration of 4.43 ± 1.45 μg g^{-1}. PAH levels observed in the present study were found to be higher as compared to most of the literature values. Among the three sampling sites selected around the International Airport, the site near landing point revealed maximum concentration of PAHs, while minimum concentration was observed at the site near take-off point. Predominance of Pyrene was observed in the airport soil. Factor analysis and isomer pair ratios suggest pyrogenic origin of PAHs in the study area.

Key words: Airport, benzo(a)pyrene, Delhi, PAH, soil, toxic equivalent factor (TEF).

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluating effects of sewage sludge on soil chemical and biological properties and heavy metals amounts (incubation experiment)

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Abstract

Recycling of organic wastes within agriculture may help maintain soil fertility via effects on physical, chemical and biological properties. This study examines the effect of sewage sludge application on soil chemical and biological properties. Dewatered anaerobically digested sewage sludge were collected from the sewage treatment plants in the 9 different regions of Turkey (İzmir, Gaziantep, Samsun, Antalya, Elazığ, Karamürsel, Ankara, Yozgat and Düzce) with 3 different risks (low-medium-high) were chosen and surface soils (0-20 cm) were taken from the agricultural lands of these religions .We studied the effects of adding different doses (0, 2,4 and 8 t dry matter (DM) ha^{-1}) of sewage sludge on selected soil characteristics. Soils treated with sludges were incubated under constant laboratory conditions at 25 $^{\circ}C$ for 0, 60 and 120 days. As a result; the addition of different doses of sludge caused a rapid and significant increasing of soil enzymatic activities, soil biomass and soil respiration, these increases were especially noticeable in soil treated with high doses of sludge. Soils pH value decreased with increasing of sludge doses and over time. By increasing doses of sewage sludge and during the time, the amount of organic matter increased. No significant change in the amount of DTPA extractable heavy metals and potassium were observed with increasing amount of sewage sludge during the incubation period. Sludge application significantly ($P<0.05$) increased the amount of microbial biomass present in the soils. Sludge application somewhat increased soil enzyme activities. In addition, a significant ($P<0.05$) variations in soil respiration were also observed in this study. The highest rate of sludge application (8 t ha^{-1}) was found to significantly ($P<0.05$) increase the functional diversity of the soil community. These results suggest that although the sludge application resulted increasing in the diversity of the microbial activity, the overall size of the soil microbial biomass and its nutrient mineralization potential were either unchanged or increased.

Key words: Sewage sludge, enzymes activity, soil respiration, soil biomass

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Potential environmental risks associated with sewage sludge application in agriculture and solution recommendations

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Abstract

Recently, sewage sludge production has significantly increased by the municipal and industrial waste water treatment plants. Therefore, disposal of sewage sludge generated from the waste water treatment plants has become an important environmental issue. The disposal of sludge products in landfills or by incineration are feasible options currently practiced in many parts of the world but both of these strategies are expensive and cause environmental problems. The application of stabilized sewage sludge to the cropland is therefore most attractive potential method because it can recycle valuable components, such as organic matter, N, P, and some other plant nutrients. Also, sewage sludge can improve physical and biological properties and agricultural productivity of soils. However, the environmental impact of this practice needs to be investigated carefully. Because, depending on the origin and composition, sludge may contain substantial amounts of toxic metals as well as beneficial nutrients. The addition of heavy metals to the soil and their subsequent transfer to the food chain is one of the major factors limiting the application of sewage sludge to agricultural land. However, knowing soil properties and heavy metals concentrations in sewage sludge are also important in order to utilize sewage sludge in appropriate doses in soil. The solubility or bioavailability of heavy metals from sewage sludge depends on soil pH, lime content, soil cation exchange capacity and soil organic matter. In this review potential risks associated with sewage sludge application in agricultural land and how we can determine the appropriate and safe sewage sludge doses are discussed.

Key words: Sewage sludge, heavy metals, toxic elements, soil properties, soil pollution.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Anthropogenic loading on soils and impact of land use on surface and groundwater quality

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Abstract

The anthropogenic loading of soils and the water pollution are one of the most significant problems, associated with agriculture. The basic factors, which influence nitrate and chemical elements leaching through the soil profile, nitrogen accumulation in the profile, movement through the geological profile and pollution of shallow aquifers with different components are: hydrogeological characteristics of the terrains, soil type, geomorphology, climate, management of agricultural lands (anthropogenic impact from fertilizers, septic systems and livestock wastes) and etc. The aim of this investigation is to present results on surface and ground water quality monitoring on the territory of a small watershed at the pilot site (near V. Tarnovo) in Northern Bulgaria. Fluctuation of the groundwater table was monitoring at permanently build pipe wells, home wells and springs. The simples for chemical analysis of surface water were taken at different sites of the Yantra River in the area of the pilot site. The influence of different land use activities on the content of chemical elements in surface and ground water has been studied in 2013 year. It was established that surface and ground water sampled from monitoring watershed has neutral to alkaline reaction and hydrocarbonate-calcium chemical composition. The dynamics of the processes, which determine the enrichment of groundwater with nitrates and their redistribution in the space, requires a periodic monitoring of their chemical composition to update the information of the status of the groundwater. The calcium and magnesium concentrations in groundwater during the 2013 year do not exceed the maximum permissible contaminate level in the standard for drinking water. It was monitored a significant variation in the data for hydro-carbonates content in the underground water, slightly influenced by the anthropogenic loading. Chlorine and sulphate contents in the groundwater could be characterized with considerably low variation. Solving the problem of water quality protection from nitrate pollution of agricultural sources requires the determination of the maximum permissible loading with nitrogen of arable lands in order to preserve the sustainability of the agroecosystem. The received information will be used as a methodological approach in further environmental impact assessment on a watershed level.

Key words: Anthropogenic loading, land use activities, monitoring, surface and ground water, chemical elements, environment protection

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Environment-friendly method for benzo[a]pyrene extraction from soils

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Abstract

A new method of subcritical water extraction has been developed for determination of benzo[a]pyrene in soils with HPLC analyses of final extracts. Optimal conditions of benzo[a]pyrene extraction were 30 min treatment of soil sample with water in a special still cartridge at temperature 250°C and pressure 100 atm. The effectiveness of this extraction was determined through the method of matrix spike with soils collected from background area in the Rostov oblast (Russia). More than 96% of the benzo[a]pyrene were recovered from soils through the method of subcritical water extraction compared to 74% recovering through the traditional hexane extraction in combination with preliminary saponification of the soil samples. The other advantages of subcritical water extraction are the use of water as an environment-friendly solvent instead of great volume of organic solvents and shorter time of analyses. The polycyclic aromatic hydrocarbons environmental contamination is usually characterized by the benzo[a]pyrene presence as a reference-point compound. This is a pollutant of a first-danger class, cancerogene and mutagen. The benzo[a]pyrene content is obligatory controlled in all environmental objects all over the world that is regulated by the standard and legal base. The modern methods of benzo[a]pyrene extraction in the environmental samples include a solvent extraction step and sample analysis is generally achieved using HPLC-fluorescence detection or by GC-MS. The subcritical water extraction is one of the most recent techniques developing for extraction of various organic compounds, including organic pollutants, from environment matrixes as a readily available, non-toxic, reusable and very low in cost as well as environment-friendly method. Benzo[a]pyrene was extracted from soils by subcritical water extraction method and compared with a standard saponification method in modification permitting to remove limiting lipid macro-components. These methods were developed and approved using the samples of ordinary carbonate heavy loamy chernozem (virgin, the 0-5 cm topsoil) taken in the Persianovskaya steppe of the Rostov region and located far from possible contamination sources. This soil revealed the following physical and chemical properties: C_{org}–3.4%, pH–7.3, ECE–37.1 mmol(+)/100g; $CaCO_3$–0.1%, the content of physical clay – 53.1% and clay – 32.4%. Benzo[a]pyrene in the extracts was quantified by HPLC with simultaneous ultraviolet (UV-1000) and fluorescence (FL-3000) detection following ISO 13877 requirements. The results of the subcritical water extraction of benzo[a]pyrene from soil showed that this method allows shortening the time extraction up to 30-40 min instead of 11-48 hours requiring for those obtained by traditional methods. The oxidation of the soil lipid fraction and the maximum transition of benzo[a]pyrene into the water solution occur in a hermetic reactor at 230-270ºC and pressure of 100 atm for 30-40 min. Under these conditions the water reveals a dielectric permeability equaled to ε=32.6–24.3 at 230-270ºC, respectively, what is comparable with ε=36.2 at 25ºC obtained for acetonitrile as an ideal benzo[a]pyrene solvent, thus leading to a complete dissolution of benzo[a]pyrene by the subcritical water. Based upon the obtained results the optimum conditions of the benzo[a]pyrene extraction from soil have been determined: the soil is treating by subcritical water at 250ºC and 100 atm of pressure for 30 min.

Key words: Benzo[a]pyrene, subcritical water, extraction, soils, pollution.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Heavy metals accumulation and transformation in soils of tegnogenic zone on the basis of the long-term monitoring research

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Abstract

The emissions from the Novocherkassk power station (NPS) comprise 1% of the total volume in the Russian Federation and up to 58% of the emissions in the Rostov oblast. The aim of this work was to assess the regularities of heavy metals (HMs) accumulation and transformation in soils subjected to aerosol emissions from the NPS on the basis of the fractional composition of their compounds. Studies have been conducted on the soils of monitoring plots distances from the NPS (1.0–20.0 km) during 15 years. The monitoring plots located on fallow areas. Soil samples for the determination of soil properties and the contents of HM compounds were taken from a depth of 0–20 cm. The soil cover in the region under study consisted of ordinary chernozems, meadow-chernozemic soils, and alluvial meadow soils. The total amount of HMs in soils was determined by X-ray fluorescence. Metals in soil extracts were determined by atomic absorption spectroscopy. The fractional composition of HM was determined using combined fractionation. A combined approach for fractioning metal compounds in soils on the basis of and parallel extractions (1 N NH4OAc, pH 8; 1% EDTA in NH4OAc; and 1 N HCl) was used. Aerosol emissions from the NPS are the major agents of technogenic impact on the soils under study in the Rostov oblast. The highest degree of contamination with metals (72 mg Cu kg^{-1}, 140 mg Zn kg^{-1}, 66 mg Pb kg^{-1}, 64 mg Ni kg^{-1}, 12 mg As kg^{-1}, 939 mg Mn kg^{-1}, 1.3 mg Cd kg^{-1}, and 145 mg Cr kg^{-1}) was observed for soils located within a radius of 5 km from the NPS along the predominant wind direction. It was marked the rise of metals mobility in the polluted soils and predominant participation of Cu, Pb, Mn, Cr and Ni organic-mineral complexes among their mobile species. The increasing of Zn and Cd mobility was provided predominantly by exchangeable forms and specifically sorbed by Fe–Mn (hydr)oxides. The environmental contamination hazard increases with the decreasing metal-buffering capacity of soils.

Key words: Aerosol emissions, the fractional composition, heavy metals compounds, chernozems.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil contamination with oil and heavy metals on Kenkiyak oil field in Aktobe region, Kazakhstan

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Abstract

Purpose of research: determination of concentration of oil products (OP) and heavy metals (HM) in soils in Kenkiyak deposit (m), exceeding the MCL. Studies have detected spots of soil contamination with oil on the territory of oilfield. On the territory of Kenkiyak deposit were discovered species of anthropogenic impact of oil contamination on soil: fuel oil, hide fuel oil, bituminized, rummaged. Soil pollution with OP is inhomogeneous on the territory of 4 workshops. A comparison was conducted of OP content in the soils of the same type in 4 workshops of deposit with different period of exploitation. Maximum contamination was determined according to the long-term impact in the old shops No 1 and No 2. Soils of new workshops are less contaminated: up to 16 levels of MPC of shop 3 shop and small excess of 1.12 MPC level in soils of shop 4. OP concentration in the samples of soil profiles reached 1425-196500 2009 mg kg^{-1}, but in some horizons did not exceed the MPC. Research conducted in 2010 also revealed soil contamination with OP exceeding MPC 400 times in soil of the old shop 2 and 142 - 388 MPC in the soil of shop 1. In soils more new shops # 3 pollution level was less- 73 of MPC value, and in shop 4 also was 388 MPC on depth 30-50 cm. For comparison in the soil of virgin section OP concentration at depth 71-100 cm was 1 MPC. Contents of oil products largely exceeds the MPC on the territory of the old shops in prolonged effects of pollution. Profile distribution of contamination of OP showed that it is different. In soil, of shops 1 and 2 maximum values in upper horizons; in shops 3 and 4 also in upper horizons and at depth of 85-110 cm in soils of the deposit it was revealed slight excess of MCL in both mobile and gross forms of lead in soil in almost all sections in upper soil horizons, as well as some exceeding of concentration of mobile forms of copper and zinc.

Key words: Soil pollution, petroleum products, gross and mobile forms of heavy metals, MPC.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Modern parameters of Cesium-137 root uptake in natural and agricultural grass ecosystems of contaminated post-Chernobyl landscape, Russia

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Abstract

Due to extremely long-term radioactive pollution significant part of Russian soil cover still contains 5-10 and more Ki/km^2 ^{137}Cs (under national ecological norm <1 Ki/km^2 ^{137}Cs). Root uptake and translocation of ^{137}Cs from soil to plant on such territories is the key to understanding of general ecological situation and land use. The estimation of modern parameters of ^{137}Cs root uptake was conducted in natural meadows and agricultural ecosystems of post-Chernobyl landscape of Tula region. The main crops of field rotation (wheat, barley, potatoes, canola, maize) occupy watersheds and slopes with arable chernozems contaminated at a level 460-670 Bq/kg (4.7-6.0 Ki/km^2), natural grassland ecosystems occupy lower parts of slopes and floodplains contaminated at a level 620-710 Bq/kg (5.8-7.6 Ki/km^2). In the arable soils ^{137}Cs uniformly distributed to a depth of A_p horizon (20-30 cm), while in meadow soils 70-80% of radionuclides is concentrated within the top A_d horizon (10 cm). These top 10 cm of soil accord with rhizosphere zone, where >80-90% of vegetation roots are concentrated, and from which ^{137}Cs is consumed. Total volume of ^{137}Cs root uptake closely depends on the level of soil radioactive contamination (correlation coefficient 0.87). So specific ^{137}Cs activity in vegetation of meadows (103-160 Bq/kg) generally more than one in agricultural crops (9-92 Bq/kg). But the values of ^{137}Cs transfer factor (TF) in the studied ecosystems vary within a relatively narrow range: from 0.01 (canola) to 0.20 (wet meadow), that confirms the discrimination of the radionuclide root uptake. At the same levels of soil contamination herbs of meadows accumulate more ^{137}Cs than *Gramineae* and weeds of agrocaenosis consist of more radionuclide than cereals. The larger are the volume of roots and their specific surface, the higher are the values of TF from soil to plant (correlation coefficients 0.71 and 0.64 respectively). Thus, level of soil radioactive pollution and biological features of plants are determinants in the process of ^{137}Cs root uptake and should be considered in land use policy.

Key words: ^{137}Cs, root uptake, transfer factor, radioactive contamination, Chernobyl accident.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil contamination study around the Buchim Copper Mine, Republic of Macedonia

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Abstract

One of the major emission sources of some metals in the eastern part of the R. Macedonia is Bucim copper mine and flotation, near the town of Radovis. Ore excavation is from open pit and the ore tailings are stored in the open, in mine vicinity. The produced copper ore from the mine is processed in the flotation plant; after the flotation of copper minerals, the flotation tailings are separated, disposed of and deposited on a dump site in an adjacent valley near the village Topolnica. During the 35 years of continuous exploitation around the Buchim Mine was created surface waste dump were have been stored more than 150 Mt and more than 100 Mt material within the hydrotailling dam. Within this study a total content of 20 elements was determined in soil samples taken from the vicinity of the "Bucim" mine, covering an area of 14.2 km^2. Analyses were performed by the ICP-AES. The results have been compared to new Dutchlist and NOAA standards and the following was concluded: As values ranged 13.1÷225 ppm with 20 samples above the optimum (29 ppm As) and 7 above action value (55 ppm As), in that context Cd values ranged 0.67÷17.9 ppm with 17 values above optimum (0.8 ppm Cd) and 1 over the action value (12ppm Cd), Cr with range 30.1÷171 ppm with 6 over optimal value (100ppm Cr) and none above action value (380ppm Cr), Cu with range 17.8÷1734 ppm with 16 over optimal value (36ppm Cu) and 3 above action value (190ppm Cu), Ni with range 9.8÷69.4 ppm with 5 over optimal value (35ppm Ni) and none above action value (210ppm Ni), Pb with range 46÷3456 ppm with 19 over optimal value (85ppm Pb) and 1 above action value (530ppm Pb), Zn with range 88÷3438 ppm with 12 over optimal value (140ppm Zn) and 1 above action value (720ppm Zn), Mn with range 169÷998 ppm with 25 over optimal value (33ppm Mn) and none above action value (48ppm Mn), Fe range 0.73÷5.02% with 21 over optimal value (1.8% Fe) and none above action value (3.2% Fe). The V, Al, Co, also, showed some increased values, but not more than optimal concentration.

Key words: Buchim mine, soil, copper, arsenic, contamination.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Anthropoghenic soil contamination connected with active mines, smelting and plants in the Republic of Macedonia

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Abstract

A few anthropogenic pollutants at the territory of the Republic of Macedonia, were studied, three Pb-Zn mines with three mills, one copper mine with mill and copper leaching facility, one Pb-Zn smelting and several mines and factories for raw minerals such is the Usje in our capital Skopje. At the Usje factory were measured values in ranges of 1.46÷2.23% Fe, 440÷940% Mn, 93.4÷104.71 mg Ni kg^{-1}, 58.57÷83.1 mg Zn kg^{-1}, 23.1÷34.9% Pb, 42.30÷60.3 mg Cu kg^{-1} and 0.59÷1.61 mg Cd kg^{-1}. The concentrations of heavy metals at Veles former smelting Pb-Zn plant were in the range: 20÷1823 mg Pb kg^{-1}, 29÷2395 mg Zn kg^{-1}, 28÷65 mg Cd kg^{-1}, 27÷81 mg Cu kg^{-1}, 39÷164 mg Ni kg^{-1}, 508÷938 mg Mn kg^{-1} and 1.6÷3.8% Fe, all of them above reference values. Around the Feni smelting plant concentrations of particular pollution elements were in the range: 16÷31 mg Pb kg^{-1}, 117÷286 mg Zn kg^{-1}, 13÷30 mg Co kg^{-1}, 43÷119 mg Cu kg^{-1}, 158÷292 mg Ni kg^{-1}, 519÷903 mg Mn kg^{-1}, 119÷236 mg Cr kg^{-1} and 2.24÷3.79 % Fe. At the Toranica Pb-Zn mine all the measured values multiplexed above the standard values. Enrichment factors ranged from, low 3.75 for nickel up to 362.5 for zinc and extreme 1587.5 for lead. The Zletovo Pb-Zn mine has been characterized by all the measured values multiplexed above the standard values with an exception of nickel. Enrichment factors ranged from mediate ones such were those for copper of 20.8, cadmium of 28.7, arsenic of 32.5 up to high ones for zinc with 341.7 and lead 925. In regards to Sasa Pb-Zn mine all the measured values multiplexed above the standard values with an exception of nickel. Enrichment factors ranged from low for manganese of 12.14 and arsenic of 15.72, median for copper of 59.15, high for cadmium of 126 and extremely high for zinc with 892.7 and lead 1201.9. In regards to the Bucim copper mine the median values for Cu in samples were 396 mg kg^{-1} and the ranges from 94.8 to 1171 mg kg^{-1}, for the Topolnica village the median values in samples were 150 mg kg^{-1} with ranges from 52.5 to 1183 mg kg^{-1} and for the Bučim village the median values were 145 mg kg^{-1} and the ranges from 85.3 to 317 mg kg^{-1}.

Key words: Heavy metals, contamination, anthropogenic, R. Macedonia.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of temperature and nitrogen fertilization on CO_2, N_2O, NO_x, and CO emissions from agricultural soils

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Abstract

Temperature rise due to global climate change may accelerate feedbacks from greenhouse gas and nitrogen oxide emissions from terrestrial soils. As the growing human population puts pressure on agricultural and biofuel production, global nitrogen fertilizer use has increased rapidly, accelerating global nitrogen output. This study quantifies the increases in the release of carbon dioxide (CO_2), nitrous oxide (N_2O), nitrogen oxide (NO_x), and carbon monoxide (CO) from agricultural soils as a function of temperature and nitrogen fertilization. Agricultural soils from a cornfield in Amherst, MA, were incubated at 10°, 20°, and 30°C with six replicates under each treatment. Nitrogen fertilizer was added to soils in three treatments. Application rates were 0 (control), 2.5 (low-N), 5 (medium-N), and 10 (high-N) g m^{-2}, respectively. CO_2, N_2O, NO_x, and CO concentrations were measured 27 times over the three nitrogen treatment periods using a chamber measurement system. Concentration measurements were made every 2 seconds over 4 minutes for each sample, yielding over 230,000 data points. Measurements were made using a Li-Cor Li-7000 CO_2 Analyzer, an LMA-3D NO_2 Analyzer, an LNC-3D NO_x Converter, and an LGR N_2O and CO Laser Analyzer. A total of 1944 final flux values was calculated. In addition, total carbon and nitrogen analyses were performed using a CHN analyzer. CO_2, N_2O, NO_x and CO emissions all increased with fertilizer addition. Greenhouse gas emissions also increased with temperature: the CO_2 flux at 30°C was 6-8 times greater than the flux at 10°C, while the N_2O flux at 30°C was up to 100 times greater than the flux at 10°C. An increase of nitrogen addition from 5 to 10 g m^{-2} corresponds to a six-fold increase of N_2O flux, while the effect of nitrogen addition on N_2O and CO_2 fluxes was dramatically reduced by day 15 after the fertilizer application. Extrapolating these data to global soils, a rise in temperature and an increase in global fertilizer use could significantly increase soil CO_2, N_2O, NO_x and CO emissions, accelerating global climate change in a cycle of positive feedback.

Key words: Climate change, anthropogenic impacts, greenhouse gases, positive feedback, flux chamber, carbon dioxide, nitrous oxide, nitrogen oxide, carbon monoxide.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes of anatomical structures in roots as a response to cadmium accumulation in barley and lettuce plants

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Abstract

The aim of this study was to investigate the impact of increased levels of Cd in the substrate on growth, Cd accumulation in lettuce and barley leaves and roots, as well as Cd induced modifications in root anatomical structures with emphasis on differences between species. Vegetation experiments were arranged with two model cultures: barley, *Hordeum vulgare* (a monocotyledon) and lettuce, *Lactuca sativa* L. (a dicotyledon) – in soil culture (quartz sand). Changes in physiological indices were studied at five levels of Cd: 0, 1, 2, 4, 6 mg l^{-1} for lettuce and 0, 3, 6, 9, 12 mg l^{-1} for barley, added as $Cd(NO_3)_2 \cdot 4\ H_2O$ solution in substrate. Plant exposure to increasing levels of Cd resulted in a progressive inhibition of growth and simultaneous accumulation of Cd both in leaves and roots of plants. Although, the Cd concentrations in the roots were much higher than in leaves of studied plants, lettuce and barley exhibited specific differences in the ability to accumulate Cd in leaves. Thus, under a 6 mg l^{-1} level of Cd in the substrate (Cd6), the concentration of Cd in lettuce leaves reached 56.0 mg kg^{-1} while in barley leaves 25.4 mg kg^{-1}. Studies on changes of root anatomical structure in conditions of Cd toxicity reveal the presence of lignified pericycle cell walls and the lack of passage cells in endodermis of barley under a Cd6 while under Cd0 passage cells are present and proximal pericycle cells are unlignified. Barley and lettuce show differences in development of endodermis under equal level of Cd contamination (Cd6) – endodermis of barley roots features lignified anticlinal and inner periclinal cell wall thickenings as well as formation of peri-endodermis while in endodermis of lettuce roots only Casparian bands are present and formation of peri-endodermis absent. Our study suggests that Cd accumulation in monocotyledon and dicotyledon plant leaves and roots differs depending on changes in root anatomical structures of these plants caused by Cd pollution.

Key words: Cadmium**,** endodermis, barley, lettuce, root anatomy.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Using amorphous manganese oxide for remediation of smelter-polluted soils: A pH-dependent stability study

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Abstract

In soil systems, manganese (Mn) oxides are commonly found to be powerful sorbents of metals and metalloids and are thus potentially useful in soil remediation. A novel poorly crystalline manganese oxide (named hereafter as AMO, amorphous manganese oxide) was used for chemical stabilization of a smelter polluted soil (initial Pb concentration of 1100 mg/kg, AMO concentration of 2%) and incubated for 2 and 6 months. The pH-static leaching test (L/S = 10, 48 hours) was performed in the pH range of 3-8, relevant for soil systems on AMO and AMO-stabilized soils. The AMO dissolution in water was highly pH-dependent and exhibited an L-shaped leaching curve. The released Mn concentration was the highest at pH 3 (34.1 g/l) and decreased to 0.09 g/l at pH 8. These concentrations corresponded to mass losses of 98.4% and 11.2%, respectively, and indicated that AMO is not very stable in water, particularly under acidic conditions. However, its stability in real soils was significantly higher. The sequential extraction analysis of AMO-stabilized soil indicated a statistically significant decrease in labile fraction of Pb and As in comparison with the initial soil. The pH-static experiments confirmed that especially under acidic conditions (pH 3) the AMO addition lead to a significant decrease of Pb and As leaching (8x and 5x, respectively) and its efficiency was more pronounced after 6 months of incubation. Based on our laboratory experiments, AMO can be considered as a promising amendment for contaminated soils and other in situ applications need to be evaluated. This study was supported by the Czech Science Foundation (GAČR 503/11/0840).

Key words: Polluted soils, Mn oxides, chemical stabilization, remediation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mineralogy and weathering of smelter-derived particles in contrasting soils

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Abstract

Soils in the vicinity of non-ferrous metal smelters are often highly polluted by inorganic contaminants released from particulate emissions, which undergo weathering processes and release contaminants when deposited in soils. Here we present the results on mineralogy and alteration of smelter-derived particles in soils near active Cu and Pb metallurgical operations. The topmost soil layers are often highly enriched in inorganic contaminants, e.g. up to 8980 ppm Cu near Cu smelters and up to 35 000 ppm Pb near Pb smelters. Heavy mineral fraction of these soils contains numerous spherical particles smaller than < 80 µm with mineralogy corresponding to particles formed by the processes in the furnace or in the flue gas cleaning system of each smelter. Copper smelter-affected soils commonly contain spherical particles were mainly composed of covellite (CuS), chalcocite (Cu_2S) and Fe-Cu oxide particles predominantly corresponding to tenorite (CuO) and delafossite ($Cu^{1+}Fe^{3+}O_2$). Secondary weathering rims on Cu-Fe sulphides are often composed of Cu sulphates and/or Cu oxysulfates along with hydrated Fe-oxides. In contrast, Pb smelter-affected soils contain predominantly anglesite ($PbSO_4$) particles corresponding final weathering product of the dust exposed in the soil system. We used a technique with double polyamide experimental bags (1-µm mesh) to study the in situ transformation of dust from a secondary Pb smelter in soils. Between 62 - 66% of the dust dissolved after one year's exposure in the soils, leading to complete dissolution of primary caracolite [$Na_3Pb_2(SO_4)_3Cl$] and KPb_2Cl_5, with formation of secondary anglesite. Release of Pb was pH-dependent, whereas not for Cd and Zn. Significant amounts of metals (mainly Cd and Zn) partitioned into labile soil fractions and became highly mobile in the soil profiles. This study was supported by the Czech Science Foundation (GAČR 210/12/1413 and 13-17501S) and IGCP Project No. 594 ("Assessment of impact of mining and mineral processing on the environment and human health in Africa").

Key words: Polluted soils, metals, smelters, particles, weathering.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Features remediation of oil-polluted soils in the North of the Russian Federation (Republic of Komi)

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Abstract

Soil petroleum pollution is characteristic for soils of many petroleum-producing countries. The success of recultivation of such soils is determined by the speed and quality of cleaning and further properties transformation of recultivated soils. Our work is devoted to the examination of properties of recultivated more than 20 years ago petroleum polluted soils. We defined physical and chemical properties and regimes of soils, fractional composition of the hydrocarbons of petroleum, the total population and the taxonomic structure of saprotrophic bacterial complex. It was shown that the ability of the studied recultivated soils to self-purification from anthropogenic hydrocarbons is determined by a combination of such a factors: 1- landscape position and removal of organic pollutants by surface water, 2-fractional composition of hydrocarbons, 3 – biodegradation and level of initial contamination with hydrocarbons. It was found that the direction and intensity of the soils evolution is primarily due to the degree of soil initial properties and regimes transformations during the recultivation procedure.

Key words: Soil, oil pollution, remediation

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Identification of heavy metal sources in soil and dust of urban and industrial areas of Bushehr Province (southwestern Iran) using multivariate statistical analyses

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Abstract

Increasing industrialization and human activities intensify the emission of various pollutants into the environment. Heavy metals cause serious environmental risks and, therefore, their effects have been examined extensively .The main objectives of this study was to determine the concentration and sources of selected heavy metals (Zn, Cu, Fe and Ni) in soil and dust in Bushehr and Assaluyeh cities located Bushehr Province, southeastern Iran as urban and industrial areas, respectively. Also, transect between the two cities as a non-urban area was investigated. Fifty dust samples from the leaves of the palm trees and fifty surface soil samples were collected nearby the selected palms. The total concentrations of Zn, Cu, Fe and Ni in dust and soil samples were measured by an atomic absorption spectrometer following the digestion with 6N nitric acid. Principal component analysis (PCA) and cluster analysis (CA), coupled with correlation coefficient analysis, were used to analyze the data and to identify possible sources of heavy metals in soil and dust. The mean concentrations of the studied heavy metals in dust of the three areas were higher than those soils nearby them. The mean heavy metal concentrations in soil and dust decrease in the order of Fe>Zn>Ni>Cu. The Zn concentration in soil and dust of Bushehr city was similar to Assaluyeh industrial area, and higher than non-urban area .A significantly positive correlation ($P < 0.01$) was found between the elemental pair's Zn–Cu and Fe–Ni in dust and soil. Two main sources of different heavy metals in dust and soil of areas were identified based on the PCA, CA, and correlation analysis. Zn and Cu seem to have anthropogenic sources such as traffic and industry activities, whereas Fe and Ni accumulation in atmospheric dust and soil presumably contributed to natural sources. In general, implementation of environmental standards in Assalluyeh industrial zone and improvement of public transportation in Bushehr city are necessary to reduce the threat of pollutants entering the soil and atmosphere.

Key words: Heavy metal sources, dust, soil, multivariate analysis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assesment of steel-smelting waste slag and moliding sand impact on ecological soil condition

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Abstract

The wastes of steel-smelting industry have high affinity with the environmental components; therefore there is no necessity of their isolation from the environment. To make decision about the possibility of using steel-to give an estimation of their impact on the smelting slag waste it is necessary soil ecological condition by testing chemical, biological indicators and toxicity. The field research was conducted in summer 2010 in Aleksin district of Tula region of Russia. The grey forest soil was subjected to mixture of steel-smelting waste slag and moliding sand. Indicators such as pH, Mn and F elements content, toxicity, organic carbon, soil respiration (Gas chromatography (GC) method), total fungal biomass (Fluorescence microscopy method), biomorphological structure of the fungal biomass, species composition and structure of the communities: cultivated microscopic fungi (Czapec Dox Agar plating) were measured. According to chemical indicators analysis results it was found that Mn and F concentrations in gray forest soil were increased after using a mixture of steel smelting slag and moliding sand in road construction. Manganese and fluorine concentrations at 1 meter away from the road are 2-3 times more than background values. Fluorine excess in soil depends not only on the road itself but also on traffic flow rate. In a model experiment it was also shown that manganese content in drainage increased according to increase in the waste amount. Wherein fluorine content in drainage waters did not exceed threshold limit values. The analysis of the extracted microscopic fungi communities (ratio 1:9 and 1:3) showed that the species richness and the numbers of the extracted fungi species haven't changed and were comparable with the control experiment during the research. The introduction into the soil of high doses of the waste (ratio 1:1) has lead to the change of species composition and its impoverishment, reduction in the quantity and proportion of Penicillium, deficiency of typical genera number for the identification (Acremonium, Paecilomyces, etc.), increase in the fraction of dark-colored fungi, including dark-colored sterile mycelium.

Key words Steel-smelting waste slag, moliding sand, ecological soil condition, environmental impact assesment.

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International Soil Science Congress

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Congress 2014
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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Desiccation of a silt block in a dam reservoir: Modelling and lab experiments

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Abstract

Mosaic 3-D cascade of silt blocks sandwiching sand-filled "proppant" cracks, discovered and described in Al-Ismaily et al. (2013,2014), determines hydro-pedological and hydro-ecological peculiarities of the corresponding area of a dam reservoir, which is occasionally filled with water and is, being empty most of the time, exposed to caustic solar radiation, high temperature and wind. In this paper, we consider evaporation from a top-soil box-shaped block, initially fully saturated during the ponding stage, and whose upper face is kept at a relatively low moisture content. We apply the method of small perturbations, assuming that in the Richards equation the relative permeability is Averyanov's 3.5-power function of the moisture content and capillary pressure is of the van Genuchten type. We solve a linearized advective dispersion equation with respect to the second term in the series expansion of the moisture content as a function of spatial coordinates and time. For 1-D evaporation in a block of finite thickness we solve a boundary value problem with a no-flow condition at the bottom and a constant moisture content at the surface. Using a code written in Wolfram's Mathematica, the transient, 3-D water content, pressure and velocity fields, as well as a drying pseudo-front, propagating inside the block, are reconstructed for various hydro-physical characteristics of soils and different block sizes and side-face boundary conditions. The effect of finite bloc sizes is assessed, i.e. 3-D flow is compared with 1-D evaporation, for which an analytical solution is available. Comparisons with laboratory experiments (theta-, TDR- probes measuring the moisture content at several in-block points) are made.

Key words: Linearized Richards' equation, mixed boundary value problem, method of perturbation, desaturation front, Averyanov's permeability function, van Genuchten's capillary pressure function.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evolution of clayey soil irrigated with groundwater of positive calcite residual alkalinity in the Lower Cheliff plain (Algeria): An experimental study

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Abstract

Over the last decades, groundwater irrigation has become the currency of many arid and semiarid regions, mainly North African regions. But the use of groundwater irrigation of poor quality may have an impact on soil salinization and physical degradation. This work focuses on a particular situation of clayey soils irrigated with groundwater of a positive calcite residual alkalinity in the Lower Cheliff plain (Algerai). Our aim is to predict the salinization process and structural degradation under the effect of water concentration by evaporation. Clay textural soil (S) is distributed in pots made by PVC tubes of 5cm diameter and 12cm high in the laboratory. The water with a positive calcite residual alkalinity ($W:AR_{Ca}> 0$) is added to pots till over-saturation of soil, then, after 24 hours, the water excess dries off naturally and the soil reaches its retention capacity. The weight difference between the wet pot and the dry one gives the necessary water volume to push the soil into its field capacity. The total evaporation of the resulted water volume is the concentration factor (CF). Soil solution contained in the pots is extracted for chemical analysis. Fifteen concentration factors were performed. As far as the waters are concentrated, the calcium ion was precipitate leading to an increase in the sodium molality of the soil solution. The increase of the concentration factors leads to sodium desorption of the exchange complex under the effect of depletion of elements with big solubility (Ca). It was observed an increase in the SAR which led to the destruction of the structure.

Key words: Clayey soil, salinization, calcite residual alkalinity, soil degradation, lower Cheliff.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil hydrophysical characteristics in the Nitra river basin (Slovakia): Their monitoring, analysis, online publishing

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Abstract

The paper is focused on the purpose made, or local monitoring of areal unit of the Nitra river basin (Slovakia, Central EU with total area 4501 km^2) in order to obtain the inputs on soil, moisture and hydrophysical characteristics of the given area. In this study, there was evaluated the share of individual soil texture classes in the Nitra river basin on the basis of map records and its comparison with the soil samples taken from the 111 selected sites. Soil samples were taken from two depths of soil profile (15-20 cm, 40-45 cm). The sites were chosen according to the percentage representation of individual soil texture classes. Based on the identification of sampling points localization and following analysis of granularity ratio, it can be concluded that the grain composition from the soil samplings does not correspond fully with the map records. Subsequently, drainage branches of moisture retention curves were measured for all sites. Then the individual points of pF curves were approximated according to Van Genuchten using GENERET-MD model and then, there were estimated middle (average) moisture lines from gained data for individual soil texture classes of the Nitra river basin. Obtained hydrophysical data were enabled on the web-portal. With the use of OpenGeo Suite software, version 2.4.3 and its components Geoserver and Geoexplorer, the data on soil characteristics were published online at: http://fzki.uniag.sk/hydrophysics/ .Thus, information about the soil characteristics in the basin is available to specialists.

Key words: The Nitra River Basin, hydrophysical chararacteristics, pF-curve

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Can preferential and matrix flow be separated at the bottom of smart field lysimeters?

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Abstract

It is a matter of utmost practical importance as well as of theoretical interest (e.g., for the assessment of soil-forming processes and soil water regimes) to estimate the vertical water fluxes in the soil (the soil hydrographs) with a reasonable accuracy and to be able to distinguish the quick downward percolation (which typically has a preferential character and is sometimes referred to as "influction") from the matrix flow in smaller pores. A weighable Smart Field Lysimeter (30 cm diameter, 30 cm depth) with an adaptively regulated suction at its bottom via a layer of permeable silica flower was used to measure the soil water fluxes at 30 cm under a short grass stand in a loamy Chernozem soils on loess. The downward flux volumes obtained by water balance of the collecting vessel over consecutive short time intervals (taken alternatively from 10 min to 24 hours) were sorted according to their magnitude and the character of the accompanying measurements of precipitation, soil water content, soil water potential, electrical conductivity and temperature. In this way, not only the rapid events can be distinguished from the medium and slow ones, but also the preferential events (arising under conditions of local inequilibrium) can be distinguished from the matrix flow ones (where a local hydraulic head equilibrium is alleged), albeit with some uncertainty.

Key words: Water flux, soil water regime, soil hydrograph, percolation, influction, macropores, mesopores, water content, potential, Chernozem, inequilibrium.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Variation of hydrodynamic characteristics for some soils in the plain of lower Cheliff, Algeria

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Abstract

The chosen study area suffered from many degradation problems of soils, these problems affect their physical, chemical, biological, and hydrodynamic parameters. The hydrodynamic parameters of these soils are mis understood. By the movement of the runoff water, the soils of the plain are subject to hydric and structural dysfunction which was assessed by the rain simulation method. The approach has been performed on two different precipitated intensities (67mm/h and 33 mm/h) in micro plots (0132 m^2) for five different soils. Simulated soil behavior depends on both physico-chemical properties and rain intensity it undergoes. The experiments have shown different hydrodynamic characteristics (runoff, infiltration, soil erodibility, particle transport, and rain imbibition) between the various soils studied.

Key words: Lower Cheliff, soil, hydrodynamic characteristics.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Depth function of manganese (Mn) concentration in soil solutions: Hydropedological translocation of trace elements in stratified soils

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Abstract

Periglacial cover beds are an important trigger of slope-water paths in sloped terrain of the mid-latitudes. Most hydropedological studies focus on the quantitative analysis about the interrelation between subsurface layering and run off processes at the slope scale. In our research we emphasis on a qualitative environmental geochemical analysis of trace elements and dissolved organic carbon in a small forest hydrological study area in the central parts of the subdued mountains of Germany (Location: Krofdorfer Forst, +50° 41' 3.69", +8° 38' 38.87"). The main objective is to assess the effect of lithological discontinuities of stratified soils within the depth functions of trace elements concentration in soil solutions (soil water and its dissolved and mobile fraction in a vertical distribution). Lorz (2008) show that depth functions of manganese (Mn) are characterized by strong pedogenic dynamics, analyzing a shortened sequential extraction of solid soil material. We investigated the hypothesis that lithological discontinuities act like aquicludes. Therefore we expect abrupt changes within the depth function of manganese as a result of such water-blocking effect (= geochemical barriers) as a consequence of mobilization under wet soil conditions. In a preliminary case study we sampled soil solutions from three different plots within a 400m-toposequence. We use in situ trench installed suction lysimeters with ceramic tips (Irrometer Soil Solution Access Tube) to extract soil water samples each 20 cm from top- (10 cm) to subsoil (110 cm). For geochemical element analysis we use an inductively coupled plasma mass spectrometry (ICP-MS). The results: A clear character of abrupt changes within the depth function could be illustrated for most of the plots. For example, at the hill slope plot a contrast of the depth function is from minimum difference of 333 ppb to maximum difference of 538 ppb between 50 cm and 70 cm profile depth (1 year sampling period). To conclude, these results demonstrate that hydrochemical quality and translocation processes of soil solutions determining an interrelation between subsurface layering and run off processes - respectively could be seen as an environmental consequence of it.

Key words: Pedohydrology, trace elements, periglacial cover beds, hillslope hydrology, geochemical barriers.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

A practical model for predicting drainage water concentration of subsurface steady states drainage condition for irrigated lands

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Abstract

Successful soil reclamation requires leaching out the excess soluble salts from the soil profile when the natural soil drainage condition is proper for this purpose. At absence of such drainage system, a surface or subsurface drainage system must be installed. In spite of advantages involved in using drainage systems with relatively shallow depth, the environmental consequences of discharging pollutants remains to be a considerable challenging factor for the integrity of surface and subsurface water bodies. This problem is partly to do with inaccurate estimation of real drainage flow discharge in a way in which the estimated drainage discharge concentration is much lower than real value. This article focuses on introducing an applied method by which drainage discharge at two levels at the top and bottom parts of the drainage structure with different concentration is affected. The methodology involved using three soil texture types (light, medium and heavy), four subsurface water salinities (8, 16, 24 and 32 dS m^{-1}), with three soil impervious layers depths (2.5, 3 and 3.5m), three deep drainage coefficients (2, 2.5 and 3 mm day^{-1}) and also combinations of the mentioned conditions. The subsurface drain spaces for four different depths (1.5, 1.6, 1.7 and 1.8 m) under steady state conditions with the designated crop pattern for annual cropping rotation in Khuzestan province climatic conditions were estimated. These were simulated with a computer program and the results were compared with the observed real data. The obtained results indicated that deepening of field subsurface drainage system does not have significant differences in achieving chemical equilibrium between the irrigation water and drainage outflow. This can be attributed to some economic and technical advantages. Quantitative assessment of the simulation results substantiates the reliability and validity of the proposed model.

Key words: Subsurface drainage, drainage water quality, drainage water concentration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of infiltration models parameters using adaptive neuro-fuzzy inference system

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Abstract

Infiltration process is one of the most important components of the hydrological cycle. The direct measurement of infiltration is laborious, time consuming, expensive, and often involves large spatial and temporal variability. Thus, any indirect estimation of this process is quite helpful. The main objective of this study was to predict the cumulative infiltration at specific time steps, using readily available soil data and adaptive neuro-fuzzy inference system (ANFIS). 63 double ring infiltration data were collected from different land uses of Kojor region. Basic soil properties including bulk density, particle-size distributions, organic carbon, gravel content (>2 mm size), and $CaCO_3$ content were determined. Infiltration models of American soil conservation service (SCS), Philip, Kostiakov, Green-Ampt and Horton were used and thus evaluated by coefficient of determination (R^2), Nash-Sutcliffe sufficiency score (NSSS), root mean squared error (RMSE) and mean error (ME). The results showed that Kostiakov model had the best fitness to experimental data with maximum of R^2 and NSSS and minimum of RMSE in all land uses. The ANFIS model was used to predict the parameters of Kostiakov model. The basic soil properties were hierarchically used as inputs to develop ANFIS models. Results of the reliability test for the developed ANFIS models indicated that ANFIS models can be can be successfully used for the estimate of parameters of Kostiakov model.

Key words: ANFIS, infiltration models, soil infiltration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Sensitivity of soil evaporation to climate change

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Abstract

The purpose of this study was to investigate the effects of climate change on bare soil evaporation in Adana (Turkey) and Chuncheon (South Korea). Potential and actual soil evaporations were computed using Penman-Monteith and Aydin equations, respectively. In simulations, the same soil was considered for the study sites. In this respect, the sensitivity of soil evaporation was studied in terms of change in air temperature, solar radiation, wind speed, relative humidity and precipitation within a possible range of ±20% from the long-term climate data of 30 years (1980–2009). The non-dimensional relative sensitivity coefficients were calculated based on the partial derivative of the dependent variable to the independent variables. Thus, the quantitative contributions of the major climatic variables to the soil evaporation were evaluated. It is concluded that for proper quantification of the effect of climate change on soil evaporation, the sensitivity analysis of the equations used is essential.

Key words: Climate change, soil evaporation, sensitivity analysis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of spatial variability of soil hydraulic properties on hydrological model for irrigation management purposes

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Abstract

Spatial heterogeneity of soil hydraulic properties effect on soil water content distribution, water flow and root water uptake. Therefore, model abstraction of parameter determination for entire field should perform to easily understand the problem and discussions about the most important aspects in hydrological model performance assessment. In this study, we used a combination of field monitoring and modeling to predict soil water content in a two layered sandy grassland soil for irrigation management purposes. The objectives were to i) investigate the variability of hydraulic properties at field scale and effect of these variations and various bottom boundary conditions on soil water status and irrigation schemes ii) to compare the direct and non-calibrated model simulations using lab determined soil hydraulic properties for 21 locations. To improve understanding of water flow and soil moisture status in areas of the field site, Hydrus 1D was run for the conditions of each location and simulated soil water content compared each together (for parameter determination abstraction). To evaluate the performance of the model in reproducing the data and spatial effects of hydraulic parameters (initial value effects) investigations, statistical evaluation coefficients (R^2, Ce and RMSE) were calculated. Result showed saturated hydraulic conductivity (K_{sat}), pore size distribution (n) and the inverse of the air entry (α) followed a lognormal distribution (p=0.05) while residual (θr) and saturated (θs) soil water content distribution were not either normal or lognormal. Log Ks is significantly correlated to log n and log α. The MVG transformed shape parameters are also significantly correlated. Indeed, statistical analysis demonstrated the spatial variability and heterogeneity of soil hydraulic properties in terms of one dimensional vertical conductivity (especially Ksat). Results OD modeling indicated water flow and soil moisture content influenced by MVG hydraulic parameters, bottom boundary condition (e.g. Ground water level) and finally an irrigation strategy (input water on the upper boundary condition). Our investigation confirmed in all locations of our field study other adjustable parameters such as rooting depth have much lower impact on simulated water content. It seems the uniform water distribution using sprinkler irrigation is not an efficient method in the field study. In this case differences of model output lead us to manage irrigation schemes precisely for different locations.

Key words: Hydrus-1D, spatial variability, soil hydraulic properties, irrigation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Impact of irrigation water quality of shallow groundwater on soils of Guerrara Region, Algeria

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Abstract

The palm dates grown in Guerrara Oasis which is dominated by alluvial soils formed of fine materials carried by floods of Wadi Aegir. The source of water in the region mainly is shallow groundwater with limited numbers of deep wells. The shallow aquifer is captured by wells with depth ranging from 3-30 meters. The objective of this study is to investigate the impact of irrigation water quality on soils of the oasis. In this context, four sites were selected inside a palm date farm, and in each site a soil profile was excavated for soil classification. In addition, soil samples were taken after each irrigation, to be subsequently analyzed in the laboratory using standard procedure. The morphological and analytical study of the soil shows that the soil is weakly to moderately salty (0.45 – 0.72 dSm^{-1}) in non-irrigated soils, and moderately to heavily salted (1.03–2.45 dSm^{-1}) for irrigated soils. The soil is slightly alkaline with a pH between 7.36 and 7.8, moderately calcareous with a values of $CaCO_3$ about 7.98–11.18%, with low to medium levels of organic matter (1.37–1.85 %), and with low levels of gypsum (1.85-11.05). The physical-chemical analysis of water shows that it is generally strongly to excessively salty (2.6–6.33 dSm^{-1}), neutral pH, with an overall chlorinated faces and calcium sulfate and magnesium. The analytical study of soil and irrigation water and the interactions between them confirm that the irrigation of soil by that water is not a big problem for the soil, provided to have a good irrigation management with respected of amounts and frequency, allowing the leaching of soluble salts in depth.

Key words: Oasis agro system, alluvial soil, shallow groundwater, irrigation, Guerrara.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Nitrogen and phosphorus contamination in some groundwater of Amik Plain, Turkey

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Abstract

The research was aimed to determine nitrate (NO_3^-), ammonium (NH_4^+) and phosphate (PO_4^{3-}) concentration and to evaluate its pollution levels in groundwater of Amik Plain. For this purpose, a total of 42 groundwater samples were collected from drilled well in September 2012. The groundwater samples were analyzed for temperature (T), dissolved oxygen (DO), salt content (SC), nitrate (NO_3^-), ammonium (NH_4^+) and phosphate (PO_4^{3-}). In addition, descriptive statistical analyses such as minimum, maximum, mean, etc., and correlation analyses among the parameters were made. The average T, DO, SC, NO_3^-, NH_4^+ and PO_4^{3-} concentrations were determined as 23.36 ^oC, 2.92 mg L^{-1}, 1.46 g L^{-1}, 7.03 mg L^{-1}, 1.60 mg L^{-1} and 73.12 µg L^{-1}, respectively. The 13 of 42 groundwater samples exceeded the permissible limit of 25 ^0C suggesting for very high quality classes. The DO concentration in all samples found lower than the permissible limit of 8 mg L^{-1} for high quality classes. In other words, all monitored groundwater showed dissolved oxygen deficiency. In this research, NO_3^- contents of the all samples are lower than the desirable limit of 50 mg L^{-1}. In only one samples, NH_4^+ contents was higher than the permissible limit of 6.44 mg L^{-1} recommended by FAO. All the groundwater examined samples in this research were lower than $PO_4^=$ limits of 6130 µg L^{-1} by FAO**.** There was a negative correlation between NO_3^- and SC ($p<0.05$). The salt content was positively correlated with NO_3^- and NH_4^+. In addition, a positive correlation was found between NO_3^- and PO_4^{3-}. As a conclusion, there was no NO_3^-, NH_4^+ and PO_4^{3-} pollution in groundwater samples. Although temperature and salt content seemed to be problems in some of the groundwater samples, dissolved oxygen deficiency was the main problem in the all examined groundwater in Amik Plain.

Key words: Amik plain, nitrate pollution, groundwater, phosphorus in groundwater.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Automation of mini disk infiltrometer based on particle tracking principle

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Abstract

Innovations in the field of experimental determination of soil hydrophysical properties should increase experiment objectivity, reproducibility and decrease its time consumption. In the following study we present basic aspects and ideas behind the novel, digital method for automated use of the minidisk infiltrometer (Model S - Decagon Devices, Pullman, WA), which could be applied without permanent construction changes of the infiltrometer body and in relatively low cost manner, using a simple electronic device with integrated digital camera (e.g. Smartphone). Negligible differences found between results of infiltration tests realized using digital image analysis and using the standard visual inspection could be viewed as a proof of the proposed method.

Key words: The minidisk infiltrometer, soil hydrophysical properties, infiltration tests

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Process modeling of drainage leakages in the function of precipitation

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Abstract

At the experimental drainage field Varna of Institute of soil science near Šabac on pseudogley soil (as per WBR, 2006 classification, stagnosol), was established drainage experiment with 3 variants of drain: 20m, 25m and 30m. Statistic modeling of conditionality of drain leakages and intensity of precipitation was prepared according to the data of daily sums of precipitation and according to the data of drain leakages collected for the period of experiment 2007-2009. For statistic modeling, in this experiment, three different statistical models were used: MA (Moving Average), AR (Auto Regressive) and ARMA (Auto Regressive Moving Average). MA model was used and observed in two stochastically processes, where conditionally first process intensity of rainfalls is "process effect" and second process, "process cause" is drain discharge. MA module primarily can be used for forecasting of the value of process and for further analysis of soil, planning, dimensioning and functioning of drainage systems. Application of ARMA model is showing the best results for prediction of values of leakage; AR model is slightly giving less reliable results, while MA model is giving lowest reliable results. Every model is showing better results for smaller spacing of drains.

Key words: MA, AR, ARMA model, precipitation, drain leakages.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The quality of water used for irrigation of agricultural soil in the basin of river Kolubara

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Abstract

This paper presents the results of testing the quality of water for irrigation during the growing seasons 2012/2013, in the basin of the Kolubara River, from Beloševac to Obrenovac, in three monitoring cycles on 16 selected sites belonging to agricultural area under irrigation. The determination of quantity of trace elements and heavy metals Cr, Ni, Pb, Cu, Zn, Cd, B, As, Fe, Hg was performed during mentioned period. The content of trace elements and heavy metals in the samples of water is generally below the MAC. In the samples no. 2, 3, 4, in the second series of sampling was recorded higher content of As above the MAC, which can be explained by drought, low water levels and potential anthropogenic pollution. In the other two cycles of monitoring are not registered concentrations of tested elements above MAC. Based on the presented and analyzed results of testing of hazardous and harmful substances in the water for irrigation of the Kolubara River, it can be concluded that it can be used for irrigation of crops and soil with restrictions and frequent quality checks during the summer months and control potential sources of pollution from industry.

Key words: Irrigation water, soil, harmful substances

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Integrated technologies for the regulation of water, salt and soil conditions supporting agricultural irrigation systems in Kazakhstan

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Abstract

The territory of Kazakhstan encompasses areas of forest-steppe, dry steppe and desert zones. In these ecosystems the following soil types are identified: chernozems, kashtan soils, brown and gray-brown soils and serozems. Analysis of the climatic conditions of these zonal ecosystems shows that to guarantee yields of agricultural crops irrigation (IR) is required. Therefore, in all areas of Kazakhstan IR systems were built which involve the transportation of water through open channels and pipelines (closed systems). IR is then carried out by furrow, strips, checks, sprinklers or drip IR. The experience in operation of IR systems in Kazakhstan indicates an emerging trend of steady depletion and pollution of water sources used for IR leading to an inevitable increase in norms of IR and fertilizer expenditure per unit of agricultural products. Additionally, current methods of managing increasing rates of IR and drainage strengthens the processes of soil destruction such as the removal of organic and mineral compounds, accelerates dynamics of alkalinity and subsequent alkalizations of soils. This deterioration in soil and water environmental conditions leads to a decrease in soil fertility and associated agricultural yield. Currently, of the 2.36 million ha of agricultural land in Kazakhstan, approximately 1.3 million ha are regularly irrigated (IRd). An analysis of the ecological status of IRd soils shows that 40-50% of irrigated land is affected by salinization and 30% by alkalinization. Currently the irrigation of crops utilizes to 60-70% of water resources in Kazakhstan. However, in areas currently IRd, - water availability has fallen to 75-95% of anticipated volumes, and in dry years decreases to only 60-70%. In this case, the areas experiencing primary water scarcity is South Kazakhstan, where more than 90% of IRd lands are situated, and includes the Syrdarya basins of the transboundary rivers Asa, Talas, Shu and Ili. As a result of this deterioration of ecological conditions of IR lands and the growth of water shortages for IR, crop yields have decreased by factors of 1.5-2 for the last 20 years. As a result of these changed economic conditions, there is increasing attention on the adoption of more advanced IR systems to halt the rate of degradation processes impacting on both root zone soils and water quantity and quality and as a way to increase the productivity of irrigated lands. Particular problems targeted include increasing the fertility of degraded IRd soils- the implementation of resource-saving IR technologies and the use of groundwater in the sub-IR and drainage water for the IR of crops. However, it is recognized that the full implementation of this approach to tackling the problems of IRd lands in Kazakhstan requires the development of an approach to support integrated water and land resources management of IR systems. To ensure the development of such an approach is based on sound science, KazSRIWE have undertaken a series of long-term studies to establish the key parameters which should support the selection of integrated water and land resources management technologies. With a focus on water saving technologies implemented in Kazakhstan include: flushing of saline soils, chemical reclamation of saline and alkaline soils, IR of crops, the use of groundwater in the sub-IR and drainage water for the IR of crops. Implementation of the developed technologies improve reclamation conditions and increase of water availability the IRd land, reduce the intensity of the contamination of water and land resources saline drainage water.

Key words: Irrigation, channel, reclamation, drainage, type of soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Experience of determining retention of easily accessible water in growing and amelioration substrates using a simple system based on glass wool

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Abstract

It is not easy to ensure ideal proportion of water, air, and solid soil particles (mineral and organic) in the production and subsequent intensive use of growing and amelioration substrates. Such substrates are characterised with high sensitivity to management involving water content. To determine an ideal proportion of the individual components in the substrate is thus indispensable. Chemical (nutrient) parameters are the primarily observed data in substrate production, while volume weight (e.g. under EN13040) is practically the only physical parameter that is followed. However, optimal water retention capacity is essential for the functional features of the substrate, particularly as to water retention and release for the needs of plants. To optimise the substrate composition as to its basic physical features (mainly water retention capacity), we modified a device used by a laboratory to a mobile version suitable for practical use in field conditions for production and quality control. The measurements showed that very small differences in the composition of components play a decisive role in the water retention capacity of substrates. It is still hard to obtain the required homogeneity in industrial production and substrates produced by small plants even showed differences in water retention by up to 60%, which has a significant impact on results in nurseries.

Key words: Water retention, substrates, soil physics.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Multimedial study guide of field hydropedological measurements

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Abstract

Soil hydropedological data measured in situ are inevitable base for the basic and consequently also for the applied research and environmental modeling. Quality of the measured data is a critical value determining the quality of conclusions which are derived based on the available measured data. The quality of the measured data depends mostly on a "human factor": The knowledge and practical experience of the technician performing the measurements. The Multimedial Study Guide of Field Hydropedological Measurements was created to present and explain some selected field measurements related to soil physics in a comprehensive, didactical and user-friendly way. The introduced topics are sampling of disturbed and undisturbed soil samples, determination of soil water content using indirect methods, tensiometry, different measurements of saturated and unsaturated hydraulic conductivity of soils, and basic lyzimetry. It is designed for students, and also academic workers and other interested members of the public. The English version enables everyone to use these guidelines and carry out each particular measurement, as well as evaluate and present the measured data correctly. The students of Czech University of Life Sciences Prague use this Guide as a regular learning material in subjects dealing with soil and water relationship since 2012. Now the 2nd revised edition is presented. The Guide is available on the internet (http://hydropedologie.agrobiologie.cz) and DVD (for asking).

Key words: Hydropedology, study guide.

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SOIL MANAGEMENT & RECLAMATION

9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application effects of biochar on hydraulic properties of sandy calcareous soil: Influence of particle size and application depth

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Abstract

A laboratory column experiment was conducted to investigate the effects of biochar with different particle sizes and application depths on hydro-physical properties of sandy soil including: soil water penetrability, infiltration rate, intermittent evaporation, water retention and saturated hydraulic conductivity. Biochar produced from conocarpus wastes was applied in different sizes (< 0.5 mm (S_1), 0.5-1mm (S_2) and 1-2 mm (S_3)) as biochar-soil mixture layer 2-cm thick at three application depths of 0 cm depth (D_0), 5 cm depth (D_5) and 10 cm depth (D_{10}). The results indicated that applying biochar restricted the movement of water penetrability as a result of decreasing the waterfront and saturated hydraulic conductivity. Additionally, the cumulative evaporation was the highest and amounted to 40.92 mm in the non-treated soil, but it recorded the lowest amount of 32.25-35.46 mm in the biochar-treated soil (especially at the application depth of D_0). Among different particle size of biochar, no significant differences of the cumulative evaporation were observed. The biochar addition caused significant increases in the amount of conserved and retained water compared to control soil. The highest amount of water conserved in soil was pronounced for S_2biochar at D_5.In addition, the cumulative water infiltration through the soil was significantly reduced by S_1 and S_2 biochar when applied at D_0.The values of saturated hydraulic conductivity for the biochar treatments were significantly lower than those for the control, with the lowest values for S_1 at D_0 and D_5. It could be concluded that applying finer particles (< 1 mm) of biochar may be more effective to improve some hydro-properties of coarse-textured soils.

Key words: Biochar, hydro-physical properties, intermittent evaporation, Water retention, hydraulic conductivity, cumulative infiltration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Steady state of carbon dioxide efflux from permafrost soil in two fallow systems

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Abstract

The greenhouse gas produced by soils is of a great interest in the context of climate change in high latitudes. There is still little experimental data on carbon dioxide efflux (CDE) from permafrost soils *in situ*. In order to estimate the rate of soil organic matter mineralization without roots and crop residues contribution from 2008 to 2013 we determined the CDE in two fallow systems: conventional (CnF) where weeds were removed by cultivation (found in 2003) and conservation (CnsF) – (found in 2008) where soil has not been treated after ploughing perennial grasses and weeds were removed manually. The research site was located at the Experimental Station "Marhinsky" of IBPC. 62°08´51´´N 129°45´45´E. Permafrost cryoarid floodplain sandy loam soil on the Lena River second floodplain terrace: C_{org} 1,32-2 %, pH_{H2O} 7,5 - 9. CDE was measured in one week intervals during growing season using static chamber methodology. Total production of $C\text{-}CO_2$ was calculated on the basis of daily average speed of CO_2 emissions. In the CnF from 6th to 11th year of the experiment (2008-2013) CDE was about 800-900 kg/ha annually during the vegetation period. In CnsF after the first year of ploughing up CDE amounted 2,500 + 190 kg C/ha, in the next 2-5 years of the experiment CDE has stabilized at a level of 1,500+150. Found out that 60% of carbon received from plant and root biomass (7 t/ha d.w.) emerged from the soil in the form of CO_2 in the first year of experiment. In the 6th year (2013), which was characterized by an unusually early warm spring (2 weeks earlier than average) and humid summer (annual norm was exceeded in 1.5 times), CDE on the CnsF reached 2,100+150 kg/ha. In CnF changes were not detected. Thus, in the present climatic conditions of Central Yakutia lower steady state of CDE from the investigated soil makes up about 800 – 900, the upper level makes up 1300 – 1500 kg C/ha which may raise along with increasing temperature and humidity during the vegetation period.

Key words: Permafrost soil, CO_2 efflux.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Organic carbon in soil aggregate fractions under native vegetation and agricultural use in Pitimbu, Paraiba, Brazil

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Abstract

Agriculture is a very representative activity in Brazil, one of the main economic resources of the country. However, the improper management of agricultural areas has negative effects on key soil properties such as soil organic matter. The aim of this research was to identify changes in soil organic carbon and its distribution in soil aggregates, depending on the transformation of native vegetation areas on pasture lands and croplands. The study was conducted in Pitimbu, State of Paraíba, Brazil. Three representative management systems were selected in a Ultisol: bean crop under conventional tillage (TIL), planted pasture (PAS) and native forest in Atlantic Forest biome (NAT). In each plot, samples of soils were collected at depths of 0-20 and 20-40 cm. Total organic carbon (TOC) was determined in the soil fraction <2 mm, according to Walkley & Black (1934). Aggregates between 8.00 and 4.76 mm were subjected to a 15 minutes wet sieving with vertical oscillation (Yoder, 1936), and fractions of aggregates were obtained in the following classes: (A) 4.76 to 2.00 mm, (B) 2.00 to 1.00 mm , (C) 1.00 to 0.50 mm, (D) 0, 50 to 0.25 mm, (E) 0.25 to 0.106 mm. The TOC of each class of soil aggregates were determined by the same method used in the total mass of soil. The results were subjected to ANOVA and mean comparison by Tukey test at 5%. There was no significant difference in TOC content of the total soil mass between TIL, PAS and NAT, and no significant effect of the sampling depth. However, TOC content in NAT (3.71 mg kg^{-1}) was higher than TIL (1.85 mg kg^{-1}) and PAS (2.66 mg kg^{-1}) along the sampled profile in A aggregate class ($P \leq 0.0006$). NAT also surpassed TIL in both B aggregate class ($P \leq 0.0445$, only in the layer of 20-40 cm) and C class ($P \leq 0.0287$). Plant diversity observed in the forest, the dense layer of leaf litter and the abundant presence of the root system of native species make NAT very protective of the carbon contained in the aggregates, especially in larger aggregates. The introduction of annual cropping and pasture in forest native vegetation areas in similar conditions to this research alters the distribution of organic carbon in soil aggregates. Studies on the sustainability of environments must consider not only the content of TOC in total mass of the soil, but also within aggregates.

Key words: Atlantic forest, conservation systems, soil organic carbon, soil aggregates, sustainability.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Change of the morphogenetic peculiarities of plain alluvial-meadow-forest soils under an anthropogenic influence in the dry subtropics river valleys of Azerbaijan

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Abstract

An important role of the river valleys in agriculture creation has been clear for science in the ancient East for a long time. The alluvial-meadow-forest soils in Azerbaijan spread in the debris cone mountainous rivers of the Great Caucasus and in the largest flood-lands part of the Kur river in Transcaucasia. The arid steppe subtropics condition is characteristic for the zone, humidity coefficient (0.3-0.5).A level of the weekly mineralized (1.0-3.0q/l) subsoil waters changes by 0.8-2.5m depending on micro relief and year seasons. These soils are shaped under high bonitet and liane plain forests (*Populitum ribosum, Quersetum carpinetum, Ulmus foliacca, Solix australior, Carpinetum corylosum* and etc.). The natural thin topsoil is characterized by the litter (AO=1.5-3.0sm) and high humic (4.0-6.2%) accumulative horizon. As a result of becoming stronger man's economy activity the forests have been cut down, that's why the large areas are used under irrigative grain, vegetable-orchard, planting of the forage plants and perennial fruit gardens. As a result of the irrigation with the long silty river waters, intensive cultivation under hydro-thermic regime, an application of organic-mineral fertilizers and other the morpho-genetic structure and physicochemical characters of the alluvial-meadow-forest soils subjected to serious changes. As a result of the presented anthropogenic influences 45-50cm of thickness of agro-irrigated cultured new soil layer has been shaped in the soil profile. Being disturbed the sowing layer structure of the irrigative soils (AUa'iz=22-25sm) getting dustry-clodiesh character, hardening of under-sowing layer (AUa''iz=18-20sm) (density-1.35-1.42q/cm^3), growing heavier of granulometric structure (<0.01mm= 60-65%), relatively reducing of humus (3.2-4.0%) and motion into the deep horizons, being fulvatic-humatic structure ($C_{h.a}$:$C_{f.a.}$= 0.9-1.2), distribution of carbonates equally over a profile ($CaCO_3$ = 6.8-8.0%), weak alkaline environment (pH=7.2-8.0) and other morphogenetic indices. The irrigative alluvial-meadow-forest soils profile is characterized by the following genetic layers system: AUa'iz-AUa''iz-B/Cg-AU^h_g-Cg. A turbidity degree of the river waters which influences on formation of soil profile and cultural soil forming process, dependent deposits and their qualitative structure, a quantity of alluvial humus (1.2-2.0%), total nitrogen (0.025-0.047%), $CaCO_3$ (3.5-5.1%), granulometric structure (<0.01mm= 62-66%), pH (7.8-8.1) seasonal regime observations. A character of the arid subtropics soil forming process (SiO_2:R_2O_3 = 3.7-4.2) of the irrigative and under forest soils has been defined on the basis of the total chemical analysis of silt fraction and soil.

Key words: Morphogenetic, anthropogenic, irrigation, dry subtropics, plain forest.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

What are the facilities of using saline soil as a forage area with halophytic plants?

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Abstract

A halophyte is a plant which is capable of surviving in a highly salty environment. Halophytic plants also can grow areas which have seriously problem as saline, alkaline or eroded etc. So that these plants provide to evaluate lots of empty areas. For examples; saline grasslands can be riched with halophytic forage plants for grazing or can be used to obtain hay. By adopting halophytic plants to get income can be provided from highly saline soil. Halophytic plants provide erosion on these kind of areas and also existing erosion can be stopped by covering on eroded areas. The goals of this study were to evaluate saline areas by planting halophytic plants and to determine these plants adaptation to environment. For these goals, first step was perennial halophytic forage plants' seeds were collected from their natural environments of the Central Anatolian region Second step was nursing plants were producted in greenhouse. One of these was producted with rhizomes. The last step was nursing plants were moved and planted on salty pasture area in Gölbaşı-Ankara-Turkey. The field experiment was conducted in fixed plots designed as randomized blocks with four replications. The test plants were A-*Leymus cappadocicus,* B-*Agropyron elongatum,* C-*Puccinella*, D-*Kochia prostrata*, E-*Atriplex lentiformis,* F-*Halimione verrucifera,* G-*Artemisia santonicum*, L-*Camphorosma monspeliaca*, M-*Petrosimonia nigdensis*, N-*Control (natural vegetation)*. All plots were irrigated to support growth in the first year. After the first year, irrigation was cancelled. Every year, after the harvesting, soil samples were collected from each plots per 20cm soil strata till 60cm depth. Soil samples were analyzed to determine the salinity parameters. The plants were observed to understand adaptation conditions and yields were measured. Plants samples were analyzed to assess some salinity parameters. The amount of salt taken from the soil by plants was calculated.

Key words: Halophyte, salinity, soil remediation, *Leymus cappadocicus, Halimione verrucifera, Agropyron elongatum, Puccinellia, Camphorosma monspeliaca, Atriplex lentiformis.*

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Response of soil organic matter to changes in the differing intensities of grazing in semi-arid rangelands in Iran

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Abstract

Carbon dioxide is one of the most important greenhouse gases in the atmosphere. Ranges and based on Carbon sequestration and soil conservation have a key role and known as dominant species in the region. In Iran, Overgrazing of rangelands, during the process of soil erosion is happening that this fact resulted to decrease soil carbon. In present study, comparative assessment of carbon sequestration capacity in the rangeland with different grazing intensity was investigated. Systematic random transect sampling with square plots was established in the region. After grinding the dried samples, organic carbon by electric furnace combustion method were measured and multiply to the conversion ratio of organic carbon in plant biomass, Carbon Sequestration by total weight in both plant and finally the base case was calculated per hectare of range. Total organic carbon stock in the ecosystem, in plant biomass and soil in site1 (low Stocking grazing) and site2 (high Stocking grazing) was 7/5 and 4/7 ton/ha, respectively. The results of the study showed that rangelands have a major role in mitigating the effects of elevated atmospheric carbon dioxide levels on global climate change. Also, the results indicated that management practices, such as grazing, and improved plant species will be concluded to increase soil organic carbon storage in the study area.

Key words: Carbon sequestration, rangeland, soil carbon capacity

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Co- Digestion of waste activated sludge and silaged mix of chicken litter and fodder beet

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Abstract

It's performed a comparative environmental assessment of various raw materials for biogas production: organic fertilizers and energy crops (sugar beet and fodder, leaves of Paulownia, spring and autumn leaves), three types of fertilizers (no bedding beef farming, pork and non-replaceable poultry fertilizers litter). The raw materials are analyzed in the following indicators: Dry matter (DM), Organic matter (OM), Organic Carbon (OC), Nitrogen (N), Nitrogen Ammonium (N-ammonium), Nitrogen nitrate (NO_3-N), Potassium (K), Phosphorus (P), pH (H2O) and heavy metals - arsenic (As), Cadmium (Cd), Chromium (Cr), Copper (Cu), Mercury (Hg), Nickel (Ni), Lead (Pd), Zinc (Zn). The results of the tested substrates from various materials (wood biomass and organic fertilizers), indicate that the tested substrates in physiochemical parameters meet all the technological requirements of the raw material for the production of biogas (CB, C, and a ratio C: N). Identified differences in the nitrogen content allow combining substrates to comply with the EU Nitrates Directive. The studied substrates and compost show content of heavy elements below the critical limits. A similar trend in outbound substrates (compost) it's observed.

Key words: Biogas, energy plants (crops), manure (fertilizer), sludges, ecological assessment

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Agroecologic valuation of organic waste in different technologies of storage

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Abstract

In previous studies (Baikov, 1987; Zaharinov, 2012) it was studied the biotechnology for anaerobic decomposition of organic fertilizers was studied; in which gas fuel-biogas and compost-substrate suitable for increasing the fertility of the soil- are produced. The objective of this stream of scientific studies and applied activity is to modify the link of bioreducers in the trophic chain of grazing type and to establish the optimal parameters for maximum ecological effect, which is evaluated according to the level of decomposition of the biomass. In Germany it has been proven in the recent few years that the effectiveness of the installations for production of biogas is raised considerably by using energy cultures. In our previous study (Shindarska, and others 2012) an evaluation was made as an energy carrier of biomass, produced as a waste product from the production of basic cereals (green mass and silage from sweet corn, hay, corn stalks and stubs, sunflower disks and stalks). The analysis of the results shows that only they can be used for direct burning. The rest of the raw materials can't be used for direct burning due to their low consistency of dry matter but they could take part as raw materials for production of biogas.

Key words: Organic manure, energy crops, biogas, compost, anaerobic technology

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of tillage on physical and biological behavior of a soil under a culture of lentil (*Lens exculenta*)

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Abstract

This work contributes to the study of the effect of three types of tillage among other conventional tillage, minimum tillage and no tillage on the physical behavior and biological soil for cultivation of legume of lentil (Lens exculenta). An experimental device has been in place for two years at the station Sebein (Institute of Technology of crops) on the basis of rotation lens / triticum durum. This test crosses three tillage techniques (conventional tillage TC, minimum tillage TM and no tillage SD), each technique is repeated three times. Through this device we were able to track the evolution of soil characteristics on various indicators, porosity, moisture, organic matter and microbial populations. The results show that no-tillage (SD) experiencing a decline in overall porosity of the layer 0-25 cm. Although the microbial biomass and density are increased in no-tillage, reduced porosity is not compensated. The conventional tillage until the second year of the experiment seems to be the best treatment.

Key words: Sustainable agriculture, microbial biomass, lens, direct seeding, soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Reclamation of disturbed areas in the industrial zones of Bulgaria

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Abstract

A huge problem exists in the industrial zones of Bulgaria on the cleanup and reclamation of pollution caused by construction debris. Old industrial areas almost dysfunctional in large part are gradually clearing parts. The problems are in their high spatial dimensions. These sites are mainly situated in 28 regional urban centers, some small and very small towns. Their functions will now be changed after their demolition and wrecking of buildings and technical infrastructure. Reclamation of disturbed areas is carried out in two stages: 1. Technical reclamation in which are carried out cleaning and site preparation; seizure and transportation of soil for their intended purpose, alignment and landscaping in its final stage, adding enhancers, seizure, transportation and spreading of the humus layer, construction of temporary and permanent roads, construction of erosion control and irrigation facilities, forming ponds. 2. Biological reclamation, whereby when the site is reclaimed for agricultural use- a complex of agricultural, agrochemical, technological and ameliorative measures for restoring the productivity of reclaimed land for 5 years after completion of technical rehabilitation and when the site is reclaimed for forestry use - forestry, agrochemical, technological and ameliorative measures for the creation of forest plantations of trees and bushes in the first three years after the implementation of technical rehabilitation and forestation. These sites can be again mostly industrial or other functions. According to the Law on Spatial Planning and the Ordinance on rules and regulations for the structure of different types of territories and development zones in three varieties industrial area green area needs to take 20-40 per cent of it, with one third of it must be provided for landscaping with trees. The problem is exposed to the example of part of the industrial area of the regional town of Blagoevgrad.

Key words: Construction debris, disturbed areas, industrial areas, technical and biological reclamation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Problems and perspectives for the agriculture in Blagoevgrad District

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Abstract

Blagoevgrad district is situated in Southwestern Bulgaria. The district area is characterized by a wide variety of natural resources that underlie the formation of a very diverse soil cover. A major problem is the non-use of the land for the benefit of us and indiscriminate wastage of this precious resource so out of ignorance and low interest for understanding the nature of the problem. Large number of agricultural land is misused. There is a very high percentage of uncultivated agricultural land, which in some cases can enhance their erosion. Arable land, combined with soil - climatic diversity, creates the conditions for agricultural production, which is the main raw material base for the development of Food Industry. The objective of this study was to determine the influence of soil diversity on the development of agriculture and to establish the extent to which the soils are affected by human activities. To achieve this purpose, the developed GIS of Soil Resources (GISoSR) is used and by following the approach for sustainable agricultural production in Arc-GIS environment by maintaining and improving soil fertility.

Key words: Arc-GIS environment, GIS of Soil Resources (GISoSR), erosion and degradation of soils, organic pollutants, heavy metals and metalloids.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of organic matter and bacteria treatments on some physical properties of sediments

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Abstract

Lately, serious ecological and socio-economical changes have been taking place in the Watershed of the Coruh River due to Coruh Dam Projects implemented by the General Directorate of State Hydraulic Affairs. Some negative effects of land degradation on natural resources of the Watershed have being observed during the construction of one of these projects, the Deriner Dam and building of new roads. However, there is not much scientific research on the degree of land degradation and success of precautions taken against it. In this study, erosion control and tree planting efforts to stop soil erosion and to improve soil properties in damaged areas as a result of building new roads, a part of the construction of the Deriner Dam, were investigated. In accordance with this purpose, soil samples were taken from three different areas; two of which are erosion control areas with terraces built and acacia and yellow pine seedlings planted and the one is an undisturbed (control) area with natural forests. In order to represent the whole study area, total of 60 disturbed soil samples were taken both from terraces and from sloping area left between terraces built for erosion control purposes in damaged areas. In addition, for comparison, 15 soil samples were taken from the undamaged natural forest area that has not affected by the road construction. Collected soil samples were analyzed for a total of six soil parameters including soil texture, pH, organic matter, total nitrogen, total lime, and electrical conductivity. By running variance analyses on these soil parameters, we tried to determine whether there are any improvements (rehabilitation) in soil properties of damaged areas with the help of ongoing erosion control and planting efforts. After evaluating statistical analyses run on the soils data, there were significant differences found for soil properties at terraces and between terraces in erosion control and reforestation areas. Moreover, it was determined that the reforestation efforts have resulted in improvements of soil properties at some degree but when they are compared to the soils of the undisturbed natural forest, it is clear that the degree of improvement is not sufficient yet. However, it can be stated that the areas planted with acacia seedlings have better soil properties than the areas planted with yellow pine seedlings.

Key words: Land degradation, soil erosion, erosion control and reforestation efforts, improvement of soil properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Water footprint of industrial tomato cultivation in Thessaly plain, central Greece

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Abstract

Agriculture plays a key role to global water stresses. In arid or semiarid areas like the Mediterranean agriculture is increasingly suffered by water shortages. The water footprint (WFP) is an index that relates water use between production and consumption, conveying the different origins of water. WFP includes the water consumed from soil moisture (called green water) or from irrigation (blue water), along with an estimation of the impact of pollution on the water resources (grey water concept). The purpose of this study was to measure the WFP of industrial tomato cultivation in Thessaly plain at Central Greece. For this purpose nine farms were selected including the main texture classes (sandy loam, clay loam, loam and clay) in the main agro-climatic cultivation zones of Thessaly plain used for for tomato cultivation in central Greece. Green and blue water footprint estimations based on datasets obtained for each farm, include volumes of water irrigation, meteorological, soil, and yield performance data. The water footprint of tomatoes produced in central Greece ranged from 23.4 to 73.4 m^3 per ton of fresh tomatoes. The water footprint of fresh tomato cultivation varies in the different farms mainly due to the local agro-climatic character, total tomato production volumes and soil conditions. The green water footprint component ranged from 1.84 m^3 ton^{-1} to 29.95 m^3 ton^{-1} or 1.84% to 29.95 % of the total water footprint, and the blue component ranged from 19.21 m^3 ton^{-1} to 43.50 m^3 ton^{-1} or 23.86% to 73.45% of total water footprint. The variability of water footprint of tomato cultivation in Thessaly plain indicates the importance of considering water issues at the local scale.

Key words: Water stress, tomato cultivation, irrigation

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

CO_2 emissions and carbon footprint of industrial tomato in Central Greece

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Abstract

The depletion of fossil resources and greenhouse emissions are key issues for the agricultural production systems. Agriculture in general contributes about 10-12% of the total global CO_2 emissions from human activities. As the vegetable industry contributes close to 60% of the greenhouse gas emissions within horticulture, it is needed for vegetables to identify their energy and carbon footprint so that to better manage their production and minimize .environmental impacts. Industrial tomato constitutes a significant agricultural cultivation in Greece covering an area of about 15.000 ha. The purpose of this study was to estimate the CO_2 emissions and measure the carbon footprint of industrial tomato in Thessaly plain, which is one of the main agricultural area of Greece. A complete randomized block design was established with the selection of nine tomato farms considered as treatments within which three plots of 3.2χ1.5=4.8 m^2 were selected considered as replications of each one treatment. In these farms, which were cultivated according to the rules of the integrated management system, the fruits yield and biomass production (separately in roots and above ground plant parts) were calculated as the difference between the amount of carbon contained in plant parts (roots, stems) and the CO_2 emitted due to agricultural activities (plowing, planting, irrigation, fertilization, plant protection, harvesting) by using an appropriate model. The results showed that the fixed quantities of carbon ranged between 1869-9026 kg CO_2 eq./ha while the emitted carbon quantities produced by the agricultural activities were 2743 to 5489 kg CO_2 eq./ha. Energy use in each farm ranged from 485.6 kg CO_2 eq./ha to 981.1 kg CO_2 eq./ha. The net carbon balance (difference between emitted by the agricultural activities amount of carbon and carbon fixed in plant biomass) ranged from -3310 to 1446 kg CO_2 eq./ha. CO_2eq for the final product range from 27,8 kg CO_2eq/tn to 54,3 kg CO_2eq/tn tomatoes indicating the appreciable possibilities of improving carbon footprint. Results from this study along with other environmental considerations such as impacts of freshwater scarcity will help to provide guidance in the design of more sustainable vegetable production practices in the region.

Key words: Industrial tomato cultivation, CO_2 emissions, carbon footprint.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimating root activity of a drip-irrigated peach orchard under the soil and climate conditions of a semi-arid region in Romania

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Abstract

Irrigation is a very important link in fruit growing of semi-arid regions. Dynamics of soil water content was studied in such a region, Dobrogea, during more irrigation cycles. The plant studied was peach, Cardinal variety, grafted on franc rootstock in a 4 m x 3 m layout, with a spindle bush canopy shape. Soil management system was represented by clean cultivation both between tree rows and in the row. It was found that the main root activity of the peach orchard occurred in the 0-80 cm soil layer, and this finding could be used for both irrigation planning and scheduling.

Key words: Chernozem soil, air porosity, drip irrigation, rooting system

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil properties and development of some coniferous tree species in Kolubara coal basin

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Abstract

From all energy sources, coal is still the most important energy resource in the world, since it - amounts about 46% of the total reserves of all resources used for energy. Large lignite basins are in our country, as well as in many other countries, the energy potential of strategic importance. The development of open pit mining as an energy-industrial complexes and the large volume of adverse impacts on the environment, obliged that integrated planning and restoration of degraded areas enable their comprehensively usage in the period after the ending of exploitation. Serbia is rich in low calorie coal (lignite) that is mainly used for electric power generation. Its proportion in the total reserves of all types of coal expressed in tons, and observed through geological (85%), balance (92%) or exploitation reserves (94%) is the largest. About 93 (%) of total lignite reserves locate in three large basins; - the Kolubara-Tamnava basin is the largest of them. The exploitation of lignite deposits in this basin occupies about 520 km^2. Impressive work on the revitalization and development of degraded land surfaces in this area has been made. The totally reclaimed area is more than 1,300 hectares, 75% of which - is covered with forest, while agricultural reclamation is carried out on 25% of the area. These initial relates of different ecosystems are justified considering the fact that the forest ecosystems are of the greatest importance for protection and maintenance of a healthier environment. In the technology employed in the opencast lignite exploitation in Serbia, overburdening of barren soil deposits is performed in a non-selective manner, which results in an occurrence of mixed or partially grouped layers of overburden from various geological periods on the surface of barren soil deposits, whose physical-chemical properties range from sterile inert sands of the Pontian geological period to heavy clay Pliocene substrata, of a very adverse hydrological and mineralogical composition. Thus, deposited pedo-substrate, of degraded structure and water-air regime, is very unfavourable in terms of survival of plants established in the process of biological recultivation by means of afforestation. Depending on the micro-ecological conditions and the type of disposals, a larger number of tree species has been used for afforestation. . The relatively large number of species was used for afforestation not only because of the great variability of the micro-ecological conditions caused by nonselective disposal of overburden, but also because of the tendency to enrich landscapes with the newly created forest ecosystems whose valorization should be moving towards the use of the landscape in post-mining period as the excursion and recreation areas. The paper presents the research results of physical, chemical and microbiological soil properties and development results of several coniferous trees species used in biological recultivation by afforestation.

Key words: Coal basin, open-pit mining, deposols, development of coniferous tree species.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assimilation experience of the delluvial salted soils in Nakhichivan

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Abstract

The salted soils which are delluvial by region spreaded in Duzdagh and its surrounding areas to the north-east side of the Boyukduz sloping plain in Nakhchivan A.R. According to the geological past the upper miocene and IV period sediments formed a basis of the sediments spreading in the zone. Settling on the left bank of the Araz river, to the northeast of the throughlike hollow called "Nakhchivan mold" this zone was a reason for weathering of the rocks by origin of salty sea lagoon of the Duzdagh sinklinal and Boyukduz anticlinal and formation of the saline soils delluvial by origin by bringing to the low zones by means of their surface streams. The area of the salted soils is more than 20 thousand hectares. These soils weren´t used for undevelopment of the river network. After the water reservoir was only built on the Araz river by Iran and Soviet Union in 1971 (1.35 mlrd.m^3), some of these soils have been begun to be irrigated under the tillage. After Azerbaijan got its independence (1991), a problem of returning of the soils being subjected to the delluvial salinization spreading in Duzdagh and Boyukduz zone has been actualized. Some of the soils in the same zones are begun to be joined the crop rotation at present. 30 hectares of the experiment area were selected in the place of the same zone where the soils were subjected to salinization. The water physical features and mechanical structure of the experimental area soils have been learnt. Then the salts quantity which is on 0-25; 0-50 and 0-100 cm of layers was determined on the research area. A type of the research object soils is sulphatic-chloridic-calcium-natiumic. The saltness on the soil surface (0-50 cm) changes by 0.25%-0.50%. Then the research zone was ploughed deeply, it was restored to a state of fit for tillage by applying fertilizer. The area was irrigated after the lucerne was sowing with the restoration. So, the soil was irrigated for 4 times by increasing 20-25% of the irrigative norm. The secondary salt survey was performed and the consequences were compared at the end of the year. Therefore a process of releasing of soils from harmful salts in the experimental zone has been continued. The salts penetrated into the low layers by leaching. Presence of the deep subsoil waters in the zone doesn´t create a condition for the secondary salinization. It was known that it is possible to release the soils from harmful salts and to get crop by planting salt-resistant cultures in the soil being subjected to delluvial salinization.

Key words: Delluvial salinization, Duzdagh, Boyukduz, Nakhchivan, saline.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Challenges of soil reclamation and restoration in Russia: Retrospective and perspective analyses

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Abstract

Russia is the country with highest intensity of minerals exploitation and transportation. These results in formation of huge areas with disturbed soil cover. Soil reclamation is one of leading process for optimization of ecological situation in post-technogenic landscapes. This process characterizes by different methodological and technological approaches. So called fast return technologies allow to restore soil-like bodied in critically places of ecological damages during 1-2 years period. These schemes are fast, relatively cheap and low time consumable, but as result of reclamation is unstable soil-like body with undeveloped plant cover and high risk of physical degradation. Monitoring of the soil cover state on places, reclaimed during last 40 years shows that fast technologies provide the conservation of soil and ecological problems, while the negative processes starts to displays during the 2nd or 3rd decades after reclamation . Among the negative process there are few critical ones: surface erosion, flooding, over compaction, degradation of vegetation. This negative experience provides the development of modern, natural based technologies of soil reclamation. These schemes uses as mechanism of re-vegetation and reclamation natural process of self-restoration which have being appeared and studied in abandoned quarries. The main concept of this green technology is to include natural restoration mechanism into reclamation scheme. As result, it is necessary to apply so called zonal adopted ways soil-plant cover restoration with chemical, biological and hydrological correction of anthropogenic landscapes. An experience of these technologies application are discussed in context of soil restoration and management as well as soil diversity of reclaimed urban, industrial, traffic and mining landscapes presented.

Key words: Soil, urban, traffic, mining, industrial areas, reclamation, restoration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Tehnozem topsoil reclamation and its transformation during agricultural use

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Abstract

One way of reclaiming man-made landscapes in central Russia is the application of the 60-cm chernozem soil humus layer above the thick sand layer. In the process of agricultural use such remediation designs throughout the thickness of the fertile layer undergoes substantial changes in the morphology, the structural organization of the soil mass, aggregate size distribution and composition.

Key words: Soil reclamation, chernozem, soil structure degradation, aggregate composition.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biochemical diagnostics of soil forest-vegetation condition after selective cutting in pine-stands of Krasnoyarsk forest-steppe

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Abstract

Structural changes of soil microbial community in first years after cutting influence on its functional activity. In the first year after cutting activity of hydrolytic soil enzymes (invertase and urease) has increased 20-30% in comparison with undisturbed stands. Irrespective of thinning intensity parameters of enzymes activity in two years after cutting varies. Particularly in pine forests with moderated and moderate-intensive thinning the catalase activity jumps up 5 to 6 times. At the same time activity of carbohydrate enzyme (invertase) decreases 2 to 3 times. To the fifth year after cutting activity both redox and hydrolytic enzymes keep below a before-cutting level. Oppression of soil biota as a result of harvesting works has negatively affected the enzymatic device of soil microorganisms. Various forms of microorganisms are included in destruction of organic matter under increasing of actual cellulose-decomposing activity in the soil of pine stands with a maximum grade of thinning. Activating of these microorganisms and their isoenzymes is probably consequence of a changing of hydrothermal conditions (such as temperature and humidity) on the tending blocks. One may think that biochemical activity depends on amount of logging residues, brightness, and hydrothermal conditions in forest floor, litter and topsoil. It has been concluded, that transforming of soil biochemical activity brightly characterizes the ecological effect of selective cuttings in Krasnoyarsk forest-steppe at the first stage of reforestation.

Key words: Antropogenic disturbance, pine-stands, selective cuttings, soil microorganisms.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Role of silicon in alleviating cadmium toxicity in maize

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Abstract

Role of exogenous application of silicon under cadmium stress in six different maize hybrids were investigated in hydroponic experiment with five treatments comprising of control, 7.5µM Cd + 5mM Si, 7.5µM Cd + 10mM Si, 15µM Cd + 5mM Si and 15µM Cd + 10mM Si. Results revealed that treatments of plants with 10mM Si application under both 7.5µM Cd and 15µM Cd stress resulted in maximum improvement in plant morphological attributes (root and shoot length, root and shoot fresh and dry weight, leaf area and relative water contents) and antioxidant enzymes (peroxidase and catalase) relative to 5mM Si application in all maize hybrids. Results regarding Cd concentrations showed that Cd was more retained in roots followed by shoots and then leaves and maximum reduction in Cd uptake was observed at 10mM Si application. Maize hybrid 6525 showed maximum growth and least concentration of Cd whereas maize hybrid 1543 showed the minimum growth and maximum Cd concentration among all maize hybrids.

Key words: Silicon, cadmium, RWC, antioxidant, maize.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

A research on determining lime requirements and characteristics of Lapseki - Biga (Çanakkale) acid soils

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Abstract

The aim of this study was to determine lime requirement and characteristics of Lapseki-Biga (Gürece, Dişbudak, Beypınarı, Doğandere, Otludere, Karacaali, Karahamzalar, Çakırlı, Adliye, Yeni çiftlik and Güleç villages) in Çanakkale acidic soils. In the study, 15 acid soils were sampled and analysed for their physical and chemical properties. Samples have been incubated for 5 months and analysed for lime requirements which depend on clay type, buffer capacity and cation exchange capacity. The Woodruff and Calcium Acetate methods were used to determine lime requirements of soils. The pH values of the study soils ranged between 5.46 and 6.37. $CaCO_3$ incubation method was used to decide the most appropriate soil lime requirement method in the study area. Results showed that the most appropriate method for Çanakkale was "Calcium Acetate" method. According to the results, lime requirements of research soils were between 100-300 kg/da. Therefore lime applications are required for these acidic soils in the region.

Key words: Acid soil, soil pH, lime requirement, Çanakkale.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of detritus input on soil organic carbon, nitrogen and sulfur concentration in a Central European deciduous forest

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Abstract

The much talked-of climatic changes of nowadays are also pointed out by the results of long-term meteorological measurements of Síkfőkút Project in northeast Hungary , since climate of the forest became warmer and drier in the last three decades. Regulational and functional processes of the forest ecosystem are variously influenced by the climate change, which has an effect on the structure and species composition of the forest; and through the changes in leaf-litter production, it influences the quality and quantity of organic materials and biological activity in the soil, both directly and indirectly. Síkfőkút DIRT (Detritus Input and Removal Treatments) Project forms a part of the DIRT Project which was organized by the US-ILTER (International Long-Term Ecological Research). General purpose of the project is to reveal the connection between the modifications of leaf-litter production and the changes of climatic conditions and land use. It also studies how the modifications, decreases or increases in litter production influence the organic material content, and physical, chemical or biological processes of soils. Our detritus manipulation experiment carried out in a *Quercetum petraeae-cerris* community examined the effects of various detritus inputs, on soil organic carbon, nitrogen and sulfur content. We applied three detritus removal (No Litter, No Roots and No Input) and two detritus duplication treatments (Double Litter and Double Wood). Eight years after the establishment of experiment significant reductions in soil organic matter content were measured in detritus removal treatments compared to control (15,8 – 24,1%). However, the increase was of smaller extent in detritus duplication treatments (6,9 – 11%). The soil nitrogen and sulfur content showed similar tendencies.

Key words: Detritus manipulation, DIRT, oak forest, carbon nitrogen and sulfur concentration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Short-term soil carbon dioxide (CO_2) emission after application of conventional and reduced tillage for red clover in western Slovakia

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Abstract

Tillage systems have impact on soil properties, crop growth and through this directly and indirectly influence the cropland CO_2 emission and therefore the global warming. In Slovakia, the wider adoption of conservation practices has barriers such as large acreage of compacted soils, the absence of detailed regionalization of suitable soils for such practices and the scientific evaluation of its application on sustainable soil productivity and environment protection. This study evaluated the short-term effect of conventional tillage (CT) and reduced tillage (RT) with (N1) and without (N0) N fertilizer application on soil CO_2 emission from cropland planted with a red clover (*Trifolium pratense*) during 40 days in 2013 on a tillage field experiment initiated in 1994. CO_2 flux, soil temperature, and soil water content were monitored during the studied period in western Slovakia. Soil CO_2 emissions were generally greater in CT than in RT when the treatments were fertilized. Opposite results were found when no N fertilizers were applied, with CO_2 emission being greater from RT as compared to CT almost the whole period studied, except 1 out of all measurements. A linear regression between CO_2 emission and soil temperature in conventionally and reduced tilled plots showed that soil temperature and not the soil moisture was a controlling factor. The highest CO_2 emission were recorded on the CT and RT plots during the first two weeks after tillage, showing that the tillage resulted in a rapid physical release of CO_2.

Key words: CO_2 emission, conventional tillage, reduced tillage, red clover.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil organic carbon fractions as influenced by vegetation type and land management: A case study in semiarid rangelands of Hamedan, Iran

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Abstract

Soil is an environmental component permanently changing due to the often cyclic processes of litter supply and vegetation cover. To investigate the influence of vegetation type on soil carbon fractions, six vegetation types, including rainfed wheat (RW), grassland (G), Astragallus–Bromus (A-B), Astragallus–lactuca (A-L), Astragallus–Artemisi (A-A), Astragallus–Euphorbia (A-E) were studied in similar environmental conditions in terms of parent material and slope aspect in Gonbad watershed, Hamadan. Total organic carbon (TOC), active carbon (AC), soil carbohydrates (CH), C mineralization (C_{min}) and basal respiration (BR) were measured in surface soils (0-10 cm) in fall and spring. TOC, AC, CH, and BR were significantly greater in A-B and A-A than RW in fall. These parameters showed no significant differences in RW, G and A-E. The amount of carbon released during the 90-day incubation was significantly greater in A-B than other covers; however, no significant difference was found between A-L and A-A. In spring, the content of AC and CH were significantly greater in the A-B than other covers. Showed non-significant difference in amount of TOC and BR in the spring; however, these indices were significantly greater in the A-B and A-A compared to other covers. In spring, TOC was significantly greater in A-B and A-A, than in autumn; however, no this index showed no significant difference among other covers in the two seasons. The content of AC in A-B was significantly higher in spring than autumn, but the seasonal changes of this index were not significant for other covers. CH was significantly higher in spring than autumn in A-B and A-L; on the contrary, the content of CH in A-A was greater in autumn than spring. The seasonal changes of BR were insignificant for the six vegetation types. In autumn, only AC and CH showed to be positively correlated. In spring however, positive correlation was observed between AC and CH, AC and TOC, BR and TOC, and also between BR and CH. It was concluded that TOC, AC, CH, C_{min}, and BR are sensitive soil quality indicators that reflect differences of land use and vegetation community structure in soils of this region.

Key words: Soil quality, vegetation type, active carbon, carbohydrate, carbon mineralization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Temperature and water potential of grey clays in relation to their physical, chemical and microbiological characteristics and phytocoenology on the Radovesice Dump

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Abstract

Radovesice Dump is a part of brown-coal Most basin, which is situated in the northern part of the Czech Republic. Grey clays are the anthropogenic substrates, which have been used here as a reclamation material in most cases. Water potential of these substrates corresponds to their physical properties, annual precipitation, soil temperature and terrain exposition. All these characteristics are the limiting factors of soil water available to plants. Area left to spontaneous succession and reclaimed area served as the experimental sites. Water potential was studied in three depths (10, 20 and 30 cm) of soil profile and the evaluated values show significant difference between individual depths as well as exposition. As far as chemical analyses are concerned, the highest values were recorded in case of reclaimed area, whereas the levels of soil moisture here were medium. On the other hand, area left to spontaneous succession showed the lowest values in this sense, however specific representation of vegetation was much large-scale. Values of phospholipid fatty acids, indicator of living microbial biomass, were relatively low in both cases. *Calamagrostis epigejos*, *Urtica dioica*, *Alopecurus pratensis* and *Astragalus glycyphyllos* belonged to the dominant herb species. It was found that spontaneous succession is more variable as far as the specific representation of vegetation is concerned, though more favourable soil physical and chemical properties provides technical reclamation.

Key words: Radovesice Dump, grey clays, water potential, soil moisture, soil temperature, phytocoenology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Impact of long term sugarcane cultivation on some soil characteristics

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Abstract

Pedologic alterations due to long term sugarcane cultivation in Haft tappe sugarcane agro industrial unit in Iran were subjected in this study. 3 soil profiles were dug, 2 in cultivated and 1 as a blank profile in non-cultivated adjacent land. Field study, laboratory analysis and microscopic observations helped to understand altered soil characteristics during the years under cultivation. The results illustrated distinct physical contrasts. More clay and less sand content in cultivated profiles in compared with the blank one were measured. Consecutive irrigation has changed the soil moisture regime and intensifies weathering and wet-dry cycles in soil and finally increases the production of layer silicates. Irrigation also increases the precipitation of suspended clay particles at these depths. Also significant reduction in soil porosity and increasing in bulk density of cultivated lands were observed in laboratory data and thin section observations. On the other hand, some chemical characteristics also have changed, like notable reduction in electrical conductivity, sodium absorption ration and gypsum content in cultivated pedons vs., non-cultivated one, as the results of leaching processes. Non-leachable salts like calcite showed any considerable difference in measured carbonate calcium equivalent data, but showed noticeable differences in calcite pedo-features in studied lands. Also the amount of cation exchange capacity and soil organic matter content were obviously higher in surface and subsurface horizons of cultivated soil profiles.

Key words: Sugarcane, compaction, organic matter, salinity, bulk density, thin section.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ecological evaluation of phosphogypsum ameliorant effect in soil

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Abstract

Phosphogypsum (PG) is a by-product of the production of phosphoric acid. The presence of important nutrients, such as potassium, phosphorus, and sulfur, makes it possible to apply PG as a fertilizer. It is also used as an ameliorant of slightly solonetzic and solonchakous soils and solonetzes. The effects of PG, which contains, together with the main component (gypsum), considerable amounts of admixtures in the form of compounds of stable strontium, fluorine, cadmium, and other elements, on the ecological state of soils are studied insufficiently. Model experiments on the effects of PG on the state of soil cenoses were performed with well reproducible conditions of artificial soils (ISO 11268-1). Seven variants of the PG/model soil mixtures were studied. The following Triad-based parameters were employed: i) chemical soil analyses (revealing the presence of potentially dangerous heavy metals), ii) ecological parameters (assessing changes in microorganism's community structure and functions, bioindication); iii) toxicological bioassays (utilizing classical endpoints such as survival and reproduction rates). The assessment of $[P_2O_5]$, $[Sr^{2+}]$, $[F^-]$ in acute tests using organisms from different trophic levels: producers (green algae and higher plant); consumers (crustaceans, mammal and protozoan), (iii) reducers (luminescent bacteria and micromycete) as well as the bioindication indices using biodiversity parameters of bacteria and fungi communities. Both positive and negative effects of the PG components were found. Thus, a significant increase in the biomass of lawn grasses was observed in the model soil with the PG content of less than 3.3%. In the soil containing more than 6.8% PG, the concentrations of Sr and F exceeded the maximum permissible values and adversely affected the living organisms. According to the basic ecological norms, the allowable content of PG should be ≤2.0% for the soils of specially protected natural areas; ≤6.8% for agricultural and urban soils; and ≤9.6% for the soils of forest, water management, and transport lands.

Key words: Ecological risk assessment (ERA), triad-based approach, soil mixture, chemical pollution, bioindication, bioassay.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of the effect of land use change from forest lands in to agricultural lands on some chemical properties of soil (Case study: Zarin Abad, Sari, Iran)

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Abstract

In order to investigate the impact of changing in usage of forest lands in to the dry farming (canola) and paddy lands on some chemical properties of soil in Zarin Abad area of Sari, Iran, from each land use were sampled in four replications from 2 depths of 0-20 and 20-50 centimeter as factorial design in complete randomized block pattern. Results showed that land use change from forest in to paddy lands, increased soil reaction from 6.43 to 7.52 but changed to dry farming (canola) had no significant effect on soil reaction. Land use change from forest to dry farming caused decrease in the amount of organic carbon about %46.5 that this decrease was about %38 in paddy lands. Amount of nitrogen was decreased in land use change from forest into dry farming but this decrease was not significant in changed from forest to paddy lands. Land use change from forest in to agricultural lands reduced the ratio of C/N too. While land use change caused increase about %397 in amount of available phosphorus in dry farming and increased about %192 in lands that converted to paddy lands but it had no effect on amount of available potassium and cation exchanging capacity. The lowest amount of electrical conductivity was observed in dry farming. Correlation coefficients between parameters showed positive and significant correlations between organic carbon with available potassium and electrical conductivity. There were positive correlations between electrical conductivity with amount of available potassium and soil reaction. Amount of available phosphorus showed a positive relationship with cation exchanging capacity too.

Key words: Land use change, forest, chemical properties of soil, Zarid Abad of Sari, paddy, dry farming

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

"Development Versus Ecosystem Services" A dilemma of urban soils in the case of Istanbul

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Abstract

Since the release of Millennium Ecosystem Assessment (MEA) Report in 2005, the significance of ecosystem services (ESs) have been under agenda of policy makers, professionals, practitioners who related to land management. The dependence of human well-being on ESs was clearly identified in MEA Report with the emphasis on biosphere as a result of rapid biodiversity-loss in the world. In this process, urbanization was emphasized as one of the major factors of biodiversity-loss as a consequence of rapid land cover change resulting from human-activities. Under these strong development dynamics in urban areas, unfortunately the nature's services especially the ones related to the lithosphere have been hidden or not rationally integrated with the spatial development process. Whereas the capital stock in soils is the foundation of all terrestrial ecosystems with several key functions including: production of biomass; storage of nutrients, substances and water; provision of habitats and species; provision of physical and cultural environment for human beings, carbon storage etc. For the last decades, several researches have been focused on ESs concept to clarify the interaction with human impacts, problems, potentials and relations for sustainable utilization of ESs, however, with weak interrelation to urban soil's ESs. Istanbul, as the most populated urban settlement of Turkey, has been experiencing rapid change of soil use where citizen's well-being is dependent on the continuity of ecosystem's functioning. In this context, this paper aims to clarify the impacts of urbanization on soil systems and intends to emphasize the importance of soils under the perspective of ESs.

Key words: Ecosystem services (ESs), soil, urbanization, land use/land cover change, spatial planning, Istanbul.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil and environmental management awareness as professional competency of the agricultural extension officers for their plans implementation

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Abstract

This study was conducted to check the Agricultural Extension Officers' (AEOs) competency level in soil and environmental management awareness, as it is important for them to interact with the farming communities having different types of soil. Data were collected from all the AEOs through a questionnaire in Khyber Pakhtunkhwa province of Pakistan. The study examines the possessed and required levels of importance were scaled from one to five on Likert scale (1 was very low and 5 were very high). Wide gap was found between the possessed and required level of competency regarding describe suitability of various soil types for horticultural and agronomic crops and reclamation of saline soil. We observed that suitability ranking of various soil types for horticultural crops (Diff. = 1.21), agronomic crops (Diff. = 1.20) and soil borne diseases (Diff. = 1.19) were the top three important competencies where training or improvement is needed. To better fill this gap we recommend that professional qualification of AEOs should be enhanced and training opportunities should be provided to them particularly to deal with soil and environmental management awareness. Thus training opportunities may increase their competency and will add highly skilled manpower to the system for sustainable development. It is therefore, recommended that AEOs may be provided pre and in service trainings of soil testing and environmental management in order to equip them with a capacity to able to work with farming community effectively to boost the living standard of farming community and alleviate poverty.

Key words: Professional competency, agricultural extension officers, developing countries, soil and environmental management awareness and plans implementation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Problems and perspectives for the agriculture in Blagoevgrad District

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Abstract

Blagoevgrad district is situated in Southwestern Bulgaria. The district area is characterized by a wide variety of natural resources that underlie the formation of a very diverse soil cover. A major problem is the non-use of the land for the benefit of us and indiscriminate wastage of this precious resource so out of ignorance and low interest for understanding the nature of the problem. Large number of agricultural land is misused. There is a very high percentage of uncultivated agricultural land, which in some cases can enhance their erosion. Arable land, combined with soil - climatic diversity, creates the conditions for agricultural production, which is the main raw material base for the development of Food Industry. The objective of this study was to determine the influence of soil diversity on the development of agriculture and to establish the extent to which the soils are affected by human activities. To achieve this purpose, the developed GIS of Soil Resources (GISoSR) is used and by following the approach for sustainable agricultural production in Arc-GIS environment by maintaining and improving soil fertility.

Key words: Arc-GIS environment, GIS of Soil Resources (GISoSR), erosion and degradation of soils, organic pollutants, heavy metals and metalloids.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ecological optimization for complex melioration of heavy clayer alkaline saline

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Abstract

The problems of root melioration of heavy clayey alkaline saline by means of the complex method application influence on the soil foreseeing combination, physical-mechanical, chemical and hydrodynamics methods are examined in the article. The necessity of change calculation occurring on soil environment with the purpose of elucidation conditions of the ameliorative effect, that or other method, for the worst influences on soil-thickness, and also establishment of synergetic effect, when in joint realization of the measures, their effectiveness increased in the most measure, important in melioration of heavy clayey saline. It is investigated physical, chemical and hydrodynamic nature of changes occurring in soil environment with the mixed structure for the complex melioration, mechanism of the swelling and limiting conditions in the process of swelling and limiting conditions in process of swelling formation are revealed. It is confirmed essential theoretical reasons about a differential connection between soil swellings with the absorption of its moisture; it is offered a formula for the calculation of the soil swelling volume. It is offered a theoretical condition for the observation of which washing of heavy clayey swollen saline becomes possible, it is introduced a notion of the soil real porosity for the evaluation of its physical condition after swelling. Three new physical parameters are proposed for the characteristics of the changeability of the physical condition of soil environment with the mixed structure: for the evaluation of the invasion scale in soil environment of the natural addition for the cultivation of soil friability index (K_f), a relative importance of this invasion to the swelling–coefficient of real porosity (K_a), for comparative evaluation of water rate in interaggregate and inside aggregate average coefficient of the relative stability of the velocity (rate) (K_c) and it is proposed a formula of washing norm calculation for the complex melioration with the use of these physical parameters. The necessity of the process of salting out in the period of soil mastering under agriculture achieves the introduction of the notion of the upper limit of economically grounded permissible salt maintenance, defining with the calculation of salt stability of cultures assimilator with the application of zero balance method, worked out on the basis of the principles of the agro ecological optimization of land melioration.

Key words: Swelling, complex melioration, heavy soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of soils degradation of Aral Sea East coast

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Abstract

The purpose of researches: to make a complex qualitative-quantitative assessment of a current state of East Aral Sea region lands, to study man impact factors (mechanical destroying, secondary salinization, drying, overgrazing, blowing etc.), to create a map of soils degradation. The current state of soils of east coast of Aral Sea, their basic physical, chemical, and morphological properties is studied. Anthropogenic transformation of soils within surveyed territory is caused both agricultural, and technogenic factors. There are following types of soil cover degradation: spatial (overgrazing), linear (a road net, lines of communications, pipelines) and local (farms, cattle-breeding hibernation). Depending on character of man impact degradation shows in full or particulate destruction of a soil profile, breaking of genetic horizons depth; changing of physical (density, structure, a porosity, cohesion, aggregation) and chemical (humus content, nutrition elements, reaction of soil suspension, allocation of salts in profile) soil properties. The soil map of east coast Aral Sea with application of GIS technology and usage of space images and field explorations was created. Parameters and criteria of soil degradation are developed. As criteria, following indicators (in percentage from initial state) are taken: decreasing of soil profile depth (A+B); decreasing of humus stock in soil profile (A+B); decreasing of the "physical clay" content (<0,01mm); increasing of water-soluble salts content; change pH a soil substrate (percentage from an average). On the basis of developed criteria, soil map and space images, the map of degradation of soils has been created. Areas of not broken and degraded in various degree soils (weak, average, strong and very strong) are shown on a map. In addition, types of soil degradation and intensity of their developing process are presented.

Key words: Soil cover, soil map, soil degradation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil studies in Kyrgyzstan

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Abstract

More than 93 % of land in Kyrgyzstan is mountainous. The arable land is located at 500 – 1800 meters above sea level. The most important problem of agriculture is the rational use of soil resources that estimates 17 million hectares, where 10.6 million hectares are agricultural land including 1.3 million hectares of arable land that 860 thousand ha of it is irrigated and 450 thousand ha - rainfed. More than 9 million hectares are pastures and hayfields estimates 175 thousand hectares. Area of saline and alkaline soils reach to 1 million hectares, eroded land - 6.5 million ha, stony soils - 500 thousand ha and wetlands - 85 thousand hectares. Negative result of soil degradation is widespread decline of organic matter. Thus, the loss of 1 cm humus horizon entails a reduction of humus reserves at 2-4 t/ha and yield - up to 2 kg/ha. Our republic because of its mountain environment is characterized by a high degree of erosion (70%). Key actions at erosion control in local conditions include appropriate agronomic system.

Key words: Soil resources, soil fertility, humus content, soil quality, soil degradation, erosion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of soil types and land use - land cover on soil organic carbon density at Maden Dere watershed

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Abstract

Identifying the primary factors influencing watershed scale soil organic carbon (SOC) spatial distribution is critical for improving the accuracy of SOC stock estimates. The primary objective of the current study is to determine the effects of soil type and land use-land cover on SOC in Maden Dere Watershed. To determine land use and land cover of the study area, Geoeye satellite image was used. Four main land use and land cover that are forest, pasture, orchard and cultivated land were determined. Results indicate soil types and land use-land cover were two influencing factors of SOC density spatial variation. SOC density of soil profiles, Haplustept (37.58 kg/m^2) was significantly higher than other soil great groups. Main reasons of this result are indicated as profile depth and pedological development. In addition, it was determined land use and land cover effect on SOC by taking soil samples. For surface soils SOC density, the lowest average carbon storage (5.05 kg/m^2) was found in cultivated soils. In conclusion, it should be developed proper land use policy and sustainable soil management and cropping practices to combat the on-going soil degradation and improve soil fertility in the study area.

Key words: Soil type, land use-land cover, SOC density, Maden Dere watershed.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of a laser lay-out on salinification degree of soil

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Abstract

By the purpose of reduction salinification, economy irrigate of water and the increases of fertility irrigation meadow and sierozem-meadow soil of Hungry steppe together with Japan International Rerearch Centre for Agricultural Sciences are carried out(spent) field experiences in farms "Khurshida Rakhmatullo Hamkor" association of water users "Yangiabad" Mirzaabad region and "Pakhtakor" association of water user, "Babur" Akaltin region. Agricultural manufacture at realization of washing, irrigation, ploughing of grounds, creation furrow, checks and alignment of crests, temporary channels and. т. д. There is a roughness of a surface of fields In result the non-uniform growth of plants lingers over of smooth current feed ditch of water and non-uniform distribution, nutritious elements on the area, spotty salinification, and also on the area. An effective way of the above specified problems is the alignment of fields from the help by the laser scheduler. The updating of the scheduler is automated to the laser device. It allows to level surfaces of a field with deviations (rejections) within the limits of ±5 cm from given gradient. The experiment is carried out (spent) with 3 variants: 1) without a lay-out (control); 2) lay-out accepted in a facilities (economy); 3) laser lay-out. After a laser lay-out at watering cotton 20 %, and on wheat 30 % of water is less spent. At irrigation water is distributed on a field in regular intervals. As a result of a laser lay-out the quantity (amount) of the dense rest in comparison with control variant has decreased -0,3 %. Besides the qualitative structure of salts was improved. In arable a layer conducting a place borrows (occupies) salts $CaSO_4$. After a laser lay-out middle salted of ground pass on weakly salted and not salted degree. Is liquidated from a surface of ground spotty salted.

Key words: A laser lay-out, salinification, ground, farmer, earth water, irrigation of ground, meadow, sierozem-meadow, dense rest, chloride, sulfate, salt, magnesium, calcium, potassium, sodium, area, plant

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Value of the Red Book in protection of soils of Azerbaijan

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Abstract

Among the problems of protection and rational use of natural resources the important place should be taken away to soils. Unlike many regions of the world Azerbaijan has a unique genofond of soils which develop in absolutely contrast ecological conditions. Studying the specifications of the distribution of these soils is necessary for spending considering geographical, geomorphologic, climatic, historical features of their individual evolution. At various stages of development of a soil science of the Republic such soils have been included in the general classification of soil types as garden, rice, relic. In due course they have lost the nomenclature importance, but have kept the historical mission. Unlike earlier used names, in systematization of soils, such nomenclature definitions as technogenically polluted, cultivated, degraded, salted which are used in modern classification of soils are included. Similarly to "the Red book" providing protection of a world genofond of flora and fauna, in «the Red Book» of soils those will be placed which have the limited area of distribution, which are on the verge of disappearance, and - have reference values for world classification of soils. Creation of "the Red Book» of soils of Azerbaijan has expedient necessity which will help to establish natural evolutionary interrelation of soil formation in time and space. According to the United Nations in the different countries it is lost up to 5-7 million - hectares of the various earths annually because of erosion, salting, bogging. The special role in protection of these soils is taken away to scientifically-educational education of the population. From this point of view,"the Soil museum" carries out a complete set and demonstration of the collected scientific material. On the basis of the analysis of complex research (in various years) the chronological scheme of historical stages of development of soil science in Azerbaijan has been made. All scientifically demonstration fund of a museum is fundamental base for creation of "the Red Book" of soils of Azerbaijan in which soils subject to protection will be included.

Key words: Genofond, resource, relic, evolution.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Different roles of soil characteristics on vegetation pattern in different grazing intensities

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Abstract

Evaluation of quantitative and qualitative changes in vegetation and soil along the grazing gradient is necessary in order to recognize the regressive changes in the vegetation and soil, and consequently to improve the rangeland management practices. The present study was carried out with the purpose of identifying soil factors affecting the vegetation distribution with various grazing intensities in rangelands of Urmia, Iran. Systematic-random sampling was done in late June to collect samples in three regions with low, medium, and high grazing intensities. Therfore, in each region, six 100m transects and along each transect, ten 1m×1m plots were establishesed. The species present in each plot were identified and the vegetation cover percentage, density and frequency of each species were recorded. Soil samples were also collected from 0-30cm depth in each plot and the bulk density, relative humidity, EC, pH, organic matter, carbon, nitrogen, particulate organic matter and soil texture were measured at the laboratory. To determine the impact of soil characteristics on distribution of plants in different grazing densities, the multivariate analyses were applied using Correspondence Analyses. The results showed that at the low grazing intensity, relative humidity, at the moderate grazing intensity, bulk density and particulate nitrogen and in the regions with the high grazing density, particulate nitrogen and particulate carbon were considered as the most important factors influencing the distribution of vegetation. Infact, the roles of soil characteristics on plant distribution were different depending on the grazing intensity.

Key words: Grazing intensity, canonical correspondence analysis, particulate nitrogen, particulate carbon, Iran.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Modified composition of clay in monument repairing

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Abstract

Clay is the most common element of construction in arid climates of Iran. In order to protect monuments, the use of new methods is unavoidable. Change in composition of clay components can be a solution to reduce the damages of climate changes. For this purpose different criteria such as number of cracks on the surface or the rate of contraction and expansion can be measured as the sign of environmental influences on buildings. This article tries to show the necessity of monument repairing by using a new sort of clay that causes increase of material capabilities to resist erosion. As a fact, any change in the component of clay must be supported by the new kind of mortar and other materials which are in relation with clay. This article also tries to provide new solution to modify the components of clay in order to make more resistance in different aspects. At first, it concentrates on the morphology of clay and then by discussion on effective factors on erosion suggests new composition of clay which is compatible with the environmental changes. The critical point is intention to use natural substance and agricultural residue which emphasize sustainable architecture. So use of this new method can be useful in both protecting historical heritage and environment.

Key words: Clay, monument, material, climate.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence on ecological salinization of irrigated soils at the delta rivers Zeravshan and Kashkadarya in Uzbekistan

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Abstract

In Uzbekistan, in particular and on deltas rivers Zerafshan and Kashkadarya concerning to Bukhara and Kashkadarya areas, land users become the farms testifying, that regions of our country really pass to market derivative attitudes. Such social and economic transformations and progress of productive forces is objective law. Nevertheless, scales and paces of progress of irrigated agriculture here requires search of the most appropriate forms of interoperability of farmers in various elementary soil areas (ESA) and structures of a soil cover (SSC). Because, progress and propagation secondary saltiness in the form of ESA and SSC on irrigated fields characterizes various degrees and characters salt accumulation. On the irrigated grounds of characterized territories are widespread deserted sandy, gray-brown and alluvial meadow grounds. Subsoil waters in territory of these soil lies on depth of 1-3 m, a mineralization of subsoil waters fluctuate within the limits of 3-10 gr l^{-1} and more, and on a chemical compound they concern to chloride-sulphatic and sulpho-chloride to types salinization. Evaporation of these mineralized subsoil waters in years hot days assists accumulation on a surface and in rooting a layer irrigated soil toxic salts NaCl, Na_2SO_4, $MgCl_2$, Na_2SO_4 and partly $NaHCO_3$. The increase of these processes of accumulation of salts in the top horizons of soil, one step at a time leads to expansion of their areas in space. This process causes to occurrence on district various ESA salted seasonal, seasonally-spotty, is constant-spotty, etc. soil among cultivated fields. The researches executed by us directed on improvement of an ecological condition highly saline soil. The above-stated oases show, that the lead washings, lay-out and entering organomineral fertilizers, also compliance with agrotechnical rules of irrigation, of 20-50 ha and more assist transformation motley on structure salted ESA and SSC in the expressed fertile fields homogeneous well the area. It makes possible models of stable progress of agriculture in territory of farms by land improvement and integration small ESA (3-5 ha) in the large homogeneous and fertile areas of the soil. For example, in territory newly irrigated highly saltined deserted sandy soil with characteristic for them motley spotty (3-5 ha) salt accumulation after a lay-out and their washings, have been organized crop of cotton on the area of 48 ha. Having watered cotton it was made under the diagram of 70-70-65 % of maximum-field humidity, and it has been brought nitrogen of 250 kg ha^{-1}, phosphorus and potassium according to on 200 both 100 kg ha^{-1} and manure of 25 kg ha^{-1}. Thus productivity of cotton has risen from 5-11 up to 28.4 μ ha^{-1}.

Key words: Soil, elementary soil areas, structures of a soil cover, secondary saltiness, organomineral fertilizers, propagation, salt accumulation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biochar effects on saline and none-saline soil properties of the Harran Plain Souhteastern Turkey

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Abstract

Effects of two different Biochars were evaluated on saline and none-saline soil properties. An incubation study was conducted using none-saline and saline soils collected from 0-30 cm depth of ikizce and Harran II series from Harran Plain, respectively and biochars of corn cobs (CC), and pistachio shells (PS). In this study, 0- 0.2- 0.4- 0.6- 1.2 and 2.4% of biochar rates were used. Soils and biochars were mixed well and wetted with water amount about 65% of field capacity of soils. Prepared mixed materials were incubated 180 days under 25±2 °C and about 65% humidity conditions and experiment was designed as completely randomized. Soil sampling was done during the 15th, 60th, 120th and 180th days of the incubation period. Soil pH and electrical conductivity (EC) values and carbon (C), and total nitrogen (N) amounts were determined in the soil samples. Study results indicated that increasing rates of biochar applications augmented the pH values slightly and lowered the EC values of the soils. More decrease of EC values existed in saline soil samples. The effects of biochar showed an increasing trend with increasing application rates and increasing sampling days. Higher applications rates (1.2 and 2.4%) of biochars much more increased the C values of none-saline soils than saline soils. When the biochar materials and the application rates were compared, the higher values of C and total N were taken from %1.2 application rate of CC and PS during the 120th day. Overall results indicated that biochars of CC and PS might be used as an organic soil conditioner to increase the soil C and N and decrease the EC values of saline soils of the Harran Plain.

Key words: Harran, biochar, salinity, corn cobs, pistachio shells, GAP region.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluating the use of different plant growth promoting bacteria in alcaline soil reclamation

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Abstract

Concerns on use of plant growth promoting bacteria (PGPR) in unfertile and poorly developed soils are increasing. The objective of this study was to evaluate usability and effectiveness of different PGPR applications for reclamation of alkali soils. Soil samples were collected from the salt and sodium affected areas of Igdir plain (Turkey). Three sulfur application doses (100, 200, 300 kg da^{-1}), three different bacteria applications (E1, E17, and A1) and three salicylic acid application doses (0.1%, 0.2% and 0.3%) were used and the experiment was conducted in a randomized plot design with 3 replications. The control groups without treatments were also used. Soil samples were incubated at laboratory under controlled conditions for 3 months. At the end of each month during the incubation period, soil samples were taken and analyzed for pH, EC, Na and amino acids. The results were evaluated for determining effectiveness and the usability of PGPR, sulfur and salicylic acid applications in reclamation of alkaline soils.

Key words: Alkali soil, bacteria, sulfur, salicylic acid.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil degradation in the drier zones: Challenge to food security in India

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Abstract

Protection and management of soil under a changing climate is a challenging issue in developing countries like India with a fast rising population and large-scale environmental degradation. Controlling soil degradation is important in achieving food security and poverty alleviation. Indian economy is largely agriculture-dependent and life of millions of rural poor is some way related to agriculture. Falling soil fertility affects the productive resource base of the economy. Out of the total geographical area of 329 million hectares, 175 million hectares, mostly in semiarid agricultural area are degraded. Extremes in climate erode the soil in the hilly regions, where the land is already degraded by anthropogenic activities. In such regions, landslides and floods reduce the area of cultivable land. Increasing rainfall seasonality and rising temperature in certain parts make the soil dry for a long duration. Intensive agriculture and unscientific irrigation leads to water logging, soil salination and alkanization in farms. Urban and domestic outflow, salinity intrusion due to groundwater overdraft in coastal zones, overgrazing, deforestation, industrial development etc result in widespread degradation of rich soil. In the arid western zone of India, wind erosion increases desertification, whereas in the plains, erosion due to floods and eutrophication due to agricultural runoff are major issues. The agricultural revolution resulted in losing fertility of rich farming lands and contaminated the soil and water. Sand mining for industrial and residential purposes adds to the already shrinking agricultural area. Efficient soil management is vital in maintaining food security. Unfortunately, the administrative and legal measures for soil protection fail because of various socio-economic and political reasons. Present paper is a comprehensive assessment of the issues associated with soil degradation in the drier zones of India. A critical review of current policies and management practices has been made to suggest guidelines for better soil management.

Key words: Soil, climate change, agriculture, India, degradation, management.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The influence of natural and anthropogenic factors on soil properties in the upper and middle Etsch Valley (Northern Italy)

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Abstract

The field studies focused on the Etsch-valley in the South Tyrolean irrigation region in Northern Italy which covers a land area of 18.500 ha. Orcharding (especially apples) is the dominant land use there. The average annual precipitation in the upper valley (Val Venosta) is about 500 mm per annum. The distribution of soil types within the region is very heterogeneous. In general, hillsides are dominated by Leptosols and Cambisols. Most of the soils on the valley floor are gleyic Cambisols, partially calcaric Fluvisols or Gleysols. Many soil sites in the study area are very close to the groundwater and reductive pedogenetic processes can easily be detected. Evidence of these processes is the presence of Gleyosols and other soil types with gleyic properties. Especially at valley bottom sites the groundwater is very close to the surface so that groundwater may rise capillarily and supply the tree roots sufficiently with water. Own field studies have shown that the spatial variability of physical soil properties can vary significantly within very small distances across the fields. The results show an extreme small scaled variation of soils at the study sites. Regosols, (gleyic) Cambisols, (calcaric) Fluvisols and Gleysols are the most common soil types in the region of measurement. The study points out that the pedogenesis of this region is influenced not only by natural factors, but also by an intensive agricultural use of the soils. In parts over-irrigation and soil compaction may endanger a sustainable use of the soils in this region..

Key words: Soil use, soil compaction, over-irrigation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Agrochemical and chemical assessment of waste from livestock farms

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Abstract

With the development of industrial farming a number of problems occur. One of these is pollution of soil, water and environment by improper storage and usage of manure. The great difficulties create liquid manure generated during water cleaning of the premises. In our country many livestock farms are left without technology solutions for storage and use of manure, this may lead to environment pollution. Waste management from livestock is related to their location, the cleaning of the premises, characteristics, availability of enough space in the area, periods of storage and utilization of manure etc. The aim of this study is to analyze and evaluate the manure from livestock farms in the region of Veliko Tarnovo and recommend technology solutions for proper utilization, to reduce pollution and gas emissions into the atmosphere. Fourteen farms in V. Tarnovo region were surveyed. The comparative agrochemical, chemical and environmental assessment of stayed and fresh manure, found that the greatest nutritional value have poultry manure, followed by pig and cattle manure. Poultry manure is highly concentrated and fast-acting. Depending on the way of cleaning we recommended technology solutions for proper storage and use of manure for each farm.

Key words: Organic fertilizers, pollution, technology solutions

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determine the effect of sludge from waste water treatment plants / WWTP/ on forest tree species in order to create energy crops in Bulgaria

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Abstract

Obligations of our country made during the negotiation process for EU membership include energy production from renewable energy sources /RES/ and their integration into the grid. Currently, this energy comes mainly from hydropower plants and a significantly lower proportion of wind-electric generators. In recent years entered into exploitation a large number of treatment plants for waste water /WWTP/. During the biological purification, large quantities of sludge were obtained, which must be utilized. The aim of present study is to determine the impact of sludge on the growth and development of forest plantations because forest plantations are raw materials for biogas production. Field experiment on Vertisols was conducted, using the stale sludge from WWTP Sofia. Two type of willows tree was planted Salix alba and Salix Viminalis- 432 pieces. Before tree planting, sludge and soil were analyzed for chemical, physical-mechanical and microbiological indicators. It was found that the sludge is biomass and has a positive impact on the growth and development of the willows. The Vertisols on which the experiment was conducted meets the requirements for rooting and development of forest plantations. Research continues to identify changes that may occur in the soil and crop resulting from the use of WWTP sludge.

Key words: Forest plantations, willow, sludge from WWTP.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

PRECOS framework: Measure the impacts of the global changes on soils, water, agriculture and territories to better anticipate the future

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Abstract

Under the impact of urbanisation and climate change, agriculture and territories are rapidly changing. Recent innovation in spatial metrology both in the fields of robotics and of information technologies and communication, makes it now possible to propose new management practices, assessment, monitoring and decision support tools. Their purpose is to assist local authorities and stakeholders for the management of their territories. In a context of increased land and natural resources scarcity, they offer the possibility of anticipating evolutions or testing the impact of envisaged developments through scenario simulation. PRECOS's holistic approach thus combines the expertise of researchers, economists and engineers in a number of fields such as water and soil resources, agronomy, urbanisation and land use, information technologies and infrastructure etc. It integrates data pertaining to these fields and is complemented by a socioeconomic and regulatory analysis of the territory illustrating its constraints and stakes. The approach articulates around a modular architecture, modelling software and spatial and temporal representations tools. It produces indicators in three core domains: soil degradation, water and soil resources and agricultural production but has the flexibility of adding other software components if local situation requires it. As representative territory of numerous situations of the Mediterranean Basin (urban pressures, overconsumption of spaces, degradation of the milieus), the Crau plain area, situated in the Southeast of France between the Alpilles and the Mediterranean Sea, has allowed to validate a prototype for the approach and to test its feasibility in real situation. The PRECOS programme has been earmarked for its innovative character and potential by the EIT's (European Institute of Innovation and Technology) Climate-KIC (Knowledge Innovation Community). It is currently (2013 - 2014) supported as a pathfinder preparing the conditions for up-scaling and adapting the approach for the international market.

Key words: Soil, water, resources, territory, urban sprawl, climate change.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Possibilities for biogas production from waste – potential, barriers and legal notices

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Abstract

Concentration of population and enhance the socio-economic development of society is related to the generation of large amounts of waste. Their accumulations have negative impact on the environment and create risks to human health. The report provides information on appropriate organic waste for biogas production in Bulgaria – waste from animal, plant and domestic origin. It is shown which type of biomass has the highest energy potential and the average gas productivity of certain biological waste. Barriers and legal standards for biogas production in Bulgaria and financial conditions for the construction of biogas plants are shown in details.

Key words: Waste, biogas, gas productivity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Preservation of soil resources at development of fields

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Abstract

At intensive development of fields the speed of formation of the disturbed lands is rather high and rehabilitation works can't be carried out before completion of the development Therefore at the mining enterprises the big areas of the disturbed lands and considerable stocks of the removed fertile soil are formed; these layers should be used for soil rehabilitation. The fertile layer is stored in clamps and kept until appearance of the areas for soil rehabilitation. Thus the period of storage can exceed several decades. In the course of removal and storage the degradation of the main agrophysical and agrochemical properties of the fertile layer takes place. The fertile layer is strongly compacted practically to critical values for vegetation development, and as a result of intermixing of different soil layers and active oxidation of soil mass the decrease in humus content occurs by 2-3%. Therefore at the expiration of the period of storage more than 10-15 years we receive, for the most part, a poor material which is required to be reclamated in order to rehabilitate soil fertility. Additional investments are also required in this case which at existing approach to carrying out of rehabilitation and under contemporary conditions practically could not be ever recompensated. Therefore it is necessary to look for new possibilities of use of this valuable material. In order to keep and rationally use the removed fertile layer it is necessary to place it at once on the surface of the disturbed land. It isn't difficult to make it at the mining enterprises where the internal dump formation prevails. It is enough to correct only logistics of movement of rocks and to place the fertile soil layer at once on the top, final ledge of dumps. But for all that one can increase the thickness of the dump up to 2 m. It will permit to place large volumes of the fertile layer on the smaller areas. At the same time high-fertile artificial soil-like formations appear which can efficiently be used. This will lead to preservation of fertility and later on, in case of need, this material can be repeatedly used for soil rehabilitation. Thus, the experience of application in Russia of the main rehabilitation technologies testifies to the need of their essential adjustment taking into account the obtained knowledge and modern social and economic conditions. It is necessary to carry out essential modernization of existing technologies of recultivation, taking into account their soil and ecological efficiency and orientation on further purposeful use of the territories under rehabilitation. Now the main objective of soil rehabilitation should consist in the localization of technogenic landscapes and reduction of negative influence on adjacent territories.

Key words: Recultivation, fertile soil layer, disturbed lands.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Knowledge of soil management and environmental sciences to the agriculture officers in developing countries

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Abstract

Agriculture Officers (AOs) play an important role in agriculture and rural development in the country through the knowledge of soil management and environmental sciences. Soil is necessary for the crops essential for survival of the human race as no soil means no food. This study was conducted to check their competency level in soil management and environmental sciences, as it is one of the important for them to interact with the farming communities having different types of soil. Data were collected from all the AOs through a mailed questionnaire. The study examines importance of said competency to AOs for their job performance in the area of soil and environmental sciences. Both, for possessed and required levels of importance were scaled from one to five on Likert scale (1 was very low and 5 were very high). It was revealed that differences exist between the level possessed and the level required and non-significant differences were found regarding the technical competency of AOs in soil sciences. Wide gap was found between the possessed and required level of competency regarding Describe suitability of various soil types for horticultural crops followed by Describe suitability of various soil types for agronomic crops and reclamation of saline soil. We observed that as per the ranking order Describe suitability of various soil types for horticultural crops (Diff. = 1.21), Describe suitability of various soil types for agronomic crops (Diff. = 1.20) and Soil borne diseases (Diff. = 1.19) were the top three important competencies where training or improvement is needed. To better fill this gap we recommend that professional qualification of AOs should increase and training opportunities should be provided to them particularly to deal with soil and environmental sciences. Thus training opportunities may increase their competency and will add highly skilled manpower to the system for sustainable development. It is therefore, recommended that AOs may be provided pre service and in service trainings of soil testing and environmental sciences in order to equip them with a capacity to able to work with farming community effectively. Moreover, the knowledge of pH of soil, important layer of soil and the structural knowledge of soil to know the soil behavior of various seasonal conditions.

Key words: Knowledge, agriculture officers, developing countries, soil management and environmental sciences.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Accumulation of organic carbon and nitrogen in reclaimed lignite mine soils under the influence of forest plantations

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Abstract

Accumulation of organic carbon and nitrogen was studied in the reclaimed lignit mine soil influenced by the forest plantations. Studies were carried out on plantation of Alnus glutinosa, Tilia argentea and Larix leptolepis. Characteristics of litterfall of Tilia argentea are enabling that the most of dead organic remains under this speaces transformes into a humus, which extends the more intense accumulation of carbon in the soil comparing to another mentioned speaces of wood. Under Alnus glutinosa, larger part of organic remains, because of narowly C/N ratio, decomposes to the final products of chemical decomposition. From that reason carbon stock in the soil is lesser than under Tilia argentea. The lowest density of carbon in the soil has been discovered under the trees of Larix leptolepis. The reason for that is lower production of litterfall in Larix woods comparing to Tilia and Alnus woods.

Key words: Barren soil, Pinus nigrae, organic carbon, nitrogen.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The manifestation of the land degradation in the Irkutsk region at conditions of the anthropogenesis

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Abstract

This paper discusses the problem of the soil degradation in the Irkutsk region. These problems are still unresolved. The analysis of the current ecological status of soils of the area, the literature review and our own material are present. The influence of the regional characteristics of soils on the degree of development of negative processes and their consequences is highlighted. The main factors of the negative human impacts on the soil and agricultural lands are revealed. The soil erosion, soil compaction, the pollution by chemicals and oil products, acidification of the environment, reducing the content of organic matter in soils, which lead to the depletion of soil fertility cause the greatest preoccupation in the Irkutsk region among the processes that cause soil degradation.

Key words: Soil, factors of soil formation, processes of soil degradation.

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SOIL HEALTH & QUALITY

9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil organic matter and soil acidity in Mangrove areas in the river Paraiba Estuary, Cabedelo, Paraiba, Brazil

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Abstract

Mangrove ecosystems are of great environmental significance, because of their fragility and role in feeding and breeding various animal species. In northeastern Brazil, the disorderly occupation of estuarine areas and the urban sprawl have led to a considerable loss of the original area occupied by mangroves. In the municipality of Cabedelo, State of Paraíba, there are about 4,900 ha. of remnant mangrove areas in the estuarine complex of the Paraíba River. However, information about the attributes of mangrove soils at this location is quite scarce. The aim of this study was to quantify the soil organic matter and soil acidity in mangroves located in the estuary of the Paraíba River, State of Paraíba, Brazil, in order to increase the database of soil attributes in this region. The study area is in local influence of the Restinga de Cabedelo National Forest (Flona), an environmental conservation unit of the Chico Mendes Institute for Biodiversity Conservation. For the choice of sampling points, we considered an area that receives direct influence of the eviction of domestic and industrial effluents. The soil of the study area is an "Organossolo Háplico" in Brazilian Soil Classification (Histosol), and was sampled at four point sites: one upstream of the effluent discharge (P1), one in the watercourse receiving effluent water (P2), one downstream of the effluent discharge (P3) and another near Flona (P4), at 0-20 and 20-40 cm, in four replications in time (28/08/2012 in the morning and afternoon, and 21/01/2013 in the morning and afternoon). Potential acidity, pH and soil organic matter (SOM) were determined. No significant differences were detected in the potential acidity of the four collection sites, which ranged from 0.38 to 0.45 $cmol_c\ dm^{-3}$. Soil pH was greatest at point P4 (7.0) and lowest at point P1 (5.8). The SOM was highest at point P1 (86.4 %) and lowest at P2 (77.9 %). The attributes related to soil acidity were not sensitive to indicate differences in the environments we evaluated, and seem to indicate the contamination of mangroves by discharge of sewage into water bodies that border these environments. The high organic matter content of soils in the mangrove may have helped avoid significant fluctuations in soil acidity, because of the large buffering capacity.

Key words: Organic carbon, conservation systems, soil aggregates, sustainability.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil quality assessment using linear and non-linear scoring functions

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Abstract

Assessing the quality of soils of GAP region with high agricultural potential for the country and development of soil quality indexes unique to the region are crucial in assuring the suitable use of agricultural areas and sustainability of soil productivity. Since irrigation started in the agricultural soils of the Harran Plain, they have been used intensively, and they have been increasingly degraded due to unsustainable management methods and cropping designs, which resulted in the loss of the production potential. After GAP development project, the land use of the region changed, and increases in crop productivity have been observed through the use of different crop varieties and chemical inputs (fertilizers and pesticides). However these increases have not lasted long and farmers have started to have difficulty in maintaining the same yield, because soil quality losses decrease the use efficiency of crop inputs. Soil analyses carried out with the support of agricultural ministry do not solve present problems and support sustainable agriculture. Instead, developing and adaptation of soil quality indexes which will make interpretation of quantitative results easy and allow comparison of different management methods among farmers would be more useful.In order to have a sustainable agriculture in the Harran plain and the other areas which are to be opened to irrigation, there is an urgent need for monitoring the soil quality with minimum data set that are easy and cheap to obtain and are effective in resolving the problems related to agriculture and environment and also explaining the problems which agriculture sector face and developing the soil quality indexes. The goal of this study was to investigate the potential of assessing and monitoring the qualities of soils in the research area with multivariate statistical methods and linear and nonlinear scoring functions. For this purpose, the soils of the Harran Plain under different soil management applications (manure application, different crop rotation) were sampled, over 400 soil samples were collected and 30 soil parameters including various soil physical, chemical and biological characteristics were determined both in laboratory and field. A minimum data set including least required soil physical, chemical and biological properties were determined using multivarite statistical methods such as Principal Component Analysis and finally soil quality indexes were obtained from selected variables using both linear and nonlinear scoring functions. This study presents the primary findings of soil quality initiative research conducted in the Harran Plain, Southeastern Turkey.

Key words: Soil quality index, Harran plain, soil management, scoring functions.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial distribution of dominant tree species in a tropical rain forest and its relation with site quality

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Abstract

Several investigations at regional or local scale have studied density-dependence and dispersal limitations on the distribution of tropical plants, while the effects of soil and site quality as drivers of tropical rainforest biodiversity has been addressed much less. Some studies have focused on the soil fertility effects on plant communities, but few have assessed the water storage capacity or the aeration and drainage conditions of the soils and their impact on species distribution. This work aims to investigate the relation between site quality and the spatial distribution of tropical rain forest diversity. On behalf of geopedological mapping and site quality assessment we studied the plant distribution patterns at the Selva Lacandona, Chiapas, Mexico. Soils and trees with dbh ≥ 10 cm were sampled in 9 plots of 5000 m^2, distributed in three dominant geopedological units. In each plot landform features and soil properties were determined. Site quality considering not only nutrients but also water and aeration capacities as well as rooting depths was evaluated by principal component analysis (PCA). We used cluster analysis as classification technique and the Index of Simpson and plant richness estimated by nonparametric estimators to compare diversity and richness between geopedological units. The relationship between plant diversity and site quality was based on canonical correspondence analysis (CCA). We identified geopedological units with contrasting site quality. The PCA accounted for 65 % of the variation and was positively correlated with pH, total nitrogen, soil aeration, water retention capacity and exchange aluminum. Both the classification and ordination techniques showed that plant diversity and richness respond to site quality conditions. The richness and diversity are smaller in floodplains, although these have the best site quality reflected in the largest growth parameters. Low altitude hills on sand and clay stones have a medium site quality but are much more heterogeneous, and also richer in tree species. Limestone mountains show the least site quality, limited particularly by rooting depth and available water holding capacity, and show a very contrasting plant community. In the study area available water holding capacity is one of the most important determinants of tree species distribution.

Key words: Tropical rain forest, site quality, tree species diversity, Selva Lacandona.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes properties some of the physical and chemical parameters in soil quality index some of a cultivated field and rangeland in different topographical positions

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Abstract

This study was carried out to expose changes some of the physical and chemical parameters in soil quality index some of a cultivated field and rangeland in different topographical positions. Soil surveys were done in three different fields at Tuzcu and Tepeköy villages. At different positions (performed-back slope–foot slope) and two different profiles (cultivated-non cultivated) were excavated. From ın described profiles, soil samples were collected. Soil sampling was done in 2005 on August. In this study; soil texture, bulk density, organic matter and KDK were examined. Result indicated that organic matter increased from summit to bottom but bulk density decreased. And the disaggregated in texture was established. It was found soil samples collected from cultivated fields were similar to properties of foot slope soil as to land use form. It was demonstrated that the parameters of soil quality index were more favorable results in horizon A than those horizon B.

Key words: Topographical positions, soil quality indicators, physical, chemical and biological properties of soil

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Long term irrigation with saline water at different levels in olive orchard: some soil physico-chemical characteristics

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Abstract

In arid region in Tunisia, the shortage of water resources of good quality, on one hand and the importance of olive cultivation under harsh environmental conditions, on the other hand, have lead to the urgent use of water resources of marginal quality such as saline ground water for olive plantations irrigation. Nevertheless, the use of such waters in irrigated lands should consider both the direct impact on crop performances and the indirect effects on chemical and physical properties of the soil. So, the aim of this study, in its first part, was to investigate the effects of saline water used for irrigation at different levels on some soil physic-chemical characteristics under natural environmental conditions in the south of Tunisia. The study was carried out in the experimental site of the Olive Tree Institute of Sfax, Tunisia. Three olive orchards were subjected over three successive years to the following treatments: T0, control field conducted under rainfed conditions; T1, drip irrigated at 50% of Potential Evapotranspiration (ETP, 600 mm water / year)) with saline ground water (ECe: 7.5 dS/m) and T2, drip irrigated at 100% ETP (1200 mm water / year) with saline ground water (ECe = 7.5 dS m^{-1}). Soil samples were taken from the surface until a depth of 1.2 m with a layer of 0.3 m. Results of this study showed that the electrical conductivity (ECe) values were higher in the upper layer than in the deeper ones, as well in rainfed as in irrigated treatments. In fact, at the upper layer (0-30 cm), these values were of 4.21, 3.72 and 2.86 dS/m, respectively in T0, T1 and T3. At 120 Cm depth, these values were of 4.7, 5.96 and 6.83 dS/m, for the respective treatments. Indeed, it is obvious that soil salinity increased with the amount of added water. In contrast, the soil organic matter content decreased with soil depth with significant differences among the different treatments. It varied from 1.3 % at (0-30 cm) to 0.34% at 120 Cm depth. In summer season, the soil capillary potential was superior to 30 Centibars (Cbars) in T0, comprised between 10 and 20 Cbars in T1 and inferior to 10 Centibars in T2 treatments. These values were enormously reduced during autumn season. Further, soil N content decreased with the soil depth; it varied from 1.05% in the upper layer to 0.8% at the deeper one and no significant differences were recorded among treatments. However, for the soil phosphorus content, it was more important in rainfed (60 ppm) treatment at the upper layer and more accumulated under irrigation (47 ppm) in the deeper one. Further, the saline water irrigation has induced the accumulation of salt ions (Na^+, K^+, Cl^-, Ca^{2+} and Mg^{2+}) in T1 and T2 at higher levels than that at T0. The soil salinity distribution (ECe) showed that the highest levels of soil salinity, accompanied with the lowest levels of soil moisture, were recorded during summer season. The rainfall occurring during autumn and winter maintain the salts leaching and thus low salinity values, in comparison to summer season. The horizontal distribution of soil salinity showed that the more moist layers (root zone) have low level of soil salinity, but at different extent among treatments. Despite, the increase of salt ions contents in SF orchard, the drip irrigation system has allowed the upholding of a stable soil structure (sandy) and the soil permeability was not too damaged.

Key words: Saline water, soil stability, arid region, olive irrigation, salt ions, sodium adsorption ratio.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ecological evaluation of west Siberia middle taiga peat soils

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Abstract

West Siberia territory is main area of oil extraction in Russian Federation. Thus, 70 % of Russian oil is extracted in the Khanty-Mansiysk Autonomous Okrug (KhMAO). Soil contamination can occur at all oil extraction stages as a result of spill of oil, highly mineralized produced water, chemicals used in the preparation of drilling fluids, drilling waste disposal. Negative impact of oil extraction to soils means as soil degradation, so migration of pollutants into adjacent environment. Therefore, it is important to carry out evaluation of soil quality and establish soil norms, at which soil perform its ecological functions. Polluted peat soils and their background analogues of west Siberia middle taiga (KhMAO) were studied. The main soil pollutants, coming from oil field facilities, are oil products, chlorides, sodium, calcium, heavy metals. It was found that peat soils can bioaccumulate and adsorb pollutants, coming from pollution sources, as a geochemical barrier. At the same time it was revealed the migration of pollutants, which was detected in the presence of oil, chlorides, sodium in peat soils in the surface peat layer and at a depth of 2.0 m. It was found the migration of oil to the nearest lake sediments by lateral flow; the oil accumulation is maximum (up to 60 g / kg) in the high layer lake sediments (0.2 m). Soils sequences were lined up resulting from pollutant type and concentrations to *assess peat soil quality* and establish soil norms, using biotic factors. Determined norms of pollutants in soils according to bioindication indexes allow peat soils perform ecological functions and there is no migration of pollutants into the adjacent environment. The results of study have revealed different sensitivity of applied test organisms, used in the experiments, to pollutants of peat soil.

Key words: Ecological evaluation, soil quality, pollution, oil, migration, bioindication, peat soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mathematical model for evaluation for soil ecological situation of mountainous province soils

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Abstract

Offered a mathematical model gives an opportunity to evaluate soil-ecological situation of soils of landscapes, under various points of view; that is, the assessment of changes of evaluation hierarchic associated/related soils of landscapes under various ecosystems; the evaluation of anthropogenic changes related with the irrigation projects in the area of new irrigation as towards of natural etalon which is distinguished by natural fertility appropriate its highest condition, as well as its initial condition; the evaluation of soil-ecological changes of ecosystems under the influence of natural processes for long-term period. Monitoring has been conducted in Butruc Cambisols and Chromic cambisols in elements of landscape, in various aquipratas, having ecosystems with hierarchic-evolutionary relationships. Introduced multiple-factorial mathematical model is used DBMS in MS Access. As an indicator of ecological evaluation of soil millieu introduced math. Model of calculating of ecological tension – K_{et} showing general condition of soil at the moment of measuring, adding direct and indirect factors registering changes. Methodological entity of conceptual model consists in identification of quantitative relationships between initial and recurrent monitoring which is summand from direct inert and functional parameters in general expression between ranges from 0 to 1. Depending on the selected etalon of soil and conditions of cultivation, coefficient of ecological tension occasionally goes beyond the range that is it obeys the conditions $K_{et} > 1.0$. Inclusion of indirect parameters in this formula assures integrity of calculations and provides high level of adequacy in the math. model of calculation of soil environment`s K_{et}.

Key words: Ecological monitoring, mathematical model.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Biological soil degradation

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Abstract

Soils contain a large number of various living organisms such as nematodes, protozoa, fungi, algae, actinomycetes, bacteria and cyanobacteria. and all these living communities is an important element of the soil ecosystem. These organisms are involved in many important events such as nutrient cycling, decomposition of organic matter, soil carbon sequestration; modify soil physical structure and regulation of water regime. Biological soil degradation means that the significant reduction in population of microorganisms or absence in the soil due to changes in the biochemical processes occurring in the soil ecosystem. Environmental factors that temperature, moisture acidity as well as human activities such as agricultural practices have lead to soil biodegradation. Considering all these important functions of microorganisms in the soil that can be said, biological soil degradation is undesirable. To avoid this situation, primarily better understanding of the biological deterioration indicator in the soil, then it is necessary to analyze the factors which cause. In this review, based on earlier studies, indicators of soil biodegradation will be examined, the factors that cause it to be released and how it effects on soil activities and agricultural practices will be discussed.

Key words: Soil, microorganisms, fertility, degradation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Applicability of enzyme activity as indicator of soil health

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Abstract

The objectives of study were to determine the most sensitivity enzymes depending on character of influencing factor (heavy metal, oil and oil products, radioactive, pesticide contamination, waterlogging and agricultural use). Soils from southern Russia were used as the objects of this study. These soils occupy the major area of Southern Russia and significantly differ in their geneses and properties: the humus content, reaction (pH), carbonate content particle-size distribution, adsorption capacity, biological properties and other properties that determine the stability to anthropogenic activities on soils. We estimated parameters of enzymes activity taking into account the sensitivity (% of change from the control), precision of measurement (experimental error and variance of measurements) and complexity of analysis (quantity of operations, time, reactants, utensils, etc.). Indicators of activity of catalase, β-glucosidase and dehydrogenases were assessed by a ten-point system. The higher the score, the more the method is suitable for the diagnosis and monitoring of soils. In general, methods for determining the enzymatic activity of soil are effective in diagnosis of agricultural use, pollution, heavy metals, microwave and ionizing radiations. Thus, indicators of soil enzyme activity can be used for biological diagnosis and monitoring. This is facilitated by high sensitivity, small variability of results, ease of determination and universal use for different soils. Indicators of enzymatic activity can be used in the diagnosis of agricultural use, pollution by heavy metals, oil and petroleum products, the impact of microwave and ionizing radiation, soil waterlogged. Methods in varying degrees are suitable for the diagnosis of degradation processes of different origin. To assess the effects of the impact of agricultural use on soil biological activity are the most informative dehydrogenase and invertase activity. For diagnosis of pollution of various nature and waterlogged are more suitable activity of catalase and dehydrogenase.

Key words: Enzyme activity, soil quality indicator, catalase, β-glucosidase, dehydrogenase.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

A study on the effects of Uromia Lake arid status on the quality of the soil in the area of Bonab, East Azerbaijan

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Abstract

By use of remote sensing data, information about saline soils can be extracted, particularly when the environmental significance and changing nature of these areas in arid environments is given. One interesting study is Uromia Lake which is done by use of a Landsat Enhanced Thematic Mapper (ETM). In recent years, the approach enables an overview of large areas and has been successfully used for land cover classification from remote sensing data. In soil science, this technique (remote sensing technique) shows a potentiality for determining soil groups, soil genesis process, soil degradation and it also reflects some soil environment interactions. Recent technological developments using remote sensing for monitoring the environment have produced a new approach that is able to provide quantitative as well as qualitative information regarding soil status. In this study we have analyzed the soil salinity of the Uromia Lake during its both arid as well as waterful times and this is done through the use of satellite images. Results of this study unfortunately shows an increase in the salinity level of the soil compared to its previous level and this is considered as a threat to the land cover of the area.

Key words: Remote sensing, soil, Uromia Lake, ETM, Bonab

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of olive oil industrials solid residuals on soil physical and chemical properties

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Abstract

This study was carried out to determine the use of pirina and pulp, as a soil fertilizer and conditioner. For this aim a greenhouse study was conducted in a randomized block design with 3 replications in 48 plots. Pirina and pulp residuals were applied to pots in 4 doses (pirina: 0%; 2,5%; 5%; 10% v/v-pulp: 0%; 2,5%; 5%; 10% v/v) with 2 bacterial applications (control and OSU-142). Application of pirina and pulp, to soil with low organic matter content, has affected physical and chemical properties positively. Depending on the applied doses and materials; aggregate stability, organic matter content, field capacity, electrical conductivity (EC), and available moisture content of soils were increased. However, changes in soil pH were not found statistically significant. When compared with control increase in electrical conductivity of soils were found as 148% and 108% with pirina and pulp applications, respectively. These values were found as 139% and 220% for organic matter contents. While aggregate stability (AS) of soils was found as 42% and 46% in controls, it was determined as 63% and 83% without bacteria, 64% and 97% with bacteria applications, for pirina and pulp, respectively. As a result it can be concluded that application of pirina and pulp to soils with low organic matter contents improves its physical and chemical properties.

Key words: Pirina, pulp, bacteria, aggregate stability, organic material.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of soil quality indicators and identification of soil quality index (A case study: Konya, Turkey)

Cevdet Şeker *, Hasan Hüseyin Özaytekin, Refik Uyanöz, İlknur Gümüş, Emel Karaarslan, Mert Dedeoğlu

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Abstract

Sustainable agriculture greatly depends on soil quality (SQ). The definition of soil quality encompasses physical, chemical and biological characteristics, and it is related to fertility and soil health. Many indicators can be used to describe soil quality, but it is important to take into account sensitivity, required time, and related properties, than can be explained. At present, a wide variety of methods are used to evaluate soil quality using vastly different indicators. A universally accepted method of soil quality evaluation would assist agriculture managers, scientists, and policy makers to better understand the soil quality conditions of various agricultural systems. A study was carried out to investigate the soil quality attributes. This study was conducted in the Sarıcalar Research Site of Selçuk University Agricultural Faculty in Konya, Turkey to study a set of inexpensive and agronomically meaningful indicators of SQ, i.e. aggregate stability, available water capacity, organic matter content, active carbon content, pH, available phosphorus and available potassium. This study analyzes the soil quality of soils studied, using Cornell Soil Health Assessment (CSHA) with described indicators in same model. A total of 20 soil parameters were used with the MDS method. For each SQ indicator, the measured value was reported as well as the associated rating score from its scoring curve. Results of the study indicated very favorable results for chemical indicators, with high rating scores for available potassium, available phosphorous, minor elements and pH (100, 100, 100, 69.9 respectively). The remaining indicators, i.e. the physical and biological indicators of SQ, had unfavorable or very unfavorable results and consequently showed evidence of low physical and biological SQ except root health. Low rating scores for aggregate stability, available water content and organic matter content (14.6, 65.7 and 34.6, respectively) were evidences of soil degradation from long-term intensive tillage and lacking use of soil-building crops or organic matter additions. Very low rating scores of penetration resistance of both surface and subsurface soils were also indicated soil degradation. Also, very low rating score for active carbon content (22.9) indicated that the soil of site was biologically degraded and inadequate. Finally from all evaluated indicators, especially physical degradation is most important problem for the sustainable agriculture.

Key words: Soil quality, soil quality indicators, sustainable agriculture.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Arid-zone soils in a changing climate: organo-chemical, physico-chemical and surface properties

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Abstract

Sandy soils encompass large territories of Africa, Central and Western Australia, the Middle East, China, etc. They also occupy the seaside areas in many countries all over the world. Soil water repellency (SWR) provides hydrophobic protection and prevents rapid microbial decomposition of organic matter entering the soil with litter or plant residues. The respective changes in soil moisture and in soil aggregate stability are the main mechanisms explaining the reduced mineralization of SOM with increasing SWR. Extracts of hot-water-soluble carbon of sandy soils from Australia, UK and Bulgaria showed that the dominant compounds were aromatic acids, short chain dicarboxylic acids (C_4-C_9), sugars, short chain fatty acids (C_8-C_{18}), esters of stearic and palmitic acids and alkanes/alkene pairs. Aromatics and fatty acids (< C_{24}) contents increased upon saponification and cleavage of ester bonds of high molecular weight and polar compounds. Specific surface area and pore distribution showed that the sandy loam soil which was least hydrophobic had micropores and adsorbed water more efficiently than the sands. Buffer and cation exchange capacities reflect the carbonate, clay and organic matter contents of the soils studied. The soils from the Black Sea coast of Bulgaria which don't contain carbonates have low buffer capacities. Climate change-induced SWR may intensify the effects of drought and thus affect SOM decomposition and plant productivity, as well as cause changes in vegetation and microbial community structure. Future research should consider the effects of increasing SWR on soil moisture and subsequently on both microbial activity and plant productivity, which ultimately influences the overall carbon balance.

Key words: Sandy soils, soil water repellency, physic-chemical properties, hot-water-soluble compounds.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil cover patterns analysis in soil processes and land quality evaluation

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Abstract

The essential soil spatial-temporal variability is mutual feature for most mature natural and particularly man-changed terrestrial ecosystems in Central Region of Russia with soil cover strongly pronounced bioclimatic zoning and geomorphologic differentiation. Soil cover patterns (SCP) detailed morphogenetic analysis and typification is useful tool for soil forming and degradation processes quantitative evaluation, land ecological state and functional quality quantitative assessment. Quantitative analysis, modeling, functional-ecological interpretation of representative SCP spatial variability is especially important for environmentally friendly and demand-driven land-use planning and decision making. The carried out 30-years region- and local-scale researches of the wide zonal-provincial set of representative ecosystems and SCP with different types and history of land-use (forest, meadow-steppe, agricultural and recreational ones) give us the interregional multi-factorial matrix of elementary soil cover patterns (ESCP) with different land-use practices and history, soil-geomorphologic features, environmental and microclimate conditions. Succession process-based analysis of modern evolution of man-changed and natural soils and ESCP essentially increases accuracy of quantitative assessments of dominant soil forming and degradation processes rate and potential, their influence on land and soil cover quality and ecosystem services. Their results allow developing the regional and landscape adapted versions of automated land evaluation systems and land-use DSS. The validation and ranging of the limiting factors of ESCP regulation and development, ecosystem principal services (with especial attention on greenhouse gases emissions, soil carbon dynamics and sequestration potential, biodiversity and productivity, hydrological regimes and geomorphologic stabilization), land functional qualities and agroecological state have been done for dominating and most dynamical components of ESCP regional-typological forms – with application of regional/local GIS, ESCP mapping, kriging, correlation tree models and adapted to region DSS. Key-site monitoring results and regional generalized data showed 1-1.5 % C_{org} lost during last 50 years period and active processes of CO_2 emission and humus redistribution. Forest-steppe Chernozem ecosystems are usually characterized by more stable SCP than forest or steppe ones. The ratio between erosive and biological losses in humus supplies is estimated as fifty-fifty with strong spatial variability due to slope and land-use parameters. These problem agroecological situations can be essentially improved by climate-smart agriculture practice development with DSS-based landscape-adaptive land-use systems and organic farming stimulation with environmentally friendly technologies.

Key words: Soil cover, soil processes, land quality, land evaluation system, land-use impact, smart agriculture, organic farming.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Central Russia agroecosystem monitoring with CO_2 fluxes analysis by eddy covariance method

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Abstract

The eddy covariance technique is a statistical method to measure and calculate vertical turbulent fluxes of greenhouses gases within atmospheric boundary layers. The 3D wind, gas concentration and other variables are decomposed into mean and fluctuating components in frame of it. The covariance between the fluctuating component of the vertical wind and the fluctuating component of gas concentration is proportional to the measured flux. The agricultural management practices are expected to impact the carbon fluxes and budget. An attractive way to compare the agricultural practices influences is to divide a crop area into subplots managed in different ways. The research has been carried out in Precision Farming Experimental Field of the Timiryazev Agricultural University (Moscow) in 2013 under the support of RF Government grant № 11.G34.31.0079. Arable derno-podzoluvisols have around 1% of SOC, 5.4 pH(KCl) and NPK medium-enhanced contents in sandy loam topsoil. The CO_2 flux seasonal monitoring has been done by two eddy covariance stations located at the distance of 108 m. The LI-COR instumental eqipments was the same for the both stations. The stations differ only by current crop version. The results have shown high daily and seasonal dynamic of CO_2 emission as the result of different and contrasted conditions: crop stage, agrotechnological operation, soil moisture and air temperature. CO_2 fluxes have been intensified after crop emerging from values of 3 to 7 µmol/s·m^2 for emission, and from 5 to 20 µmol/s·m^{2}for sink. Stabilization of the fluxes has come at achieving plants height of 10-12 cm. The resulted CO_2 sink during the day is approximately 2-5 times higher than emissions at night. For example, in mid-June, the sink value was about 0.45 mol/m^2 during the day-time, and the emission value was about 0.1 mol/m^2 at night. Autumn and winter data are fluctuate around zero. Obtained unique for Russian agriculture data are useful for land-use practices environmental assessment, for soil organic carbon dynamics analysis and agroecological evaluation. The further investigation will be done in comparison with data for neighboring forest ecosystem.

Key words: Greenhouse gases, eddy fluxes, ecological monitoring, agroecosystems.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil taxonomic and functional classification of agricultural sites in important agricultural regions

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Abstract

The paper aims at the classification and functional assessment of agricultural sites by using uniform criteria and indicators. Those information could be useful for trans-national comparative assessments of overall soil quality and site-specific sustainable agricultural use of soils. We studied some representative soil profiles in globally important regions of cereal cropping. These regions are Europe, Northern China, Prairie regions of the North America, and steppes of the Western Siberia and Kazakhstan. Soils were taxonomically classified according to the World Reference Base for Soil Resources (WRB 2006). Their overall quality for cereal cropping was assessed by the Muencheberg Soil Quality Rating (M-SQR, Mueller et al., 2007). The majority of sites under study were agricultural research sites. The taxonomic soil classification according to the WRB 2006 and national soil classification keys allocate names to soils. These names are associated with typical processes and properties but do not provide sufficient information about soil quality and crop yield potentials. The indicator-based M-SQR was practicable and yielded in plausible soil quality scores. Depending on land use intensity and data availability, M-SQR scores can explain about 50-80% of the crop yield variability. We conclude that the combination of the WRB 2006 with M-SQR scores provides sufficient information about both soil properties/processes and their quality for cropping. It has potential for combined taxonomic and functional mapping over Eurasia. This kind of soil characterisation meets both the basic conception of V.V. Dokuchaev and the requirements to soil classification systems of the 21th century.

Key words: Soil function, soil classification, Muencheberg soil quality rating, WRB 2006, crop yield.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Physical and chemical soil indicators of arid ecosystems in Azerbaijan

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Abstract

Some of the physical and chemical characteristics of gray-brown, sierozem-meadow soils under natural phytocenosis of the arid ecosystems of Azerbaijan have been studied. Gray-brown soils (Siyazan-Sumgait massive) covered with halophytic vegetation have a small amount of humus such as 0.53-0.85% (7.63-12 t ha^{-1}) and weakly saturated with nitrogen 0.029-0.046% (0.41-0.65 t ha^{-1}). The vegetation formation change is accompanied by changes in the humus content of soils. Thus, under deciduous trees of the forest belt humus increases to 1.3-1.7% (18.5-23.8 t ha^{-1}), and the amount of nitrogen reaches 0.072-0.093% (1.0-1.4 t ha^{-1}), which is associated with the activities of humus forming saprophages. Under coniferous plantations content of humus and nitrogen reduces to 0.46% (6.9 t ha^{-1}) and 0.026 (0.36 t ha^{-1}). The soils are heavy and contain up to 52-90% of the physical clay. The soils are saline (1.5-1.8%) with chloride, chloride-sulphate composition of salts, and the underground waters overlain at the depth of 5-7 m with mineralization of 10.8-16.8 g l^{-1}. The sum of the absorbed bases is 18.9-20.1 meq $100g^{-1}$ soil and of carbonate is 9-23%. The humification corresponds to the fulvate type (Cr. C. / Cf. K = 0.65). Gray-meadow soils (Salyan region), forming under the saltwort vegetation, are characterized by minimal content of humus (0.54-0.63%), nitrogen (0.030-0.035%) and their reserves (7.02-8.19 t ha^{-1} and 0,390-0.455 m ha^{-1}.). Under the wormwood ephemeral vegetation a quantity of humus and nitrogen increases to 0.71 - 1.10% (9.23-14.30 t ha^{-1}) and 0.036-0.055% (0.468-0.715 t ha^{-1}). Total absorbed bases varies on cenosis between 54.3-62.3 and 43.0 - 51.1 meq $100g^{-1}$. The total carbonate level is high: 13.7-18.9%. Reaction (pH) of alkaline soil solution varies between 7.9 and 8.2. The underground waters are at a depth of 1.7-3.0m with salinity 5-15 g/l. The soils are saline (1.7-3.0%) with chloride and sulfate-chloride salt composition. Humification develops on fulvate and fulvate -humate type - Cr. C. / Cf. K = 0.45-0.91. The soils are medium loamy and heavy loamy with a physical clay content of 45-65%. Meadow-gray soils (Shirvan steppe), developing under a wormwood-ephemeral vegetation are characterized by the high value of the sum of exchangeable bases mg.ekv./100 20-30 g soil. On the basis of composition of 50-70% calcium predominates. The soils are clay, the content of physical clay reaches 60-90%. A quality of salts in the profile varies between 0.1-0.9% in which sulfates predominate. The reaction (pH) of the soil solution is alkaline 8.0-8.2. The underground waters are at a depth of 5-10 m. The content of humus and nitrogen varies between 1.6-2.1% and 0.088-0.115%, the stocks of which are respectively 22.4-29.4 t ha^{-1} and 1.32-1.72 t ha^{-1}. Humification develops on humate and humate-fulvate type - Cr. C. / Cf. K = 0.8-1.1.

Key words: Humus, salinity, absorbed ground.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil as a fundamental living system in urban areas

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Abstract

Human well-being is dependent on the capital stock on the Earth which generates a flow of goods and services to support human welfare. Natural capital as one of those includes the lithosphere, hydrosphere, atmosphere and biosphere, and the most biologically active zones of soils. Soil, as the foundation of all terrestrial ecosystems, has an important role for the continuity of living organisms together with the services it provides (Production of biomass; Storage, filtration and transformation of nutrients, substances and water; Provision of habitat, species and genetic biodiversity; Provision of the physical and cultural environment for humans and their activities; Provision of raw materials; Carbon storage and cycling; Protection of archaeological heritage etc.). A very large proportion of the ecosystem services provided by soils are actually provided by the soils' biotic community. Therefore, soil biodiversity is critical for ecosystem functioning and sustainable land management. However, as the world continues to urbanize humans have lost contact with soil and the services it provides to sustain life. According to World Urbanization Prospects Revision Report of United Nations (2011), the world urban population is expected to increase by 72 % by 2050 and the level of urbanization is expected to rise from 52 % in 2011 to 67 % in 2050. As the human population increase, humans are becoming the dominant species and threat living systems on Earth desperately. Accordingly, a review of the literature shows that cities and urban processes have had dramatic but varying impacts on soil physical and biochemical properties and pollutant loads, all of which affect the life-supporting services of soils. In this context, the paper aims to clarify the importance of soil systems as the Earth's natural capital and the impacts of urbanization processes on physical and biochemical properties of soil under the increasing pressure of anthropogenic activities.

Key words: Natural capital, soil system, biotic community, ecosystem functioning, ecosystem services (ESs), urbanization

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The role of probiotic microorganisms in the control of health and fertility of soil

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Abstract

The method of microbial diagnostic based on gas chromatography – mass spectrometry of fatty acids, hydroxy acids and fatty aldehydes – was used for the study of the soil microbial community. Mass spectrometry of microbial markers (MSMM) method permits simultaneous determination of more than a hundred microbial fatty acids *in situ* in clinical, biotechnological or environmental samples without precultivation and biochemical test materials and primers. Some beneficial probiotic bacteria in soil's microbial community such as *Acetobacter diazotroficus*, *Bacillus* sp., *Bifidobacterium* sp., *Clostridium butyricum, Lactobacillus rhamnosus*, *Rhodococcus* sp. and other are discussed in this article. Metabolites of these bacteria are persisting in soil, has great potential for agricultural applications due to their ability to promote plant growth and suppress plant diseases. Soil conditions *in situ* as well as physiological features of these microorganisms allows to present the following trophic chain: hydrocarbons (plant's exudates and residues) → products of their oxidation by rhodococci (or mycobacteria) → free aminoacids and biomass proteins (metabolism products of rhodococci and mycobacteria) → products of their fermentation by clostridia (or propionibacteria)→ volatile fatty acids (acetic, propionic, isobutiric, butyric et all.). This syntrophic association may be the basis for agricultural ecosystem and can support the compounds of soil's health and fertility production. MCMM data confirm that anaerobes of *Clostridium* and *Propionibacterium*, and aerobe actinobacteria of *Rhodococcus* and *Mycobacterium* are dominant in soil and *Acetobacte rdiazotroficus*, *Bacillus* sp., *Bifidobacterium* sp., *Lactobacillus rhamnosus*, *Clostridium* spp. are always present in the microbial community of soils. Questions concerning the potential effects on plant health (the oxygen content, redox potential, water activity, concentration of nutritious elements) and soil biofertilization (formation of water-stable aggregates, humus preservation) in agricultural systems are considered.

Key words: Probiotic bacteria, soil, biofertilization, lipid, fatty hydroxy acids and fatty aldehydes biomarkers, gas chromatography – mass spectrometry, volatile fatty acids.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Allelopathy of root exudates of invasive species *Ambrosia artemisiifolia*

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Abstract

Invasive plant *Ambrosia artemisiifolia* (Asteraceae) of North American origin is an important agricultural weed in Europe and also occupies large non-crop areas with a range that is likely to accelerate under climate change. Its pollen grains are noxious aeroallergens and cause summer hay fever. Allelopathic compounds in rhizosphere of *A. artemisiifolia* may play an important role in its invasiveness. Knowledge on allelopathy of root exudates of *A. artemisiifolia* will be presented. (This text was created within the framework of the Grant LD14020 "A new compounds of water-soluble root exudates of *Ambrosia artemisiifolia* cultivated under different conditions")

Key words: *Ambrosia artemisiifolia*, root exudates, allelopathy, weed.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The ecological properties of soil in pasture fields of Konya Plain, Turkey

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Abstract

In this study, mycorrhizal fungi potential, total fungus, bacteria and actinomycetes number of (Sarayönü, Çumra, and Karapınar-Konya) pasture soils were determined. As a result of this study, mycorrhizal fungus potential has changed belong to location. Besides, mycorrhizal fungus number has found between 100–160 number 10 g^{-1} soil. The lowest spor number was obtained from in Çumra location. Also, the similar results were obtained from Karapınar and Sarayönü locations. The majority of spore's genus which was obtained from pasture area is *G. mossea*. According to the results the number of other microbial population obtained in this research area. The highest number (1.25 x 10^5 number g^{-1}) of total fungi obtained from Sarayönü, the lowest number (0.20 x 10^5 number g^{-1}) of total fungi obtained from Karapınar soils while the highest mycorrhizal infection rate (8.0 x 10^7 number g^{-1}) was obtained from Karapınar. The lowest mycorrhizal infection rate (3.96 x 10^7 number g^{-1}) was obtained from Sarayönü. Also both the lowest (2.06 x 10^7 number g^{-1}) and the highest number (11.5 x 10^7 number g^{-1}) of actinomycetes were obtained from Karapınar soils.

Key words: Mycorrhiza, total bacteria, total fungi, total actinomycetes.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of soil degradation and loss of organic matter in Dezful, Iran

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Abstract

Measurement and assessment of environmental soil quality and soil degradation, or vice versa, is important in Iran. Thus, based on the analysis of existing standards and scientific studies, we developed a set of representative soil quality (soil erosion) of organic matter for various human uses of the land. Soil organic matter (SOM) replacement of damaged areas (for example, low SOM content and the C/N) can be achieved by adopting conservative practices such as conservation tillage or no-tillage methods (e.g., direct seeding). Some areas with high values (range 2.50% - 2.97%, average 2.62%), mainly locate in the northern part of the study area, representing only 0.1% of the total surface area. The low SOM content of soil morphology, especially on the hill where the erosion processes in the areas are intensive, agricultural practices adopted. Land degradation and soil conservation and sustainable strategy to underpin the policy supported by sound scientific management of land and water. If human and natural processes occurring in the soil, reducing the quantity and quality of biomass, which is based on raising money for reconstruction. Improve land use rotation with forage crops, returning crop residues to the soil, growing green manure crops and the provision of appropriate exogenous organic matter and soil (compost, manure, sewage sludge, etc.).

Key words: Soil quality, degradation, soil organic matter content.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

A modified soil quality index (SQI) to assess soil quality of alpine grassland

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Abstract

The soil quality assessment can provide a tool to quantify the combined physical, chemical and biological response of soil to different disturbances and land use changes. Our objective was to employ a modified soil quality index (SQI) to assess soil quality. Four experimental sites with different degradation levels (i.e., severely degraded grassland (SDG), heavily degraded grassland (HDG), moderately degraded grassland (MDG) and non-degraded grassland (NDG)) were selected as a case study conducted in alpine meadow of Qinghai-Tibetan Plateau (QTP). Fifteen physical, chemical and biological soil indicators were chosen in each type of grassland. In order to select the appropriate indicators, PCA and correlation analyses were also employed. Therefore, the ratio of microbial biomass nitrogen to total nitrogen (MBN/TN), urease, proteinase and soil organic carbon (SOC) were found to be most important indicators for assessing soil quality. We concluded that there were significant differences of SQI in different types of grasslands under the severity of disturbance. NDG had a higher SQI than the other three types of grasslands, and SDG had the lowest SQI among the four experimental sites. It was concluded that SQI is effective for assessing the soil quality of alpine grasslands in the QTP. The intensity of disturbance had a negative effect on soil quality in the QTP.

Key words: Soil quality index, Qinghai-Tibetan plateau, alpine grasslands.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The investigation of pathogenic situation of soil irrigated by treated waste water

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Abstract

The competition for the resources of clean water which allocated for agricultural purposes against drinking, domestic and industrial uses etc. is increasing each passing day. Because of this reason, nowadays, reuse of treated waste water in agriculture is considered as one of the most important and sustainable water resources. High cost investments are being made for reducing the negative environmental impact of the urban waste water and the operational costs of the facilities are also very high. However, the water treated to certain extends and generally suitable for agricultural irrigation is emptied into various water bodies such as the sea and rivers instead of reuse in agricultural. Many countries like Spain, Israel, Tunisia, USA, etc. use treated waste water for agricultural irrigation. Although pilot applications are carried out in Turkey, the main concern is the health risk stemming from microbiological contamination form agricultural products grown with treated water. The fact that use of treated waste water in irrigated agriculture by suitable irrigation methods and control applications has been proved to reduce the microbiological risk. Redirecting the treated water which is treated under costly processes and restored the quality features for a clean environment into agriculture provides a considerable amount of water supply for plant production. The Research was conducted at International Agricultural Research and Training Centre Menemen-İzmir-Turkey in the late summer period in 2013. In this research, lettuce were irrigated by 3 different irrigation methods, drip irrigation, subsurface drip irrigation and furrow irrigation, with domestic sourced treated waste water. The total viable bacteria, E. coli counts and salmonella test of treated waste water used for irrigation were run. The soil samples were taken from the depth of 0-20 cm, where is including the most intensive layer of microbiological activities, two times in a year, before irrigation and after harvest. Total viable bacteria, coliform bacteria and E. coli counts were determined. Helminth eggs and protozoa (*Giardia lamblia*) detection tests were run. According to the results of analysis, it was shown that, the total viable bacteria, fecal coliform and E. coli counts after irrigation were increased and helminth eggs and protozoa cysts were not detected. According to the analyses of soil samples before irrigation by treated waste water salmonella was also counted beforehand. It is thought that, this case can be a result of the feces of winged living around the trial area.

Key words: Waste water, reuse, soil, irrigation, pathogen

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of vegetation type on selected soil quality indicators in a semiarid rangeland in Hamedan, Iran

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Abstract

Soil quality approach can be used to describe changes in soil health due to vegetation community structure and land use management. Our objective was to assess the response of some soil quality indicators to different vegetation types including rainfed wheat (RW), grassland (G), Astragallus-Bromus (A-B), Astragallus-Lactuca (A-L), Astragallus-Artimisia (A-A) and Astragallus-Euphorbia (A-E) in a semiarid experimental rangeland in Hamedan, where environmental conditions in terms of slope aspect and parent material were similar. Bioavailable phosphorus (P) and potassium (K), substrate-induced microbial respiration (MR_I) and the activity of phosphomonoesterase enzyme (PMEase) were determined in surface soil (0-10 cm) in spring and autumn. The pre-eminentamount of P concentration among any of the compared vegetation types was for A-L in autumn. Although there was little differences in bioavailable K between A-E, A-B, A-L and A-A, this index appeared to be significantly lowerin G and RW. The differences in MR_Iamong different vegetation types were not significant in separateseasons; however, this parameter was significantly higher for A-B and RW in autumn and spring, respectively.Moreover, A-B, A-L and A-A vegetation types showed higher amount of MR_Iin spring compared to autumn. As for PMEase, A-A and A-B showed to be highest in autumn; while in spring, A-A and A-L demonstrated the highest phosphatase activity. In comparing seasons, PMEasein A-L, A-A and A-E was significantly higher in spring than autumn. Strongly significant positive correlation was found between PMEaseand MR_I, as well asK andPMEasein spring. Overall, soil quality is highest under vegetation types composed of perennial shrubs, irrespective of season. The seasonal changes of soil quality indicators should be considered in soil health assessment.

Key words: Soil quality indicators, enzyme, vegetation community, substrate-induced respiration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Simulating topographic attribute effect on soil organic carbon using multilinear regression, artificial neural network and neuro-fuzzy methods

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Abstract

Soil organic carbon is one of the most important soil characteristics and any changes in its content and composition, affect soil physical, chemical, and biological characteristics. The objective of this study was to predict and evaluate the effects of topographic attributes on the soil organic carbon content at a pastureland in Mereg watershed, western Iran. IN this research, topographic attributes include the primary factors such as elevation, slope, plan and profile curvature, transposed aspect and secondary factors such as aspect-slope index, wetness index and stream power. Stepwise multilinear regression (MLR), artificial neural network (ANN) and adaptive neuro-fuzzy inference system (ANFIS), have been used for modeling soil organic carbon. A *multilayer perceptron (MLP) artificial neural networks* with *back-propagation error* algorithm and neuro-fuzzy analysis based on fuzzy c-means clustering algorithm were employed. In order to evaluate the models, root mean square error (RMSE) and coefficient of determination (R^2) were used. The obtained results indicated the calculated R^2 and RMSE were 0.28 and 0.35 for the MLR, 0.65 and 0.2 for MLP and 0.96 and 0.05 for ANFIS models. Results showed that adaptive neuro-fuzzy inference system with the fuzzy c-means clustering algorithm was more feasible than MLR and MLP and had high accuracy in predicting and modeling of soil organic carbon content.

Key words: ANFIS, c-means clustering, MLP, topographic attributes

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fluorine in the system "Environment - Man"

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Abstract

State of people's health is one of the indicators which display changes in the quality of the environment. Natural waters are one of the main sources of supply of physiologically important chemical elements into human organism. Above 75% of the population of Ukraine consume water from surface sources of water supply, which are "moderately polluted" and "polluted" according to classification by quality class. This results in reduction of life span, growth of morbidity, increase of number of ill people, reduction of the population in Ukraine. Quality of drinking water is one of the main ecological problems of not only Ukraine but the entire mankind. World Health Organisation (WHO) pays special attention to studying diseases, associated with consumption of low-quality water. It is to such diseases that dental diseases belong to. Fluorine has the big biological value for a human body. Teeth, and then the bone tissue are the most sensitive to fluorine. By far major part of fluorine, which accumulates in an organism, accumulates in these organs. Low content of fluorine in drinking water results in development of dental caries, high content – in fluorosis. Content of fluorine in ground waters of Ukraine depends on different natural factors (climate, chemical composition of water bearing rocks, tectonic structure). The lowest concentration of fluorine, mainly up to 0.5 mg/l, is observed in waters of the western areas of Ukraine and the Ukrainian Polesye. With further movement from the west to the east, and especially from the north to the south, concentration of fluorine in waters increases, reaching the maximum in the Dnepropetrovsk area (to 4.5 mg/l). Our research was aimed at identification of impact of fluorine content in drinking water on the state of some dental diseases in the population of Ukraine. The research which has been performed has shown that there is a clear dependence between content of fluorine in natural waters and such diseases of population as caries and dental fluorosis. It is reasonable to carry out regular monitoring of natural waters in order to assess fluorine both in Ukraine and other countries for prevention of sickness rate, including dental diseases.

Key words: Fluorine, ground waters, health of people.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of different soils and their properties for geomedicinal values

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Abstract

The relationship between geologic materials and human health has been known for centuries. Most of the elements present in the earth's crust are useful to human being. More than 2000 years ago Chinese texts describe 46 different minerals that were used for medicinal purposes. Indian Ancient Literature Vedas also describe use of soil as a medicine. In the present day context it is need of our to co-relate the myths of use of soil as a medicine with sound scientific base. In Marathwada region of India there are many such places where the local residents use natural resources for disease and health management. Considering this knowledge of local people, it was thought to conduct scientific study on these soils so as to build data on basic soil properties that are enforcing the medicinal value. Hence, the investigation on "Evaluation of different soils and their properties for Geo-medicinal values" was conducted during the year 2011-12. Representative soil samples and to find out relationship between soil properties and medicinal parameters. Soil Physical and Physico-Chemical Properties studied were Soil Colour, Soil Structure, Soil Texture, Density, Electrical Conductivity, Organic Carbon ,Free $CaCO_3$ Plant Available Nitrogen , Phosphorus , Potassium ,Calcium, Magnesium, Sulphur, DTPA extracted zinc, iron, copper and manganese ,Heavy and Light Minerals ,Special Elemental Analysis : Iodine (I), Arsenic (As), Selenium (Se) and Microorganisms like Bacteria , Fungi, Actinomycetes In all 12 different soils were collected. These are 1. Calcium Carbonate Rich Soil 2 Soil from Sulphur Deposits 3. Soil from *Lonar* Crater 4. Soil of *Gadhi* 5. *Multani* Soil 6. Soill from Ants' Living home 7. Red Soil 8. Soil from *Janwal* Butte 9. High Clay Soil 10. Forest Soil 11. Soil under Banyan Tree : 12. Normal Soil. The results showed that the physical properties of soil viz., soil colour, soil texture, soil structure, bulk density, porosity was influenced due to nature of soil. Their study is essential to know the mineral makeup and influence of soil forming factors on soil genesis and nature of soil. Soils having higher pH viz., soil from ant's living home used for washing of hairs due to presence of swell-shrink clay and sodium (high pH). Soils containing high organic matter is a resource for antibiotics. Multani soil contains lowest organic matter and high salt concentration, hence suitable for cosmetic industry. Due to presence of high calcium carbonate highly calcareous soil used for cloth washing. Depletion of nutrients specially N, P and K in cultivated soil may poses a problem of malnutrition. Calcium carbonate content rich soil contained low zinc and iron which is one of the reasons of prevalence of anemia in the region. Soil from sulphur deposits are used as a disinfectant due to its high content of sulphur. Cultivated soil showed low concentration of Iodine, Arsenic and Selenium and did not show consistency in results.

Key words: Medicinal value of soil, geomedicinal value, soil properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of rice husk compost application on soil quality parameters in greenhouse conditions

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Abstract

Effects of rice husk compost (RHC) on some soil quality parameters under greenhouse conditions were investigated. Experiment were conducted in a randomized plot design with different application doses of RHC (0, 3, 6 and 9%) into surface soil (0-20 cm) with three replications in a greenhouse of Agricultural Faculty in Ondokuz Mayıs University. RHC application generally improved the soil quality parameters according to the control treatment during the experiment carried out with growing tomato plant in the greenhouse in 2010. The soil organic matter (OM) contents significantly increased by the application of RHC in the following order; 9%>6%>3%>0%. While RHC applications in the greenhouses significantly reduced pH contents of soils according to the control, the RHC application increased the values of respiration rate (CO_2), EC, NO_3-N and available phosphorus (P). While the exchangeable Ca values of soils generally decreased, the exchangeable Mg and K values generally increased according to the control with RHC application. Bulk density (BD) values in the greenhouse were reduced with RHC application doses in the following order 0%>3%> 6%>9%. The values of field capacity (FC), permanent wilting point (PWP) and available water capacity (AWC) generally increased according to the control with the application of RHC dosses in the following order 9%>6%>3%. The highest positive correlations among the physical, chemical and biological properties were found between OM and PWP (0.924**), AWC and FC (0.907**), OM and FC (0.897**), CO_2 and PWP (0.862**), PWP and FC (0.791**); while the highest negative correlations were found between BD and FC (-0.854**), BD and PWP (-0.871**), BD and OM (-0.868**), BD and CO_2 (-0.838**), BD and P (-0.821**), Ca and FC (-0.812**). The highest tomato yield (7.77 ton/da) was obtained with the 9% of RHC application. RHC application to the soil in greenhouse generally improved soil quality and tomato yield.

Key words: Rice husk compost, soil quality, tomato, greenhouse.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of ethylene-bis-dithiocarbamate (Mancozeb) on carbonhydrate metabolism and some haematological parameters of albino (wistar) rats

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Abstract

Mancozeb, an ethylene-bis-dithiocarbamate (EBDC), has been one of the most commonly used fungicides in commercial utilization for several decades. Because of its importance and the number of people potentially exposed such as workers who engaged in the production and use of the fungicide, people living in agricultural areas where the compound is sprayed, and people consuming polluted products. Thus, the present research was carried out to search if there is a toxic effect of mancozeb on the metabolism and some haematological parameters of albino (wistar) rats. Twenty-four animals were divided into three groups (eight rats per each). The first group was kept as a control. The second and the third groups were administrated with drinking solutions of mancozeb LD50/5 and LD 50/10, respectively; and food and water provided *ad libitum*. Body weight gain was recorded regularly for four weeks. On day 28 after overnight fasting, animals were killed and blood glucose, serum cholesterol, serum triglycerides, serum creatinine and serum urea concentrations and red cell (RBC), white blood cell (WBC) counts and haemoglobin (Hb) content were determined. Mancozeb treatment decreased body weight gain, serum glucose and white blood cell (WBC) number. Whereas red cell (RBC) number and haemoglobin (Hb) content were increased. In addition serum cholesterol, serum triglycerides, serum creatinine and serum urea concentrations were significantly elevated. In general mancozeb has toxic effect on the previous studied parameters.

Key words: Mancozeb, fungicide, toxicity, rats, metabolism, red cells, white cells.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of irrigation on soil quality in Adıyaman province following Southeaern Anatolia Development Project

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Abstract

Irrigation demand all around the World is in an increasing trend which even dramatically threatens drinking water supplies. Several small and large scale irrigation projects are launching for irrigating marginal lands such as sloping, stony, shallow soils for meeting population pressure by governmental or private intuitions. Irrigation in early years in new irrigated areas for example rainfed wheat, cultivated in Southeastern Anatolia of, yield increased from 1200 ton/ha to 6500t/ha which is beyond expectations of farmers. This yield is obtained by applying excess amounts of fertilizers particularly nitrogen and phosphorous. Excess use of nitrogen is known to decrease soil organic matter along with polluting water sources. Fixation of phosphorus by high calcium carbonate content of the soils of the Adıyaman caused excess use of phosphorus fertilizers. Moreover, increased water flow from sloping lands to bottom lands triggered salinity built-up. Soil profiles from fields located in various geographic location such as sloping land, flat land and valley bottom were sampled for comparing effect of irrigation within 18 years (1995-2013) in Adıyaman region following irrigation. Results revealed a significant change in soils' carbon and phosphorus content after the introduction of irrigation to the fields. But, the level of deterioration is not at a critical level. Thus, detailed and planned irrigation scheme is needed for sustaining soils quality in Adıyaman region where socio-economy is largely depending on.

Key words: Irrigation, soil quality, carbon, salinity, Adıyaman.

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SOIL MINERALOGY & MICROMORPHOLOGY

9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The spatial distribution of pedogenetiques of soil processes in the valley of Oued righ (Sahara North East): An approach microscopic and mineralogical

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Abstract

Agglomerated in the form of a string palmerais of the Valley of Oued Righ span close to 150 km from Oum Thiour (Oued Souf wilaya) in the North to El Gill (wilaya of Ouargla) South they are considered as the main agricultural Northern Sahara eastern zone, however, cultivation of fragile OASIS ecosystems should not be submitted has a characterization based only on physico-chemical soil results. The modern characterization of soil stems primarily from the nature of pedogenesis that has spawned and pedoclimatic conditions governing their operation. Starting from this principle, our study is combine the mineral soil and microscopic aspect SEM from different geomorphological levels identified by a study conducted in collaboration with the Department of geography at the University of Reims.For this we have a sequential approach following geomorphic changes. This study has identified 05 geomorphological level starting from the basic level of the large chotts results morphoscopiques and mineralogical obtained on samples different geomorphological levels it would seem that the distribution of clay minerals in this landscape exclusively obeys a distribution format managed by the wind. The Mineralogical diversity encountered in the procession of each level comes in contrast with the law of geochemistry for samples of the same level or for those of adjacent levels. This discontinuity observed between different levels does not appear to be governed by processes encouraging a possible reorganization downstream of silicate minerals originally degraded upstream. Indeed the geochemical environment of this Saharan region cannot allow such developments given the very pronounced rainfall deficit. Thus the presence of a mobilizing agent whose action exceeds the limits of the Sahara bottom is responsible for this relatively random distribution in the landscape of the Valley.

Key words: Sahara, salty soils, gypsum, geochemistry, morphoscopie, wind.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Degradative crystal-chemical transformations of clay minerals under the influence of Cynomacterium-Actinomycetal symbiotic associations

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Abstract

Cyanobacteria and actinomycetes are essential components of soil microbial community and play an active role in ash elements leaching from minerals comprising the parent material. Content and composition of clay minerals in soil determine the sorption properties of the soil horizons, water-holding capacity of the soil, stickiness, plasticity, etc. The aim of the study was to analyze the structural changes of clav minerals under the influence of the cvanobacterial-actinomvcetes associative growth. The transformative effect of cvanobacterial-actinomvcetes associations on the structure of clay minerals - kaolinite, vermiculite, montmorillonite, biotite and muscovite - was observed, with the greatest structural transformation of the crystal lattice being noticed under the influence of association in comparison with monocultures of cyanobacterium and actinomycete. The range of the transformative effect depended both on the type of biota (component composition of association) and on the crystal-chemical parameters of the mineral itself (trioctahedral mica - biotite, was more prone to microbial degradation than the dioctahedral - muscovite). The formation of the swelling phase – the product of biotite transformation into the mica-vermicullite mixed-layer formation was revealed as a result of association cultivation. The growth of associative thallus and monocultures of cyanobacterium and actinomycete promoted the removal of potassium (K), magnesium (Mg) and aluminum (Al) from the crystal lattice of the rock sample of vermiculite. Leaching of elements due to the influence of cyanobacterium-actinomycetes associations growth exceeded the release of cations observed in the sample under the influence of the growth of cyanobacterium and actinomycete monocultures and in the control sample of vermiculite. The study of cyanobacterial and filamentous prokaryotes (actinomycetes) communities that existed even in the early stages of the Earth's history helps to understand the causes and nature of the transformations undergone by the atmosphere, hydrosphere and lithosphere of the planet. Through the process of photosynthesis cyanobacteria contribute to the accumulation of organic matter and nitrogen fixation by enriching the substrate with bound nitrogen compounds, thereby making it more suitable for settlement by more highly organized organisms.

Key words: Cyanobacterial-actinomycetes symbiotic associations, clay minerals, dioctahedral and trioctahedral mica

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil micromorphology from Masudpur: Snap-shots of Bronze Age life and reconstruction of mid-Holocene environmental conditions in NW India

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Abstract

As a part of the *Land, Water and Settlement* project, geoarchaeological investigations carried out in and around two Indus sites of Masudpur I (Sampolia Khera) and Masudpur VII (Bhimwada Jodha) near the village of Masudpur in Haryana, India have revealed interesting information about the activities and behaviour of the inhabitants of these settlements. In particular, within the sampled sequences from the trenches, several activity areas have been identified, such as open spaces used for crop-processing or general floor build-ups interrupted by occasional disturbed layers, all filled with settlement-derived debris and with evident periods of abandonments. Off-site soil samples have revealed bedded sand deposits beneath Masudpur I whereas Masudpur VII was built on a dune system indicating a symbiotic relationship with the prevalent environmental system. This paper will highlight the nature of human activities, prevalent environmental conditions and site-formation processes of these sites as depicted through the techniques of thin-section analysis and geochemical studies.

Key words: Soil micromorphology, on-site activity, off-site activity, symbiotic relationship

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Micromorphology of meadow-steppe small saline soils of Northern Kazakhstan

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Abstract

Meadow-steppe small saline soils of Northern Kazakhstan have been studied and their genetic features shown at micro level. It was determined that upper saline horizon is characterized by grainy structure of aggregates, presence of organic matter in the form of plant residues in various stages of decomposition, releases soil meso- and micro-fauna and humus, as well as the presence of eluvial sites. It was noted that micro-morphologically saline horizon of solid structure and consists of aggregates-blocks of irregular and angular shape, tightly adjacent to each other and separated by a network of fine cracks. Their formation is due to the flush of soil material and its subsequent cracking in alternation of processes: humidification - drying. Horizon is characterized by a sharp decrease of organic matter and accumulation of fine dispersion of clay material. Illuviation process is accompanied by the presence of a streaky, flow and solid optical orientation of clay, appearance of incrustation that fill isolated pores and clay kutans on pore walls. It is shown that subsaline horizon is characterized by the presence of carbonate microforms, such as impregnation and efflorescence and appearance of gypsum in pores- cameras. In general, in transition horizon micromorphological pattern is the same as in the previous one, with a slight increase in the content of carbonate and gypsum, as in soil mass like in pore space. All forms of carbonate new forms are represented by micro granule calcite. Single crystals of gypsum are observed in soil material, main bulk of gypsum is concentrated in pores, often forming druses. It was determined that the characteristic form of parent rock units are calcareous carbonate round forms - ooids, which apparently have formed from petizised clay material under the influence of bicarbonate solutions or may be a product of erosion of clay deposits.

Key words: Micromorphology, soil quality, optically oriented clay, carbonates, gypsum.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil morphology as an indicator for assessment of drainage system efficiency in sugarcane cultivated lands, South Khuzestan, Iran

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Abstract

Land drainage is one of the operations that increases land production and also ensures sustainable land use. Soil scientists attempt to achieve a scientific procedure for operating a drainage system with the most efficiency, based on the correlation between soil morphological characteristics, mainly soil colour and redoximorphic features and water table behaviour. The aims of this study were investigation about of the efficiency of drainage system through soil morphology and micromorphology characteristics and finding the existence of episaturation or endosaturation, in south Khuzestan sugarcane cultivated lands after years of artificial drainage. 5 pedons were dug and characterized based on their morphology and micromorphology features. The observation of redoximorphic features in studied pedons showed some considerable differences in drainage class between artificial drained field under cultivation and virgin land without it and the only contrast was shallower ground water table in non-cultivated one. 4 pedons were classified as Somewhat poorly drained and the one was classified as Well drained. These drainage classes show that despite the existence of artificial drainage system, the problems have not been eliminated yet. All pedons showed horizons with low chroma colours in deeper horizons and different types of redoximorphic feature at different depths. Also micro-morphological observations proved that the lands were involved in endosaturation due to high ground water level.

Key words: Endosaturation, ground water fluctuation, drainage, redoximorphic features, soil morphology, soil micromorphology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Comparative mineralogical characteristics of red soils from South Bulgaria

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Abstract

The present study aims to compare mineralogical composition of red soils, formed on marbles in South Bulgaria. We used mineralogical analysis of heavy and light mineral fraction in immersion under polarizing microscope and X-ray diffraction analysis of bulk sample and clay fraction. Three test polygons, located in South Bulgaria were examined: Petrovo, Nova Lovcha and Dobrostan, which are characterized with different latitude, altitude, and exposition. Three or more sites from each polygon were sampled and analyzed. The red soils are formed on white and gray calcite and calcite-dolomite marbles, impure silicate-rich marbles and only in one site – on marble breccias. We determined the following mineral phases in red soils: calcite, dolomite, quarts, and feldspars, mica, illite-type mica, illite, smectite, vermiculite-smectite, and kaolinite. Besides calcite and dolomite, heavy minerals are represented by amphibole, titanite and epidote, and minor amounts of zircon, garnet, tourmaline, rutile, pyroxene, andalusite, kyanite, sillimanite and apatite. Opaque minerals are predominantly goethite and hematite. Plant tissue is abundant in light fraction from the uppermost soil horizons. Analyses of heavy mineral fraction show presence of metamorphic and igneous minerals which indicate participation of weathering products from other rock types in the nearby area. The types of heavy minerals in soils depend more on composition of parent rocks and geomorphic position than on climate type. Soils from Nova Lovcha show similar composition, but the quantity of goethite and hematite significantly increase in soil from plain. Typical high-metamorphic minerals as andalusite, kyanite and sillimanite present only in Nova Lovcha, while garnet dominates in Petrovo and opaque minerals - in Dobrostan. Red soils, formed on slopes, where erosion prevails over accumulation, contain more illite, smectite and vermiculite-smectite, and very few or no kaolinite, whereas the kaolinite is dominant in soils formed on plain. The mineralogical composition of clays in different polygons depends on geomorphic position (altitude, slope or plain), and less on climate type. The weathering processes in the highest polygon Dobrostan (more than 1200 m) are in early stage (illite, vermiculite-smectite, and smectite), whereas in Nova Lovcha (above 700-900 m) and Petrovo (1000 m) the domination of kaolinite suggests an advanced weathering processes. This study was accomplished under financial support of project DDVU-02-20/2010, from Bulgarian Science Fund.

Key words: Red soils, mineralogy, clay, X-ray diffraction

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of soils formation origin based on mineralogical studies (A case study: Marand region)

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Abstract

Soil formation and evolution in different parts of the world can be affected by soil forming factors of climate, parent material, relief, organisms and time. In this research work the role of parent materials in soil formation and their effect on soil mineralogical and physico – chemical properties were studied. Samples from four selected soil profiles around Abarghan village in the North East of Marand region located between 45° 49' 16" to 45° 57' 12" East longitude and 38° 23' 55" to 38° 28' 59" North lantitude were prepared and phisico- chemical and mineralogical properties analyzied. The area soil moisture and temperature regimes are Xeric and Mesic respectively with 441.7 mm annual rainfall and 10.8 °C mean temperature. Based on mineralogical analysis, soil X – ray diffraction results showed that clay minerals of smectite, illite, chrorite, kaolinite and quartz are dominant in soil samples. Also powder analyzing of parent rock by XRD, refers mainly to the presence of quartz, calcite and feldspar with montmorillonite, illite, chlorite and kaolinite minerals. In profile 1, there is a little calcite in addition to above named minerals while parent rock analysis of profiles 2 , 3 and 4 showed pyroxene and amphibole respectively. Therefore comparison of obtained results from analysis of clay and parent rock in all samples refers to presence of same minerals and autogenic, insitu weathering and formation of soils, except in 2Bk horizon of profile 4 with discontinuity. Also more smictite in profile 1 refers to neoformation of this mineral under weak drainage and moist condition with high amount of base cations.

Key words: Amphibole, calcite, clay minerals, pyroxene, quartz.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Studying the significance of climatic conditions on weathering levels and clay minerals for some soils from Northern Iraq

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Abstract

Nine soil samples were selected from three different locations in Ninavah Governorate. The locations included Makhmour, Hamdania and Zakho. The studied areas were selected according the variation of annual temperature and rainfall. Soil orders of Makhmour and Hamdania are both within Aridisols, but Zakho soil is a Vertisols. Soil profiles were described according to USDA and three soil samples from each profile were collected from three depths (0-20, 20-40 and 40-60 cm). Soil routine analysis had been done on each samples beside chemical analysis by using (XRF) Technique. We used different equations including: chemical index of alteration (CIA), index of chemical variation (ICV) and weathering index (WI). The results obtained from these equations indicated that the highest levels of weathering levels was found in Zakho soil (Average annual rainfall 550 mm) and the lowest weathering levels in Makhmour soil (Average annual rainfall 240 mm). Results of XRF Analysis also showed a clear increasing in immobile oxides of (SiO_2, Fe_2O_3 and Al_2O_3) and trace (rare) elements (ZrO, MnO and TiO_2) in Zakho soil and decreased in Makhmour soil. However the mobile oxides of (CaO) and the loss in ignition was increased in Makhmour soil and gradually decreased in Hamdania and reach its lowest levels in Zakho soil. Results obtained from X-ray analysis of clay fractions showed that the major minerals in Makhmor soil are Smectite, Palygorskite and Vermiculite (Average annual rainfall 240 mm), while the dominated minerals in Zakho soil are Illite, Vermiculite and Kaolinite (Average annual rainfall 550 mm).

Key words: Minerals, weathering, X-ray, XRF, oxides.

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SOIL GENESIS, CLASSIFICATION & MAPPING

9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Agricultural grouping of soils
(On the area of north-east slope of small caucasus in Azerbaijan)

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Abstract

We grouping agricultural soils, so any plant or plant group that is not take into account, only on the basis of genetic-productivity properties and fertility of the land. Our republic`s soils are divided into 5 agricultural groups which depending on their features of natural fertility, the level of contemporaneity, their agromeliorative and meliorative measures. According to our research average bonitet of examined area equal to 41. We have calculated comparative the quality of being valuable ratios of soils by adopting the numbers which we got equal to one. Comparing the numbers which we got of soil`s comparative valuation ratios (CVRS >1), we saw that there is no need to additional measures for increasing the fertility of I, II, III group of soils, but there is a need to necessary complex improving (agromeliorative, fitomeliorative so the measures against the erosion and improving) measures and additional charge for arriving the fertility of IV and V group to average level on this area. Development of agriculture and from the point of view productivity of the land carrying out of the registering measures is one of the necessary measures of the day.

Key words: Group of soils, agricultural soils, bonitet, fertility, quality of soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Potassium reserves in the Vladimir opolie soils from the perspective of content of minerals – carriers of elements plant nutrition

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Abstract

The aim of the study is estimation of potassium reserves of agrogrey heavy clay loam soil of Vladimir opolie on the basis of differentiated analysis of its contents in fractions less than 1, 1-5, 5-10 microns. The object of research is agrogrey heavy clay loam soils of a trench created on the loess loam. Minimum content of aluminum and iron as well as the greatest amount of silicon oxide is noted in the plough layer. The latter could be explained by involvement of eluvial part of natural soils. The content of elements oxides in oozy fraction significantly differs from that of the bulk soil. The amount of silicon oxide is sharply reduced whereas the way of its distribution on a profile is uniform (49.5-51.2%). Significant increase in iron and aluminum oxides content (10.1-11.1% and 18.2-19. 1%, respectively) is noted. In comparison with the bulk soil the oozy fraction is enriched with gross magnesium. The amount of calcium oxide potassium oxide content in silt is only slightly greater than its quantity in the soil as a whole. The gross chemical composition of oozy fraction indicates that this fraction consists mainly of clay minerals characterized by high amounts of aluminum, iron, magnesium and potassium. The main components of fraction are irregular mixed-layered units, mica – smectites with the high contents of smectite packages dominate. Smectite phase and hydromicas comprise 85-90% of the sum of silt components. The amount of kaolinite and chlorite fluctuates within 10-15%. These minerals are sources of potassium, magnesium and determine soil anions behavior. Reserves of potassium in oozy fraction is the highest in comparison with fractions of a fine and medium dust as the main potassium carriers are minerals comprising more than 80% of all minerals of fraction. Thus, the greatest amount of such nutrients as potassium, phosphorus, magnesium is fixed in fine fractions, in the oozy – phosphorus, and magnesium, in oozy and fine-dust fraction – potassium, magnesium. Periodic addition of part of illuvial horizon during plowing is necessary for compensation of natural nutrients stocks. The last prevents textural differentiation of a profile, fills up number of fine fractions along with elements of plant nutrition.

Key words: Potassium reserve, agrogrey soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Pyrogenesis and automorphic soil formation in continental taiga of Northeast Asia

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Abstract

Until recently, the understanding of pedogenesis of mountain-taiga soils in the continental Northeast Asia, which is based on permanent transformation of parent rock into zonal soil, was accepted without consideration of active influence of pyrogenesis. Thus, the whole complex of soil processes and events caused by wildfires was not considered. In general, we agree with concepts that consider fire as primarily anthropogenic factor, which is closely related to human activity. During thousands of years wildfires accompanied soil formation in the continental part of the Northeast Asia and exerted decisive influence on the processes of soil formation. The influence of pyrogenesis becomes apparent during the period when zonal vegetation is eradicated and successional stages of regeneration are formed through temporary forms of phytocoenoses. It leads to interruption of pedogenesis which is continued on a new cover of diluvium deposits, washed off from a watershed surface and covering partially or completely cut surface of humus horizons of primary soils. Thus, in the absence of covering glaciation, automorphic soils with polycyclic profile are formed, which are composed of two or sometimes three degraded humus horizons with plenty of embedded charcoal. This indicates that soils pass 2-3 stages of zonal pedogenesis during the period of their development, which typically lasts for 2-2.5 thousand years. The scale, high frequency and versatile effects of pyrogenesis allow us to consider it as a subfactor of soil formation especially in humic continental regions of the permafrost zone.

Key words: Pyrogenesis, cryogenic soils, permafrost.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Late Pleistocene paleocryogenesis and a variety of modern soils and soil cover on the center of the East European plain

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Abstract

From the middle of the last century it was shown that the periglacial phenomena are rather well shown in modern landscapes outside the area of modern permafrost of the center of the East European plain. The study of paleocryogenesis in the soils and the soil cover long time were engaged the geologists, then the researchers of the Quaternary period and the paleogeografists. Since 1974 of research of soil scientists on this problem, are successfully conducted in different regions. It was shown that the paleocryogenic phenomena are distinctly shown in soils and soil cover on this territory. However, now almost not studied in the history of formation of soils there are the early stages of their development relating to the period of transition from a Late Pleistocene by the Holocene when the begun soil formation was strongly influenced the cryogenic processes. Chernozems, gray forest and sod-podsolic soils of the center of the East European Plain were studied. It is shown that created at the end of Late Pleistocene (17000-15000 years BP) was formed paleocryogenic polygonal-blocky microrelief considerably expressed on the soil surface. This microrelief is caused by existence of the wedge-shaped buried in soil thickness and parent materials the depth 3 m or the congestions (condensations) of wedges-shaped the depth about 1-1,5 m. The conducted researches on three types of soils allowed to add ideas of influence paleocryogenesis on modern soils and a soil cover. In particular it became clear that the paleocryogenic microrelief directly participates in differentiation of a soils and a soil cover. The microrelief and its structure-forming units are one of the leading factors causing intensity the soil processes and, as a result the distinctions on a number of morphological, physical and chemical properties of modern soils and the parent material. The position of soils on a complex of elements of paleocryogenic microrelief (the microelevation, microdepression) is considerably reflected in their morphology. To each of components of a complex there corresponds the type of a profile determined by existence or a lack of certain genetic horizons, a form and degree of expressiveness of separate morphological features. The paleocryogenic microrelief expressed on a modern day surface has noticeable impact on soil formation, determining by that heterogenety of a soil cover. The soil cover of the center of the East European plain, caused by influence of paleocryogenesis, differs on the microrelief elements at the level of a subtype of soils.

Key words: Pedology, paleopedology, paleogeography, paleocryogenesis, a variety of soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Initial soil formation on the eluvium-diluvium solid carbonate rocks

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Abstract

One of the most important theoretical and practical problems of contemporary soil science is initial soil formation on eluvium-diluvium solid carbonate rocks as well as investigation of the formation peculiarities of morphogenetic characteristics of Rendzic Leptosols (Rendzinas) under the influence of ligneous and herbaceous agricultural vegetative formations. According to physical and geographical zoning territory under investigation (Bila Hora tract) is located within the boundaries of Voronyaky natural area of Western Podil'sk Upland of Western Ukraine. Podil'sk strata-layer upland landscapes are dominating in the investigation area landscape structure. They are mainly covered with loess-like loamy soils, partially with clear plane carbonate rocks exposed as a result of the outwash. In the spots where the native cretaceous marl rocks come out on the surface, a widely spread type of surface deposits are formed, which is the eluvia-diluvium crust decay of these rocks. Those are the deposit rocks of a mixed loamy-carbonate structure. The contents of the loamy material of which vary from 10 to 30%, calcite – 35–90%. That is why the source rock on the territory under investigation is the eluvia crust of deposit weathering of the Cretaceous system upper section, which is presented by cretaceous marls. Aiming to study the peculiarities of morphology, the contents and characteristics of Rendzinas formed on eluvium-diluvium of the cretaceous marl within the boundaries of Bila Hora tract, we have carried out detailed phytocenotic soil investigations in different geomorphological-hypsometric terms and under different vegetative formations. On the ground of the results, some macromorphological features of initial soil formation are brought to light: the peculiar horizon of bedding (O) and mineral humus-accumulated horizon (A) were formed under the ligneous vegetation and the upper weakly-humused part of soil formation rock (A/C_{Ca}) is separately distinguished. The general capacity of the profile varies from 6 to 20 cm; turfed (Ad), humus-accumulated (A) and transit horizons (AC_{Ca}) were formed under the perennial herbs (with admixture of moss). Their general capacity varies from 23 to 38 cm; typical Rendzic Leptosols (A_P-AC_{Ca}-C_{Ca}) were found on the fallow. Their general capacity varies from 38 to 60 cm. The differentiation of physic-chemical characteristics of Rendzic Leptosols in interdependence with their formation in various geomorphological-phytocenotic conditions is traced.

Key words: Initial soil formation, eluvium-diluvium cretaceous marls, Rendzic Leptosols.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soils of the wetland complex of eastern North Algeria "Morphological character and analytical results"

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Abstract

The soil survey of wetland complex of El-Kala was made on the basis of geomorphological typology. It has recognized six areas that are home to several stations, each station, we made transect in which several cuts or soil profiles were analytical morphological analysis. The morphological description of the different profiles highlighted several soils differ mainly by the thickness, color, organic matter content, texture and structure of their horizons. The design of profiles showed that the soil located at the upstream of the depression are formed by two or three places, whereas those located at the downstream cannot be six. Particle size analysis showed that most soils are generally sandy texture. However, we note the presence of some pretty rich clay horizons. The physico-chemical analyzes also revealed that the humidity increases from top to bottom profiles studied. Similarly, the state of the organic matter is evaluated by measuring the fiber content and pyrophosphate index defining the index or regeneration REG peat, to classify the condition of the soil organic matter of the follows. • At the top of the profile, the organic material is fresh. • The center of the profile, the organic material is more or less decomposed. • In the lower part of the profile, the organic material is decomposed. Therefore, this result may say that we are in the presence of the regenerated peat.

Key words: El-Kala, wetland complex, organic soil, soil typology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Importance of water quality in wet depressions in the operation soil of El-Kala region, Northern Algeria

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Abstract

Wetlands are ecosystems that thrive in any climate, provided that the water balance at the soil remains positive. For this precipitation, infiltration, runoff play an important role in the saturation and congestion areas. In Algeria, despite the global deficit, wetlands have been developed for the site conditions. Wet El-Kala complex is the best example because it contains several wetlands, some of which have evolved into bogs. This complex is fed by waters mainly rained origin of the morphology of the land contributes to their accumulation. To know the quality of water that feed or permeate these environments, we collected during two periods (dry and wet), water samples. The distribution of our sample cover a portion of the set of wet sites. On these samples we performed a physicochemical characterization, the results show that we are in the presence of fresh water often lightly loaded oligotrophic slightly brackish in places rarely salty. These results reflect the nature of the substrate and the origin of the water and despite the opposition between the two sampling periods.

Key words: Wetlands, El-kala, algeria water, running, soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Transformation of soil cover on the dried bottom of the Aral Sea

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Abstract

The new land with more than 5,000 sq. km was formed in the result of more than 50 year-use of river discharge of large the Amydarya and the Syrdarya rivers for agricultural, industrial and other needs on the water area of the Aral Sea. Soil cover of the dried bottom is rather varied and presented with 38 types and combinations. Studies of soil conditions with the aim to establish current changes in time of soil cover and plant family was provided. Soils of ecological profile going from the former root cost to the west of the sea area were the objects of studies. Plant associations, wastelands were described by the length of profile successively. Soil cuttings with selection of samples with the depth of 3.5 m till the level of ground water were laid down. Research was conducted during the period of 1990 and 2006. Comparative analysis by years of observation shows that during the 16 years period some changes in chemical content of soil especially graphically are traced in the band of reclamation till 30 km from the former root cost i.e. on those areas where wash character of soil desalinization happens. Here the content of water-soluble salt in upper 0-40 cm cover was reduced in 1.9-2.6 times and in underlying horizons it was increased in 0.3% on the average. With removal from the root cost, amount of salts in the upper horizon is increased which is characteristically for effusion character at close bedding level of mineralized ground water. During the research period, soil transformation was happened by the other indexes, too. Some relief of mechanical content of soil was happened in cuttings which are closer to the former root cost. Closer to water area it was not changed, however, increasing of sand fractions was traced in upper horizons. Conducted research testifies the fact that significant changes in transformation of soil on the dried bottom of the Aral Sea were happened during the 16 years period. In the band of reclamation of the first year's desalinization and some relief of mechanical content of soil happens. Closer to water area conversely the process of salt accumulation in upper horizons of soil at the expense of effusion character is going on.

Key words: Dried bottom, salts, soil, transformation, mechcontent, period.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Some key concepts of urban soils classification

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Abstract

Based on investigations and mapping of the soils of Saint-Petersburg, there were established principles of urban area soils classification. Possible scenarios of changes in the initial structure of the natural soil profile have been considered, which are invariably associated with urbanization process. A new diagnostic horizon has been outlined, namely the Introduced horizon. Having regard to specific structure of anthropogenic soils and peculiarities of soil formation in the urban milieu, it was suggested to indentify, within "Classification and Diagnostics of Soils of Russia" (CDSR), a novel unit – "Introduced soils". This unit groups the soils wherein the introduced horizon (I) with depth of less than 40 cm lays on a mineral bedrock (D) formed in situ or introduced from outside. Six types of soils have been identified within the unit "Introduced soils" in terms of the humus and organic horizon and the characteristics of the mineral bedrock. All these types allow for identifying certain subtypes depending on presence in the bedrock of evidences revealing mechanisms of its formation and depending on "natural" attributes such as gleying, carbonate content, ferritization, and that is reflected by complex subtypes. In the WRB system, on the basis of the aforesaid principles, it was proposed to introduce a new qualifier to group the soils that feature an introduced horizon and underlaying mineral bedrock.

Key words: Classification, anthropogenic soils, introduced horizon.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Armenian plateau tefro-soil series as a record of major paleoecological events in Pleistocene

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Abstract

Armenian plateau is the part of Lesser Caucasus mountain system characterized by a massive folding-clumpy texture and strongly marked neogene-anthropogenic volcanism caused a process of soil-vegetable formations partially burying under lavas and piroclastic sediments. To its west is the Anatolian plateau and to its southeast is the Iranian plateau. Most of the Armenian Highlands is in Turkey's Eastern Anatolia Region, and also includes northwestern Iran, all of Armenia, and western Azerbaijan. Archaeological excavations registered that the territory of modern Armenia was populated by ancient people of Early, Middle and Late Paleolithic Acheulian culture dated from 150 000 to 1 760 000 BP. We investigated excavations carried out by Armenian-Russian archeology expedition (2010, 2013 years, excavations by Lyubin V.P., Belyaeva E.V., Kolpakov E.N. (IHMC RAS)) on the Lori plateau (north part of Armenian plateau). Thus, the purpose of our study was to examine characteristics of buried soils and pedosediments to restore the paleoecological conditions of ancient people habitat. Open pits and excavation walls represent the tefro-soil series and reflect the record of Pleistocene history events. They are placed at an altitude of 1500m in steppe zone named in literature as Lorean steppe. The modern soils of investigated territories (Muradovo, Karahach, Dashtadem and Kurtan sites) are predominantly mountain chernozems. There were measured such paleoclimatically informative soil characteristics as carbon isotope composition of humus, the different characteristics of the organic matter, magnetic susceptibility, phosphorus oxide content derived from inorganic and organic parts of the soil. The evidence of past volcanic activity diagnosed not only by morphological indications (banks of ash and mud deposits), but also by high values of a magnetic susceptibility and high concentration of inorganic phosphorus forms. The isotopic composition of organic carbon becomes lighter with increase of the depth and values of δC^{13} are close to -28‰ in all objects except for Dashtadem site profile (because of short profile); volcanic sediments has most lighter values of δC^{13}. This may be due to elevated concentration of carbon dioxide from volcanic eruptions in atmosphere. The tuff-ash sediments from Karahach open pit dated by archaeologists as 1.7-1.9 million years BP and therefore, buried by these sediments soils or pedosediments characterize earlier period corresponds to the previous Earth paleomagnetic epoch Matuyama with negative magnetization. Judging by the light weight values of the isotopic composition of carbon, this period was warmer and more humid than modern. The isotopic composition of organic carbon was correlated with the data of magnetic susceptibility, so that periods of high temperatures correspond to periods of rising volcanic activity.The culture layers 2 and 3 from Muradovo site are being carbonated and therefore indicating later arid phase of soil formation. Thus he collected data indicates the multiple abrupt changes of hydrological regimes, types of plant formations, and repeated volcanic activity over the past 1.9 million years.

Key words: Palaesols, paleoclimate, Armenian plateau, tefro-soil series, archeological soil science.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Principles of soil mapping of urban areas

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Abstract

The topsoil of urban areas is radically different in composition and organization from the natural and agricultural landscape topsoil. In the course of soil mapping of the city, it is necessary to introduce the concept of a soil urban space, the characteristic features of which are the discrete topsoil and clear geometric shapes of areas due to purely anthropogenic factor. The soil urban space is characterized by fractional area pattern, much of which cannot be reflected in the map scale. Man-made introduced soils are dominating. The soil urban space is represented by a combination of soil areas and non-soil formations in various proportions: urban and pedological combinations. The anthropogenic factor is the leading one in shaping the composition and geometry of the urban pedological combinations. In Saint-Petersburg, based on analysis of the percentage of soil formations and non-soil formations, the soil contours geometry and their distribution, there were identified 6 types of soil urbanized space. When showing soil contours on the map, the following was taken into consideration: the type of organization of the soil urban space, the nature of the distribution of the soil areas and non-soil formations in urban pedological combinations, the soil composition in urban pedological combinations. The legend of the soil map of Saint-Petersburg consists of three groups of mapping units. The units showing one predominant soil belong to the first group. It includes natural, anthropogenically transformed, introduced and composite soils. The second group includes a combination of soils. This group consists of three subgroups: combination of natural soils, combination of natural and anthropogenically transformed or introduced soils, urban pedological combinations–combinations of natural and anthropogenically transformed and introduced soils, and non-soil formations. The legend of the soil map of St. Petersburg contains more than 60 soil-mapping units. The soil map is implemented in the scale of 1:50,000 using MicroStation V8i software.

Key words: Soil map, man-made soils, anthropogenic factor, composite soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial prediction of soil classes using multinomial logistic regression modeling: A case study from an Iranian arid region

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Abstract

Soil surveys are necessary sources of information for land use planning, but they are not always available. Digital soil mapping techniques appear to be an interesting alternative for traditional soil survey techniques. Therefore, the main objectives of this study were prediction of soil classes by multinomial logistic regression in Bam region of Kerman province. We were used for prediction of soil great groups by relating those with predictors such as terrain attributes, remote sensing and geomorphology map. A confusion matrix was used to calculate aspects of map accuracy. The geomorphology map at the fourth level (geomorphic surface) was a powerful predictor unlike the other levels (landscape, landform and lithology). Terrain attributes and finally remote sensing indices after geomorphic surface were imported as predictors in the prediction. The map purity over all soil great groups was above 0.70 in both calibration and validation locations. This method provided good predictions for Haplosalids, Torriorthent, Haplogypsids and Petrocalcids that shown by high values for users' accuracy and producers' reliability. Poorer performance was observed for Haplocalcids and Haplocambids. The results showed soils with better reliability are those highly influenced by topographic and geomorphic characteristics at least in this study area (e.g. Haplosalids, Haplogypsids and Torriorthents) and soils with very low reliability and accuracy of prediction are hardly influenced by the topographic and geomorphic characteristics (e.g. Haplocambids). The results showed that geomorphologic and topographical factors are still the most important source of environmental information, to help us to identify soils and their properties better and enable us to apply these derivate as input data in digital soil mapping.

Key words: Digital soil mapping, multinomial logistic regression, geomorphic surface.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The study of the structure of a soil cover of Absheron by method of relief sculpture

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Abstract

Absheron is one of the most ecologically unfavorable regions on Earth due to heavy pollution of air, water and soil. The rich flora and fauna is exposed to severe anthropogenic influence. The object of study is the Absheron, which is the largest unit of Azerbaijan. This is a complex industrial cluster, with a predominance of petroleum, petrochemicals, subtropical fruit growing and viticulture. In addition to the major oil and gas fields there is a network of health centers, recreation and tourism in the area. We view the foothills on the South-western part of the Absheron peninsula and adjacent territory of Gobustan, which are covered with eruption of mud volcanoes. They create a form of relief in the form of conical hills with relatively steep slopes of a hill near the volcano. Products of eruption of mud volcanoes are common, mainly in the southwestern part of the peninsula. In order to study the structure of the soil surrounding foothill areas of the north-western part of Absheron we have chosen cartographic method of learning. The types of land cover patterns that differ in appearance (on the map), physicochemical and biological properties were found and examined. Ecological mapping is a relatively young discipline. Therefore, analysis of the environmental situation is inseparable from its mapping. Thus, different types of land cover patterns identified in the study area were reflected on the map, which displays plastic geometric properties of the soil surface.

Key words: Absheron, ecological, soil cover.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Some soil properties related with different physiographic units and land use in Van lake basin

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Abstract

The objective of this study was to determine the relations among some soil properties related with different physiographic units and land use in Van Lake Basin. Surface soil samples (0-20 cm) were taken from forty different points having different physiographic units (hill, hillside, colluvial hill side, alluvial deposit, valley bottom, plain, land base, alluvial terrace, lacustrine terrace, lacustrine, colluvial) and land use (follow-wheat, wheat, natural vegetation, clover, pasture) in Van Lake Basin. Some soil properties (soil texture, salinity, pH, lime content, organic matter content and available phosphorus) changed due to land use and physiographic units. Boron, copper, iron, manganese and zinc contents for different soil sampling points varied between 0.008 and 3.466 ppm, 0.443 and 3.245 ppm, 0.98 and 230.40 ppm, 1.05 and 66.49 ppm, and 0.389 and 5.731 ppm, respectively.

Key words: Land use, physiographic units, soil properties, nutrients.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil formation on terraces with different elevations in Meric catchment

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Abstract

In this research soil formations at different elevations on Meric watershed have been investigated. Terrace number 1 has been formed on young alluvial deposites (flood plain) at 30 m elevation 0,71 km from Meric river. Terrace number 2 (miocene-pliocene age) is about 1.5 km away from the river and at 37 m altitude. Terrace number 3 is the same age as terrace 2, and 3,4 km away from river at 61 m altitude. Physical-chemical properties and some weathering rates of these soils have been investigated. There were many buried horizons and sediment accumulations in soil profile on terrace one. On the other hand, clay illuviations were observed in other 2 terraces (argillic horizon together with medium and strong prismatic structure). The weathering progress has been evaluated by the Chemical index of alteration (CIA) - $Al_2O_3/Al_2O_3+CaO+Na_2O+K_2O$. Silt/clay ratios have also been observed. This ratio was greater in terrace 1 than other terraces. These soils were formed by fluvial sediments where there were low clay formation and young soils. Additionally, $CaO+MgO/Al_2O_3$ ratios were investigated. This ratio was lowest in terrace 2, and highest in terrace 1. Decalsification was low in terrace 1, while pretty high in terrace 2. $SiO_2/Al_2O_3+Fe_2O_3+TiO_2$ ratios were high in A horizons, and low in B horizons and sub horizons. Of the investigated soil profiles, number 1 was classified as Entisols and other profiles as Alfisols.

Key words: Soil formation, weathering rates, Meriç catchment, soil terrace.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Magnetic susceptibility parameter in the evaluation of spatial heterogeneity of soils due to the influence of paleoecological factors

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Abstract

The purpose was to identify patterns of spatial variation of soil properties due to the influence of paleoecological factors (in particular, the Late Pleistocene cryogenesis). To achieve this purpose the parameter of magnetic susceptibility (MS) was selected. It gives information about the course of a number of elementary soil processes directly in situ and allows to express MS through objectively measured physical quantity. The role paleocryogenic microrelief and its structure-forming elements in the formation of magnetic compounds of iron changes in the zonal direction. Paleocryogenic structures differentiate water-air conditions the nature of the variation which causes heterogeneity of soil properties at a high taxonomic level (subtype). Soil cover in the area of soddy-podzolic soils (Albic Luvisols) is a complex consisting of linguiform subtypes in blocks and gleyey subtypes in the interblocks depressions. In the area covered gray forest soils (Grey Phaeozems) typical subtypes were formed in blocks, while subtypes with the second humus horizon were associated to interblocks. Chernozems clay-illuvial typical (Luvic Chernozems) formed in blocks in the northern forest-steppe zone of chernozems and in the delineation of their interblock depressions chernozems clay-illuvial podzolized (Luvic Phaeozems) formed. Hidden patterns were found with using variography in spatially distributed data, namely homogeneous structures were identified and their characteristic dimensions were defined. Structure-forming elements of paleocryogenic microrelief (relict cryogenic wedge structure) in the humus horizons of chernozems form sites of increased content ferrimagnetics (cross section of about 3-4 m) which delineate block elevations in space. In gray forest soils similar areas have the sizes no more than 1-2 m and these areas are associated with the second humus horizon. The analysis of MS distribution topoisopleths showed sensitivity of this parameter to signs pedo-, litho- and cryogenesis. And it can contribute specification of the results received in the integrated paleopedology research.

Key words: Magnetic susceptibility, paleocryogenic structures, paleocryogenic microrelief, spatial heterogeneity, variography

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Gravelly as diagnostic indicator for soils under subalpine meadows (for example reserve "Basegi")

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Abstract

Mountain soils are of interest to researchers because of their little scrutiny and features of mountain soils. The presence of gravel in the profile is an important diagnostic indicator, especially for mountain soils. The ratio of large, medium, fine gravels affects soil formation processes, which leads to the formation of a plurality of different soils. The purpose of research is to study the distribution of rubble in the profile of mountain soils. Object of study is subalpine soils in the reserve *Basegi* at the altitude of 570-850 m above sea level. *Basegi* relates to lowlands of the Middle Urals. The morphological features under subalpine meadows formed soil divisions (organic-accumulative, litozem) which have no signs of podzolized profile and are poorly differentiated into genetic horizons. Contents of rubble varies widely in the studied soils and according to the classification of varieties by content of stones and gravel are not stony, weak-, medium- and strong gravelly. Distribution of rubble in the profile can be divided into three groups. Found that soils formed under grassland ecological communities, have different origins. Thus, the studied soil profiles are either the result of modern soil formation or consist of modern soil horizons and buried paleosoils horizons (in the lower part of the profile), or formed as a consequence of dust particles with the wind and the growth of soil on top. Aeration material fall-out leads to the formation of undifferentiated soils with the manifestation in them sod pedogenesis and burozemic pedogenesis processes. Thus, gravelly is an important diagnostic indicator for mountain soils as it helps to determine their genesis, change of environmental conditions, the intensity of weathering and pedogenesis occurring in soils. Ambiguous distribution, in profile confirms the high spatial variability of topsoil on mountainous territory, different correlation and the manifestation of weathering and pedo-genesis. Therefore, while monitoring this parameter is recommended to use.

Key words: Sub-alpine meadows, national park, mountain soils, gravelly, genesis, soil formation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The impact of land use change on soil carbon stocks in the southern taiga sub-zone of the European part of Russia

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Abstract

Until recently, a lot of arable lands were abandoned in many countries of the world. About 25% of such abandonments were found in Russia. More than 50% of the total abandoned area is now located in the Taiga zone of European part of Russia. Land-use changes affect soil organic carbon stocks and can either lead to sequestration or emission of CO_2. Character of changes depends on climatic zones, soil geneses, previous land use history and other factors. We have studied the dynamics and structure of carbon stocks in post-agrogenic ecosystems during the natural reforestation of abandoned arable land. A chronosequence of post- agrogenic ecosystems on soddy-podzolic loamy soils was investigated (Kostroma region, 58.670° N, 43.310° E). The sequence includes croplands, meadow (7 years), young forest (20 years), forest (45 years) and spruce forest (80-100 years). It was shown, that a self-restoration of forests leads to the sequestration of carbon. Total ecosystem carbon stocks increase from 5.2 kg C/m^2 in the agroecosystem to 27.6 kg C/m^2 in the spruce forest (80-100 years). It may be explained, first of all, by the increase of phytomass and, in the less extent, carbon accumulation in the soil. The phytomass carbon storage increases in 48 times, while in the soil – only in 1.4 times. The maximal rate of carbon accumulation in the post-agrogenic ecosystems is equal to 0.24 kg C/m^2 per year. In the process of postagrogenic succession there are structure changes in carbon stocks in ecosystems. In agroecosystems, 93% of the total stock of carbon is a soil carbon. During the reforestation, proportion of this pool is reduced to 57% in the young forest (20 years), further decreasing to 30% and to 22% in spruce forests aged 45 and 80-100 years, correspondently. Soil carbon stocks dynamics was also investigated, during self-reforestation, in the framework of computer simulations based on the carbon cycle models NAMSOM, as a function of soil texture and land use history.

Key words: Post-agrogenic ecosystems, reforestation, chronosequence, carbon stocks, carbon models

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Regional analysis of soil middle-term trends due to phytocenosis and climate changes

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Abstract

Comparative-geographical and functional-ecological analysis of soil middle-term evolution trends has been done in the regional sets of representative landscapes in Central region of European Russia and Central Siberian region with especial attention on phytocenosis, land-use and climate changes. The regional sets of key plots include: (a) 2 contrast southern-taiga spruce ecosystems with different podzoluvisols and hydromorphic levels in the Central Forest Reserve, Tver region; (b) comparable with one of them succession set of neighboring reforestation plots "0 → 10-15 → 20-25 → 30-40 → 90-100 → 100-120 → 250-300" years after plowing and hayfield; (c) comparable set of forest-steppe Chernozem plots with different land-use practices "forest → virgin steppe → hayfield → pasture → long-term bare fallow" in the Central Chernozem Reserve, Kursk region; (d) cedar forest plots with man-made severance felling and active development of ground vegetation in the Ermakovskiy station of Sukachev Institute of Forest (SIF), Krasnoyarsk krai; (e) climate-change determined successions of pine forest plots in the forest-steppe station "Pogorelskiy Bor" of SIF and Lugavskoye forestry. Soil profiles and soil cover patterns repeated detailed investigations together with long-term climate and vegetation monitoring data analysis shown essential regional and landscape diversity of dominated (at the ecosystem level) current trends of topsoil transformation due to their zonal and provincial features, current bioclimatic conditions and their middle-term changes, local mesorelief and parent materials, hydromorphic state determined by them, land-use practice and history, natural or man-made succession stage. Investigated regional multi-factorial matrix of soil middle-term transformations and processes allow us to assign five principal trends of their development: (i) Strong local spatial-temporal variability and successional dynamics of soil cover patterns in frame of mature forest ecosystems with unessential changes of average data at the ecosystem level; (ii) Multiple growth (in 2-5 times) of litter with essential changes in its structure and composition; (iii) Qualitative change or development of new humus horizon; (iv) Restoring of disturbed or truncated topsoil; (v) Development of topsoil with qualitative changes of soil features and characteristics.

Key words: Soil geography, soil middle-term evolution, regional trends, phytocenosis dynamics, climate changes, land-use impact.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The actualities of soils classification improvement in Lithuania

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Abstract

The new tendencies of soil classification have appeared in Lithuanian soil school since 1999. Since then the soils in Lithuania were classify according to the WRB 1998 soil classification diagnostic principles. There was created the new LTDK-99 soil classification. Despite the fact that this classification expanded the limits of Lithuanian soil knowledge, this classification also highlighted some of the relevant soil knowledge and classification problems. The discussions are held not only about the newly created terms but also about the several newly distinguished first-level groups of soil diagnostic characteristics. Mostly the discussions are held about the identification and diagnostics of cambisols, planosols, arenosols, regosols. Also, there is an idea to impose one more group to this classification – stagnosols. The origin of the secondary clay minerals is linked to the glaciogenic territory formation peculiarities. However, there is no proof that the clay minerals in the soils of territory of Lithuania might appear due to brownification. Also, there are no scientific surveys proving that in Lithuania identified cambisols are specific due to brownification formed nontronite. Due to the intensively appearing lesivelation in these soils the discussion is held whether the soils are identified in the right way. Due to the complicated glaciogenesis of Lithuanian soil deposits, appears a problem to identify planasols. In edition WRB 2007 planosols were identified according to the pedogenesis in old, strongly weathered binomial deposits. The examples are usually connected with South America, southern and eastern Africa subtropical zone's old, strongly weathered plateaus. Meanwhile, according to the WRB 2007 classification the planosols that are identified in Lithuania are assigned to stagnosols. It means it is assigned to the soils that are originated due to the territorial soil forming deposits binomial genesis and stagnification. The problem of arenosols and regosols classification appears due to the peculiarities of diagnostics. The diagnostic features are similar in both groups of soils and are connected with the primitive pedogenesis in them. The existing problems of Lithuanian soil diagnostics underline the questions of classification of soils in Lithuania. Apart from that, the question about the soil diagnostics allows to think about the classification evolution tendencies. The report points out the possible ways to solve the discussed problems.

Key words: Soils of Lithuania, actuality of classification, cambisols, planosols, stagnosols, arenosols, regosols.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil information system of Zhambyl area

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Abstract

The main purpose of research is to develop a soil information system of Zhambyl region comprising a series of electronic maps (soil, evaluation score map, etc.) as well as geographically related database on main morphological and physic-chemical properties. Soil database structure was designed and soil data tables in MS Excel for data entry have been prepared. The database contains information on 678 profiles in three blocks. Section description includes number and location of profile, name of soil , depth, thickness of humus horizons A+B, type of soil, depth of dense rocks layer, depth of effervescence , depth of carbonates, salts, gypsum , type of plant community, landscape forming plants, and projective cover and height of plant cover. Section of morphological properties is represented by the following components: depth and lower boundary horizon, index of genetic horizons, type and amount of carbonates, soluble salts, gypsum, stones, roots, soil color, structure, compaction, moisture, and mechanical composition. Section of chemical and physic-chemical properties includes humus and nitrogen, CO_2, gypsum, absorbed calcium, magnesium, sodium, potassium, aluminum and hydrogen, hydrolytic acidity, pH of water and salt suspension, mobile forms of nitrogen, phosphorus, potassium, and soluble salt content. Soil map is created based on field studies using GIS technology and use of remote sensing data. The main map unit is soil genera. Outlined genera differ in carbonate content, salinity, alkalinity, and other characteristics. The map also shows the texture of soils and soil structure. Soil surface structure is displayed by means of connecting characters between index numbers in heterogeneous soil contours: complexes, combinations, spot, and exposition conjugation. Percentage correlation of components in the contours lays in map database and divided into three groups: 10%, 10-30 %, 30-50 %. Total area of the map and the territory is about 144.2 thousands km^2. Legend to the map consists of 128 numbers, total 3567 contours have been outlined. The represented map in comparison with the previous, significantly clarifies the structure of latitudinal and vertical soil zones. In addition, the map shows soil areas, which have not been outlined before, and reflects changes in soil cover associated with modern economic activity.

Key words: Soil information system, soil data base, soil map, current state of soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Bio-morphogenetic diagnostics, nomenclature and classification of Azerbaijan soils

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Abstract

Morphogenetic Diagnostics, Nomenclature and Classification of Azerbaijan Soils has been prepared on the basis of the newest ideas concerning the available printing and fund materials of the field, chamber, laboratorial researches, laboratory of soil genesis geography and mapping, soil science corresponding to the plan of themes in the Institute of Soil Science and Agrochemistry of ANAS. Protection and preservation of the available soils require the soil diagnostics formation which is up to the contemporary requirements. The materials concerning the soil diagnostics, nomenclature and classification constantly expand and improve. At present there is a need for the new soil diagnostics and classification which are up to the international standards and national requirements. The local soil condition and individual characters are assumed as a basis by using of the ideas and principles of WRB, FAO-UNESCO schools, Russian soil science in the given Azerbaijan soil classification preparation. The soil classification and morphogenetic diagnostics has been worked out by paying attention to the both natural factors and man's economic activity (agriculture, industry, life). The soils morphogenetic structure is assumed as a main principle in Azerbaijan soil classification. The soil is classified naturally and its morphogenetic diagnostics is given. For the first time great soil taxons (soil class, section, type) and low taxons (soil subtype, sort, type, diversity, line) which meet the international and national requirements separated and a large diagnostics has been given. Formation of the soils contemporary diagnostics and classification concerning the International standards will be basis for the preparation of the Red Book of Soils.

Key words: Bio-diagnostics of soils; nomenclature and classification of soils; soil taxons; protection and preservation of the available soils; Red Book of Soils.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Geochemical combination in the structure of soil cover Baraba lowland

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Abstract

Baraba lowlands - a vast low plain drainless - in conditions of semi-arid climate formed as an area of accumulation of soluble salts. However, the spatial distribution of them in Baraba largely depends on the nature of the surface, meso-and micro-relief, which varies greatly in different parts of the lowlands. Key areas, selected for study, are confined to the three geomorphological districts: Ob plateau, high and low geomorphological steps Baraba. Each key areas is a catena, comprising three main elementary landscape: eluvial, transit and accumulative. Eluvial elementary landscape catena at Ob plateau has a height of 152.5 meters above sea level. Leached chernozems formed here. Balance of substances is determined mainly by the migration of cyclic type, performing the biological cycle of carbon and nitrogen. Transit elementary landscape with an altitude of 152.5 – 112.0 m asl has a more pronounced slope to the north-east. This fact intensifies the process of surface leaching. On the other hand, a higher level of groundwater determines the increase manifestation of solodization process. Therefore, the main soil cover of this site constitute complexes hidrometamorphosis chernozem with gray forest solodized and soloth soils. Accumulative elementary landscape is characterized by a predominance of concave surfaces with numerous micro-depressions. The aggregate of processes solodization, alkalinization, peat formation generates extreme complexity of soil cover here. Unlike landscapes Ob plateau the highest position on the high geomorphological steps Baraba can not be attributed to eluvial elementary landscapes. Low altitude gradient in mesorelief and proximity of groundwater to the surface causes semihydromorphic conditions. In low geomorphological steps of Baraba ridges relief predominates. On ridges the eluvial elementary landscapes are formed. Automorphic mode here promotes steppization and the formation of chernozem with signs of alkalinity. Middle position of the catenas occupied soils with a predominance of processes alkalinization of the soil profile - hidrometamorphosis chernozem salty, deep and medium solonetses. At the bottom of the slopes evaporative-percolate mechanism of soil differentiation dominated, which results in the formation of complexes solonchakous meadow and saline soils with soloth soils. Catenas end extensive undrained blind valley, in which formed peat bog and fen peat-gley soils, often slightly saline.

Key words: Relief, catena, elementary landscape, structure of soil cover, salinization-desalinization, solodization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Distribution of Vertisols with gilgai topography in Russia

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Abstract

Vertisols and vertic soils are regular but scarce component of soil cover in European Russia between 44°N and 54°N latitude. They are dominant in soilscapes at the West and the Central parts of the Northern Caucasus piedmont plains and at the Volga-Akhtuba floodplain. Other soilscapes in European Russia include Vertisols and Vertic soils as associated soils with their shear from 0.5% to 15-30%. Areas of Vertisols with gilgai topography occur at the Volga-Akhtuba floodplain, on the bottoms of large shallow depressions within Caspian and Kuban-Azov lowlands, at Yankul Depression in Stavropol Krai and on the very gentle slope in Kamennaya Steppe (Voronezh Region). There are three patterns of gilgai topography in European Russia: (1) round or normal gilgai; (2) lattice gilgai with trend to circular orientation; (3) a new pattern which we named "alluvial lattice-wavy dendritic" gilgai with one or several shallow channels for discharge of flood water. Round gilgai developed on eluvium of Maykop swelling clays in the Yankul Depression provides formation of soil association comprising Mollic Stagnic Vertisols (Humic, Bathysodic, Hypereutric, Pellic) in micro-depressions and Calcic Mollic Stagnic Sodic Vertisols (Calcaric, Humic, Endohyposalic, Hypereutric) on micro-highs. Vertisol areas with gilgai topography at the floodplain have no significant differences between soil properties at micro-highs and micro-valleys. Soils are Endogypsic Stagnic Vertisols (Hypereutric, Bathyruptic). The study was carried out at the support of Russian Foundation for Basic Research, projects no. 06-04-08323, 08-04-01195, 11-04-00710, 13-04-10174, 14-04-01694.

Key words: Round gilgai, dendritic gilgai, soil association.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ukranian Chernozems: Past, Present and Future

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Abstract

Ukraine occupies a leading place among the countries in the world where chernozems are spread. The total area of world chernozems equals about 314 mln ha, among which Ukraine occupies 27.8 mln ha. Chernozems cover the main area of agricultural lands (65.0%), which is the basic fund for obtaining agricultural production. Tillage and constant cultivation cause a considerable decrease of living organisms in chernozems and gradual "sterilizing", which leads to the loss of structuralness and self-condensation of soil mass. The usage of heavy agricultural equipment accelerates this process which leads to the condensation of root contained horizons to the values 1.4–1.6 g/cm^3. Drought and over moistening are more sharply distinguished on the condensed horizons causing the depression of plants. Harvest on over condensed chernozems decreases by 15–30%, but when the condensation amounts 1.5–1.6 g/cm^3, the yield decreases by 50–75%. Long lasting researches of Ukrainian chernozems showed that average losses of humus in typical chernozems equal to 0.7–1.9 t/ha, in ordinary chernozems – 0.3–0.7 t/ha, in the southern chernozems – 0.3–0.6 t/ha. Decrease of humus in chernozems intensifies the development of erosion processes. The analysis of researches showed that 24.9% of chernozems of Ukraine are eroded. Among them slightly eroded chernozems amount 17.8%, average eroded - amount 5.27% and heavily eroded - amount 1.9%. Eroded arable lands amount 30.4%, the area of eroded feeding lands amounts 45.2% and washed off lands amount 1.9%. Large-scale irrigation of chernozems caused new problems. The main part of irrigated lands is situated in the southern steppe subzone – 1.6 mln ha, where chernozems predominate. New processes, untypical to these soils, take place on irrigated plots of chernozems. They are: the rising of ground waters level, water flooding, secondary salinity, salinization, alkalization, carrying-out of nutrients, and deterioration of physical and physical-mechanical properties. During the last 40 years considerable changes in chernozems took place due to the intensification of agrotechnogenic impact. Due to the extensive system of agricultural production on the first stage, the process of evolution of soil fertility is characterized by a gradual degradation. In typical chernozems humus content decreased by 21–38%, absorbed calcium – by 26–37%, mineral nitrogen, soluble phosphates and metabolic potassium –by 34–40%, 39–40% and 22–24%, correspondingly.

Key words: Chernozems of Ukraine, humus, agrotechnogenic impact, soil fertility.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The influence of excess moistening on change of the properties of calcic chernozem

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Abstract

During the last decades soils in a steppe zone are characterized by the development of some degradation processes. Special place among them occupies process of expansion of areas of soils periodically saturated with water. Presence of water has adverse physical and chemical soil characteristics. The general tendency for all investigated soils was the development of salinization. The significant decrease in quantity of soil carbonates was also observed. Narrowing Ca^{2+}/Mg^{2+} ratio in composition of soil carbonates was marked. The development of the local humidifying results in change of the humus state of the Chernozems that causes its degradation despite an increase in the total humus content. The soils studied under different duration of waterlogging have shown that these tendencies will increase when waterlogging conditions are continues.

Key words: Phaeozems, Soil Organic Matter, Chernozems, locally hydromorphic soils, humus structure

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Automorphic soils of North Forest – Tundra subzone (North-East of European Russia)

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Abstract

Ecotone's contact position responds for the specificity and complex character of soil formation processes in biogeocenoses of forest-tundra landscapes. Transitional zones are naturally contrasting and demonstrate most dynamic fluctuations and trends, diverse landscapes and soils, prominent relict and inherit signs. We have analyzed drained soils of loose-sandy (podzolic podburs, illuvial-iron podzols) and loamy (cryometamorphic soils and illuvial-iron svetlozems) deposits in the north-eastern part of European Russia. Soil names are given according to the Russian soil classification system (2004). Vegetation is dominated by large-size dwarf birch lichen-mossy associations. Open spruce and spruce-birch forests belong to well-drained slopes of river valleys and are dominated by dwarf birch and undershrub-lichen associations. Analysis of structural organization and differentiation of weathering products, litho-chemical determination method of soil profile maturity degree, all in complex, allowed for the conclusion that the study soils are different-aged formations in similarly one-type soil profile. Podzolicpodburs and podzols have been revealed for morphologically less prominent podzolization signs due to strong cryogenesis processes which cause covering of skeleton grains with humus-iron films. The Al-Fe-humus podzolization process is inherited from previous soil formation stages. The Al-Fe-humus illuviation process is a current process. Illuvial-iron svetlozems possess features of evolutionary current cryogenic phase as redox-Al-Fe-humus podzolization in upper soil subprofile, and evolutionary previously formed lower soil layer. We have identified the dependence of formation, chemical composition, and profile distribution of concretions responsible for gleyzation degree and cryogenic processes intensity, on landscape position and soil texture.

Key words: Podburs, podzols, svetlozems, cryometamorphic soils, meso-micromorphology, inherit signs.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Genesis of slope pedocomplexes in cryogenic landscapes of Central Yakutia

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Abstract

Buried soils of slope deposits in Central Yakutia are part of the past paragenetic landscapes, formed on a functional-dynamic basis. The burial of soils in the widespread layers of the ice complex basically occurs by activating natural exogenous processes: avalanches, landslides, mudflows. These processes, in turn, can be invoked in exceptional circumstances, natural or anthropogenic, or in their entirety. For arid conditions of Central Yakutia the movement of loose soil on the slopes is generally due to the original cryogenic processes - solifluction and cryogenic creep. The article focuses on the morphological descriptions of the physical and chemical properties of buried pedocomplexes in the thickness of slope deposits of the alas hollow wall, high terraces above the flood plain of the Lena middle course and Aldan downstream, as well as present automorphous soils associated with their slopes of autonomous landscapes. The profiles of the two buried soils opened in the gully evacuation cone on the alas wall clearly indicate the fire origin of coals in their humus horizons. It is impossible to determine the nature of termination of soil formation in the river valleys on morphologic data of soil cuts. Only deep study of the properties of buried soils and stratigraphic referencing of horizons will imply in the future the insight of paleogeographical conditions of their formation, as well as new information about trends and rates of processes of soil formation in different time periods of development of cryogenic landscapes in Central Yakutia.

Key words: Cryolithic zone, slope processes, buried soils, pyrogenesis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Developing new approches for decreasing the need for expert knowledge and improving the quality and accuracy of soil maps for detailed soil survey on selected test area in Adana Yumurtalık Provience

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Abstract

The objectives of this study are; minimizing the need of experts knowledge in detailed soil survey by taking advantage of the new technological developments, investigating the usability of 3D satellite images and improving the quality of Soil Survey based on soil series. The study was carried out, in an area of about 100 km^2 within the boundaries of Yumurtalık County in Adana. November 2012 dated stereo WorldView-2 digital satellite data was used as the basic cartographic material, because during that period vegetation cover was minimal. In order to identify the profile locations, for the defination of the soil series that are present in the study area, a combined four stage new approach was applied in which; three-dimensional satellite imagery, topographic maps, geological maps, and provincial land resource maps were tested and has been successful. As a result, need for expert knowledge is minimized in order to, identify the soil series profile locations. Using up to date and objective spesific satellite data acquired in the proper season alloved the observation of many land forms and enabled users with relatively less experience to determine and draw soil boundries with higher accuracies. The use of the tablet computer has been investigated in field work howewer, the expected performance was not be obtained because, the computer was not suited for field conditions. In order to overcome this problem; and improve accuracy and quality of the maps in field creation of a mobile (portable) system provided more efficient approach. Data collected with grid method provided the most suitable semivaryograms identified for each feature map created in the selected test area; in order to determine pedometrics approach and geostatistical modeling in detailed soil survey mapping studies. However, the map obtained from modeling of soil properties in three different depths at each point, proved to be not susccessful. Therefore, creation of soil series maps with grid method and systematic sampling for data collection is contrary to the nature of the soil series. 17 soil series were identifed and these series were classified as Inceptisol, Vertisols and Entisols Ordos. Slope, soil depth, stoniness, high content lime and heavy textures of the soils were determined to be the limiting factors for the use of these soils.

Key words: 3-D satellite imagery, WorldView-2, geostatistics, digital mapping, detailed soil survey and mapping, Adana- Yumurtalık.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of land suitability and potential production of Gambir (*Uncaria gambir* Roxb. L) at Salido Saribulan, Pesisir Selatan Regency

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Abstract

Gambir (*Uncaria gambir* Roxb. L) is a specific commodity of export in West Sumatra. Area of Gambir tree increases about 8 % per year in West Sumatera and until 1998 its production increased about 17% per year. However, in 1999 its area does not parallel with its production. In the last five years, the volume of export increases about 82.81%, while its value of export reaches US $ 2.5/kg. Therefore, this commodity has a strategic value for city's earnings. One of predicted causes is the use of unappropriated land. The aim of this research is to measure levels of land suitability in the buffer zone. TNKS (The National Park Kerinci-Seblat) in order to get the area, which is suitable for growing commodity of Gambir tree. To evaluate land suitability, quantitative model from FAO is used by combining environmental data, climate and condition of land (physical and chemical characteristic of the land). Estimation of Radiation Thermal Production Potential (RPP). Every data is measured (rating) individually and included in several mathematical formulas. After that, potential production of a land based on climate (Climate Production Potential) = CPP) is obtained quantitatively. By changing certain variant of this model program, it can predict the result of the plant in another area. By entering the real data of a land plant production, this model can predict the real plant production of land (Land Production Potential= LPP). Salido Saribulan area is included in class of land suitability S3f which is suitable for growing Gambir tree with a limitation factor of nutrient retention. Potential of actual gambir production at Salido Saribulan is 5 ton/ha, which is higher than actual gambir production.

Key words: Gambir (*Uncaria gambir* Roxb.L), Radiation Thermal Production Potential (RPP), Climate Production Potential (CPP), Land Production Potential (LPP).

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Paleosols and climate of the steppe zone in early iron age: Identifying short term warming of climate on slightly-sensors soils

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Abstract

The climatic conditions of the Early Iron Age (from the first millennium BC to the first millennium AD) were characterized by alternation of short humid and arid periods, which had a considerable effect of direction of soil forming processes. In our work paleoclimatic reconstructions are based on the studying of changes in chemical and morphological properties of paleosols buried under burial mounds (kurgans). Objects of study was soil of complex of 5 burial mounds with ridges-"mustaches" Solonchanka IX in in the dry steppe zone of Zauralskoe plato (Orenbirg region, Russia). Kurgan group consist of one central kurgan and four smaller kurgans (20 m in diameter) connected pairwise by stone ridges. The northern and southern ridges are 86.5 and 103 m long. The complex dates from the late fourth century AD (the turn of the Late Sarmatian and Hun times); therefore, the age of kurgans is 1600 years (Lyubchanskii and Tairov, 1999). Comparative chronological, comparative geographic, and soil archaeological methods were used. Morphological parameters of soils were described, and their chemical properties were determined by conventional methods. The calculation of relative parameters (organic carbon contents, carbonates, readily soluble salts, and magnetic susceptibility) provide the possible to compare the properties of soils comprising different chronosections, either pertaining to different topographic elements or separated spatially. It was established that humid episode of the Late Sarmatian time was not long, and already a hundred years later in soils of low terraces reflected next climate aridization. The paleosols under the kurgans 1600 years ago is characterized by a higher organic carbon content and deeper location of the carbonate horizon, compared to the recent soil. This indicates that an increase in atmospheric humidity took place in the fourth century AD. A similar episode dated to the late third to fourth centuries AD left its traces in soils within dry steppe zone in the Lower Volga region (Demkin et al., 2004) and the desert–steppe zone of the Volga–Don interfluve (Demkin et al., 1998; Borisov, 2002). The turn of epochs in the Azov steppe was also marked by considerable climatic changes (Pesochina, 2004). Arid conditions of soil formation characteristic of the fourth to second centuries AD became more humid in the second to fourth centuries AD, with the magnitude of evolutionary changes not exceeding the generic taxonomic level.

Key words: Paleosols, paleoclimate, steppe zone, Early Iron Age.

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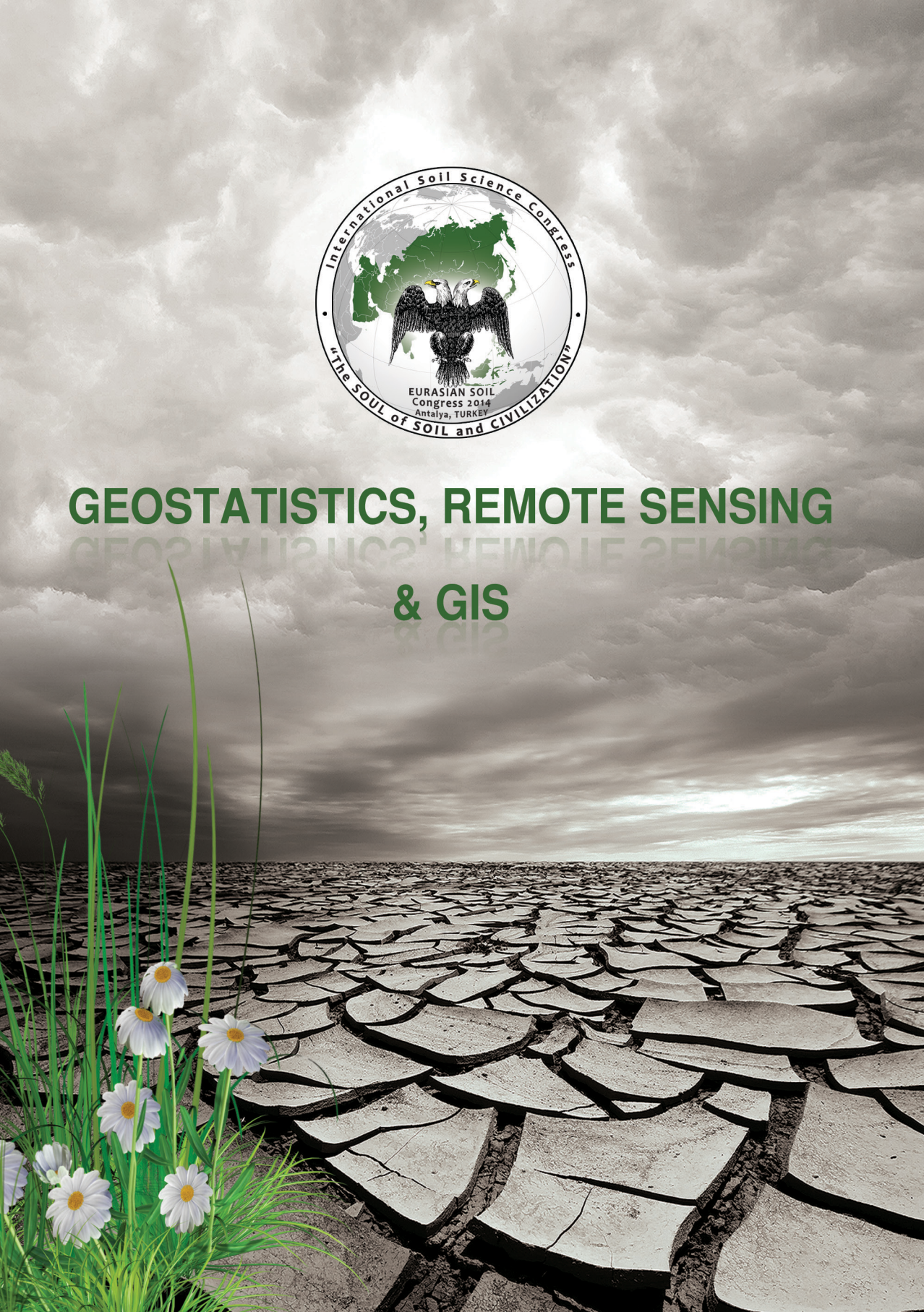

GEOSTATISTICS, REMOTE SENSING & GIS

9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Monitoring of soil moisture and salinity at wide areas by using wireless sensing network

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Abstract

To collect data and to convert this data into information; has become the economic and strategic resources. Nowadays, data produced or acquired with multilayered and hierarchic logic is visible and shared, transformable and appraisable for reveal of decision. When the data is noticeable and being shared can provide economical and strategic results. Sharing data on the paper is difficult and time consuming, high cost and effort needed. Data existing is not only enough in the any places, data gains value during they are fastly, attainable, accurate, analysable, problem solving according to decision makers demand. It is believed that yield quality and quantity is related to proper irrigation methods. Understanding of variable about environment according to time and location makes contribution to farmers' decision for their cultivation methods. For instance, knowing of soil, climate, soil moisture characteristics helps to use less water and energy during irrigation season and make contribution to yield quality and quantity. At the soil moisture deficiency conditions, irrigation is needed for optimum plant growth and yield. Over irrigation at the arid and semi-arid climate condition caused high water table and salinity increases. Changes of salinity severity during season can damage plant according to plant type and caused yield losses. Wireless sensing network is a current system applied to more field. By using of Wireless sensing network system data can be derived and transform to knowledge for data evaluation and analyse. In the research, soil moisture, salinity and temperature monitored with wireless sensing network system in a yield growing season and data (temperature, salinity, moisture) were compared with classical methods. According to the this result, mechanizm of wireless sensing network observed and monitored. Changes of moisture and salinity with time and learning of water budged is a special point for irrigation otomation by passing from data sent with cable system to mobile phone. This project is needed more test and improvement. At the same time, this system should be compared with current system and economical analyses should be made.

Key words: Soil moisture, salinity, wireless sensing network, irrigation systems.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Water erosion indication using remote sensing

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Abstract

Water erosion is a major problem of land degradation, which affects the environment, including to land and water resources and agricultural systems productivity. These negative effects depend on the climatic characteristics, the topographic expression, soil characteristic, vegetation and land use systems. Traditionally, the laboratory and ground tests are used to detect erosion or obtaining input for modeling, but with the launch of space systems the use of satellite imagery is increasing. With the current availability of satellite images with high spatial resolution, such as Landsat 8, SPOT, ASTER, RapidEye, it is possible to identify the ravine system and the dynamics of gullies form by serial imaging over large areas. Also, the detection and control of certain small signs, including soil erosion level increased significantly. The aim of the study was the classification and mapping of erosion in agricultural landscapes using multispectral remote sensing data with high spatial resolution. Soil erosion identification according to satellite data is based on the integrated use of satellite data, and supporting thematic and cartographic information on the spectral and agrochemical properties of soil cover. Thus, the methodology includes soil erosion level classification within soil homogeneous areas based on mathematical and statistical modeling of humus content by spectral characteristics of soil and vegetation cover. The map of humus contamination and erosion distribution within agricultural test site was developed. The results will serve as the basis for cartographic modeling to determine the erosion degradation of soil cover in the system of soil remote monitoring, prediction of various scenarios of degradation processes, risks reduction, and making timely precautionary measures against degradation of both ecosystems and agroecosystems.

Key words: Aerospace monitoring of agricultural landscapes, soil, water erosion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mapping of saline soils from processed satellite images and agro-ameliorative measures against salinization

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Abstract

The article deals with the mapping of the saline soils in the Kur-Araz lowland, prepared on the basis of the electronic maps of the agricultural lands and made by the digital processing of the images taken from the artificial satellites of the Earth "LANDSAT-TM" in 1998 and "IKONOS" in 2008. The aim of the work is the definition of the area of saline soils of the Kur-Araz lowland according to the maps of agricultural lands, made in 1998 and 2008 due to the results of the processed satellite images and due to the suggestions on the agro-ameliorative measures preventing the salinization process. It was ascertained that for the past 10 years, from 1998 to 2008, the area of the saline soils increased by 66.5 thousand hectares as a result of not following the agrotechnical and agro-ameliorative measures, and also of the poor state of the collector-drainage network in the investigated farmlands. For the improvement of the ameliorative conditions of soils, the alternation of crops on the arable lands and the supervision of the proper operation of the drainage-collector network are necessary.

Key words: The Kur-Araz lowland, saline soils, the artificial satellites of the Earth "LANDSAT-TM", "IKONOS", digital processing, satellite images.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Climate change impact on soil salinity and vegetation of Selçuk-Izmir

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Abstract

Climate Change is one of our world's important problems. Agriculture and forestry has shown vulnerability to heat waves and drought. Changes in precipitation and evaporation patterns and the rising temperature will cause soil, agriculture and ecosystem problems in the future. In this study we have chosen Selçuk-Izmir. Selçuk is located in south of Izmir and is a region with different ecosystems. Region is heavy on different types of agricultural activities. The quality of soil is very important to agricultural activities and vegetation. In this study we investigated the climate change impact on soil quality. Our concentration was on soil salinity. We have taken soil and water samples. The samples were analyzed for different soil and water indicators after and before rain seasons to determine washing effect of annual rain. With results from analyses we made a model with GIS environment about the expected soil salinity in region in different precipitation scenarios.

Key words: Climate change, soil, soil salinity, GIS, Selçuk.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimating soluble organic nitrogen by artificial neural network and multiple linear regression

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Abstract

Soil soluble organic nitrogen (SON) plays a significantly role in nitrogen biogeochemical cycling. However little investigation has been made in pasture soils. Therefore our objectives were 1) to predict SON by ANN (artificial neural network) and MLR (multiple linear regressions) models and 2) to determine the most important factors influencing SON. This study was conducted in a hilly region with an area of 2400 ha under natural pasture land. Then topographical attributes and soil properties measured. MLR and ANN models were used for prediction SON. The MLR model and ANN model for predicting SON resulted in MEE, RMSE and R^2, 0.041, 0.103, 20% and 0.01, 0.024, 94% respectively. Based on the results, it appears that MLR models had lower efficacy to predict the SON than did the ANN model. A reason for these findings can be attributed to the nonlinear relationships existed between soil and topographic attributes and the SON. ANN technique can estimate these relations using nonlinear functions. Based upon the coefficients of sensitivity of the ANN models, CCE, aspect, CA, silt, RSP, SCA, shaded, clay, Mean C and STI were top ten important factors affecting SON pools. Results indicated that topographic attributes were the most important factors for predicting SON. Topography is as one of the pedogenic factors, which significantly influences the spatial distribution of soil moisture, temperature and organic matter. Topographic attributes affected SON directly through movement water in soil and soil moisture and indirectly through their effects on soil organic matter and soil total N.

Key words: Soluble organic nitrogen, models.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mountain landscape mapping of Armenian and Anatolian upland by Remote Sensing Data: Basin approach

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Abstract

The soil mantle research and space mapping of the Armenian and Anatolian Upland were made by the using remote sensing data. The watersheds of four large basins like the Black sea, the Caspian Sea, the Mediterranean Sea and the Persian Gulf were represented on the territory of the Armenian Upland and also the confined basins of Van and Sevan lakes form special watershed basins. It helps to characterize them as major geosystems with definite predominant direction of substance displacement and with climatic peculiarities also. According to space images such forms of landscape as folded, volcanogeneons and tectogeneons-volcanic are clearly seen. For soil mantle deciphering it was suggested to use such characteristic as types of morphostructures as the means of the largest taxon and mapping element. It is suggested to point out 3 types and 7 subtypes of morphostructures showing geologic – geomorphological peculiarities of the mountainous country being under research: folded and blocky-folded mountain structures; volcanic massifs; intermountain depressions, troughs, and river valleys. Landscape and soilscape deciphering of the major morphostructures were executed within the types and subtypes. The scheme of landscape research and mapping on the space images deciphering materials can principally be represented by a set of major positions: sea basin → basic macroexposition; climate conditions → morphostructural type → morphostructural subtype → vertical zonality (sequence) → predominant soils and landscapes. The peculiarity of folded mountains is defined by the way the watershed basins are formed on their slopes. The mountains soil mantle formation occurs under the conditions of interaction of the two biosphere processes - high vertical zones and river litho drainage basins. That's why the slopes of folded and blocky-folded mountains are subjected to different changes connected with the advanced dynamics of such basins which leads to the soil vertical sequence degradation. The vertical zonality is not so clearly expressed here, especially in the boundaries of medium-mountains. The soil mantle composition is defined by the size and vertical zonality of the mountain massif, its affiliation to a certain sea basin and macro exposition. The phenomena of soil zones interference, inversion and migration often occur here. So land cover inside mountain river basins has original structure. The Armenian and Anatolian Upland Soil and landscape maps were compiled with use of data of remote sensing in 1:800000 scale.

Key words: Mountain landscape, soil and landscape mapping, space images.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ukrainian experience in the space imagery data use for diagnostics and parameterization of degraded Chernozems

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Abstract

The set of natural and socio-economic factors cause intensive development of degradation processes in the soils of Ukraine. According to various estimates, more than 50% of Chernozem soils are more or less susceptible to physical, chemical, physico-chemical types of degradation, such as water and wind erosion. To provide modern requirements concerning geometrical and geographical accuracy and objective diagnosis of degraded Chernozems, it is promising to use high resolution multispectral satellite imagery, as primary quantitative information. In this regard, the laboratory of remote sensing of soil cover of National Scientific Center "Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky" (NSC ISSAR) has been making a detailed study of possibilities of multispectral space scanning data application for digital mapping of Ukrainian Chernozem soils since 2000. Analysis of space data informativity has been implemented in the course of the research. This analysis allowed to reveal regional features of changes in the optical characteristics of Chernozem soils and to describe their dependence on physical and chemical soil parameters. The acquired results were used to single out and parameterize specific soil contours including degraded areas of Chernozems (erosion, salinization etc). Space images of degraded Chernozems are more contrast, which allows to practice two basic directions of study: 1) analysis of the mutual location of the soils contours and evaluation of their spatial structure; 2) parametric description of selected properties of degraded soils within soil contours (with the mathematical, geo-statistical methods and methods of multidimensional data processing).

Key words: Soil cover, chernozem soils, geoinformation technologies, remote sensing, multispectral space scanning, cluster analysis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Predicting of wet aggregate stability using artificial neural networks in a pilot area, Kahramanmaraş, Turkey

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Abstract

Since end of the 1990s, one of the most popular subjects is estimation engineering in soil science. This popularity results from necessity of database update, easiness requirement by researchers and demand of reduce the cost by funders. Artificial Neural Networks (ANNs) are most common prediction tools. The objective of this study was to investigate suitability of ANNs for predicting wet aggregate stability (WAS) in pilot area of Kahramanmaras Sutcu Imam University Campus, located in the Southern Anatolia, Turkey. In the research area, soil samples were collected from topsoil (0-15 cm). Seasonal fluctuations of structural strength were considered in methodological construction. Correlation matrix and path analysis results were regarded as statistical guides before operated ANNs. Different algorithms were treated for the best estimation. Accuracy of the ANNs was evaluated using by coefficient of determination (R^2), root mean square error (RMSE) and mean absolute percent error (MAPE). According to the results of this study, R^2, RMSE and MAPE varied from 0.55 to 0.99, 2.12 to 11.33 % and 3.55 to 20.0 % for all algorithms. The best predicting results were obtained from resilient backpropagation algorithm (RProp) when the R^2 and RMSE regarded as criteria. When MAPE opted for evaluation criterion, one step secant backpropagation (OSS) algorithm gave the best results. ANN approach suitable to estimate the WAS values of soils in the research area.

Key words: Artificial neural networks, erodibility, soil, wet aggregate stability.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial distribution of some soil properties in Altınova state farm soils

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Abstract

This study was carried out Altınova State Farm soils at the selected 64 km2 (8km * 8 km) test site. Soil samples were collected with 500 m spaced at 287 locations. Total of 1036 soil samples were collected per 20 cm until 1 m soil depth. Some soil analyses; such as soil pH, electrical conductivity, carbonate content, bulk density and texture, were exerted to soil samples. The descriptive statistics were computed according to soil analyses results, and spatial distribution of the soil properties were determined geostatistically using kriging method. Appropriate variogram modeling was performed with parameters (nugget effect (C_0), the threshold value (C_0+C), the structural distance (A_0)) for each soil properties and soil depths. Maps were generated using GIS software for each soil properties and depths with variogram parameters. Both kriging and soil analysis results were compatible. Calcium carbonate content showed the highest variability among other soil properties, with a 73.28 % coefficient of variation at soil depths of 0-20 cm while soil pH showed the lowest variability from other soil properties with 0.006 % coefficient of variation at soil depths of 0-20 cm. The surface soil bulk density values changes generally from 1.28 to 1.34 g cm^{-3} and these values were harmonious to soil texture classes belongs to each of the soil depths. Bulk density values have lower standard deviation and coefficient of variation values with mean value 1.30 g cm^{-3}. According to analysis results and kriging evaluation, lower electrical conductivity values were determined with ranging from 0.275 to 0.316 dS m^{-1}. The average soil organic matter content was 1.60%, with ranging from 3.85 to 0.07%. The deeper soil formation and higher clay contents (mostly higher 40%) were observed at the southeastern parts of the study area, which belongs to mostly common Altınova series, during soil sampling studies. However, clay content values increased after 20 cm depth especially at 40-60 and 60-80 cm depths with increasing depth. The soil pH values and calcium carbonate content generally increased when increasing depth. pH values ranged from 6.82 to 8.44, with the mean overall pH value of 7.79. Similarly soil analysis and kriging results showed the calcium carbonate content of the study area ranged mainly from 0.32 to 55.80 %, with overall mean value 16.29%.

Key words: Soil properties, kriging, geostatistic,GIS.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil sampling optimization for precision farming using Bayesian approach

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Abstract

Precision farming requires knowledge about the variability of plant nutrients within a field. Traditional soil maps contain information about the distribution of soil classification units. Nutrients content can change greatly as a result of agricultural treatments, and their distribution does not always coincide with soil map units. Traditional soil maps may be insufficient for precision farming. However, information contained in soil maps may be used to reduce the number of sampling points and optimize their locations. Bayesian approach can be used in this case establishing relationship between a priori and a posteriori information. Study was conducted on two agricultural fields situated the territory of Bryansk State Agriculture Academy (Russia) under financial support RFBR grant N 13-04-00480. Relief is presented by undulating watershed areas. Soil cover of the territory is very complicated. The main soil units are agrogrey soils that are located on the small increases in the landscape and agrogrey soils with second humus horizon that are located on the small depressions (Phaeozems Albic, FAO, 1998). Total height difference between small increases and small depressions is about 2-3 meters. The initial soil cover is disturbed by the expression of erosion processes and effects of land reclamation performed in the area in 80th. Varying degrees of eroded and degraded soils can be found. Soil samples were collected on two fields (12 and 52 ha) at the depth 0-20 cm (262 samples) using stratified random scheme. Mobile phosphorus and potassium contents were determined. Soil maps of 1980 and 2008 were used as the priori information. The accuracy of nutrients content maps, which were made using prior information and without it, were compared. It was found that the use of soil maps as prior information reduce the number of sampling points by about 30% without a significant loss in accuracy of the mobile phosphorus and potassium contents spatial distribution. The influence of the prior information depends on the time of mapping and the agricultural land use intensity.

Key words: Bryansk Opolje, Phaeozems Albic, Bayesian approach.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mapping soil salinity in irrigated land using optical remote sensing data

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Abstract

Soil salinity caused by natural or human-induced processes is certainly a severe environmental problem that already affects 400 million hectares and seriously threatens an equivalent surface. Salinization causes negative effects on the ground; it affects agricultural production, infrastructure, water resources and biodiversity. In semi-arid and arid areas, 21% of irrigated lands suffer from waterlogging, salinity and/or sodicity that reduce their yields. 77 million hectares are saline soils induced by human activity, including 58% in the irrigated areas. In the irrigated perimeter of Tadla plain (central Morocco), the increased use of saline groundwater and surface water, coupled with agricultural intensification leads to the deterioration of soil quality. Experimental methods for monitoring soil salinity by direct measurements in situ are very demanding of time and resources, and also very limited in terms of spatial coverage. Several studies have described the usefulness of remote sensing for mapping salinity by its synoptic coverage and the sensitivity of the electromagnetic signal to surface soil parameters. In this study, we used an image of the TM Landsat sensor and field measurements of electrical conductivity (EC), the correlation between the image data and field measurements allowed us to develop a semi-empirical model allowing the mapping of soil salinity in the irrigated perimeter of Tadla plain. The validation of this model by the ground truth provides a correlation coefficient $r^2 = 0.90$. Map obtained from this model allows the identification of different salinization classes in the study area.

Key words: Soil salinity, electric conductivity, spectral indices, principle component analysis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Remote sensing of evapotranspiration above a Mediterranean forest canopy, Case study: Bissa forest, Algeria

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Abstract

Evapotranspiration (ET), is a fundamental process of the hydrological cycle, water balance and management of climate, particularly in the southern Mediterranean areas characterized by harsh climatic adversities. The rate of evapotranspiration is controlled by several factors such as wind and water availability. Remote sensing is an important technological trend that can assist the estimation of evapotranspiration at each point of the study area and provides its geographical distribution. In this context, the Surface Energy Balance Algorithm for Land (SEBAL) and the Simplified Surface Energy Balance Index (S-SEBI) are the most common remote sensing algorithms used to estimate the surface energy balance. As the SEBAL algorithm needs the solution of a complex iterative process, the S-SEBI algorithm was used in this study with four Landsat-5 Thematic Mapper (TM) images, to assess the daily evapotranspiration in Bissa forest, one of the healthiest Algerian forest located south of the Mediterranean sea. Results showed that intensity of evapotranspiration in the study area varies over the different seasons, the highest ET values were reached during spring (April) due to water availaibility in this season, within the range from 5.1 (bare soil) to 9.7 mm/day (dense forest) and a daily mean value of 7.86 mm/day, the lowest ET values were shown during the dry season i.e., summer (July) with a range from 1.8 to 4.1 mm/day and a daily mean ET of 3 mm/day, autumn and winter (October and January) showed an intermediates mean values of 3.5 and 3.8 mm/day respectively and range from 1.8 to 4.8 mm/day. The highest surface temperature values were recorded during July with 325 (°K) of maximum and 297 (°K) of minimum, the lowest surface temperature values occurred during January with 299 (°K) of maximum and 282 (°K) of minimum. The relationship between normalized difference vegetation index (NDVI) and ET (mm/day) showed that the highest ET values coincide always with the highest NDVI values except for January where even the lowest NDVI values correspond to higher ET, the highest determination coefficient (R^2) between ET and NDVI was obtained during summer season with a value of 0.6. Thus, the present work shows the promising possibilities of remote sensing to solve the energy balance equation.

Key words: Evapotranspiration, remote sensing, S-SEBI, Bissa, Algeria.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluating environmental sensitivity to desertification in El Fayoum depression, Egypt

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Abstract

This study aims to use spatial analyst tool in a Geographic Information System (GIS) to assess the environmental sensitivity for desertification in El Fayoum Depression, Egypt. The thematic layers of soils, vegetation and climate quality indices are the main required data for estimating the Environmental Sensitivity to desertification. These layers were established in geographic information system depending upon land surveying and laboratory analyses data, Landsat ETM image, Digital Elevation Model (DEM), geological map and climatic data. Spatial analyst tool in Arc-GIS 9.3 software is used for matching the thematic layers and assessing the desertification index; accordingly, the map of environmentally sensitive areas of El Fayoum Depression is produced. The obtained data reveals that the high sensitive areas for desertification in the study area are found in the southern parts of Qarun Lake, it represents 18.31 % of the depression area. The areas of sensitive for desertification exhibit an area of 54.09 % of the total area. The areas of moderate sensitive for desertification exhibit an area of 27.6 % of the total area. The integration of different factors contributing to desertification sensitivity may lead to plan a successful combating. The use of remote sensing data and GIS is proved to be useful in visualizing the sensitivity situation of different desertification parameters.

Key words: Desertification sensitivity, land degradation, geomorphology, El Fayoum.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Soil erosion risk assessment with ICONA model in Madendere watershed

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Abstract

Soil erosion is one of the most important environmental problems in most area of World. The aim of this research is to determine soil erosion risk assessment with ICONA model in Maden Dere watershed of Kocaeli, Kartepe district. The soil erosion risk assessment stages of this model occurred seven steps. Main parameters of these steps are slope, geology, land use, land cover information. A potential erosion risk map (step 3) was obtained from the slope (step 1) and lithofacies layers (step 2) generated using a digital elevation model (DEM) and digital geological and soil maps. As a result of this process, the distribution of the erosion risk classes was 7.58% (low), 4.96% (moderate), 3.75% (medium), 26.19% (high), and 57.53% (extreme). Land use (step 4) and land cover (step 5) layers derived from GEOEYE 2013 image data classification were combined to produce the soil protection map (step 6). The soil protecting map clearly showed that 58.35% of the study area was classified as very low and 38.20% of the study area was classified as very high. In addition to settlement is the remaining of area 3.45%. Soil erodibility and soil protection layers were combined to form the ICONA soil erosion status map in the final step (step 7). This final map showed that 50.07% of the study area had high and very high was sensitive. The rest of study area 49.93% had lower (settlement, very low, low and appreciable) erosion condition. This study also showed that GIS and RS techniques play an important role in determine of soil erosion risk studies.

Key words: ICONA, Madendere watershed, soil erosion risk, geographic information system.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The assessment of resource potential of agro-landscapes of Belarus with use of geo-information systems on the basis of soil cover structure

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Abstract

A variety of soil-land resources requires a differentiated approach to recording and evaluating its modern environmentally safe and economically efficient state. Rational use of soil and land resources necessarily implies consideration of all of their distribution and overall assessment. As a result of research the methodological approaches to determining the resource potential of agro-landscapes were developed and their approbation by the example of concrete objects was performed. The possibility of typing soil combinations and characterizing by their unity of properties and features of agricultural landscapes can treat them as types of land. The basis for the selection of some soil combination, in addition to the shape of the structure of soil cover, is the specificity of the four environmental conditions: orographic, geomorphological, lithological, hypsometric ones. Remote sensing data – aero photomaps and satellite imagery – can give additional material for verification of geo-systems. As the result, an unified legend for maps of soil cover structure made for the whole territory of Belarus and combines 50 types of soil combinations, or types of land distributed differently everywhere. The foundation of the information component of the rational use of soil-land resources is a systematic inventory of the natural conditions of agro-landscapes based on soil cover structure within the boundaries of invariant units – land types. The possibility of using geo-information systems in the inventory of natural and anthropogenic environment with an estimate of resource potential was determined. The dependence of the production cost of agricultural production on the value of the resource potential of agricultural organizations was established and the suggestions for rational use of land erosion and wetland agro-landscapes was developed.

Key words: Soil cover structure, soil combination, resource potential, assessment, geo-information systems.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of the European soil standards on the territory of Azerbaijan

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Abstract

At present the integration to the European and international structures goes on in many directions, including scientific. Against a background of globalization it is fundamentally important to form an adequate soil-information space which would ensure progressive international cooperation in the field of soil science. As known, the new digital soil database of the Mediterranean and Caucasus Countries' territory in the format of the soil geographical information system of the European Union (EU) is being prepared within the program for the Extension of the European Soil Database (ESDB). This research intends to create the Soil Geographical Database of Eurasia at scale 1:1,000,000 as a part of the European Soil Information System (EUSIS). The current stage of the Azerbaijan soil resources inventory on supranational level is closely linked with the processes of adaptation of the country to the conditions of new geopolitical realities. It is of fundamental importance to preserve and develop the national scientific and practical traditions and their harmonious integration with the EU soil inventory. Taking into consideration the urgency of the problem, we have made research in order to create the digital data base of the soils of the Republic of Azerbaijan. The digital soil map of Azerbaijan has been prepared in a scale of 1:1000000 using modern geoinformation technologies and taking into account the ESDB requirements. During the analysis of soil database of Azerbaijan some difficulties that impede the integration process to the ESDB were revealed. These difficulties can be divided into the following groups: General difficulties: •Difference in scientific-methodical approaches •Difference in terminology and the language barrier •Difference in perception of new technologies. Technical difficulties: • Accessibility problems with the primary data • Paper format of the soil data sources • Great variety of cartographic and attribute data • Absence of the digital spatial and attribute database. Technological difficulties: •Low level of the information technology use (software and hardware) in soil-agrochemical researches •Mastering problems of modern approaches in soil science research including the use of IT by some specialists. Generally, the work that has been done brought to a conclusion that the knowledge available on soils of Azerbaijan makes the integration to the EU soil-geographic data base possible

Key words: Soil database, integration, geoinformation technology.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mapping & monitoring of waterlogging and salinity in irrigated lands (Iraq) using multi-temporal Landsat images and GIS

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Abstract

Soil, vegetation, water are considered the main key for agricultural projects. the agricultural activity in Iraq, particularly irrigated land faces challenges which is presented as , the most important limited farmland exploited effectively in addition to land degradation and decline and the lack of a continuous spaces ground arable involved in agricultural production, and that the main objective of reclamation of soils in Iraq is to remove of excess salts in the soil, which is one of the major problems identified for cultivation in irrigation lands where accumulation of salt around root of plants. The study aims to highlight the great importance of the use of remote sensing to identify, monitor and evaluate the changes caused by the man in the environmental situation of the region by calculating the coefficients of vegetation NDVI and salinity Index SI, over three decades and a special follow-up to the problem of salinization and the current LULC especially uses of agricultural land of the Dujailah project within Wasit province as a model of reclaimed land projects in Iraq ,which is located south of Wasit province at a distance of 29 km from the city center. By using of remote sensing techniques (satellite images Landsat multiple wavelengths and multiple time periods (SRS/MSS,TM,ETM+,LC8), geographic information systems GIS, and GPS, many digital processors has been used to determining the units and the current pattern occupied by exploitation of its for agricultural uses and compare it with the traditional field work ,satellite images Landsat8 /2013 and satellite images of historical archival (1976, 1990, 2002), using a (ERDAS 9.2) and (ARC / GIS9.3) software Package. The results indicated by visual and digital Landsat images interpretation and field observations supported by using the GPS and ancillary data shows seven units for land use in the region and by analyzing vegetation index (NDVI) and salinity Index (SI) data, 2013 is the best year to increase vegetation and field crops than in years 1976, 1990, 2002, and 1976 is the worst in the deterioration and decline of vegetation and salinity desertification.

Key words: Salinity, Landsat, NDVI, SI, LULC, ERDAS, GIS, irrigated lands

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of soil salinity in Akdala irrigation area using GIS technology

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Abstract

The problem of soil salinity is one of the main problems of soil science. Particularly sharp it is in arid regions where secondary salinity processes are widely manifested which are associated with irrigation, groundwater elevation and formation of irrigation- hydromorphic or semi-hydromorphic soils. Monitoring secondary salinization is an important issue, which at the present stage of development of science cannot be solved without involvement of the GIS technology, including satellite imagery. In this regard, the main purpose is to study soil surface in Akdala irrigation area and drawing of maps using GIS and digital mapping method. Salt survey was conducted in traditional ground method, and for mapping soil salinity was used GIS MapInfo Professional software. The data on the degree of salinity of the upper 0-20 cm soil horizon shows that main part of studied soil areas are saline in varying degrees. As can be seen from the salinity map data, 58.0% of the surveyed area is occupied by saline soils. The predominant soils are low, medium and high degree of salinity, which occupy 19.3% of the surveyed area. The share of non-saline soil is 42.1%. In the second 20-50 cm soil horizon compared with the upper horizon, the share of saline soils increases up to 70%. Strongly, weakly and medium saline soils prevail according to the occupied area. Share of area occupied by very strongly saline soils is 4% of the total area of surveyed soils. The area occupied by non-saline soils reduces to 30.0%. On salt concentration in 50-100 cm of soil horizon in the surveyed area, there is similar situation in upper 20-50 cm horizon, and area of very highly saline soils - 3.8% , strongly saline - 19.2% , medium saline - 26.7% , slightly saline - 11 5% . In conclusion, it should be noted that more than half of the territory of Akdala irrigation area is occupied with soils with saline surface, salt is concentrated in the near-surface 20-50 and 50-100 cm of soil horizon and represent a real threat of secondary salinization.

Key words: GIS, soil salinity, digital mapping.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial variations of physical and chemical properties of sediments deposited in the reservoir of the Borcka Dam in Artvin, Turkey

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Abstract

Large dams cause important changes on flow regime, sediment deposition and its distribution in rivers they are built. When inundation starts with the building of dams, water surface area increases, flow rate decreases and finally sediment carried away by the river is deposited in reservoir. It is important to know amount, quality and distribution of sediments in respect to both monitoring reservoir capacity of dam and modelling some basic features of watershed area. The aim of this study conducted within the Borcka Dam reservoir was to estimate some physical and chemical properties including grain size distribution, penetration resistance, aggregate stability, moisture content, organic matter content and pH at two depths (0-10cm and 10-20cm). In addition, another objective was to analyze special distribution of this properties. For this purpose, study area was divided into transects with 10mx50m and penetration resistance values were determined at each intersection points of the transects. Moreover soil samples were also taken at the intersection points for laboratory analysis. Data gathered were evaluated using descriptive statistics and ANOVA while geostatistical analysis were used for calculating spatial variability of data. Results indicated that commonly texture classes were loam at surface layer and silty loam at subsurface layer. Moreover the penetration resistance values, sand content and aggregate stability values at surface layer were significantly ($p<0.01$) higher than subsurface layer, and moisture content, clay content silt content, pH and organic matter were significantly ($p<0.01$) higher than surface layer. Geostatistical analysis showed that all properties were described by isotropic variogram and range values were lower at subsurface layer than surface layer.

Key words: Reservoir, sediment, geostatistics, kriging, spatial variability.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Use of GIS tools and some soil characteristics for making suitability maps for growth and cultivation of blueberry (*Vaccinium myrtillis* L.) and Northern highbush blueberry (*Vaccinium corymbosum* L.)

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Abstract

Basis for understanding of the spatial distribution of specific plant species is in the knowledge of the specific soil characteristic, climatic and orographic demands of certain plants. Plant species of the genus Vaccinium originating from the eastern part of North America where they were transferred to Europe. In this paper we prepared suitability map for the growth of blueberry (*Vaccinium myrtillis L.*) and cultivation of Northern highbush blueberry *(Vaccinium corymbosum L.)* in the Federation of Bosnia and Herzegovina using GIS tools and some soil characteristic. In paper, as the major limitations for growth of the blueberry (*Vaccinium myrtillis L.*) and cultivation of the Northern highbush blueberry *(Vaccinium corymbosum L.)*, we used pH value of the soil, soil depth (source: Basic Soil Map of Bosnia and Herzegovina, 1:50 000), elevation and aspect (source: Digital Terrain Model of Bosnia and Herzegovina). Map as the end result allows the user to get answers to questions related to the growth of the blueberry (*Vaccinium myrtillis L.*) and cultivation of the Northern highbush blueberry *(Vaccinium corymbosum L.)* in the Federation of Bosnia and Herzegovina.

Key words: pH value, soil depth, elevation, aspect, analysis, GIS tools, limiting factors, blueberry, Northern highbush blueberry

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Remote sensing use in the discrimination of landscape patterns diversity in the lower Cheliff plain, Algeria

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Abstract

Located 220 km to the west of Algiers, the plain of the lower Cheliff extends over 60000 ha. It suffers from many endangering problems mainly soil salinization and climate aridity translated in its important ground surface diversity. Through this work, we used remote-sensing capacity by processing a Landsat image data to characterize the landscape diversity over the whole study area. the main landscape units detected by visual interpretation are ; the saline depression of sebkhat, the two irrigated perimeters of Ouarizane and Djediouia, the free water surface of El-Merdja, in addition to the Cheliff wadi, the non saline soils of Benziane valley and the Gaa which contain uncultivated saline soils dominated by halophytes vegetation. The remote-sensing data with measured salinity from the ground surface layer, vegetation cover, and land use data have been used to map 13 classes corresponding to various diversity landscape units using the supervised classification method of minimum distance algorithm. The validation of the applied classification was done by the contribution of field missions based on land use inventory, salinity measurement, and vegetation cover (sampled in spring 2011 and 2012), also the intrinsic characteristics of the environment were used to describe the resulted classes of landscape patterns and to get more information about their diversity. The obtained classes from the digital analysis correspond to the reality of the ground diversity in term of landscape patterns and it presents variable spatial distribution.

Key words: Landscape diversity; remote-sensing; vegetation cover; Land use; salinity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Combination of remote sensing and kriging to improve soil salinity mapping in the Hmadna plain (Algeria)

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Abstract

The plain of Hmadna is located in the western part of the plains of Cheliff (North-western of Algeria) with a surface of more than 10,000 ha. The salinity mapping at the scale of the whole plain is difficult to undertake because it would be necessary to collect and analyse a large number of samples in order to reach a good spatial estimate. The satellite's remote-sensing capability, with the quantity of information which it offers and its broad field of view, seems to be the most suitable tool to chart salinity when the spectral data are combined with a reduced number of soil samples. The necessary precondition for the operational use of this technique is the existence of a good correlation between the data measured directly from soil samples with that resulting from the remote-sensing. The objective of this work is to show the importance of using optical sensors with a very high spatial and spectral resolution in the improvement of the mapping surface layer soil salinity. In the first part of this paper we develop a relationship between the remote-sensed data (WorldView-2) and the measured salinity of ground samples (as expressed by sample electrical conductivity (EC), through statistical analysis (ordinary kriging) to create a salinity index just in the sample area for this dataset. Then in the second part of the paper, we apply this developed relationship to the whole of the WorldView-2 image set, to extrapolate a soil salinity map for the whole area.

Key words: Salinity, remote sensing, geostatistic, GIS.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of regression models and artificial neural networks for soil color sensing by digital number and top of atmosphere data

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Abstract

Surface soil color (SC) is one of the most important and efficient physical soil properties for classification, evaluation and mapping soils. The conventional method of soil color measurement are time consuming and costly, moreover can not provide a suitable solution for large and impassable areas. Remote sensing imagery is a technique which produces a rapid, efficient and inexpensive predictions of different soil properties e.g. soil color. Using new analytical methods in modeling the relationships between soil color and various remotely sensed data, accuracy and efficiency of predictions should be improved. Artificial Neural Networks (ANNs) are one of the new analytical techniques for modeling nonlinear relationships in data. It seems that using of neural network for modeling relationships between soil color and various remotely sensed data can be promising. The main objective of this study was to compare the sufficiency and accuracy of multi linear regression models between digital number and Top of Atmosphere data with soil color attributes opposite of the artificial neural networks., The investigation was conducted in Gorganrood watershed located semiarid region, surroundings of gorgan city in Golestan province of Iran. Munsell hue, value and chroma of surface soil were visually determined by three observers under diffused daylight. Then in single band images, digital numbers (DNs) were derived from sampling points then TOA reflectance values, were calculated of them. Statistical analyses were employed to consider the relationships between observed Munsell attributes with DN values and TOA reflectance data with multiple linear regression models and artificial neural networks. Results show a significant improvement and reliability in color determination with remotely sensed data by regression and artificial neural networks. The TOA reflectance values provided most accurate and efficient results in multiple linear regressions. In fact through the digital number conversions to the TOA reflectance, these data have been own the higher potential for soil color predicting more than DN values. Whereas an analyses result of neural networks doesn't show any improvement using TOA reflectance data compare to digital number values. The only difference between TOA reflectance and DN value is a simple transformation. Using the ANN, this transformation is carried out automatically in the training phase. In other word, if we ignore applying an efficient transformation to the features, AAN adjust the weights in such a way to do it automatically. Therefore, TOA reflectance and DN values lead to similar results.

Key words: Soil color, digital number, Munsell attributes, neural network, TOA reflectance.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial distribution of copper in soils around the Mazraeh Mine, North-West of Iran

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Abstract

Heavy metal contamination causes serious environmental and health-related problems around the world. Mazraeh copper mine has been established since 1960 in the north-west of Iran. Thus, the garden soils around the mine may be contaminated by heavy metals, particularly copper. Sampling was conducted at 30 sites in a way that encompassed about 1500 ha between the Mazraeh mine and the Ahar river. Obviously, the contamination of the river is important but not addressed in this research. Total concentration of copper was determined not only at both upper (0-10 cm) and lower (10-30 cm) soil depths but also at surface accumulated sediments. Statistical and geostatistical analyses were carried out using SPSS and GS+ software, respectively. According to the results obtained the spherical and Gaussian models were two best fitted approaches to interpolate the concentration of copper for the whole study area because of their higher R^2 and lower *RSS*. The inverse distance weighting (*IDW^2*) method was used for interpolation due to the limited data. The mean copper concentration of the samples was twice compared to the world guideline value (50 mg kg^{-1}). The collapse of the tailing dam may be the main reason for copper contamination which was occurred due to heavy rainfall on 2009, from 24 to 27 May (inclusive).

Key words: Contamination, Mazraeh copper mine, tailing dam, spatial distribution.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Spatial variability and availability of micronutrients related to soil properties under different land uses in Bafra alluvial deltaic plain

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Abstract

The main aim of this research conducted in lands of the Fener village located at Bafra Delta Plain where has been used different land usages was to determine spatial variability of micro nutrient elements [Available Fe (Av.Fe), Cu (Av.Cu), Zn (Av.Zn), Mn (Av.Mn)] and affecting soil factors of their variability. Soils of the study area was classified as Inceptisol, Entisol and Vertisol that were intersected points in grid lines sized 300 m x 300 m. Total 131 soil samples were collected from 0-30 cm depth and 14 soil physical and chemical properties such as Clay, Silt, Sand, pH, Electrical Conductivity (EC), $CaCO_3$, Soil Organic Matter (SOM), Total Nitrogen (TN), Available Phosphorus (Av. P), Exchangeable Potassium (Exc. K), Exchangeable Calcium (Exc. Ca), Exchangeable Magnesium (Exc. Mg), Exchangeable Sodium (Exc. Na), micro nutrient elements as well were analyzed. In order to determine affecting soil factors for micro element variation multivariate regression analysis was performed. According to analysis results, it was obtained the highest R^2 value (0.40) for Av. Cu whereas, the lowest R^2 value (0.11) was found for Av. Zn. Moreover, to generate spatial variability of microelements semivariogram and kriging methods were used in the study area in where average Fe, Cu and Mn concentration was found enough level for plant growth whereas average Zn was determined low.

Key words: Micronutrients, multivariate regression analysis, spatial variability, alluvial soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Information support of land and water productivity management models on the basis of SOTER in Uzbekistan

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Abstract

The SOTER was selected as a systematic and higher-order mapping and database development method that covers terrain and soil data serving as input for basin models. A methodology was elaborated to work with soil map on a million scale. However this methodology could be applied for larger scales used when developing national terrain and soil databases depending on task given. The SOTER database was developed for terrain of the Chirchik-Akhangaran rivers basin on an area of 14900 km^2 in Uzbekistan. It serves to provide data for a set of models applied for water management in the basin. The vast area of the Chirchik-Akhangaran basin and wide range of locality elevations (220-3500 m above sea-level) explain latitudinal and altitudinal soil-climatic zonality. Under general background of vertical soil zonality, which foms the main genetic differences, the soil quality and agro-production characteristics undergo considerable changes under influence of many natural and economic factors. This made for diversity of soil-formation processes and soils in genetic and agro-production terms. The following soil types are identified in the basin: (1) Light-brown high-mountain grassland-steppe soils in combination with grassland, marsh-grassland and marsh soils; (2) Mountain brown soil; (3) Sierozem. Besides, intergrade zone soil is identified: meadow-sierozem, and sierozem-meadow. The SOTER database was formed on a 1:200 000 scale soil cover map of Tashkent province comprising the Chirchik-Akhangaran basin. SOTER database has the following hierarchical structure: (1) Terrain; (2) Terrain components; (3) Component data; (4) Soil components; (5) Soil profile; (6) Soil horizons; (7) Vegetation. The soil map of the basin includes 42 soil types transformed into SOTER unit. Based on formation principles of the SOTER database, we deem it possible to take a soil contour of soil classification for the Chirchik-Akhangaran basin as a SOTER unit. To this end, information on specific soil profiles was gathered and included morphologic description of soil profile, per genetic horizon, chemical composition of soil, and physical properties per genetic horizon. The information base can be integrated in GIS environment. The developed database contributes to such models as CROPWAT, HBV, EPIC, RZWQM, and ISAREG.

Key words: SOTER, soil, Chirchik-Akhangaran basin, water management, models

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of pasture territories using remote sensing data

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Abstract

Nowadays in all developed countries of the world and in particular, in Uzbekistan the big urgency is getting use of remote sensing data (RS), mainly satellite images of the medium and high resolution for carrying out of cartographical, geological, ecological, agricultural and other researches. The report discusses methods for studying the condition of grazing land based processing and analysis of satellite images. In the report considered methods of studying of a condition of pasture territories on the basis of processing and the analysis of satellite images. Studying of pasture territories of Nurata area was carried out with use multispectral satellite images Landsat 7 and 8, with the spatial resolution of 30 meters. Processing of satellite images was done with use of software products Erdas Imagine and Envi. Characteristic signature of vegetation and its condition is the spectral reflective ability characterized by the big distinctions in reflection of radiation of different wavelengths. Knowledge about relation between structure and a condition of vegetation with it spectral reflective abilities allow using satellite images for mapping and identification of types of vegetation and their condition. The analysis of satellite images begun with improvement of visual perception of objects in the image. A combination of 3 bands of satellite images, received in a visible range have allowed to receive a colour composition in natural colours. For identification and interpretation various kinds of pasture plants various methods of definition of an index of a vegetative cover (NDVI, Vegetation Index, DVI, RVI, ARVI, SAVI), methods PCA and classifications, and also some kinds of processing which have allowed to define a condition of a vegetation cover in investigated territory were used. In of satellite images the vegetation cover, foothill plains with the rarefied vegetative cover and deserted territories, and also water channels are distinctly interpreted. On the basis of processing and the analysis of RS materials were studied the condition of a vegetation cover of investigated territory, and also their types and distribution areas. During field verification works results of processing of satellite images have been approved by various methods. So in the processed satellite images are observed various phototone and a structure of images, depending on density, size and height of the vegetation cover. At carrying out of verification works on district conducting control points are defined conformity of certain types and forms of vegetation cover to certain phototones and structures of images. On the basis of processing and analysis, interpretation of RS materials and field verification works was generated a map of a condition of a vegetation cover in pasture territories. Thus, the obtained data have formed a basis for an estimation of a condition, types and degree of distribution of a vegetation cover of pasture territories. Data can be used for monitoring of a condition of the pasture areas, and also for estimation of natural potential of investigated territory suitable under pasture grounds.

Key words: Satellite images, pasture, processing, vegetation Index, classifications, phototone, structure of images, monitoring.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The spatial distribution of the topsoil carbon stock and the impact factors in the grassland of Qinghai-Tibet Plateau

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Abstract

The soils of the grassland in Qinghai-Tibet Plateau (QTP) store a large amount of carbon because of the cold and humid climate, and it is quite sensitive to global climate changes. However, little studies have investigated the spatial patterns and impact factors of the soil carbon in the grassland of QTP. In our study, we forecasted the carbon stock using MODIS-NDVI data based on the relationships between them. And relationships between soil carbon stock and soil temperature, soil moisture, soil conductivity, soil hardness and elevation which collected from 141 profiles were explored. The results showed that the soil carbon stock increased from the northwestern to the southeastern in the QTP, corresponding to the distribution of the NDVI values of the grassland. In addtion, it could be found that the soil carbon had a larger value in alpine meadow than in the alpine steppe. The soil carbon stock had the best correlation with soil moisture which indicated that the soil moisture was the main impact factor affecting soil carbon stock. The soil carbon also had good correlation with soil conductivity whereas weakly with elevation.

Key words: Soil carbon stock, MODIS-NDVI, grassland, Qinghai-Tibet Plateau, soil physical properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of annual soil loss and sediment input of Pazar County of Tokat Province in Turkey by using USLE, GIS and Remote Sensing

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Abstract

The Universal Soil Loss Equation (USLE), developed by the United States Department of Agriculture (USDA) in 1930s, has been a widely used mathematical model that describes soil erosion processes. In the past decade, many researchers integrated the USLE with Geographic Information Systems (GIS) in order to calculate and map soil losses properly. In this study, the annual soil loss of Pazar county of Tokat province was modeled and mapped by using the USLE, GIS and remote sensing (RS). Following this methodology, precipitation erosion index (R), the degree of slope and length of slope (LS), soil erodibility (K), vegetation cover-land use (C), and soil conservation (P) factors were separately calculated and mapped in GIS environment. Field observations and a LANDSAT-7 ETM+ satellite image taken on 18 September 2012 were utilized to calculate C factor. Then, all produced factor map layers were multiplied each other to develop an annual soil loss raster map. According to the produced annual soil loss map, study area was summarized in five classes including very slight, slight, moderate, severe, very severe erosion classes.

Key words: Soil erosion, USLE, GIS, Remote sensing

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Establishing spatial database of some soil properties of Zinav Lake Basin by geographic information systems

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Abstract

Determining spatial characteristics of soil properties is the first necessary step for a sustainable soil management. In this study, some soil variables of Zinav Lake Basin were mapped by utilizing geographic information systems (GIS). A total 70 geo-referenced surface soil samples (0-20 cm) were collected from the field studies between the years 2012 and 2013, and analyzed to determine electrical conductivity (EC), soil reaction (pH), texture (clay, silt, sand), organic matter (OM), total nitrogen (N), and lime (CaCO3) soil variables. Utilizing geographic references of sample points and determined soil variables, a point (XYZ) database was established in Microsoft Excel. This point database was used to create 30 m resolution interpolated surface maps of focused soil variables in GIS. Throughout the mapping process in GIS, Kriging (spherical variogram) interpolation method was utilized. In the basin, EC varied between 0.2-0.4 ds, and pH get the values between 8.22 and 8.72. Sand, silt and clay values changed between the values of 16.80-37.07%, 5.60-44.24%, and 43.55-63.43%, respectively. $CaCO_3$ altered between 9.21 and 42.84%, and N got the values between 0.045 and 0.145%. Finally, OM changed between 1.06 and 4.40%. With the developed raster maps, a valuable soil database available for the future management studies was created for Zinav Lake Basin which is the biggest natural lake in Tokat Province and Kelkit Basin.

Key words: Geographic information systems, interpolation, mapping, Zinav Lake Basin, soil, remote sensing

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluating pixel separation techniques for recognizing existing Phenomenon in mixed pixels of thermal remote sensing images

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Abstract

Applying thermal infrared remote sensing pictures are of the most important parameters in recognizing most of phenomenon and understand their inter-relationship. For instance, fire recognition, cities heat island, studying sea levels, studying land surface temperature. Since the size of remote sensing images are so big that information of several phenomena's may be mixed in one pixel and in other words, local separation ability of thermal remote sensing is low. Hence, we will face mixed thermal pixels. One way to obtain exact information of thermal images is separating sub pixels of each pixel, that thermal pixel separation is one of its methods. Based on research results in this paper some applicable and important models for separation of thermally mixed pixels are provided hare. Generally, these relations are based on emissivity and other physical and chemical properties of phenomena's and their environments. Based on obtained results, these methods help to recognize and extract useful information and it seems that these methods have more hope to help researches in order to get more information from infra-red images.

Key words: Thermal remote sensing, sub-pixels, mixed pixels, emissivity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Studying Dust Particles (DP) by using images of MODIS sensors: "Case study: Sanandaj town"

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Abstract

Dust Particles (DP) phenomena's are of the most important natural threats that have invaded Iran in recent years, specially southern, western and south western parts and also have an increasing rate. This phenomena has two sources, internal and external, that the first one has less than 10 percent share and the other one is more than 90%. Iraq and Syria has the most external effect. Concentrations movement path's and stability duration measurement in the region are of the main reasons of producing DPs that can be studied using remote sensing images specially those which record climatic changes daily. In the recent research DPs phenomena entering Kurdestan province has been analyzed using MODIS sensors of TERRA satellite. The base of these results is using information resulted from analyzing visible, infrared and microwave range bands of multi-spectral sensors. From obtained results of data resulted from mixing infra-red and visible bands of multi-spectral sensors, the probability of high quality recognition and identification of DP volumes becomes possible.

Key words: Dust particles, remote sensing, MODIS, natural threats, Sanandaj.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Studying global warming using remote sensing technologies

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Abstract

Global warming and climate change resulted from human activity, is considered as one of main factors causing fault in life network that has gathered a lot of global attention recently. To control and management the disastrous effect of this phenomena has been provided, nationally regionally and globally. In this case, using remote sensing images as a new born technology may have important role in studying temporal and spatial global temperature of the earth. One of the most important methods to study earth temperature is using information resulted from interpretation of satellite images, specially, thermal images. The base of this methods is using information resulted from decomposing and analyzing pixel spectral value of limited band range of visible, near-infra-red and thermal of multi-spectral sensors. To study global warming in this paper, sensor images were used that thermal bands and have high temporal separation power containing MODIS and moderate temporal separation power sensors such as ETM+ and TM. Obtained results indicate that by using exact interpretation of satellite images, specially thermal images, we can continuously study earth global temperature and factors affecting this phenomena and march to best control and management by providing successful answers.

Key words: Global warming, remote sensing, MODIS, ETM+, TM.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Web GIS Application in integral management of natural threats

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Abstract

In Iran, more than 31 natural threats has been recorded and still repeating. The number of recorded flood during past 40 years has become 111 times bigger and the rate of soil erosion has the 1st place in country. It should be noted that no place is immune of natural threats ever in Iran. To reduce and fight against these threats, natural threats integrated management is inevitable. In few past years, Geography Information Systems (GIS) has been applied to evaluate natural disaster risks such as earthquake, tornado and flood. In current research, which is of applicable researches, based on obtained information; the ability of Web-GIS has been provided using descriptive methods. In this paper, the considered crisis is storm in city. Generally, having a right and exact estimation of risk amounts that threatens different areas of country, is essential for its righteous management. In this context, the entry, classification, analysis and graphic presentation of data Risk can be done through a Web-GIS system is discussed with regard to the involvement of the network.The results of these analyzes can land development planning and preparedness and crisis management also be used by the insurance company.

Key words: Integrated management, natural disaster, Web GIS.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessing soil degradation and its relationship to soil quality base upon remotely sensed data

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Abstract

One of the most important environmental hazards is soil degradation. One consequence of the degradation is the negative impact on soil quality. Soil quality considered important indicator of agricultural and environmental sustainability, many researcher introduced relationship between soil properties and soil quality. Soil quality assessment is a complex and it is not possible directly, so that recommended appropriate indicators of soil quality can be evaluated. Soil quality indicators related to physical, chemical and biological soil properties. Soil quality cannot be determined based on a certain property. But soil quality related to physical, chemical and biological properties. Remote sensing is expected to provide the opportunity for improvement of the incomplete spatial, temporal and thematic coverage of the regional and global soil properties. Traditionally, remotely sensed imagery, support division of the landscape, soil landscape units rather homogeneous soil composition. Change detection is the process that provides possibility of observing and recognition differences and disputes of time series of phenomena, patterns and ground conditions. Remotely sensed data, due to having features such as timeliness, duplicate, multi-spectral, variety radiometric, appropriate spatial resolution, digital format, allowing computer processing, have high potential for spatial and temporal variation of the environment. Remote sensing technology offers the potential to assess soil quality at various scales rapidly, repeatedly and inexpensively. However, the variation of spectral response of soils with depth and soil type, and the mismatch in spatial, spectral and temporal resolutions of different sensors may require intensive data processing and complex models.

Key words: Soil degradation, soil quality, remote sensing.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Assessment of salinity indices of TM and ETM + sensor data to detect soil salinity

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Abstract

Identification of salt-affected soils because of their dynamic, special and temporal changes is essential for sustainable agricultural management, especially in (semi-)arid environments. If the salinity problem cannot be immediately remediated, either for physical, technological, or economic reasons, the land will eventually become totally unproductive and will be abandoned. To map saline soils, different direct and indirect methods have been developed. Synoptic view of satellite remote sensing sensors make it a unique instrument to identification of land resources and salt affected soils. The spectral response of bare soils and vegetation species is different, and they both respond to different salinity conditions. It should be possible to map soil salinity using an integrated algorithm of the spectral responses of bare soil and vegetation as an indicator. In the this study the possibility of spectral indices have been tested in order to classify salt-affected soils; therefore the index SI, NDSI, IS Modified, VSSI, BI, NDBI and NDVI have been evaluated in order to identify and monitor soil salinity.

Key words: Salt affected soils, salinity index, landsat sensors.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimation soil organic matter base on remote sensing data and GIS technique

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Abstract

To assess the quality of soil properties as indicators of soil quality is benefiting. Those measurable characteristics of the soil, the soil's capacity to affect production capabilities are called soil quality indicators. Soil organic carbon (SOC) is an important index of soil quality. Spatial variations in soil quality resulting from changes in soil organic carbon accumulation. Atmospheric CO_2 capture and storage of carbon sequestration in soil is called. Soil organic carbon can be expressed as a representative of soil quality. A great source of organic carbon and most dynamic global carbon cycle and atmospheric carbon that is double the total carbon in the biosphere. Much of the organic carbon in soil organic matter, and chemical properties, physical and biological soil is determined and has a major role in soil fertility. Higher concentrations of organic carbon indicates higher quality soil. Although soil organic carbon component of soil organic matter, the following two are used interchangeably. Soil organic carbon can be measured in the laboratory or on-site estimate. Need to develop models of cheap, accurate and efficient for large-scale monitoring of soil quality, tend to technologies such as remote sensing and geographic information system (GIS) created. This article includes information from current methods of measuring tools around to compare and combine the GIS. The results show that the spectral reflections recorded by the sensor and soil organic matter have meaning there is an inverse relationship, Therefore, combining the results of spectral and field measurements of soil organic matter can be estimated in a GIS environment.

Key words: Soil organic carbon, remote sensing, soil quality, GIS.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Qualitative assessment of desertification risk by an integrated index

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Abstract

Soil is the end product of the influence of the climate, relief, biotic activities, and parent materials acting over periods of time. Soil is one of the main natural resources in the world. Regional scale of soil degradation Evaluation is important, because degradation is incompatible with sustainable development. Policy Makers involved in land use planning require tools to evaluate soil degradation, so they can go on to develop measures aimed at protecting and conserving soils. With the development of GIS and remote sensing techniques, the ability to develop such models has greatly improved. This paper describes a GIS-based approach using remotely sensed land cover and to model for the qualitative assessment of desertification risk. The proposed methodology was developed and tested in Kashan area. Six driving factors of desertification (overgrazing, vegetation productivity, soil fertility, water erosion, Wind erosion and seawater intrusion) were modelled-simulated over two time periods to investigate the spatio-temporal evolution pattern of desertification-prone areas. Model results were normalized, weighted and combined into an Integrated Desertification Index (IDI). Ranging from 0 to 1 (representing the best and the worst conditions, respectively), and classified into five desertification risk levels. The implementation, the performance of the methodology and benefits provided by the modeling approach to land management authorities for monitoring processes of land degradation are fully described in the paper.

Key words: Desertification, risk, remote sensing, Kashan area.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Digital mapping of landscapes based on soil morphology in the plain of Lower-Cheliff (Algeria): Application of remote-sensing

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Abstract

The Plain of Lower-Cheliff is one of the most studied north Algerian areas in terms of soil and water dynamics either in space or in time but it is very poor in term of landscapes mainly those related to vegetation. Here in this brief study we used a digital elevation model to detect the soil morphology of our study area mainly slopes and altitudes then to extract and classify the different landscape patterns using the method of supervised classification applied on a satellite imagery of Landsat TM type to present the spatial distribution of the main morpho-landscpaes in a digital spatial map. The resulted classes from the image are mainly: cereal-crops, tree-crops, garden-crops to the east side of the area also, halophytes and bare soils to the west side. The digital elevation model shows that the variation of elevation is not that important as the slope but it is still the one that controls the distribution of landscapes in the plain according to the overlay, elevation/landscapes: halophytes and bare soils locate in low altitudes commonly called depressions following the soil salinity concentration at this level, other crops locate in mid to high altitudes away from soil salinity that endangers agricultural practices in the area, finally we can say that the spatial distribution of any landscape in the area is directly related to soil dynamics and characteristics.

Key words: Landscape, soil morphology, salinity, satellite image, digital map, Lower-Cheliff.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Investigating of vegetation density for Sinop Province using remote sensing and geographic information system techniques

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Abstract

Remote Sensing technologies could be easily obtained many auxiliary data which was used to relating to spatial analysis such as Normalized Difference Vegetation Index (NDVI) studies. NDVI is used with remote sensing technology and Geographic Information System Techniques. This index is one of indices developed for vegetation which is accepted in worldwide. NDVI for this study using satellite image and GIS was aimed. This study belongs to Sinop Province that has been conducted in the area of about 568,464 km² and located between the latitudes 41° 12' 22" - 42° 04' 45" north and longitudes 34° 13' 44" - 35° 24' 39" east. In this study, spatial distribution of plant density in Sinop province was mapped by using LANDSAT-7 ETM+ images and NDVI. LANDSAT-7 ETM+ images belong to 24 October 2005. Obtained NDVI map was classified as very weak, weak, moderate and intensive plant density classes for the first time by utilizing Braun Blanquet cover abundance classes (BB) and geographic information systems (GIS). The accuracy assessment of the created classes was performed by utilizing ground truth data collected from 124 points throughout the study area. The accuracy of NDVI classes was found as 89.60 %. The results of the study indicated that the majority of the Sinop province takes place in the very weak class (37.5 %). This was followed by intense (28.4 %), moderate (25.7 %) and weak (8.4 %) plant density classes. The results demonstrated that the about half of classes have intense and moderate class. And also the results concretely demonstrated the high potential of Sinop province in terms of plant biological diversity and agriculture. In addition remote sensing and GIS have important role to generate accurate and fast data.

Key words: Vegetation, remote sensing, geographic information systems, Sinop.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Land take and soil sealing in North-Eastern Romania

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Abstract

Statistical data from Corine Land Cover as well as ancillary topographic maps and aerial image interpretation have been used to monitor land take in the northwestern part of Romania and soil sealing in the largest city here. Soils ensure a number of vital functions, which can be affected by a large number of factors and processes. Among these during the last decades land take and soil sealing have been recognized as important problems and included by the European Union on the main list of threats to soil quality. In Romania in 2006 the percentage of artificial surfaces was of 6.3, more than the European standard, while sealed terrains held 1,6%, under the European mean. For comparison, during 1990-2006, in the northeastern part of Romania, land take increased from 9.14 to 9.26%, consuming 3022 ha. At the country level the rate has started to grow gradually, from 1218 ha/year after 1989, increasing to 1515 ha/year during 2000-2006. From this surface the study region accounts for 101, respectively 335 ha per year. The main losses have been recorded by rice fields, vineyards, orchards, pastures and coniferous forests, with many interchanges between arable terrains, pastures and other agricultural uses. It can be seen that in this „peripheral" area of Romania, the changes in urban sprawl, land take and implicilty soil sealing have started later than compared to other countries, but are continuing at a faster pace. This is probably best shown by the territorial evolution and soil sealing of Iaşi, who after 1990 witnessed a decrease in population of 7.8%, but an increase in the built surface of 18.5%

Key words: Land take, soil sealing, Romania, urban sprawl.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Creating a surface soil texture map with the indicator kriging technique: A case study of central Iran soils

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Abstract

Most of the techniques for mapping the distribution of categorical variables demand high level of knowledge and technical support. In current study to map about 8000 hectare of surface soil texture of HASSANABAD the Hassanabad region in the eastern part of the Isfahan province in central Iran, we use a simple interpolation method of geostatistical techniques called indicator kriging (IK).The indicator approach is used to describe the spatial variability of categorical soil data. The aim of this study is to run the indicator kriging technique to create the soil texture map as conditional probability. To execute the mapping process 120 points were sampled (0-30 cm) and analyzed to determine their soil texture. The indicator variable is a binary variable that shows the existence of each soil texture in the study area with the indicator 1 and the absence of each soil texture with the indicator 0. After transforming the absence (0) or existence (1) of each soil texture in sampled point, the experimental indicator variograms were computed for indicator data of soil texture in the Ilwis GIS. Prediction of soil texture classes was done by ordinary kriging (OK). Finally, six soil texture maps for six identified soil textures in the study area were created.

Key words: Indicator kriging, soil texture map, geostatic, GIS.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Using multi-variable indicator kriging for mapping central Iran soil quality

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Abstract

The concept of soil quality is related to agriculture productivity, sustainable agriculture, environment quality and human health. Identification, measure and defining limits for specific soil indicator that are related directly to soil quality enable us to monitor soil quality on a landscape. In the current study to create soil quality map for central Iran soil in Isfahan province we use developed method to integrate multiple variables. In this method the most important soil variable that affected soil quality in the study area has been identified and then critical values for each identified soil quality variable were determined. Finally we integrated soil quality parameters into an index to produce soil quality map for the study area. This map can indicate the areas of a landscape that have a high probability of having good soil quality according to predetermined criteria. So this method can provide probability map in different range from small agriculture land to universal scale. Also this method is flexible to compare soils of different region and can be used to provide a map for other multivariable soil parameter.

Key words: Indicator kriging, soil quality, landscape

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ability of geostatistics to mapping soil salinization distrubition in each soil serises : A case study on Central Iran soil

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Abstract

Increasing soil salinization rate its important environment crises in the last decades especially in dry and semi dry lands. To determination soil salinization distribution in each soil series in central iran soil we use ordinary kriging (OK) and indicator kriging (IK) technique. Ordinary kriging is simple method of gesostatistics technique that used to mapping the distribution of quanitative variable. Soil series are a categorical variable. Most of the techniques for mapping the distribution of categorical variables demand high level of knowledge and technical support in current study to mapping. We use a simple interpolation method of geostatic techniques that called IK. The indicator approach is used to describe the spatial variability of categorical soil data. To run these two technique 120 soil profile where excavated and described to identifying all soil series in whole study area finally 9 soil series where identified. All 120 soil profile where analyzed (0-30cm) to determine their EC (electrical conductivity) and creating the distribution map in study area. To creating the distribution map with each two method (OK and IK) the ilwis software were used. Finally the predicted map can show the distribution of salinization in all 9 identified soil series in study area. So this method can be useful tools to manage land resource.

Key words: Indicator kriging, soil quality, landscape.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Minimum data set analysis in hazelnut areas using multivariate statistics and geostatistics methods

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Abstract

Hazelnut is one of the most important industrial agricultural products for the Blacksea region in Turkey. The main aim of this research is to form minimum data set in Ordu and Giresun in where hazelnut has been intensively cultivated. In the result of factor analysis performed using 11 soil phsical and chemical parameters, it was determined five factors that have more than 1 eigenvalue and these factors explained variation of data set about 78%. Factor 1 was called as micronutrient factor in determined factors. It was found that this factor was the most identfy for variation of data set with about 19%, whereas Factor 5 called as vailable boron factor was explained the lowest variation (aproxiamatelly 10 %) in data set.

Key words: Hazelnut areas, minimum data set, physical and chemical analysis, principal component analysis, spatial variability.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Capability of different interpolation models and pedo-transfer functions to estimate some soil hydraulic properties in Büyükçay Watershed, Turkey

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Abstract

Most of the basins or catchments have insufficient data to make conservation planning for sustainable natural resources use. In addition to that, intensive soil sampling is neither feasible nor economic in a large studied area. Therefore, interpolation models and pedo-transfer functions (PTFs) have important roles in these cases. The main objectives of this study were to estimate and compare some soil hydraulic properties in Büyükçay Watershed using different interpolation geostatistical models and PTFs. Three geostatistical models (Inverse Distance Weighting-IDW, Ordinary Kriging and Co-kriging) and pedo-transfer functions (continuous and class) were applied and compared in this study. In 84 soil samples, texture-structure, hydraulic conductivity, soil depth, organic matter, saturation degree, field capacity, and permanent wilting point were determined. According to the results, among geostatistical algorithms, ordinary co-kriging generally yields better results for all soil hydraulic properties with lower MAE and MSE values than ordinary kriging and IDW. Within PTFs, soil hydraulic properties were estimated with high reliability using continuous approach; however, class PTFs showed less sensitivity to space variability than geostatistical methods.

Key words: Geostatistics, pedo-transfer functions, Büyükçay Watershed.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Monitoring salinity and yield loses at the local irrigated Wua District by using GIS analyses

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Abstract

Salinity is a problem for farmers at the irrigated lands with shallow water table in the arid and semi-arid climate condition causing yield losses. Monitoring of soil salinity is utmost important for crop pattern and yield losses, particularly at irrigated lands. Imambakir Water User Association (WUA) located at the Harran Plain faces problems of salinity, excessive and uncontrolled irrigation. Because of topographical, climatical structure and over irrigation water table increase and salinity problems occurred at the Imambakir WUA. After GAP irrigation, remarkable areas affected with salinity problems and farmers lost their yield. This is a result of over irrigation and severity increase of salt accumulation. In order to mapping of the salinity for WUA's areas, soil samples were collected and analyzed for 2004, 2009 and 2012. Analyses results of soil were integarated with map and salinity map completed according to combination analyses of soil samples and field observation in GIS media. In order to estimate of yield loss, salinity map were integrated with land use map created from satellite images. It is interesting that huge yield losses were determined at saline-alkaline affected locations. Because of excess salt accumulation, farmers cannot grow their crops at saline-alkaline fields. At the another salt affected lands, moderately and slightly saline, have being taken under cotton, barley and wheat cultivation with yield losses. Corn cannot grown at this places which is not resist to salinity. Because of this, salinity mapping and monitoring is a crucial point at this district. Harran is a first irrigated plain with GAP project. DSI gives enough water for all plain according to crop patterns, water user associations (WUA) are distributed this water to farmers. But, farmers are used excess water at the northern part of plain and farmers live at the southern location cannot get enough water for irrigation. This is some time caused fight between farmers. Because of the water scarcity, farmers are used drainage water. Not a few farmers used waste water for irrigation. Using this low quality water for irrigation increasing salt accumulation in the soil. As a result, salinity map for 2004, 2009 and 2012 were integrated to landuse database and yield losses were determined and monitored. At same time, drainage water contribution to sail salinity and economical yield losses were evaluated.

Key words: Salinization, GIS, yield loss estimation, salinity mapping, drainage water.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Mapping soil salinity in Jeffara Plain of Libya using inverse distance weighting method

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Abstract

Soil characteristics differ continuously along the field and cannot be calculated in all places. Understanding the spatial variation of the soil characteristics offers many options to manage large scales of soils correctly. It also considers an important determinant for efficiency of farm inputs and yields. Geostatistical analysis theories provide a number of mathematical and statistical methods for integrating the spatial and temporal coordinates of measurement in data processing. It can be used for permitting description and modeling spatial patterns, prediction at unsampled sites, and assessment the measurement error mode. In Jeffara plain, Libya, soil salinity is one of the major soil limitation factors for agricultural production. Spatial information on the soil salinity is increasingly needed, particularly for better soil management. In this paper, 147 soil profiles spread within Jeffara plain randomly were considered for mapping. The average soil salinity was determined based on electrical conductivity (EC) using 1:5 soil-water extraction. The raw data of the soil salinity in the study area was examined using Explor Data Histogram, Normal QQ plot combining with general QQ plot and Trend analysis. Based on the Exploratory spatial data analysis tools, the soil salinity data in the study area was not normally distributed with various types of data transformation. Therefore, the IDW method was selected to produce the prediction map for the soil salinity in the study area. The IDW method was applied with different powers (2, 3, 4 and 5). Spatial trend was calculated and spatial distribution of field salinity status was additionally analyzed and quantified. Mean Prediction Errors (MPE) and Root-Mean-Square Prediction Errors (RMSPE) were used to evaluate the models. The results showed that the values of MPE and RMSPE were 0.22 and 3.3, respectively. The study suggests that the spatial variability of soil salinity at the study area can be mapped using the IDW method at power of 4 since it performs well compared with other IDW powers.

Key words: Spatial analysis, Jeffara Plain, soil salinity, IDW, prediction.

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International Soil Science Congress

EURASIAN SOIL
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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of drought stress on grain yield and P, K, Ca and Mg uptake of wheat cultivars

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Abstract

Plants are exposed to a multitude of natural biotic and abiotic stresses. Drought is a major abiotic stress that severely affects food production worldwide. Plant nutrient uptake from the soil is dependent on soil moisture, fertilizers applied, soil chemicals, and some other environmental factors. The objective of this study was to gain a better understanding of how water deficit affects grain and macronutrients yield of bread wheat cultivars. Two field experiments were conducted at the Agriculture Research Station of Saatlo in West Azerbajjan during 2010-11 and 2011-12 to examine the effects of water supply (normal irrigation and post anthesis drought stress condition) on macronutrients uptakes and grain yield in five winter wheat cultivars (Zarrin, Peshgam, Orum, Zareh and Mihan). Irrigation and cultivars showed significant differences in grain yield, and macronutrients uptakes. Grain yield and grain macronutrients uptakes (P, K, Ca and Mg) in all cultivars decreased with decreasing water availability. These results suggest that wheat cultivars respond differentially to water deficit and macronutrients. The highest grain yield per unit area under well-irrigation and water deficit was obtained for Zareh and Mihan cultivars, respectively. The highest grain P and K uptake under well-irrigation was observed in Zarrin and Orum cultivars, respectively. Also in this study, Zareh cultivar has the most Ca and Mg uptake under well-irrigation but under water deficit condition Mihan has the highest grain P, K, and Mg uptake.

Key words: Grain yield, macronutrient, water deficit, wheat cultivars.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Sulfur application and sowing date influence yield and some grain quality parameters of corn

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Abstract

Appropriate sulfur fertilization can lead to significant improvements in yield and quality in crop production because of having affects the availability of essential plant nutrients. The aim of this study was to investigate the influence of sulfur application on soil pH, macro and micro plant nutrients of corn grain in early and late sowing date. The experiment was conducted with randomized block design in Aydın province under Mediterranean climate conditions in 2013. Hybrid corn cultivar 31D24 was used as a material of the study. three different Sulfur (S) fertilization levels (0 (control), 400 and 800 kg S ha^{-1}) were applied before the ten weeks from each two different sowing date. Sulfur application and sowing date did not affect directly K, Mg, Cu concentration of grain. Generally, Ca, Fe, Zn and Mn concentration of grain were decreased with delaying sowing date. The result of the study showed that yield and yield component of corn such as grain yield, cob length, thousand grain weight and grain number per cob appears to be higher to S fertilization than control group, with increased grain size under S-fertilization conditions. In addition to the effects on yields, sulfur application increased the grain protein and starch concentration more than without sulfur treatment, on the other hand 800 kg ha^{-1} S had negatively affected on the ash and oil concentration in grain in both sowing date. It was revealed that grain yield, cob length, thousand grain weight and grain number per cob, ash and oil content of seed consistently decreased with delaying sowing date. The findings suggested that the decrease of grain yield of corn plant with delaying sowing date may be overcome by yield increased with S application.

Key words: Corn, sulfur application, sowing date, grain quality.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Increasing the phosphorous fertilizer efficiency by organic matter in calcareous soils

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Abstract

Fenugreek (*Trigonella foenum-graecum* L.), belongs to subfamily *Papilionaceae* of the *Leguminous* family, is an erect annual herbaceous plant. Because of edible and medicinal values of its seeds, it has widely cultivated in Iraq for a long time. A major problem of Fenugreek planting, one of the major strategic crops, in Calcareous soils is the high pH and $CaCO_3$ levels which are predominantly responsible for the low bioavailability of the macro and micro elements. Higher pH condition leads to nutrient availability disorders in the soil either by loss or fixation. Use of compost in the semi-arid lands increase N, P, K and O.C. in the rhizosphere and improved the physical properties besides soil fertility. This study was conducted at two soils, Aridisols and Entisols, at Ninevah province in Northern Iraq, which varied in some physical and chemical characteristics. The experiments were applied in each soil during autumn season 2011 - 2012 to study the effect of four levels of organic matter (0, 2, 4 and 6 ton.ha^{-1}) and four levels of phosphor (0, 80, 160 and 240 kg.ha^{-1}) and their interaction on quantity, concentration and nutrients uptake of fenugreek plant. The results showed that the use of higher levels of organic matter and phosphor fertilizer and their interactions caused a significant effect on yield and increased the N, P and K nutrients content of the plant. Interaction effect of organic matter and phosphor fertilizer at higher concentrations were more significant than each factor alone. Organic matter treatment at a rate of (6 ton.ha-1) with (240 kg P ha-1) gave an increase in some of the characters in the both soils. Aridisols soil appeared a response for fertilizer of all levels studied compared with Entisols soil. The treatment combination of organic matter and phosphor fertilizer at the two locations affected significantly the plant content of elements and quantity by increasing the total yield and seed elemental contents in the two soils.

Key words: Fenugreek, fertilizer, Iraq, manure, nutrient uptake.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determine the effect of compost received in production of biogas and its impact on yield and quality of crop production

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Abstract

The shortage of electricity in Bulgaria requires demand for renewable energy sources. Interest in the production of biogas from organic waste has intensified in recent years. Anaerobic fermentation during biogas production is associated with obtaining of digestate (compost). Several studies have found that compost is rich in micro and macro nutrients and can be used as an organic reserve in agricultural practice. The aim of this study is to determine the effect of digestate on yield and quality of crop production at the ratio of raw materials in biogas installation - pig manure and markets waste 70:30. Indicator culture is the lettuce. The studies were carried out on two soil types. Different percentage of digestate was tested with untreated soils as controls.

Key words: Digestate, biogas, anaerobic fermentation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of different soil amendment on total phosphorus availability

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Abstract

Phosphorus (P), is a vital macro element for plant growth. Due to heavy addition of P fertilizer, amount of total P in soils increased while plant available P decreased year to year. In recent years, environmental pollution, especially phosphorus, which is an affiliate Phosphorus fertilizer use in limiting the reduction of eutrophication, is one of the main purposes. In this study, the effects of different soil amendment (cattle and chicken manure, sulfur) application on soil total P availability were investigated. The study was carried out under the greenhouse conditions as a pot experiment. Soil was collected from the 0-20 cm depth of İkizce series in Harran Plain soils at the Harran University research area in Eyyubiye Campus. Treatments were 0, 4 and 8 t/ha for chicken manure, 0, 20 and 40 t/ha for cattle manure and 0, 0.75 and 1.5 t ha^{-1} for Sulfur. Cattle and chicken manure applications increased available P in soil.

Key words: Total phosphorus, available phosphorus, soil amendment.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of biologic fertilizers on different forms of phosphorus and corn yield in Moghan region

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Abstract

Calcium and phosphorus in soils often complex formation occurs but rarely with iron and aluminum, Due to the high capacity of soils to fix phosphorus, its mobility in soil is very low in comparison with other elements. In calcareous soils major factor in decreasing phosphorus sorption capacity is phosphorus precipitation in form of calcium phosphate. Organic and biologic fertilizers increased uptake due to the increased solubility and decreased precipitation. The purpose of this study was to evaluate treatment 50 kg 3 kg acid humic (T_1), 5 kg acid humic (T_2), 50 kg superphosphate + 3 kg acid humic (T_3), 100 kg superphosphate + 3 kg acid humic (T_4), 50 kg superphosphate + 5 kg acid humic (T_5), 100 kg superphosphate + 5 kg acid humic (T_6), 1 kg pgr (T_7), 1 kg pgr+50 kg superphosphate (T_8), 1 kg pgr+100kg superphosphate (T_9). on the changes in the different forms of phosphorus, NaCl+NaOH-P, citrate bicarbonate (CB-P), citrate bicarbonate dithionate (CBD-P), and HCl (HCl–P), at planting, middle of the growing season and harvest time and also on corn yield with correlation coefficients in different soil with different forms of phosphorus. The results of this study showed that treatment (T5) have the highest yield and biological efficiency, with an average of 5077 and 10135 kg/h, respectively. The lowest grain yield and biological efficiency owned treatment (T1), with an average 3887 and 7429 kg/h, respectively. The difference between the two treatments is significant at the 1% level. Investigation various forms of phosphorus showed that the amount of phosphorus absorbed by carbonates and calcium in all treatments except treatments (T_7,T_8,T_9), in the middle of the corn growing season and harvest time with time was reduced and Significant differences were observed at the 5% level. While the uptake of phosphate by iron and aluminum and phosphorus levels did not differ much. Study of the correlation coefficient between soil properties and different forms of phosphorus showed a significant correlation at 5% level between the percentage of clay, lime, phosphorous with calcium phosphate and calcium carbonate were observed. While the correlation between other characteristics and different forms of phosphorus was non-significant. ph decreased, in fact, increased soil exchangeable phosphorus. Calcium tri-phosphate of sulfuric acid, phosphate, mono-calcium phosphate, which is converted to di-calcium phosphate and mono-calcium phosphate so more soluble and increased the absorption

Key words: Phosphorus fractions, superphosphate, biologic.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Ecological problems and nitrogen balance in vegetable crops growing

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Abstract

Nitrogen balance, based on long-term field experiments, is the main tool for optimisation of the fertiliser application under specific soil and environmental conditions. The purpose of this study is to focus on the nitrogen balance and some ecological problems in agricultural system. The impact of precipitation, irrigation water and fertilizer application on main soil characteristics, N-uptake by plant production and N-output by drainage water are estimated in this investigation. The study is carried out on Fluvisol (near Plovdiv) in Southern Bulgaria. Ecological assessment of nitrogen fertilizer application has been made of data from field experiments with different vegetable crops (eggplant, green beans and carrots) over the period 2009-2011. The experimental design includes control (N_0) and three treatments with nitrogen application –N_{80}, N_{160} and N_{240} on the background of $P_{80}K_{80}$ kg.ha^{-1}. The field plots are equipped with modification of Ebermayer type of lysimeters, which collect drainage water from 100 cm depth of soil profile. According the received data it was observed that compensation between the amounts of N input and output was achieved in two variants (N_{80}, N_{160}) for eggplant and carrots. The data showed that the including a green beans in this study is not suitable because it is difficult to control nitrogen balance in the plant-soil system. Reducing the nitrogen input to the amount applied by precipitation and irrigation water is the most ecological-friendly technological decision and very important factor for environment protection.

Key words: Agricultural system, fertilization, nitrogen balance, nitrogen leaching, vegetables, environment protection

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Establish changes in the system "Soil-Fertilizer-Plant" as a result of fertilization with sludge from wastewater treatment plant

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Abstract

Under intensive use of chemical fertilizer the balance of organic matter are disturbed and chemical and physical properties of soil are degraded. To maintain and improve soil fertility is necessary to import organic fertilizer periodically. Incorporation of organic material contributes to the increase of soil organic matter and preserves the quality and quantity of soil nitrogen. The lack of organic fertilizers requires seeking of alternative options. Such reserve is sludge obtained during biological wastewater treatment. Despite the existence of legislation on the use of sludge in agricultural practice, there is still mistrust among farmers for their use. The aim of the study is to establish the changes in system "soil-fertilizer-plant" as a result of fertilization with sludge. In 2006 and 2007 on selected arrays of cultivated soils of Sofia region was imported sludge from WWTP- Kubratovo as soil improver, accordance with the legislation. Crops are corn and sunflower. The rate of sludge was calculated on the basis of chemical analysis for nitrogen content, soil differences, requirements of crops, etc. In 2013 (after 5-6 years of cultivation) in the same arrays are taken average samples and analyzed for the same chemical properties. During the whole period in this area the chemical fertilizer are not imported. The results found that the use of sludge as a soil improver does not represent environmental risk and can be used in agricultural practice to maintain and improve soil fertility and crop yields, according to legal requirements.

Key words: Sludge from WWTP, the balance of organic matter, organic reserve.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of soil and foliar application of magnesium on yields and quality of *Vitis vinifera*, L. grapes

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Abstract

The three-year field trial with the vine variety Müller Thurgau was focused on the effect of various methods of application of magnesium fertilisers on yields and quality of grapes. In the past visual symptoms of Mg deficiency appeared repeatedly on leaves of vine (intercostal chlorosis) grown on light soil with a low supply of Mg in the experimental locality Žabčice (South Moravia, Czech Republic). The experiment consisted of five treatments: i) unfertilised control; ii) spring soil application of Kieserite - 20 kg Mg ha^{-1}; iii) spring soil application of Kieserite - 20 kg Mg ha^{-1} + 5 foliar applications of a 5% solution of Epso Combitop – Mg, S, Mn, Zn; iv) 5 foliar applications of a 5% solution of Epso Combitop – Mg, S, Mn, Zn; v) Five foliar applications of a 5% solution of Epso Top – Mg, S. No visual symptoms of magnesium deficiency appeared on the leaves after magnesium applications. The average three-year yield of grapes of the unfertilised control was 7.39 t ha^{-1}. In all the fertilised treatments (2-5) the yields increased significantly in contrast to the control, i.e. as follows: 8.37-8.96-8.31-8.24 t.ha^{-1}. The yields of treatment 3 were significantly higher (8.96 t.ha^{-1}) than of the other fertilised treatments. The average sugar content of grapes of the unfertilised control was 16.6 °NM. The sugar content of the fertilised treatments (2-5) increased significantly as follows: 17.6-18.4-17.4-18.3 °NM. No significant differences were seen in the contents of titratable acids (6.20-6.82-6.63-6.89-6.86 g l^{-1}) and pH of must (3.23-3.33-3.36-3.36-3.26) among the treatments. The results showed that the best yields and sugar content were achieved in treatments where soil and foliar applications were combined (Kieserite + Epso Combitop). For magnesium nutrition of vine crucial is the soil application of magnesium because tens of kg is required per 1 ha. Foliar application is a complementary method of fertilisation suitable particularly for nutrition with microelements (Zn, Mn).

Key words: Vine, magnesium, soil and foliar application, yields, sugar, acids, pH.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of green algae *Chlorella vulgaris* as microbial fertilizer

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Abstract

Green algae, *Chlorella vulgaris* stimulates plant growth by production of hormones, vitamines, improves soil structure, increases soil aeration, absorbs havy metals from soil. Microbial fertilizers with *Chlorella* sp. are used succesfully as monovalent inoculum and combined with rhizobacteria as mixed inocula. The aim of this research was to evaluate the effect of *Chlorella vulgaris* on the initial growth of wheat, maize, bean, onion and lettuce and microbiological activity of rhizospheric soil. The experiment was conducted in controlled conditions in three repetitions. The inocula was applied as foliar fertilizer by spraying. Plant material was taken 30 days after treatment which was followed by the measurment of plant growth parameters (stem length, stem fresh mass, root length and root fresh mass). Soil microbiological activity included the determination of total number of bacteria (TNB), number of actinomycetes (ACT), fungi (FNG), animoheterotrophs (AMH), azotobacter (AZB) and dehydrogenase activity (DHA). *Chlorella vulgaris* affected positively the length (28,5 % increase) and fresh mass (17,9 % increase) of maize root, stem length of wheat (24,2 % increase), stem mass of lettuce (56,34 % increase) and uniform increase of stem and root length of bean. *Chlorella vulgaris* increased the number of aminoheterotrophs in the maize rhizosphere while the number of other investigated groups of microorganisms did not change significantly.The influence of plant species was more significant. The activity of dehydrogenase enzyme was not affected by inoculation with green algae. *Chlorella vulgaris* produces biologically active substances, increases the level of photosynthesis. It is a source of macro and micronutrients, amino acids and hydrocarbons. The application of green algae is recommended for production of crops and vegetables on all soil types.

Key words: Green algae, stimulation of growth, foliar treatment.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of homogenous and localized supply of various N-forms on growth and mineral element composition of rape cultivars in a split-root system

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Abstract

In most agricultural soils of high fertility, nitrate is the predominant nitrogen (N) form in the soil solution and is, therefore, supposed to be the most important N source for plant uptake. On the other hand, plants usually perform best on mixtures of both N-forms compared to sole nitrate or ammonium. The aim of this study was to determine the effects of homogenous (HS) and localized (LS) supply of various N-forms on growth, morphology and mineral element composition of two oilseed rape cultivars. Two winter oilseed rape cultivars (Apex, Bristol) were grown in a double split-root vessel (2 x 5.5 L) filled continuously aerated nutrient solution. One from each cultivar, 2 plants were grown under 1000 µM N concentration with six different N form combinations [(AA ,NN, MM, NA, A0, N0); (A: ammonium, N: nitrate, M: ammoniumnitrate 0: no N)] and with four replications. As the N source, $Ca(NO_3)_2$, and $(NH_4)_2SO_4$ was used. The pH was maintained neutral by adding $CaCO_3$ and to hamper nitrification, a nitrification inhibitor was applied. HS supply of MM increased the shoot and root growth compared to HS supply of NN and LS supply of NA. Strong reduction in shoot and root dry weight occurred when ammonium was supplied as HS (AA) or LS (A0). Apex showed more, but Bristol less sensitivity to ammonium. No significant differences existed among two cultivars. Similar to shoot and root dry weight, total root length significantly decreased under HS supply of AA or LS supply of A0. In contrast to dry weight reduction, total root length was increased at LS supply of N0. HS supply of AA and LS supply of A0 increased considerably the shoot N concentration whereas strongly reduced Ca^{2+} and K^+ concentrations. In contrast to ammonium, the shoot Ca^{2+} and K^+ concentrations were increased at HS supply of MM, NN and LS supply of NA and N0. Experimental results showed that shoot and root growth were enhanced when ammonium and nitrate were homogenously supplied whereas a slight decline occurred due to LS supply of both N-forms. Therefore, for a better yield both N-forms should be evenly distributed in the soil or in other growth mediums. Under HS supply of AA the root growth was impeded and shoot N accumulation was increased while the uptake of Ca^{2+} and K^+ was decreased and may therefore plants showed severe ammonium toxicity. However, this problem could not be solved by supplying of ammonium only at one side of the compartment (A0).

Key words: Nitrogen, cultivar, N-form, split-root morphology

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of different organic and inorganic materials on growth of maize plant (*Zea mays L*) under greenhouse conditions

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Abstract

It is well known that the intensive use of chemicals in agricultural production systems causes important environmental problems in both soil quality and human health. Therefore, use of organic fertilizer is so popular and compared to chemical fertilizers for sustainable agriculture. The aim of this study was to investigate the effects of compost and different inorganic materials such as ground glauconite, pyrite, rock phosphate and their combinations on growth of maize plant under both mycorrhizal and nonmycorrhizal conditions. The treatments were control, compost, rock phosphate, glauconite, pyrite, compost+rock phosphate, compost+glauconite, compost+pyrite, compost+rock phosphate+glauconite, compost+rock phosphate+pyrite, compost+rock phosphate+ glauconite+pyrite. The experiment was carried out under greenhouse conditions at University of Çukurova, Faculty of Agriculture, Department of Soil Science and Plant Nutrition. The experiment was carried out in the low fertile and with high $CaCO_3$ content Karaburun soil series. In the experiment, shoot dry matter, plant diameter, plant length, root dry matter, root length and root infection was determined. The results shown that the application of compost+rock phosphate increased shoot dry matter, plant diameter and plant length compared to other treatments of maize plant under mycorrhizal conditions. In addition, root dry matter and root length was increased with application of compost+glauconite traetment under nonmycorrhizal conditions. These experiments also shown that in generally the mycorrhizal application made a difference between treatments.

Key words Organic and inorganic materials, mycorrhizae, maize.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fertility of irrigated dark chestnut soils in long-term application of mineral fertilizers in the South East of Kazakstan

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Abstract

One of the key factors in conservation of soil fertility and increase of crop productivity is rational and efficient use of fertilizers, taking into account the biological needs of the plants and availability of soil mineral elements. World experience of production and application of mineral fertilizers in different regions of the globe shows that fertilizer ensures the conservation of soil fertility, increase of crop productivity and harvesting of 50% additional yield. In this regard, relevant research area is the improvement of existing methods and techniques to increase soil fertility in cropping. Our soil observations were carried out on irrigated dark chestnut soils of the south-east of Kazakhstan, on which more than 60 years vegetable crops are grown in conditions of the intensive vegetable crop rotation. The purpose of research is scientific assurance of conservation and reproduction of soil fertility and development of methods of rational use of natural resources. The obtained results of conducted soil studies have shown that dark chestnut soils in southeast of Kazakhstan have undergone significant changes during the long period of use in irrigated land cultivation. Parameters of soil fertility (agrochemical, agro physical, biological properties) are largely determined by types of crop rotation and systems of fertilizer application. In general, the studies were conducted of the patterns of changes in soil nutrient status - intensive vegetable crop rotation in long-term use of fertilizers, income of mineral nutrients of crops in vegetable crop rotation and their removal depending on the duration of application of fertilizers on irrigated dark chestnut soils of the south- east of Kazakhstan.

Key words: Soil, soil fertility, mineral fertilizers, nutrient stocks, removal of nutrients.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence sodium humate on uptake of lead and cadmium by main crops in rice- alfalfa crop rotation

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Abstract

Currently environmental issues and search for methods of regulating flow of toxicants in the system soil-plant-human are on the first place. Therefore, the use of sodium humate as a detoxicant, which not only improves soil structure, increases the biological activity, but also is effectively used to reduce the mobility of Pb, Cd that is most relevant issue. Aim of this study is to determine the efficacy of different doses of sodium humate on the effect of Pb, Cd on main crops in the area (rice, wheat). Studies were conducted on Akdala irrigation area which are fundamentally different from periodically irrigated soils in specifics of soil processes occurring under conditions of constant flooding. The results of the study of different doses of sodium humate (5, 10, 15, 20 t/ha) as a detoxicant gave a more positive result on rice than on wheat. It was determined that the most effective dose of the detoxicant which allows to reduce the transition of metals from soil to rice, are different doses of 15 and 20 t /ha, which reduced accumulation of lead in reproductive organs to 100%. In wheat the use of smaller doses of sodium humate (2.5, 5, 7.5, 10 t/ha) did not provide the expected result. From all doses, a dose of 5 t /ha was effective in roots and straw, where content decreased to 50.8 and 31.0% , but in respect of grain it increased by 18.4%. In option with Cd only at a dose of 20 t/ha of sodium humate, the experiment shows the highest possible reduction of intake for rice organs: grain (-55.6 %) > straw (-47.4 %) > roots (-39.4 %). At maximum dose of the detoxicant 10 t / ha there is observed the significant decrease in intake of Cd by wheat organs: grain (-53.3 %) < straw (-57.1%) < roots (-75.5 %). Thus, it can be concluded that in regard of spring wheat the use of various doses of sodium humate as a detoxicant did not provide positive results. On rice the use of different doses of the detoxicant was effective, particularly in reproductive organs. Therefore, it is proposed to use sodium humate as a detoxicant in soils contaminated with lead and cadmium in rice growing.

Key words: Lead, sodium humate, rice, wheat, remediation.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study the effects of different levels of NPK fertilizers on control of Verticillium wilt and yield of potato

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Abstract

Verticillium wilt is one of potato diseases of in the Fars province. The farmers can reduce some of these damages by plant nutrition management. In order to determine effects of NPK fertilizers levels on Verticillium wilt and yield of potato, a field experiment was conducted at the Eqlid Agriculture Research Station in 2010-2011. The experiment was randomized complete block design with 13 treatments and 3 replications. The treatments were NPK fertilizers base of soil test and 20-40 % fewer and more of soil test. The symptoms of disease, yield, weight and number of tubers per plant were calculated. In the first year, the results indicated a significant difference (5 % level) in yield, height and symptoms between treatments. The highest yield (41000 kg/ha) was obtained by use of the potassium and phosphorous fertilizers base of soil test and nitrogen 40% more of soil test. Lowest symptoms showed using nitrogen and phosphorous base of the soil test and potassium 20 % more of the soil tests. In the second year, there were significant different (5 % level) in yield, height and symptoms between treatments. The highest yield (35600 kg/ha) and lowest symptoms were obtained using the K and P base of soil test and N 20 % more of soil test. The combined analysis of variance of two years results showed that the highest yield and lowest symptoms were obtained by use of the P and K fertilizers base of soil test and N fertilizer 40 % more of soil test.

Key words: Nutrient elements, potato, Verticillium wilt, yield.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Improvement of drought tolerance and grain yield in common bean by *Rhizobium* strains

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Abstract

Drought is an environmental component that affects crop yields worldwide. In nature, this stress is multifaceted problems that are usually associated with other adverse circumstances, which limit plant performance such as water shortage and nutrient deficits. Thus, improving stress tolerance and yield in crops are major goals for agriculture. Microorganisms could play an important role in adaptation strategies and increase of tolerance to abiotic stresses in agricultural plants. Here, we show that common bean plants inoculated with rhizobium strains are overexpressing stress tolerant, and that there is a substantial increase in grain yield. In order to study the effects of water stress and rhizobium strains on yield and drought tolerance in common bean, a field and greenhouse experiment was conducted at the Eqlid agriculture research station in Iran during 2011-2012 years. This study performed the base on randomized complete block design in split plot experiment with 12 treatments in 3 replications. The treatments were irrigation base of 30,60 and 80 % of available water (Aw) of soil in mean plots and 54, 58, 160 and 177 rhizobium strains seed inoculated in sub plots. Water irrigation content, water use efficiency, plant nitrogen, yield and yield components were determined. The results for 2 years showed that, the water stress and rhizobium strains have significant (at 5 %) effects on yield and yield components. In water stress condition, the resistance of bean plant will be increasing 20-40 % by rhizobium inoculated treatment. The 177 rhizobium strain and irrigation base of 60 % available water have most of irrigation water use efficiency.

Key words: Bean, rhizobia, water stress, yield.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Zinc and cadmium effects on growth and their contents in rice plant (*Oriza sativa* L.) Part 1: Vegetative growth

Ali Cherati Araei *

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Abstract

This research have been arranged to study of zinc and cadmium on the rates of their absorption by rice and on some growth characteristics of the plant (*Oriza sativa* L.) in vegetative growth. Twenty soil samples with the widest range of physicochemical properties, especially with respect to the levels of available zinc and cadmium, were selected out of some 40 surface soils (0-30 cm) collected in rice paddies of the east Mazandaran. A randomized complete block factorial experiment with three levels of zinc (0, 5 and 10 µg Zn/g soil as $ZnSO_4$, $7H_2O$), two levels of cadmium (0 and 3 µg Cd/g of soil as $CdSO_4$, $8H_2O$) and three replications was carried out on 20 soils in the green house using plastic containers. Results of this study showed that shoot dry matter production increased as a result of zinc treatments. The rates of increase of dry matter production in response to 5 and 10 µg Zn/g soil were 15 and 14 percent, respectively. Even though the concentration of zinc in rice shoots were not appreciably affected by zinc additions, but total absorption of this nutrient however, increased with increasing rates of its application. This apparent discrepancy can be explained in terms of increases in dry matter production in response to the increasing rates of zinc fertilizer (dillution effect phenomenon). The addition of 3 µg Cd/g of soil did not affect the rate of growth of rice plants. On the other hand, the total absorption and the tissue concentrations of cadmium did not exceed the ppb range despite the application of 3 µg Cd/g of soil. Effects of interaction between zinc and cadmium on the growth rate of rice plant (shoot dry matter production) and its zinc and cadmium contents were quite negligible and statistically insignificant. However, there seemed to be negative correlation between plant Zn and Cd concentrations.

Key words: Rice, zinc, cadmium, rice paddies, absorption.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Zinc and cadmium effects on growth and their contents in rice plant (*Oriza sativa* L.) Part 2: Reproductive growth

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Abstract

This research has been arranged to study zinc and cadmium on the rates of their absorption by rice and on some growth characteristics of the plant (*Oriza sativa* L.) in reproductive growth. Twenty soil samples with the widest range of physicochemical properties, especially with respect to the levels of available zinc and cadmium, were selected out of some 40 surface soils (0-30 cm) collected in rice paddies of the east Mazandaran. A randomized complete block factorial experiment with three levels of zinc (0, 5 and 10 µg Zn/g soil as $ZnSO_4$. $7H_2O$), two levels of cadmium (0 and 3 µg Cd/g of soil as $CdSO_4$, $8H_2O$) and three replications was carried out on 20 soils in the green house using plastic containers. Results of this study showed that application of zinc during rice plants seed formation stage had insignificant effect on the yield of rice grain and even decreased it to some extent. However, zinc application increased the concentrations of this nutrient in the grain. The average concentrations of zinc in the unhusked rice grain increased significantly. The total uptake of zinc by rice grain increased but not significantly different in statistical terms. The negligible increase in total zinc absorptions can be explained in terms of small decreases in the weight of rice grains. Cadmium application did not affect the yield of rice grains, and cadmium concentration appreciably. Effect of Zn-Cd interactions on the yield of rice grain, Zn and Cd concentrations was shown to be insignificant statistically, negligible and without any particular trend.

Key words: Rice, zinc, cadmium, rice paddies, absorption.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of split and foliar application of nitrogen on the yield of wheat

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Abstract

A field trial was carried out as a completely randomized block design in factorial with 3 replicates. Factors were as fallows; A) Split application of Nitrogen including N1{ basal (50%) + stem extension (50%)}, N2{ basal (25%) + stem extension (50%) + heading (25%)}, N3{ basal (25%) + tillering (25%) + stem extension (25%) + heading (25%)}, N4{ basal (20%) + tillering (20%) + stem extension (20%) + heading (20%)+ ripening (20%)} and B) Foliar application of N including F1{no foliar application}, F2{foliar application in pollination + heading} and F3{foliar application in pollination + heading + ripening}. Foliar application was done in 2.5 Kg of urea per 1000 liter of water. Results showed that main effects of nitrogen split application in N3 increased grain yield of wheat as much as 6141 Kg/ha in comparing to other nitrogen split application including N1, N2 and N4. The more split application of N, the more increasing of wheat grain yield but in N4 decreased grain yield of wheat equal to N1.This revealed that more N split application with a fixed amount of nitrogen did not complete nutrient acquisition of wheat crop in different growth stage especially in tillering and stem elongation. Foliar application of N increased grain yield of wheat in comparing to control, but statistically did not any difference between F3 and F2 treatments.

Key words: Wheat, nitrogen, split application, foliar application.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Relationship of soil cadmium content and wheat grain cadmium concentration in some wheat cultivated regions of Iran

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Abstract

Wheat as the main food source has a main role in producing the proteins, and calories of the city and village societies of Iran. Today, the specialists' interest is toward the production and supply of the healthy food. Therefore, the wheat production with the high nutrient values (full of proteins and micronutrients), should be considered which has no pollutants such as cadmium. In this study, meanwhile, investigating the soil cadmium content and its concentration in the wheat grains, the relation between the soil cadmium content and its adsorbed value by wheat crop was investigated in some of the wheat farms of Fars, Khorasan and Mazandaran provinces. Keeping in mind, with the wheat crop area information of the related farms of each of the above provinces, in some of the farms with different characteristics (especially the P, Zn, and EC values), the soil and wheat grains samples were taken. The cadmium concentration in the soil and the wheat grains were measured with the standard methods. Using the statistical analysis, the correlation between the some of the soil and plant parameters, including the cadmium concentration in the soil and the wheat grains were determined. The results obtained showed that, the mean soil cadmium concentration in the Fars, Khorasan and Mazandaran provinces were in the order of 320, 187, and 323 µg/kg (ppb), and the mean wheat grains concentration in the Fars, Khorasan and Mazandaran provinces were in the order of 303, 250, and 263 µg/kg (ppb). The correlation between the wheat grains cadmium with the cadmium and other characteristics of the soil including the amount of Cl, P, and EC values were not significant statistically. Overall, we conclude that the cadmium concentration in the soil and the wheat grains were not passed the normal pollution rates. Therefore, the adsorbed and stored values in the wheat grains were not of such importance, and meanwhile there is no hazard in using the wheat crop produced, and the possibility of cadmium existence in the food chain (animal-plant) were not followed.

Key words: Cd, wheat, soil, phosphorous, EC, Cl.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of the phosphopotassic fertilization on wheat culture irrigated with saline water

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Abstract

To improve the state and plant resistance to salinity which is our objective in this study, we worked on the fertilization in salted medium. The experiment comprises two doses of phosphorus P1, P2 and four doses of potassium K0, K1, K2, K3 while using two levels of water salinity S1 and S2. The experiment is carried out in pots of vegetation with a durum wheat culture. The experimental device applied is ¨split-plot comprising 16 treatments and 3 repetitions. Our results show that salinity has a significant effect on the reduction of growth and yield of plant; however the fertilizer has contributed to the improvement of the aptitudes of the plant in salted medium. The phosphoric fertilization played a very important role, the highest dose P2 gave the good results of growth, yield of grain, yield of straw and the weight of 1000 grains. However the potash contribution has a less clear effect, but it is noted that the weak and medium dose K1 and K2 are the best on some parameters under the conditions of our experiment. Concerning the content of the grains of phosphorus, we noticed that the highest contents are recorded in the most saline treatments. Besides the treatments having received the dose P2 present sodium contents of the grains weaker than those having received the dose P1 what shows the importance of phosphorus under these conditions. It seems that the fertilization in saline condition ensures a favorable nutritional medium against to the aggressiveness of salinity.

Key words: Salinity, phosphorus, potassium, wheat.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Studies of impacts of food waste compost and NPK fertilizer application on carrot and ryegrass yields and on soil chemical properties

Andrea Balla Kovacs *, Ida Kincses, Rita Kremper

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Abstract

In a two-year pot experiment the impact of food waste compost was investigated and was compared with mineral fertilizer. The compost effects were evaluated for two years on the available nitrogen, phosphorous and potassium in sandy soil and on the yield of carrot and ryegrass. A randomized complete block design were used with control, NPK mineral fertilizer and compost treatments (10t/ha, 20t/ha, 30tha, 50t/ha, 50%compost: 50% soil) Each treatment were set up with four replications. In the first experimental year compost, up to 30t/ha dose, linearly increased the yield of carrot. In this treatment (30t/ha) the carrot yield was as high as the value of the mineral fertilizer treatment. The highest compost doses, both 50t/ha and 50% compost already decreased the sizes and weights of carrot and caused branching. In the second year of the study increasing compost application enhanced the growth of ryegrass up to 50t/ha dose. In the 30t/ha and 50t/ha treatments the grass yield was much higher than the value of mineral fertilizer treatment. In the second year only the 50% compost treatment caused reduced grass yield. The available nitrogen, phosphorous and potassium of soil significantly increased with increasing compost doses in both experimental years. The increasing change of available nutrients also was traceable in the nutrient uptake of carrot and ryegrass. Results of our study proved that food waste compost provided nitrogen, phosphorus and potassium for crop grow in both experimental years, but the application of high doses must be avoided. The optimal dose may depend on the species of the plant and on the soil type as well. To determine the optimal dose and to avoid too high dose of food waste compost further studies are needed.

Key words: Food waste compost, carrot, ryegrass, sandy soil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Differences in nutrient status of highbush blueberry peat and mineral soils in Latvia, 2011-2013

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Abstract

Highbush blueberries (*Vaccinium corymbosum* L.) are relatively new fruit crop for Latvia (~ 200 ha) with high market demand, processing and export possibilities. At present, highbush blueberries in Latvia are cultivated on light acid mineral soils rich in organic matter as well as in extracted raised bogs on bare sphagnum peat. While blueberries require low pH and fertility level for proper growth and yield, the specific acid growth conditions can cause significant nutrient supply problems. Knowledge concerning the optimization of mineral nutrition of blueberry crop in Latvia especially in two widely different growing medium is still incomplete. The main aim of the research was to find out the nutrient status of blueberry crop cultivated on mineral and peat soils in Latvia to evaluate actual fertilization practices, revealed main differences and nutrient imbalances. Together 60 peat and soil samples from different blueberry producing sites were collected during 2011–2013 and analyzed on plant available nutrients (N, P, K, Ca, Mg, S, Fe, Mn, Zn, Cu, Mo, B), as well as soil pH and electrical conductivity (EC). In general, the agrochemical results of blueberry soils demonstrated high heterogeneity in nutrient concentrations for both substrata. The highest concentration range in mineral soils was found for S and Mn, the lowest for Zn and B. For the peat soils, the highest concentration variance was found for Cu and Mn, the lowest – for N, Mo and B. Statistically significant differences were found between mean nutrient concentrations in diverse blueberry growing medium. Significantly higher mean concentration of P, K, Fe, Zn, Mn and Mo was found in mineral soils. Although broad range of nutrient concentrations in soil and peat samples was found, the research revealed seriously decreased levels of N, S, Cu and B in the vast majority of samples. In addition, deficiency of Zn was found for mineral soils, but K and Mo for peat soils. Corresponding to low level of nutrients in the growing medium, about 70 % of soil and peat samples had suboptimal soil EC. Our results suggest that less than 50 % of nutrient indices were in optimal range for both mineral and peat soils. Whereas, the percentage of indices in deficient range was significantly higher for the blueberries in peat soils (45%) to compare with the mineral soils (35%). Therefore corrections of nutrient imbalances must be done to avoid reductions in growth and yield of blueberry plantings in Latvia.

Key words: *Vaccinium corymbosum* L., peat and mineral soils, mineral nutrition, soil testing.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Improving nutrient elements uptake in lettuce under Light Emitting Diode irradiation

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Abstract

The development of human population relies on vegetative parts of plant species for nutrition and other human activities. Light Emitting Diodes (LEDs) as high intensity sources of visible radiation could be used for growing selected horticultural and agronomic plants under controlled environments where plants take benefits from the LED lighting such as dwarfness and increased productivity and quality. The devices fabricated in this study were installed in four incubators each containing 100% red LEDs, 100% blue LEDs, 70% red-30% blue LEDs and 100% white LEDs. In each cabinet, 120 LEDs were set on a 24" × 24" sheet of aluminum platform and the solid-state design was affixed to a ceramic and steel support to facilitate efficient heat transfer to the mounting substrate. Lettuce plants (*Lactuca sativa* L. Cv. Grizzly) transplanted at four leaves stage in plastic pots (10×10 cm) containing cocopeat-soil (50:50) were randomly arranged in three replications in each cabinet. Greenhouse grown plants were also used for comparison. Pots were irrigated once per day with tap water. Application of blue LED light on lettuce plants for two months increased leaf water content and led to elevated concentrations of Mn, Zn, Fe, Ca and nitrogen compared to field conditions. However; the highest wet and dry weight of lettuce and Mg content was achieved in plants grown under red-blue (70% red-30% blue) LEDs. It seems that application of LED lamps on seedling plants could increase productivity and stimulate their uptake of nutrient elements. LED lighting may provide a novel tool for agricultural research and production due to its positive influence on plant morphology and composition for improving economic yield and nutrient quality of edible vegetables.

Key words: Lettuce, Light Emitting Diode, nutrient elements, growth chamber, greenhouse.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of selenium application on plant growth, quality and yield of lettuce (*Lactuca sativa L.*) and accumulation in plants

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Abstract

Selenium (Se) is an essential element for humans, animals and plants. Elevated doses Se can cause toxic effects. The major source of Se in most human diets is provided by plants. The goal of this study was to evaluate the impact of Se on plant growth, quality and yield of lettuce (*Lactuca sativa L.*). The experiment was carried out in the Department of Horticulture at Ataturk University field condition in Erzurum, Turkey. The three different doses of selenium and three different cultivar lettuce were used. The solutions were applied to plant root zone for three times during plant growth. Results showed that the effects of different doses application of Se were important on plant growth, quality and yield when comparing with control.

Key words: Lettuce, selenium, yield, plant growth, accumulation

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of zinc application on yield and zinc content of corn plant

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Abstract

Zinc (Zn) deficiency is commonly encountered in most of agricultural soils in Turkey and the world. Zinc is one of the most essential elements in human, plant and animal feeding. Zinc deficiency in several plants has been studied to remove with fertilization by lots of researchers. In this study, effects of zinc fertilization (0, 1, 2, 4 kg Zn da^{-1} as $ZnSO_4.7H_2O$) on yield components of corn (*Zea mays L.*) were investigated. Zinc application into soil increased the grain yield (7.09%), 1000 grains weight (7.11%), Zn contents in leaf (24.63%), straw (25.49%) and grain (22.13%) of corn according to the control significantly ($P<0,05$). As a conclusion, optimum Zn application dose to increase grain yield and Zn content of corn was found to be 2 kg Zn da^{-1} while it was 1 kg Zn da^{-1} for silage production.

Key words: Zinc, fertilization, corn, grain yield, Zn content.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of humic acid on yield under irrigation with saline water

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Abstract

In most irrigation situations, the primarily water quality concern is salinity levels, because salts can affect both the soil structure and crop yield. Good quality irrigation waters' scarcity leads using saline or the other type waters for agricultural irrigation. But there are some technical precautions to use these type waters. Recently, researchers try to use soil conditioner material. Some chemical and organic substances are used to improve the structure of the soil and increase its porosity. One of them is a humic acid production called "Base Actosol". Base Actosol contains 12% humic acid. Humic acids are active elements in organic soils and important for the conversion of fertilizer into available plant nutrients. It is said that humic acid prevents nutrition loss by making chelate and also pressured some undesirable ions effects. A factorial pot experiment was conducted in greenhouse as randomized plots. Our aim was to determine this material can or not inhibite ions impactions in saline waters and what is effect on plant growing degree under saline irrigation condition. And also we wanted to see that humic acid can provide or not to save fertilizer with N. We studied with two levels nitrogen fertilizer (optimum dose of N and 75% of N), five humic acid levels (0.0; 350; 700; 1050 and 1400ppm) and five different salinity levels of irrigation water (0,0; 0,75; 1.5; 2,25 and 3.0dS/m). Maize was grown (*Zea mays*) in pots along 50 days and we applied saline water 9 times. Finally, we measured soil salinity and the yield. Statistical datas showed us that interaction of humic acid and water salinity on plant dry yields were significant with level 99% probability. Also, we tried to find out interaction between some ions (Ca, Mg, Na, K etc.) contained by plant and humic acid.

Key words: Humic acid, base actosol, saline water, soil salinity, nitrogen fertilizer, yield.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of phosphorus and sulfur fertilizer applications on the growth and element uptake of wheat (*Triticum sativum)* grown in calcareous soil

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Abstract

In Central Anatolian soils, the uptake of phosphorus fertilizers by plants is particularly difficult because of high lime content. It is necessary to apply sulfurous fertilizers in calcareous soils in order to help plant phosphorus uptake and at the same time to prevent the sulfur deficiency of the plant. In this way, it will be possible to obtain both high quality products and high yield. It is reported that in plants sulfur is effective on product quality as the basic building block of amino acids like cysteine and methionine and also plays an important role in biological processes related to heavy metal toxicity and salinity tolerance. It is necessary to use the convenient form of sulfur fertilizer together with a convenient amount of phosphorus needed by the plant in order to obtain a good product quality and high yield. For this purpose, a greenhouse experiment was carried out with elemental sulfur (S) and phosphorus (P) fertilizer to determine nutrients uptake and growth of wheat plants grown in calcareous soil. Four levels of elemental sulfur (0, 10, 20, 30 and 40 mg kg^{-1}), three levels of P (0, 40 and 100 mg kg^{-1}) were tested at the Agricultural Faculty Experiment Greenhouse, Selcuk University -Konya. The soil used in the experiment was taken from a depth of 0-20 cm from Karapınar district of Konya province. The soil was slightly alkaline pH (7.82), contained a small amount of organic matter (1.89%), a high percentage of lime (56.47%) and loamy texture. The K, Mg, Mn and Fe contents of the soil were little, the P content of soil was medium and the Ca and Cu content of soil were sufficient. The plants were irrigated by using pure water after the planting process. The experiment was completed at the formation of grain. The effect of sulfur and phosphorus fertilizer applications were determined to wheat growth parameters (plant height, plant weight, number of spikes, number of grains per spike, grain weight). The phosphorus and sulfur elements of plants were analyzed. Weekly plant height values significantly changed with phosphorus applications ($P<0.01$), whereas sulfur applications did not cause a significant change in plant height. Plant shoot values also significantly increased with increased phosphorus and sulfur applications ($P<0.05$). Furthermore, significant differences were observed between P and S fertilizer application doses in terms of plant element content ($P<0.05$ and $P<0.01$).

Key words: Calcareous soil, wheat, elemental sulfur, phophorus, nutrients uptake.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of zinc fertilizer applications on yield of some registered chickpeas varieties

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Abstract

In this study, the effect of zinc fertilizer applications on different chickpea varieties and the most suitable zinc application dose were investigated under the field conditions in April-August of 2012. 10 types of chickpeas (*Cicer arietinum* cv. (Azkan, Yasa, Gokce, Argentina, Ilgaz, Inci, Israel-Ukrain, Israil-Rusya, Cagatay and Russia 5/7) were studied under irrigated conditions. Zinc was applied to the soil at four doses 0, 0.5, 1.0, 1.5 kg da^{-1} before sowing. Chickpea samples of each variety were harvested mainly taking into account maturation periods. Plant height, grain yield, thousand grain weight, grain zinc, nitrogen and phosphorus contents were determined in chickpea varieties. Grain yield were determined with respect to ripening state in harvested chickpea samples in the end of the vegetation period. According to the results of the statistical analysis, there was significant ($P>0.01$) differences between zinc application doses. There were significant important differences between plant height ($P<0.01$), but were not important difference thousand seed weight and seed yield. The increased yields in Zn applied plants was the result of increased number of pods per plant at Gokce type of chickpea. But the application of increasing zinc fertilizer doses were not positively effect on grain yield in other chickpea varieties.

Key words: *Cicer arietinum L.*, zinc, nitrogen, phosphorus.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of mineral fertilization on changes in the value of yield structure components of spring triticale

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Abstract

Mineral fertilization is one of the key factors of yield forming of cereals, which part in the development of crop grain yield amounts approximately 40-50 %. For example, share of other agronomic factors: tillage, crop rotation, variety, sowing, plant protection, harvest and storage, in yield forming of wheat constitutes 3-8 %, 10-12 %, 15-20 %, 10-15 %, 10-15 % and 12-15 %, respectively. The study was undertaken to determine the effect of mineral fertilization on the change in the value of yield structure components of spring triticale. One-factor field experiment was carried out in 2006-2009 at the Mountain Research Station in Czyrna (545 m), Beskid Niski, South Poland. The soil of the experimental field was formed from Carpathian flysch, belongs to V quality class and 12 oat-potato-mountain complex of agricultural suitability. Forecrop for triticale was potato fertilized with FYM and without (0 – control) or with mineral fertilization (70 kg N, 50 kg P, 70 kg K · ha^{-1}). Sum of rainfall during the growing seasons (IV-VIII) ranged from 292.6 to 530.2 mm, whereas multi-year mean amounts 470.8 mm. Mineral fertilization of spring triticale significantly increased grain yield, from 3.20 to 4.12 t · ha^{-1} (by 28.8 % an average). Its relatively low efficiency could result both from deficiency or excess of rainfall in individual years. Mineral fertilization caused an increase of ears number by 24.6 %, mass of a thousand grains by 13.1 % and number of grains per ears by 10.2 %. The share of yield structure elements in the change of triticale yield under the influence of fertilization resulted in 44.2 % of the greater density of ears, in 37.3 % of better grain filling, and only in 18.5 % of the more abundant grain in the ear. These results confirm an impact of the mineral fertilization on density of triticale blades and filling the grain. The smallest share of the grains number per ears could be due to delayed sowing date of spring triticale under experimental conditions, which fell on the second decade of April, which significant reduces the ear length and the floors number in the ear.

Key words: Spring triticale, yield, components of yield structure, mineral fertilization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation the effect of irrigation water salinity and Fusarium fungi on seven safflower cultivars

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Abstract

In order to study the effect of Salinity levels of Sodium chloride and Soil type on the characteristics of some grown seeds and the resistance rate of Fusarium fungi (quantitative length evaluation of necrotic part in plants gorget) in biotypes of safflowers, an experiment was factorially conducted by using two salinity levels of sodium chloride (20% and %50 salinitys, seven biotypes of acanaceous and non-acanaceous safflowers (Iraqi 222, IL111, K.H.64.68, and Varamin 295,Local Isfahan , Padideh and 340779), two types of soil (caly, sandy-clay), in a three times randomized complete block design. The variance analyzing results showed that between the levels of all factors, there was meaningful difference for 2 studied characteristics. According to the results obtained from the comparison of factors means, genotypes of Iraqi 222, K.H.64.68 and 340779 under the condition of 20% salinity and genotype of Iraqi 222 under the condition of 50% salinity contained the most numbers of grown seeds. On the other hand the most resistance rate against Fusarium mushrooms was related to genotype K.H.64.68 under the condition of clay soil and 20% salinity, genotype IL111 under the condition of clay soil and 50% salinity and local genotype of Isfahan under the condition of sandy-clay soil with 20% salinity, Based on the results obtained from the liner regression and simple correlation coefficient there was positive and meaningful correlation between two evaluated characteristics in the probability level of 1% and the relation between them was estimated as linear and positive one (y=0/545+0/234x), where X refers to the number of grown seeds and y refers to the resistance against Fusarium.

Key words: Fusarium fungi, Irrigation water salinity, safflower.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of planting date and density on calendula and peppermint herbs

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Abstract

A factorial experiment was conducted with a completely randomized design to evaluate the effects of planting date and density on calendula herbs and peppermint. It had 3 replicates and was done in Khosroshahr research farm, Tabriz in 2006. Under studied factors were: 3 planting dates (10 May, 25 May and 10 June) in 4 densities (25, 35, 45, 55) of the plant in square meters. The results of variance analysis showed that there was 1% probability significant difference between the effects of planting date and bush density on the leave number, bush height and the bush dry weight. But the mutual effect of the plant date in mentioned traits density was insignificant. Regarding the traits mean comparison, the total maximum dry weight was about the 55 bush density in mm. Also, the bush high density in mm causes the bush growth and its mass reduction. When there is the density grain, the flower number will increase due to bush grain in surface unit. Overall, we can conclude that 10 June planting and 45 bush density in mm is the most suitable items and results in favored production with high essence for these crops.

Key words: Essence, herbs, planting date, density.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The study of important agronomic traits by multivariate analysis in winter rapeseed cultivars

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Abstract

In order to group winter rapeseed cultivars according to evaluated traits, an experiment was conducted in the Research Greenhouse of Agriculture Faculty, University of Tabriz, Iran. The experiment was included 12 cultivars of winter rapeseed and 3 levels of water deficit stress. Gypsum blocks were used to monitor soil moisture. Water deficit stress was imposed from stem elongation to physiological maturity. According to the principal component analysis, five principal components were chosen with greater eigenvalue (more than 0.7) that were including 81.34% of the primeval variance of date. The first component that explained the 48.02% of primeval variations had the high eigenvalue for root volume. The second component could justify about 13/64% of initial variations and had positive association with leaf water potential and proline content and also had negative relationship with leaf stomatal conductivity. The third, fourth and fifth components expressed around 18.10, 4.83 and 4.68% of the initial variations sequencely. The third component had the high eigenvalue for plant dry weight. The fourth component put 1000-seed weight, seed yield, Silique per Plant and root dry weight against plant dry weight, chlorophyll fluorescence and leaf water potential. The fifth component had the high eigenvalue for root dry weight, root volume and 1000-seed weight.

Key words: Winter rapeseed, water deficit stress, principal component analysis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The use of exogenous proline as a potential practice for improving olive salt tolerance: Effects on salt exclusion mechanism and photosynthetic activity in young Chemlali olive

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Abstract

The ability of exogenous compatible solutes, such as proline, to counteract salt inhibitory effects was investigated in two - year - old olive trees (*Olea europaea* L. cv. Chemlali) subjected to different saline water irrigation levels supplied or not with exogenous proline. Leaf water relations (relative water content, water potential), photosynthetic activity, leaf chlorophyll content, and starch contents were measured in young and old leaves. Salt ions (Na^+, K^+, and Ca^{2+}), proline and soluble sugars contents were determined in leaf and root tissues. Supplementary proline significantly mitigated the adverse effects of salinity via the improvement of photosynthetic activity (Pn), relative water content, chlorophyll and carotenoid, and starch contents. Pn of young leaves in the presence of 25 mM proline was at 1.18 and 1.38 times higher than the values recorded under moderate (SS1) and high salinity (SS2) treatments, respectively. Further, the proline supply seems to have a more important relaxing effect on the photosynthetic chain in young than in old leaves of salt stressed olive plants. The differential pattern of proline content between young and old leaves suggests that there would be a difference between these tissues in distinguishing between the proline taken from the growing media and that produced as a result of salinity stress. Besides, the large reduction in Na^+ accumulation in leaves and roots in the presence of proline could be due to its interference in osmotic adjustment process and / or its dilution by proline supply. Moreover, the lower accumulation of Na^+ in proline - treated plants, compared to their corresponding salinity treatment, displayed the improved effect of proline on the ability of roots to exclude the salt ions from the xylem sap flowing to the shoot, and thus better growth rates.

Key words: *Olea europaea* L, salinity stress, proline supplement, photosynthetic activity, ions contents, salt exclusion.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Long term irrigation with saline water at different levels in olive orchards: Effects on nutritional traits of adult olive tree (*Olea europaea* L. cv Chemlali)

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Abstract

In arid region in Tunisia, the shortage of water resources of good quality, on one hand and the importance of olive cultivation under harsh environmental conditions, on the other hand, have lead to the urgent use of water resources of marginal quality such as saline ground water for olive plantations irrigation. Nevertheless, the use of such waters in irrigated lands should consider both the direct impact on crop performances and the indirect effects on chemical and physical properties of the soil. So, the aim of this study, in its second part, was to investigate the effects of saline water used for irrigation at different levels on some nutritional traits in leaves and fruits of adult olive tree (*Olea europaea* L. cv Chemlali) grown under natural environmental conditions in the south of Tunisia. The study was carried out in the experimental site of the Olive Tree Institute of Sfax, Tunisia. Three olive orchards (10 - year - old) were subjected over three successive years to the following treatments: T0, control field conducted under rainfed conditions; T1, drip irrigated at 50% of Potential Evapotranspiration (ETP, 600 mm water / year)) with saline ground water (ECe: 7.5 dS/m) and T2, drip irrigated at 100% ETP (1200 mm water / year) with saline ground water (ECe = 7.5 dS m^{-1}). Results obtained in this study showed that the lowest values of leaf N content were recorded during summer season in coincidence with pit hardening process. These values were of 1.3, 1.4 and 1.5 %, respectively for T0, T1 and T2 treatments. A significant increase was observed during autumn season (2.0, 2.6 and 2.8 % for the respective treatments). In fruits, a progressive increase in N content was observed under the different treatments. In November, it reached 1.7, 1.8 and 2.3%, respectively in T0, T1 and T2 treatments. However, those of P content, they were of 0.12, 0.14 and 0.15%, respectively. Foliar K content seems to be more sensible for irrigation water salinity levels. Indeed, the K levels were of 0.25, 0.28 and 0.32 % in T0, T1 and T2, respectively during September. In November, a significant increase was observed and the levels were of 0.68, 0.72 and 0.84% for the respective treatments. In fruits, K contents, at the harvest time, were of 0.66, 0.72 and 0.78% in T0, T1 and T2, respectively. In parallel, olive fruit weight was of 0.5, 0.58 and 0.72 g in September and increased to reach 1.13, 1.18 and 1.28 g at the harvest time, for the respective treatments. From these results, it seems that the saline water used for Chemlali olive irrigation did not seem to affect seriously the olive nutrition pattern.

Key words: Saline water, olive irrigation, nutritional status, fruit growth, arid region

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of phosphate solubilizing microbe on soil phosphate, growth, yield of maize and P fertilizer efficiency on Ultisol at field and green house experiment

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Abstract

Ultisol is soil that has the problem of soil acidity, low organic matter and low available macro nutrient, in particularly, low P availability. There is only a small part of phosphorus available for plant because most of the phosphate was still present in the soil fixed by soil colloids. Some soil microbes known as phosphate solubilizing microbes have capability to dissolve phosphate that transforms P fixed into the soluble P. The field and green house experiment conducted at Jatinangor, West Java Indonesia to determine the effect of PSM on phosphate solubility, growth and yield of maize and phosphorus fertilizer efficiency. Steril soil of Ultisols was used at green house experiment. Design experiment of Randomized Block Design (RBD) was used in field and green house experiment, consisted of two factors and three replications. Phosphate solubilizing microbe as the first factor consisted of four levels, i.ephosphate solubilizing bacteria (PSB), phosphate solubilizing fungi (PSF), mixture of PSB and PSF. While the second factor was P fertilizer consists of five levels (0%, 25%, 50%, 75% and 100% doses of recomendation). The results of the field experiment showed that application of phosphate solubilizing microbes significantly improve the yield of maize in Ultisol Jatinangor, but did not significantly affect soil P, available soil P, phosphatase and P uptake of plants. Application of a mixture of PSB and PSF has a better effect on soil available P and yield of maize. Phospate fertilizer dosing at a dose of 25 %, 50 %, 75 % and 100 % recommendations increased available soil P. Fertilizer of P could inhibit the activity of phosphatases. Phosphate fertilizer with dose 50 % recommendation gave better effect on soil P and yield of maize. Greenhouse experiment results showed that PSM inoculant did not significantly affect soil P, available P, phosphatase and P plant uptake, plant dry weight on Ultisol. Phosphate solubilizing fungi increased significantly activity of phosphatase, whereas inoculant mixture PSB and PSF gave a better effect on plant dry weight.

Key words: Fertilizer efficiency, maize, phosphate solubilizing microbe, soil phosphate, Ultisol.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Regulation of growth and some vital physiological processes in salt stressed maize (*Zea mays* L.) plants by exogenous application of plant growth compounds

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Abstract

The mechanism of growth amelioration in salt-stressed maize by exogenously applied nitric oxide (NO), diurea (DU) and thiamin (TA) was investigated. Maize seedlings were planted in pots containing soil subjected to 0 or 100 mM NaCl through irrigation water. Two levels of NO (3 or 6 ppm, DU (400 or 500 ppm) or TA (100-125 ppm) were sprayed to the leaves of maize seedlings 10 days after germination. Salinity stress caused considerable reduction in plant dry biomass, chlorophyll content and relative water content in the maize plants, but increased electrolyte leakage. Foliar applications of DU or TA were found to be more effective in checking salt-induced shoot growth inhibition. Salinity increased Na^+ contents but decreased those of K^+, Ca^{2+} and P in the leaves and roots of the maize plants. Foliar-applied DU or TA increased the contents of K^+, Ca^{2+} and P, but decreased that of Na^+ in salt stressed maize plants with respect to those of the salt-stressed plants not supplied with diurea or thiamin. The results of the present study indicate that foliar application of diurea and thiamin compounds alleviated the detrimental effects of salinity and increased resistance to salinity in the maize plants by improving plant growth.

Key words: Corn, salinity, nitric oxide, diurea

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of compost treatments on some nutrients element uptake by corn plant (Zea Mays L.)

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Abstract

In this study, effects of hazelnut husk compost and tea waste compost applications on nitrogen uptake by corn plant *(Zea mays L.)* in greenhouse conditions was investigated. Trial was established according to randomized parcels experimental design and as three corn variety (early, medium and late varieties), two organic materials, (hazelnut husk compost and tea waste compost) four different mixing ratio (0%, 2%, 4% and 8%, volumetrically) and a three replicates. Mixing compost into the soil improved root and shoot growth of corn plant and the content of N, P, K. Compost applications, shoot and root dry weight of plants was higher in early varieties (51.74 g, 7.88 g respectively); however, the content of N, P, K of plants increased in late variety. Tea waste compost and the dose of 8% were found to be the most effective medium and the dose on the content of root and leaf N, P and K. The compost and dose applications have affected nitrogen uptake, but varieties has not significant. Leaf N% content of plant changed depending on variety; and 8% dose of tea waste compost was more effective in early (1.27%) and late (1.25%) varieties. Root and leaf K, root P contents of the plant increased in late variety (134.80 mg kg^{-1}, 57.91 mg kg^{-1}, 36.91 mg kg^{-1}, respectively), tea waste compost and 8% dose conditions, but leaf P content of the plants growing early varieties (42.94 mg kg^{-1}) has been higher. Hazelnut husk compost, especially 4 % and 8 % doses are prominent on early varieties.

Key words: Compost, nitrogen, potassium, phosphorus, root and shoot weight.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects on some microelement contents and growth of rocket plant (*Eruca Sativa M.*) of growing media and salt applications

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Abstract

In this study, effects of different growing media and salt applications on microelement contents and growth of rocket plant *(Eruca Sativa M.)* in greenhouse conditions were investigated. Trial was established according to randomized parcels experimental design and as five media (torf (T), tea waste compost (TWC), hazelnut husk compost (HHC), natural hazelnut husk (NHH) and tea waste compost + hazelnut husk compost (TWC+HHC)), three salt treatments (control, NaCl and $CaCl_2$) and a three replicates. Physico-chemical and chemical analyses of the different media were made. Plant growth and macronutrient (N, P, K, Ca, Mg), micronutrient (Fe, Cu, Mn, Zn, B) contents of plants were determined. For rocket growth, salt applications have a negative impact, and the highest dry matter weight was obtained with the hazelnut husk compost and control (no salt). On the other hand, $CaCl_2$-treated media had the greatest content of macro and micronutrients of plants except for K, Na and B. Natural hazelnut husk media with $CaCl_2$ application was highest B, Mn and Zn contents of plants, the highest Mg content was obtained with TWC + HHC media.

Key words: Rocket, media, $CaCl_2$, NaCl, macro and micro nutrients.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of nitrogen fertilization on the size of herb yield of the two forms of peppermint and oil content and yield

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Abstract

Peppermint is an essential oil plant because of its content of menthol - the main component of the essential oil, and it is widely used in medicine, food, confectionery, perfume and cosmetics. The aim of the research was to evaluate the effect of nitrogen fertilization on yield of the herb and oil content in two forms of peppermint. Two-factor field experiment (split-plot) was conducted in the years 2006-2008 on a peppermint production plantation in Michałów village (Świętokrzyskie Voivodeship). The two forms of peppermint: *Menta piperita pallescens* (P) and *Menta piperita rubescens* (R) were the first research factor. The second research factor were the two levels of nitrogen fertilization: 1). first level (K) 100 kg·ha^{-1}N applied before the start of vegetation; 2). second level (N) 150 kg·ha^{-1} were applied in two stages: half before raising and half in shoot elongation phase. The research has determined the yield of herb (kg·10m^{-1}) and oil content (%%) in dry weight of herb (using Dering method) in the subsequent years (2006-2008), and swaths (2 yields in each vegetation season). The compared peppermint forms were not significantly different in the size of herb yield (R - 9,47, P - 9,92 kg·10 m^{-1}). However, the significant differences were found between the analyzed forms in 2006 and 2007 in the second swath. The higher yield has been obtained from the R (*rubescens*) herb form, compared with the P (*pallescens*) form, in both (R-5,52, P – 1,57 kg·10 m^{-1}) and in 2007 (R- 4,0, P – 1,99 kg·10 m$^{-1)}$. The interaction of the compared forms with the fertilization in 2007 has been also found significant. Of the two applied levels of nitrogen fertilization, the higher herb yields were obtained with the higher dose of N in the first swath in 2006 (14,7 kg·10 m^{-1}) compared to the control yield (11,06 kg·10 m^{-1}), and in 2007 in the second swath (N – 3,57, K– 2,41 kg·10 m^{-1}). The compared forms of peppermint did not differ significantly in the content of essential oil i.e. neither between the forms (R - 3,20, P - 3,17%), nor in the level of nitrogen fertilization. The ssignificant differences occurred between the years of conducting the experiments. The essential oil content in the raw material coming from vegetation season of 2008 was significantly lower (2.84%) compared with its content in 2006 (3.38%) and 2007 (3.34%). In addition, the highest content of essential oil was found in the herb harvested in first swath in 2006 at the control field (3.44%), and the lowest in the herb coming from second swath in 2007 (1.38%) also at the control fields. In the conducted 3-year-long research, there were no significant differences in the size of the yield of herb and also in the essential oil content or the compared forms of peppermint, or in the applicable levels of nitrogen fertilization. Oil content was significantly lower in the herb in 2008, compared with its content in the raw material coming from the years 2006 and 2007.

Key words: Peppermint, nitrogen fertilization, herb yield.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of phosphorus fertilizer on chestnut soil properties of Mongolia

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Abstract

Rapid growth in agricultural production over the last forty years has affected phosphorus balance, one of the most significant soil properties, and thus resulting in a serious phosphorus loss (50.7%) from the soil. Our objective was to evaluate the possibility of bringing this negative outcome back to normal by estimating the agronomic effectiveness of three P fertilizers: single superphosphate (SP), activated phosphorite (AP) and raw milled phosphorite (RMP), studied in a field experiment on wheat grown on chestnut soil, utilizing from the rock phosphate deposit in Northern Mongolia which is considered one of the greatest phosphorus-bearing deposit fields in the world. The mineral fertilizer for our comparison was single superphosphate. The soil samples were collected from the research field before planting and after harvesting at the depths of 0-20cm in the soil. An experimental treatment block design was selected using a simple sequential method with four replications. The five treatments that we applied on chestnut soil consisted of a control without P and $N_{60}K_{60}$ as a base and three sources with P: $N_{60}K_{60}$ SP_{60}, $N_{60}K_{60}AP_{60}$, $N_{60}K_{60}RMP_{60}$. Our result shows that the available phosphorus content of chestnut soil in the surface layer increases starting from May and decreases in August and September. Considering the average result from our five-year research study on using phosphorus fertilizer with NK base, the amount of available phosphorus in chestnut soil in comparison with the control treatment without fertilizer increased by 4.5mg/kg. The available phosphorus content at the depth of 0-20cm in the chestnut soil of the Northern Mongolia has increased by 6mg/kg under the influence of superphosphate, by 11-12mg/kg under the influence of activated phosphorite, and 3mg/kg in the raw milled phosphorite, however, the provision level of readily-available P increased only under the application of activated phosphorite fertilizer.Based on our research efficiency of various NK-based phosphorus fertilizers in the composition of mineral phosphate fraction and the available P content in chestnut soil, we discovered that activated phosphorite fertilizer is no less than single superphosphate fertilizer in terms of degree and quality.

Key words: Chestnut soil, phosphorus fertilizer, phosphorite, Mongolia.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of potassium chloride on some responses of annual shoots of *Citrus aurantium* seedling under low temperature stress

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Abstract

Citrus is one of the most important fruit plants of the tropical and subtropical areas and because of its sensitivity to low temperature stress, it generally suffers from damages of frost occurrence in northern Iran in some years. Potassium nitrate application can help the plant against cold stress. The purpose of this study was to investigate some physiological response of annual shoots of *Citrus aurantium* seedling under low temperature stress to KCl application. Accordingly, a pot experiment with four levels of KCl (0, 2.5, 5, 10 mM) was carried out in a completely randomized design with four replications under low temperature stress (-3°C). ANOVA results showed that the effect of KCl was significant on indices of electrolyte leakage, leaf damage percentage, leaf water content, chlorophyll a, total chlorophyll and carotenoids contents at ambient temperature of -3°C. But these treatments had no significant effect on indices of leaf water potential, water soaked percentage, leaf color, chlorophyll b and damage of shoots. Mean comparisons test indicated that application of 5 mM KCl - through reducing electrolyte leakage and leaf destruction percentage to the lowest amount along with keeping the highest leaf water, chlorophyll a and b and carotenoids contents - was effective on the stability of seedlings against the low temperature stress.

Key words: Citrus, potassium chloride, low temperature, electrolyte leakage, carotenoids.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of potassium nitrate effects on some responses of *Citrus aurantium* seedlings in sub-zero temperature

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Abstract

Subzero temperature is one of the most important plant abiotic stresses which reduces citrus yield in northern Iran. One of the strategies to enhance plant tolerance to the frost stress is potassium nutrition. Accordingly, the present pot experiment was conducted in a randomized complete design with four replications to evaluate the effect of KNO_3 application (0, 2.5. 5. 10 mM) on *Citrus aurantium* annual seedlings physiological responses under cold stress of -3°C. ANOVA results indicated that KNO_3 had a significant effect on the indices of electrolyte leakage, leaf color, leaf water, total chlorophyll and carotenoids contents, while other indices such as leaf water potential, water soaked percentage, chlorophyll a and b contents, percentage of leaf destruction and shoots damage were not statistically affected. Mean comparisons test showed that applying 2.5 mM KNO_3 - due to decreasing electrolyte leakage to less than 50% and keeping the highest leaf water and total chlorophyll contents - was effective on the tolerance of *Citrus* seedlings against cold stress of -3°C.

Key words: Citrus, Subzero temperature, potassium nitrate, water soaking, electrolyte leakage

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of the different levels of agricultural technology on ash and mineral content in grain of some varieties of spring barley

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Abstract

The aim of the study was to evaluate the impact of different levels of agricultural technology, including the level of N fertilization and plant protection products) on the ash content and minerals in grain of 8 varieties of spring barley: 2 varieties for brewing and 6 varieties intended for food or feed industry. Two-factor field experiment (split-plot) was conducted in 2010-2012 at the Institute of Cultivation and Production of Malopolska Plant Growing Company, Polanowice near Krakow. The first factor research consisted of 8 varieties of spring barley: 2 varieties for brewing (Blask, Stratus) and 6 varieties intended for food or feed industry (Atico, KWS Olof, Nagradowicki, Rubinek, Skarb, Suweren). The second factor was the two levels of agricultural technology: A1 (10/20/50 NPK kg.h^{-1}) and A2 (additional N fertilization in amount of 20 kg.h^{-1} and fungicides Amistar 250 EC+ Tilt Turbo used in the shooting phase doses 0.6 0.6 1 ha^{-1} in the earing phase, as well as growth regulator Cerone 280 SL at a dose of 0.75 1ha-1 applied in the late phase of shooting). Determination of ash content was performed by gravimetric method according to PN - ISO 2171.1994. Determination of Na, K, Ca, Mg, Fe, Zn, Mn was conducted by flame atomic absorption spectrometry (F-AAS), and Cu (PN-EN 14084:2004) by flameless atomic absorption spectrometry (ET-AAS) after microwave digestion in a microwave sample preparation system (MarsXpress). The average ash content was significantly differentiated by the year of cultivation, and was the highest in 2012. The highest ash content was characteristic for a brewing variety Stratus (2.55%). The average identified content of minerals, except iron, depended significantly on the variety, and with the exception of calcium and zinc also from the year of cultivation. The average content of most minerals (except for potassium, sodium, iron) was significantly depended on levels of agricultural technology.

Key words: Ash, minerals, spring barley, nitrogen fertilization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of Clinoptilolite on mineral substance of raisins in organic grape growing

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Abstract

Turkey is a major producer country of grapes growing in the World. Viticulture is one of the major branches of agriculture with respect to production area and its large share of income in Turkish national economy. Since 1985, Turkey producing and exporting organic raisins, is a world leader in the production of raisins. The research was established in 15 years old Sultana Çekirdeksiz vineyard under irrigable soil conditions in Alaşehir-Yeşilyurt Viticulture Research Station during organic production phase from 2006 to 2007. The objective of this study was to determine the influence of an applied clinoptilolite on mineral substance analyses of the raisins. It was carried out according to randomized block design trials with three replicates consisting of 12 vines per parcel. Mineral substance analyses of the raisins obtained from the applications were performed using the ICP-AES technique. It was found that there was an increase in average potassium (K), magnesium (Mg), zinc (Zn) calcium (Ca) and phosphorus (P) contents and a decrease in copper (Cu) contents application of clinoptilolite as compared to control and a difference of 5% was determined between applications.

Key words: Sultani Çekirdeksiz, clinoptilolite, mineral substance, organic raisins.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of nitrogen efficiency of sunflower (*Helianthus annuus L.*) cultivars

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Abstract

Nitrogen (N) is an essential element for plant growth and is the nutrient taken up in the largest amount by plants. Determination of N efficient genotypes that can yield well under low N conditions is considerable reducing the nitrogen load in the environment. An experiment under controlled conditions was carried out to determine of nitrogen efficiency (NE), physiological efficiency (PE), nitrogen uptake (NU), nitrogen content and mineral nutrient contents of seven sunflower (*Helianthus annuus L.*) cultivars (Sirena, Sonbro, Sanay, C-70165, Coban, Tr-3080, Rimisol) grown under N-insufficient and N-sufficient conditions. Nitrogen application significantly increased the N content and N uptake of sunflower cultivars tested. Sanay and Coban had significantly higher N content than the other cultivars. Nitrogen efficiency defined as dry matter production rate under N-insufficient and N-sufficient conditions and physiological efficiency defined as dry matter production per unit of N uptake were differed among cultivars. Sirena and C-70165 were being the most efficient cultivars. Nitrogen efficiency varied from 65.2 to 96.5 and physiological efficiency varied from 9.58 to 59.43.

Key words: Sunflower, nitrogen efficiency, nitrogen content, nitrogen uptake.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Micro nutrient status of broccoli and leek growing area in Torbalı, Izmir

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Abstract

This study was undertaken Torbalı district of Izmir, where intensive Broccoli and Leek farming takes place. For this aim soil and leaf samples were taken from 30 Broccoli and Leek representing this area. The soils were examined for their physical and chemical properties (pH, total soluble salt, $CaCO_3$, organic matter, texture, Fe, Zn, Cu, Mn) and leaves for their micro nutrients (Fe, Zn, Cu, Mn). Results were composed with that of the cited reference valves to find the suitability of soils for Broccoli and Leek and nutrient status of the crop. In addition, soil and plant relationships were investigated by statistical evaluations. According to the results obtained from this research for Broccoli, 56.6 % of plantations are insufficient in Zn, 3.3% in Mn, for Leek 43.3% of plantations are insufficient in 13.3% in Mn.

Key words: Broccoli, leek, soil characteristics, micro nutrition, soil and plant relationship.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Do Turkish soils need potassium fertilization for major crops?

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Abstract

The supplies of potassium to a plant during its critical stages of growth are the main factors that define growth and yield. Potassium has several effects on crop philological mechanisms. Plant species depended potassium for water uptake, color development and protein development. During 2012-2013 several field experiment were conducted at Cotton Research Institution, Nazili-Aydın Çukurova University, Adana and Giresun Hazelnut Research Station, Giresun. The objectives of this project were to evaluate the effect of two K fertilizer sources application on yield and production of maize, melon, cotton and hazelnut grown under field conditions. Also the objective of the work was to transfer the obtained knowledge and technology of fertilizer application to growers, fertilizer company dealers, and decision makers in Turkey. Field experiments were conducted with the effects of different rates of K application from two sources (KCl and K_2SO_4). Two K fertilizer sources were applied. Yield increases resulting from K application mostly appeared under conditions of low soil K level. Results from the maize experiment in Adana during 2013 indicated that the highest maize grain yield (12.8 t/ha) was obtained with the application of 60 kg K_2O/ha as KCl, while a similar application of K_2SO_4 produced maize grain yield of 11 t/ha. For year 2013 the results shown that the highest maize grain yield (14.5 t/ha) was obtained with the application of 60 kg K_2O/ha as KCl, while a similar application of K_2SO_4 produced maize grain yield of 12.0 t/ha. It seems that KCL fertilizer applied plot produce 13.6 % more yield. Results from the watermelon field experiment at the same site indicated that the highest watermelon fruit yield of 55 t/ha was obtained with the application of 120 kg K_2O/ha as KCl, while a similar application of K_2SO_4 produced 41.6 t/ha of watermelon fruit. Results from the cotton experiment at Cotton Research Station, indicated no significant differences among all treatments including the control on any of the cotton yield. Hazelnut plant given high response to K fertilizer sources. K fertilizer increased hazelnut yield with increasing K fertilizer. With control fertilizer 2275 kg/ha hazelnut was produced however with 480 kg/ha fertilizer application 3566 kg/ha hazelnut was produced. Overall results showed that for crops yield and quality K fertilizer is needed. It seems that there is need to do more research on K fertilizer application.

Key words: Potassium fertilization, potassium uptake, maize, watermelon, cotton, hazelnut.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Changes in soil nutrient supplying capacity in case of organic and NPK fertilized onion cultivations

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Abstract

In our comparative greenhouse experiment we examined the effect of EM- 1 microbial yield enhancing vaccine, an organic cow manure and an NPK fertilizer on the nutrient supplying capacity of the soil. The test plant was onion (Allium cepa L.) and the applied soil was humic sandy soil. 15 pots got (NPK) fertilizer application, another 15 pots treated with organic cow manure (Bio.1.), and again 15 pots with wheat straw and yield enhancing vaccine (EM- 1) (Bio.2.), 15 pots got no treatment (control). The dry matter production and the element content of plant samples were also determined, from which the element uptake was calculated. We also determined the amount of readily available nutrients in the soils of several treatments. The 0.01M $CaCl_2$ soluble K, NO_3^--N, NH_4^+-N, PO_4^{3-}-P contents, pH of soil, and the AL-P_2O_5, AL-K_2O of soil also were determined. The increasing effect of NPK fertilizer on the yield was greater than that of organic manure and EM-1 + straw. In the growing season the soil pH reduced as an effect of NPK fertilizers, which can cause problems in further cultivations The other two treatments (Bio.1 and Bio. 2.) did not change or slightly increased the soil pH. The 0.01 M $CaCl_2$ soluble K content of soil in control significantly decreased by the end of the growing season, while significant differencies in K contents of the treated soils were not observed. The amount of 0.01 M $CaCl_2$ soluble NO_3^- -N, NH_4^+-N, PO_4^{3-}-P content of soil proved the fact that in case of organic treatments (Bio.1., Bio.2.) the mineralization of soil organic matter becomes faster due to the intensified soil microbial life. The AL-K_2O content showed similar results proportionately as the 0.01 M $CaCl_2$-soluble potassium content. The AL-P_2O_5 content of Bio1 soil was greater in its tendency than that of Bio.2. and NPK treatments. The AL-P_2O_5 content of the control soil significantly reduced compared with the soils of organic and fertilizer treatments. Organic fertilization had a positive effect on the mineralization of nutrients in the soil.

Key words: Onion, fertilization, mineralization.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of vermicompost and chicken manure on yield and quality of summer squash (*Cucurbita pepo* L.cv. Sakız) and soil physical and chemical properties

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Abstract

In this study, potential utilization of vermicompost and chicken manure in summer squash growing (*Cucurbita pepo* L.cv. Sakiz) and their effect on soil physical and chemical properties were investigated. The study was conducted in open field conditions with randomized block design with four replicates. Treatments included control (C); vermicompost VC_{100}= 100 kg da^{-1}, VC_{200}= 200 kg da^{-1}, and VC_{400}= 400 kg da^{-1}; chicken manure CM_{300}= 300 kg da^{-1}, and CM_{600}= 600 kg da^{-1}. At the end of the experiment, pH values were found to be lower in soils treated with vermicompost and chicken manure compared to the control. On the other hand, EC and organic matter contents of soils amended with organic fertilizers were significantly higher than those of the control soil. The increase in EC values did not occur in a level to cause any salinity problem. Total N, available P, DTPA-extractable Fe, Mn and Zn concentrations in soils increased with application of vermicompost and chicken manure compared to the control. Exchangeable K, Ca, Mg, and DTPA-extractable Cu contents, however, did not show any significant change. The vermicompost treatment VC_{400} and chicken manure treatments CM_{300} and CM_{600} showed significant positive effects on yield (total yield, early yield, number of plant and fruit, average fruit weight) and quality (1^{st}, 2^{nd}, and 3^{rd} grade), and soil physical and chemical properties. When the chicken manure treatments were compared to each other, there was no significant difference detected between CM_{300} and CM_{600}. Therefore, chicken manure application in the rate of 300 kg da^{-1} may be economically more feasible for farmers. When the vermicompost treatments were compared to each other, VC_{400} resulted in more significant positive effects than VC_{200}, which is the commercially recommended dose, suggesting that vermicompost application in the rate of 400 kg da^{-1} may be recommended to farmers in summer squash growing in order to obtain high yield and quality. The organic fertilizers investigated in this study are important in terms of organic and sustainable agricultural production. Further studies are needed, especially, toward utilization of vermicompost in Turkish agricultural sector as an alternative material to improve soil organic matter content, yield and quality.

Key words: Vermicompost, chicken manure, summer squash, yield, soil organic matter.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The management of quality and safety of chemical fertilizers in Turkey

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Abstract

This article is focused on the defining of the system established in 2004 in the context of management of quality and safety of chemical fertilisers used for farming. The implementation of this system is based on two essential regulations which are "Chemical fertiliser regulation" and "Chemical fertiliser inspection regulation". These two regulations have been also issued in line with the Regulation (EC) No 2003/2003 of the European Union dated 13 October 2003 relating to fertilisers in the context of alignment with EC acquis. The "Chemical fertiliser regulation" apply to inorganic primary nutrient fertilisers, solid or fluid, straight or compound, including those containing secondary nutrients and/or micro-nutrients, with the minimum nutrient content established in Annexes of the Regulation. Moreover, where the micro-nutrients are the normal ingredients of the raw materials intended to supply primary (N, P, K) and secondary (Ca, Mg, Na, S) nutrients, they should be declared, provided that these micro-nutrients are present at least in the minimum quantities specified in the Annex. A fertiliser belonging to a type of fertilisers listed in Annex and complying with the conditions laid down in the Regulation, is designated as 'EC fertiliser'. The requirements for minimum context of the fertilisers specified in Annexes of the regulation are controlled and the designation of "EC Fertiliser" is performed by the Ministry of Food Agriculture and Livestock (MoFAL) which is the Competent Authority. The audits for EC Fertilizers which are in the markets are carried out by the provincial directorates of MoFAL in line with the "Chemical fertiliser inspection regulation". This regulation is also based on the Law No 4703 which regulates the quality of products in the market, suitability analysis and auditing of the markets. In the framework of the "Chemical fertiliser inspection regulation", the chemical fertiliser companies has been licensed in three ways; "Producer", "Contracted Producer" and "Importing Company". There are 1536 companies which have been holding the Chemical Fertiliser License. On the other each product has been certified in line with the "Chemical fertiliser regulation" and "Chemical fertiliser inspection regulation". There are 19 636 certified chemical fertiliser in Turkey.

Key words: EC Fertiliser, inspection of fertilisers, Law No 4703.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Plant growth and potassium supply dynamics on a chernozem soil of a long-term fertilization and irrigation experiment with maize monoculture in Hungary

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Abstract

For the plant production used soil's nutrient supplying ability ideally should correspond to the needs of the plants. The aim of our experiment work is to study as precisely as possible, how the dynamics of growth and nutrient uptake of the maize plant develop during the vegetation period. For their determination the basis of our research work was a long-term fertilization and irrigation monoculture maize field experiment that has been set up in 1984 near to Debrecen, Hungary. The soil of this experiment is a medium-heavy, loam texture calcareous chernozem type based on loess. The humus soil layer is about 70-90 cm. Its upper layer has become leached due to the intensive production in the past decades, so it doesn't content any significant lime-amount. Therefore, the soil pH is slightly acidic in the production layer, which is favorable for nutrient-mobilization and -uptake. This field represents the production circumstances of the chernozem soils of Hungary with excellent productivity. Effects of three factors were studied: genotypes of maize (3), irrigation levels (2) and fertilizer dosages (6). The total number of investigated treatments (plots) was 36. Plant samples were collected 7 or 6 times during the vegetation period, and the above-ground dry matter and the nutrient uptake of plants were determined. For characterizing and describing of the plant growth and nutrient uptake dynamics was used the so-called "S-type" (acceleration – saturation) equation as follows: $y=A/(1+\exp(-k*(x-x0)))*(1-b*x)$, where "y" is the actual value of the measured (dependent) factor on the day "x" after plant shooting, "A" is the maximum value of "y", "x0" is the day of maximum growth rate of "y" (point of inflexion) and "b" is the rate of decreasing of dependent value for one unit. According to our results and calculations it can be concluded, that beside the previously used soil and plant nutrient-content the consideration and calculation of the plant-extracted nutrient-amount – depending on the applied hybrid and other agrotechnological measurements – is suggested in order to characterize precisely the nutrient-supply of maize. This parameter informs us not only about the available nutrient-amount at the sampling time, but about the supply level of the plants until the sampling time as well. We suggest for sampling times the intensive vegetative growth period, the switch between the vegetative and generative growth phases (silking), just as the grain-filling phase.

Key words: Chernozem, maize, biomass and nutrient uptake dynamics.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of spraying nutrient solution "BASAK" and Salicylic acid in some vegetative growth and flowering parameters of Stock plant *Mathiola incana* L.

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Abstract

An experiment was conducted at the nursery of Agricultural Faculty, Kufa University during growing season 2012 – 2013 to study the effect of spraying nutrient solution "BASAK" and Salicylic acid on some vegetative and flowering parameters of Stock plant. Experiment was adopted in Randomized Complete Block Design (RCBD) with three replicates in two factors first three concentration of nutrient solution "BASAK" (0, 2 and 4 ml L^{-1}). Second three concentration of Salicylic acid (0, 50 and 100 mg L^{-1}) and their interaction, using Least Significant Difference (LSD) test to compare the means. Results showed that spraying nutrient solution at concentration 4 ml L^{-1} or Salicylic acid at concentration 50 mg L^{-1} increased significantly growth parameters (plant height, number of leaves, shoot dry weight, total content of chlorophyll and soluble carbohydrates, number of main roots, root dry weight, number of inflorescence and floret, diameter of floret and inflorescence dry weight, compared with control treatment which gave the least vales. Resulted showed that spraying nutrient solution at concentration 4 ml L^{-1} and Salicylic acid at concentration 50 mg L^{-1} increased significantly vegetative and rooting growth parameters (plant height, number of leaves, shoot dry weight, total content of chlorophyll and soluble carbohydrates, number of main roots, root dry weight) and flowering parameters (number of inflorescence per plant and floret per inflorescence to 7.67 and 47.00, diameter of floret to 4.17 cm and inflorescence dry weight to 2.27 g), compared with control treatment.

Key words: Nutrient solution, Salicylic acid, stock plant, *Mathiola incana* L.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of fermented liquid organic fertilizer and potassium for nutrient uptake and yield of rice at tropical upland

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Abstract

Experiment entitled "The effect of fermented liquid organic fertilizer and potassium for nutrient uptake and yield of rice at tropical upland " has been conducted in screen house at Padang, West Sumatera from Juni to November 2013. The goal of research was to get the right formula of natural fermented organic fertilizer in various compositions to substitute the use of potassium fertilizer at tropical upland rice. Experiments conducted in factorials the form of treatment with 2 factors, at first factor consisted of 5 types of organic fertilizer compositions, namely; P1. (20% C.odorata + 70% coconut fiber + 10% activators), P2 (40% C.odorata + 50% coconut fiber + 10% activators) ; P3. (60% C.odorata + 30% coconut fiber + 10 % activators); P4. (80% C.odorata + 10% coconut fiber + 10% activators), P5. (activators), and second factor consists of three levels, namely K2O ; K0 . 0 kg ha^{-1} ; K1 . 25 kg ha^{-1} K2. 50 kg ha^{-1} at a dose of liquid organic fertilizer given 1 : 5 (liquid organic fertilizer + water), given every 2 weeks, which begins at planting. Replication of treatments was performed 3 times, so it found as many as 5 x 3 x 3 = 45 pot experiment. The data were analyzed using analysis of variance (F test) and could be continued by HSD test at 5% significance level. Parameters were observed during the treatment, among others; Analysis of nutrient content and composition of the liquid organic fertilizer includes macro nutrients (N, P, K, C-organic, pH) and micro (Fe, Mn, Zn, Cu, B and Co). Analysis of plant cover; nutrient uptake, N, P and potassium, weight of dry milled grain. The results showed that administration of P2 without applying the potassium fertilizer application improved nutrient uptake of N, P and potassium and grain yield up to 29% at tropical upland.

Key words: Chromolaena odorata, fermented liquid organic fertilizer, tropical upland rice, potassium.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Nitrogen optimization for blueberry cultivation

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Abstract

Highbush blueberries (*Vaccinium Corymbosum* L.) are becoming more and more popular in Latvia and area of commercial plantations is increasing annually accounting 220 hectares in 2012. One of the points of interest is balanced fertilization to match the crops' need for development of good stand, as well as to secure the high yield potential with relevant quality characteristics and storage properties. Similar to other horticultural crops, nitrogen management is quite complicated due to it mobility, transformations, effect on plant winter resistance, vegetative growth, berry storage properties, taste etc. As blueberries prefer the acid growth medium, some differences might be relevant for choise of nitrogen form – ammonium or nitrate. The nitrogen management for blueberries was chosen as a main topic for experiment set up in Varmiera district in 2012 where plantation was established 4 years ago. Experimental plots with blueberry cultivar 'Chippewa' were arranged on gently slope. Original topsoil's reaction was pH KCl – 6.11, organic matter content 30 g kg^{-1}. Five experimental plots each of them consisting from 8 bushes was set up. Soil reaction was determined potentiometrically, organic matter in mineral soil according to the Tyurin's method, in organic materials – by dry combustion, total nitrogen using Kjeldahl method, but mineral nitrogen ($N–NO_3$ and $N–NH_4$) – spectrophotometrically. Samples of leaves from each experimental plot were taken during the vegetation for NPK nutrition diagnosis. Research showed that nitrogen fertilizer applications significantly affected ammonium and nitrate ion concentration in soil (0 – 60 cm). Sphagnum peat (pH KCl 3.0) as a soil modifier allowed efficiently reduce the soil reaction at the root zone and provided an optimal environment for blueberries as well as increased organic matter content in the soil. Interactions of nitrogen applications and peat mineralization also was studied as well as nitrogen immobilization in the root zone.

Key words: Fertilization, nitrogen forms, blueberry cultivation, soil properties.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of ground magnesium limestone, basalt and organic fertilizer application on the growth of rice planted on acid sulfate soils in Malaysia

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Abstract

Rice growing on acid sulfate soils suffers from Al^{3+}, Fe^{2+} or H^{+} stress. A study was conducted to determine the effects of ground magnesium limestone (GML), basalt and organic fertilizer application on the growth of rice planted on the soils. Result showed that pyrite (FeS_2) was sporadically distributed in the coastal plains of the Malay Peninsula, occurring up to 10 km from the present coastline. When these areas were drained, the pyrite was oxidized, releasing acidity, Al and Fe. The root cells of rice grown on the soils were severely damaged by the Al and/or Fe, reflected by the negative correlation between root length and Al or Fe concentration. Applying GML or basalt at 4 t ha^{-1} increased water pH but it was still below 5, implying that Al still remained a threat to rice plant. Al^{3+} was attracted to the negatively-charged cell walls of the roots. These roots released organic acids which, in turn, chelated the Al^{3+}, rendering it inactive. When the soils were submerged under water, Fe^{3+} was reduced to Fe^{2+}. The latter would be taken up by rice plants via their roots. Due to treatment, water pH was above 3. Therefore, the reaction of Fe hydrolysis was in the reverse order, resulting in the precipitation of $Fe(OH)_3$, appearing as brown crust on the rice roots which prevented further uptake of Fe^{2+}. The color of the rice roots was reddish, indicative of the presence of $Fe(OH)_3$ on them. The critical pH and Al concentration were about 6 and 30 µM, respectively. The pH and Al concentration of untreated paddy field were above the critical level. To overcome these problems, GML or basalt can be applied at appropriate rates. The best way is to apply basalt in combination with organic fertilizer a few months before the growing season. The dissolution of basalt had released SiO_4^{4-}, which hydrolyzed to release OH^- and H_4SiO_4. Si can be taken up by rice plant, preventing the incident of rice blast.

Key words: Acid sulfate soil, aluminum toxicity, iron toxicity, pyrite, rice

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fertilization systems impact on crop rotation productivity and heavy metals content in shallow sod-podzolic loamy soil

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Abstract

Field study of organic, mineral and complex fertilization systems was fulfilled on experimental plots of the Perm Agricultural Scientific Research Institute in 1993-2010 years. Average yields in fifth rotation varied from 2831 to 3859 FU ha^{-1} as influenced by fertilization systems. Provided yields compared with control treatment (no fertilizers). Essential advantage of complex fertilization systems guaranteed humus, mobile phosphorus and potassium content raise was determined. The maximum yields (3859 FU), but minimum crop returns were obtained from combination of manure annual providing 20 t/ha and equivalent mineral fertilizers application. The highest net returns were gained after mineral fertilizers application and complex system with manure annual providing 5 t/ha and equivalent mineral fertilizers doses. Mineral fertilizers and FYM may be the sources of heavy metals soil contamination. Essential production and soil pollution by heavy metals in given studies was not noted after long-term (about forty years) manure and mineral fertilization. All studied fertilization systems caused some raising of soil content, Cu and Cd decreasing and did not influenced Pb concentration. Cu content in winter rye grain increased, Zn content – reduced. The excess of MPC was not observed. Field tests were conducted to evaluate effect of regular sewage sludge use on heavy metal content in sod-podzolic soil. Periodical application of sewage sludge 40 t/ha^{-1} for five rotation cycle (1976-2007) increased heavy metals general content (Hg, Cd, Pb, Zn, Cu) in the plowing horizon of sod-podzolic soil in 1.1-2.7 times, acid-soluble and mobile forms (Cd, Pb, Zn, Cu) and in 2.1-4.4 1.8-6.0 times, respectively, but the excess of MPC and APC was not observed. In the soil, where sewage sludge was applied over 20 years ago, the excess of Cd MPC was noted. Long-term field experiment with sewage sludge application proved its efficiency as manure, advanced the humus content, available phosphorus, exchange potassium, soil celluloselytic activity increasing and, as a result - yields of crop cultures: clover and barley. Soil density decreasing and the accumulation of heavy metals in plants were also noticed. However, their content did not exceed permissible levels.

Key words: Fertilization system, FYM, crop rotation productivity, heavy metals content.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of humic liquid fertilizer on six genotype of bread wheat in the end of drought conditions

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Abstract

Wheat is one of the most valuable plants on the earth which occupies near one-eighth of the overall surface and also it is clearly important as human nutrition, source of animal feed and forage. In Iran, bread wheat is one of the most important crops and drought stress in many areas at different growth stages has sharp reduction effect on wheat grain yield. In order to investigate the effect of humic liquid fertilizer (potassium humat) on quantitative and qualitative traits of six genotypes of bread wheat (Gaskozhen, Sabalan, 4057, Roozi -84, Quboostan and Saratoosskaya-29) an experiment in terminal drought condition by factorial split plot method has been done based on randomized complete block design in three replications in the research station of Ardabil Islamic Azad University, Iran. Results showed the number of grains per spike, grain weight per spike, grain yield and protein content was meaningful for each variety. Genotype 4057 with 2.98 tons per hectare had the highest grain yield. The most grain protein with an average 14.80 belonged to Saratoosskaya-29 variety and grain yield was increased about 31.36 percentage. So humic liquid fertilizer (Potassium humat) as miraculous natural substance can be used for increasing the quantity and quality of organic bread wheat cultivation.

Key words: Bread wheat, terminal drought, potassium humat.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Estimation effect of selenium depending on the level of mineral nutrition for barley

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Abstract

One of the essential trace element for humans and animals is selenium (in an amount of 40-200 mg day^{-1}). Deficiency of this element in the soil affects its content in plants and products. Studies on selenium enrichment plant foods are relevant now. However, when we use selenium via leaves, we must take into account environmental factors and, in particular, the deficiency in the soil of major nutrients (NPK). The aim of our research is to study the effect of selenium on the barley plant (*Hordeum vulgare* L) on soils with different levels of mineral nutrition. Investigations were carried out in green pot experiments (2011 and 2012 year). For these experiments we use soddy-podzolic soil with different humus content: 2.3% (less fertile - 2011yr) and 3.4% (more fertile – 2012 year). Different levels of NPK were presented: control, NPK 0.1 g kg^{-1} and NPK 0.2 g kg^{-1}. Sodium selenite was used via leaves at the tillering stage of plants in the concentration of 0.05%. In 2012, options were the same, but the concentrations of sodium selenite were as follows: 0.05 and 0.01%. Selenium was determined by fluorometric analysis. In the first experiment (2011year) selenite treatment was accompanied by a decrease in biomass straw and barley grain (15-20%), regardless of the application of fertilizers ($N_{100}P_{100}K_{100}$ and $N_{200}P_{200}K_{200}$) in soil. Selenium concentration in straw and grain significantly increased, that leads to increased removal of the element 20 times ($N_{100}P_{100}K_{100}$) and 30 times ($N_{200}P_{200}K_{200}$). However, it should be noted that plants use the nitrogen more efficiently on levels with using selenium with adding of complex mineral fertilizers ($N_{200}P_{200}K_{200}$): the ratio of protein to non-protein nitrogen was increased. In the second year of studies (2012) application of mineral fertilizers on more fertile soil increased the proportion of unproductive biomass. Biomass straw after treatment with selenium (0.05% Se) was significantly reduced (26%), and grain weight - increased (39%). Selenium content and removal of this element by grain during selenite treatment increased proportionally the using concentrations, which was accompanied by an increase in nitrogen content at the level of mineral nutrition $N_{200}P_{200}K_{200}$: at 1.47% (0.01% Se) and 1.57% (0.05% Se). Thus, the results are evidence on the relationship of selenium with nitrogen metabolism in plants.

Key words: Selenium, deficiency of selenium, barley, soil nutrients, yields, structure of the crop.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Responsiveness cultivars of potato on mineral nutrition

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Abstract

The potato is important in the agriculture because not only the great food value of the crop, but also forage and technical. In this regard, the role of research becomes relevant into the development of more efficient technologies for growing cultures, allowing to increase the productivity of the potato fields. The purpose of research - to identify the most effective method of doses calculation of nutrients at potato cultivation. Studies conducted in the Perm region in 2012 in the experimental field of the Perm State Agricultural Academy. For cultivation were used 3 cultivars of potatoes - Fresco, Nevsky, Lugovskoi. In the experiment were studied 4 methods for calculating doses of nutrients: the recommended doses of nutrients, taking into account the soil fertility (for early ripening variety Fresco - $N_{50}P_{50}K_{110}$, medium early variety Nevsky - $N_{100}P_{100}K_{110}$, middle - Lugovskoi - $N_{150}P_{150}K_{165}$); for additional yield increase tubers ($N_{108}P_{54}K_{36}$, $N_{135}P_{90}K_{54}$, $N_{135}P_{90}K_{54}$); to compensation for takeout nutrients with the planned harvest ($N_{75}P_{30}K_{120}$, $N_{100}P_{40}K_{160}$, $N_{125}P_{50}K_{200}$); to compensation for takeout the planned harvest, taking into account the soil fertility ($N_{67.5}P_{18}K_{36}$, $N_{90}P_{24}K_{48}$, $N_{112.5}P_{30}K_{60}$). The soddy shallow clay loam podzolic soil is characterized by agrochemical properties: humus – 2,3%, pH_{KCl} – 5,5, H and Sum were at 3.3 and 18.8 $mmol_{(+)}$/100 g soil, respectively, exchangeable P_2O_5 - 94 mg/kg and K_2O - 131 mg/kg. According to results of the experiment, there was a significant increase in the productivity of potato in the varietal sequence: early ripening < medium early < middle. Tuber yield was increased when for calculating doses nutrients used method for additional increase tuber yield (25,6; 34,2; 48,5 tonnes/ha, respectively) and for compensation for takeout nutrients (21,3; 32,0; 51,5 tonnes/ha respectively). Data on weight fraction of dry matter and of starch in the tuber were ranged from 18.3% to 26.4% and from 14.6% to 18.2%, respectively. The highest dry matter content in the tubers has accumulated the Lugovskoi, smallest – the Nevsky. Introducing mineral fertilizers decreased the solids content in the composition of tubers. The maximum values the indicator for each cultivar was obtained on variants without mineral fertilizer. Most recoupment of 1 kg fertilizer application is marked on early ripening cultivar and was 253,5 kg. Least responsive turned the middle (from 3,8 to 98,7 kg). Maximum return nutrients were obtained by introducing doses calculated by taking into account the compensation removal of soil fertility, the yield ranged from 45,6 to 51,5 tonnes/ha.

Key words: Cultivation of potatoes, a group of precocity, methods for calculating doses of elements of potato nutrition, plant productivity.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Levels of Trichothecenes A and B in cereals determined by two-dimensional gas chromatography

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Abstract

Mycotoxins are defined as secondary metabolites produced by fungi e.g. *Fusarium, Aspergillus, Penicillium*, etc. as a result of primary infection or during improper storage of food products. Mycotoxins may cause diarrhea, vomiting, reduced feed intake, weight loss, tissue necrosis, hemorrhage throughout the digestive tract, cancer, changes in reproductive organs, abortion and death. Among mycotoxins, trichothecenes, fumonisins, moniliformina, zearalenone are frequently found in cereals, especially in and wheat, barley, rye, oats and corn. The content of fungi metabolites in the final product is influenced mainly by the raw material processing of during post-harvest (transport, storage, cleanliness). The purpose of this work was to evaluate the influence of storage conditions on trichothecenes A and B levels in cereals and cereal products. Examined cereals (oats and wheat) were provided from different Polish regions, and wheat bran and oat were purchased in retail outlets. Cereal samples were stored under different conditions, including various temperatures and periods of time. Two-dimensional gas chromatography coupled with mass spectrometer GCxGC-TOF/MS Pegasus 4D was used for mycotoxin content determination. In the investigated samples a high levels of HT-2 toxin were observed. A storage in the incubator during first period of experiment resulted in an increase of the toxin content in oats and wheat. The levels have not changed after the second period of storage. In case of HT-2 toxin, a significant increase in samples of wheat bran and oat after the first storage period was noticed. After the second period of storage the levels were increased. After storage under refrigerated conditions during the first period of storage the HT-2 toxin level raised in wheat samples and remained stable after the second period of storage. For oat and bran samples any impact of storage period on toxins levels were not observed.

Key words: Mycotoxins, trichothecenes, cereals, storage, GCxGC-TOF/MS

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Suitability of olive mill waste (OMW) as fertilizer to protect the environment

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Abstract

In Algeria especially in Kabylie, the olive oil production generates a large amount of wet pomace and vegetable water. Pressing olives also poses serious environmental damage. Indeed, thousands of cubic meters of this biomass is dumped into the environment especially water system, thus constituting a real threat to the flora, fauna and groundwater. The by-products of olive can be used to improve agricultural production while protecting the environment. Valuing margines for sustainable olive friendly environment. Thus, the environmental problems of its by-products remains intact in our country. It was therefore necessary to find how to value these byproducts in other sectors, particularly agriculture. The objective is to study the impact of the contribution of different doses of vegetable on the physical, chemical and biological soil properties in an olive grove in the region of Sidi Aich northern Algeria. The studied soil is a Calcosol textured silty clay and sand. Slightly alkaline to moderately alkaline pH, low electrical conductivity, the total rate of limestone and high active calcium, a deficiency of carbon, total nitrogen and phosphorus. Given the results of this study, the contribution of the dose of vegetable 100 m^3/ha is best suited for improving phosphate and chemical properties of soils. In addition, the abundance of some important soil macro-invertebrates such as annelids and gastropods, considered bioindicators tells us about the effect of enriching the food potential of these soils.

Key words: Olive mill waste (OMW), fertilization, bioindicators, soil, *Oleaeuropaea* L.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of different levels of municipal solid waste compost and sewage sludge on yield and concentration of some heavy metals in green pepper plant (*Capsicum annuum Var robustin)*

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Abstract

To study the effect of applying different amounts of municipal solid waste compost (MSWC) and sewage sludge (SS) on yield and concentration of some heavy metals including nickel (Ni), chromium (Cr), cadmium (Cd) and lead (Pb) in organs of green pepper plant, a pot experiment was conducted in completely randomized design with four replications in 2012. Treatments were included control, % 5 MSWC, %10 MSWC, %5 SS, %10 SS, 5% MSWC and SS and %10 MSWC and SS. Results showed that addition of MSWC and SS increased the yield of pepper (wet and dry weight) and the most amount of that was in %10 MSWC and SS treatment so that it showed an increase of about % 349 in wet weight and about %283 in dry weight as compared to the control. The yield of shoots had significant increase in dry weight too but no significant effect was observed in wet weight of the shoots. Application of these fertilizers increased plant height as compared to control which the most of that was increased about %28 in %5 SS as compared to control. Also, adding MSWC and SS caused significant increase on concentration of heavy metals in fruits, leaves, shoots and roots of pepper plant and with increasing the level of fertilizers, the amount of concentration of heavy metals in plant were increased. Concentration of Ni in fruits exceeded the critical level for humans in all of treatments except in control and %5MSWC and the concentration of Cd exceeded the critical level for human in all of treatments except %10 MSWC and %5 SS too. Transfer index showed that, accumulation of heavy metals in pepper plant were more in roots than shoots and Cd with 0.52 had more mobility in plant as compare to Pb (0.44) and Ni (0.14).

Key words: Municipal solid waste compost, sewage sludge, lead, nickel, cadmium, chromium, green pepper

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of liquid organic fertilizer on plant growth, quality and yield of pepper (*Capsicum annum* L.)

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Abstract

Various fertilizers are used for in order to increase product yield and quality in the cultivation vegetables. Therefore, the products obtained from different sources can be used as fertilizer. The fertilizers of sourced organic is one of them which started to be used frequently in recent years. For this reason, this study was conducted to determine the effects of liquid organic fertilizer on plant growth, quality and yield of pepper (*Capsicum annum* L.). The experiment was carried out in the Department of Horticulture at Ataturk University under unheated greenhouse condition in Erzurum, Turkey. The four different doses of liquid organic fertilizer and two different cultivar peppers were used. The solutions were applied to plant root zone for three times during plant growth. Results showed that the effects of liquid organic fertilizer treatments significantly affected on the plant growth, quality and yield when comparing with control.

Key words: Pepper, fertilizer, organic, yield, plant growth.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Poultry feather wastes recycling possibility as soil nutrient

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Abstract

Poultry feathers are produced in large amounts as a waste in poultry slaughterhouses. Only 60-70% of the poultry slaughterhouse products are edible for human being. This means more million tons annually worldwide (Papadopoulus et al., 1986; Williams et al., 1991; Hegedűs et al., 1998). The keratin-content of feather can be difficulty digested, so physical, chemical and/or biological pre-treatment are needed in practice, which have to be set according to the utilization method. Feather was enzymatic degraded, and then fermented in separated bioreactors. The anaerobic bioreactor system (4 digesters with 6 litre volume) was controlled by ACE SCADA software running on Linux platforms. Pot scale seed germination tests were established to suggest the quantity of digested slurry to be utilized. The chosen test plants were lettuce *(Lactuca sativa)* and maize *(Zea mays L.)*. In case of reproduction test Student's t-test was applied to examine significant differences between the root lengths of the control and the treated plant species. In case of pot seed germination variance analysis with Tukey's test was applied to examine significant differences between the root lengths of plants, grown on different treatments. The effect of treatments on germination ability of the plant species was expressed in the percentage of the controls. According to Student's t-test significant difference was found between root lengths of different treatments. Based on variance analysis with Tukey's tests could be detected a significant difference between the treatments. Utilization of the fermented material reduces the use of fertilizers and because of its large moisture content it reduces the watering costs. Recycle of the slaughterhouse feather and different agricultural wastes and by-products can solve three main problems: disposal of harmful materials, producing of renewable energy and soil nutrient.

Key words: Poultry feather, recycle, seed germination, root length.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of water deficit on grain yield and Fe, Zn, Mn and Cu uptake of wheat cultivars

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Abstract

Water deficit is an environmental factor that may influence grain yield and nutrient uptake of wheat (*Triticum aestivum* L.). The objective of this study was to evaluate the effects of water deficit on grain yield micronutrient uptake of bread wheat cultivars. Two field experiments were conducted at the Agriculture Research Station of Saatlo in West Azerbaijan during 2010-11 and 2011-12 to examine the effects of water supply (normal irrigation and post anthesis drought stress condition) on micronutrients uptakes and grain yield in five winter wheat cultivars (Zarrin, Peshgam, Orum, Zareh and Mihan). Irrigation and cultivars showed significant differences in grain yield, and micronutrients uptakes. Grain yield and grain micronutrients uptakes (Fe, Zn, Mn and Cu) in all cultivars decreased with decreasing water availability. These results suggest that wheat cultivars respond differentially to water deficit and macronutrients. The highest grain yield per unit area under well-irrigation and water deficit was obtained for Zareh and Mihan cultivars, respectively. The highest grain Zn uptake under well-irrigation was observed. Peshgam cultivar and Zareh cultivar has the most Fe, Mn and Cu uptake under well-irrigation. However, under water deficit condition Mihan has the highest grain Fe, Zn, Mn and Cu uptake.

Key words: Grain yield, micronutrient, water deficit, wheat cultivars.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Agronomic benefits and environmental risks of applying nitrogenous fertilizers to sandy soils cultivated with watercress

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Abstract

Glasshouse vegetable trial was conducted for two seasons using watercress as a common salad leafy vegetable, with the aim of evaluating the agronomic benefits and environmental risks of applying different combinations of organic and inorganic N fertilizers to a sandy soil. The results showed that, all fertilizer application rates had the capacity to stimulate vigorous growth, nutritional status of watercress plants, and to increase N recovery and concentration by watercress plants compared to control. Over both seasons of this study, all these improvements in growth quality parameters of watercress plants were in most cases not significantly different at the higher fertilizer application rates of 280 and 420 kg ha^{-1}. This finding indicates that the plant response due to the increasing of fertilizer application rate is subject to diminishing returns. Where the diminished yield per unit of fertilizer N addition was clearly seen, beyond which further additions will not improve the yield. Results of this work showed that, major considerations in applying of inorganic N fertilizers alone on sandy soils cultivated with leafy vegetables are the increase in residual nitrate in soils, the increase in groundwater contamination potentials by nitrate, and the threat of nitrates build-up in plant tissues. Under conditions of this study, high application rates of inorganic nitrogen fertilizer (420 kg ha^{-1}) caused high levels of nitrate accumulation in watercress plants, and on being consumed by living beings, pose serious health hazards. In general at the rate of 280 kg ha^{-1} equal combined organic and inorganic fertilizers, no health problems could be foreseen to humans or animals from food chain movement of nitrates. Under the conditions of this study, incorporation of combined organic and inorganic fertilizers into sandy soil cultivated with leafy vegetables at the rate of 280 kg ha^{-1} nitrogen using drip irrigation system was the best management strategy practice to reach optimum agronomic benefits while minimizing environmental impacts.

Key words: Health hazards, leafy vegetables, nitrate pollution.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determination of municipal solid waste compost and nitrogen on nutrients elements and heavy metals concentration in spinach and soil

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Abstract

Municipal solid waste compost (MSWC) is a valuable organic carbon source which recently has been under attention in all parts of the word. In some cases, MSWC offers some heavy metals such as lead, Cadmium, Nickle and Chromium to soil that could be uptake by plant root system which these elements could harm human health seriously . Soil have important role in burial of municipal soil waste compost (MSWC) and MSWC have special role in physiochemical properties of soil. This research was conducted to survey the effects of MSWC on some of soil parameters and Spinach yield and uptake of micro and macro nutrients and heavy metals. By these objectives, an experiment was conducted to determine the effects of municipal solid waste compost (MSWC) and Nitrogen on fresh yield, nutrients elements concentration and heavy metals concentration in spinach and soil in filed of Agricultural Research Center of Tehran that is located at 35 km south west of Tehran at 51.39 E longitudes and 25.19 N altitudes with 1050 m above sea level with loam soil texture. Experiment was conducted with split plot design in form of randomized complete block (RCBD), with three replications and 9 treatments. Nitrogen factor included of 3 nitrogen fertilizer levels 0, 100 and 200 kg N ha^{-1} and MSWC included of 3 levels 0, 10 and 20 ton ha^{-1}. The results showed that MSWC positively increased some soil chemical parameters such as electrical conductivity, organic carbon, soil nitrate, phosphorous, potassium, and available trace elements significantly. Data also indicated that soil concentration of heavy metals such as Pb,Cd,Ni and Cr were affected by application of MSWC and the increased was significant .Data also demonstrated that use of MSWC increased macronutrients and micronutrients concentration in Spinach leaves significantly. On the other hand, heavy metal concentration, were increased by using of MSWC. Application of MSWC and nitrogen showed a positive significant effects on yield (P>0.1).With respect to maximum permitted level of heavy metals in soil and crop, use of 10 ton MSWC.ha^{-1} and 100 kg N.ha^{-1} nitrogen was recommended.

Key words: Municipal solid waste compost, spinach yield, heavy metal, Pb, Cd, Ni.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Investigation of nitrogen and boron effects on cotton properties in Iran

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Abstract

Iran, soils suffer from lack of organic matter, so main portion of Iranian soils shows nitrogen deficiency, for this fact, Nitrogen is the most important elements for crop production in Iran and agriculture production are highly depend on this elements. Boron is an essential element that cotton needs during all stages of growth and fruiting stage. Researches indicated that Boron has been universally recognized as the most important micronutrient for cotton production. Cotton (*Gossypium hirsutum* L.) is very sensitive to Boron deficiency .This study carried out to determine the effect of application rates of N in soil and foliar application of Boron on quantitative and qualitative parameters of Varamin variety of cotton (*Gossypium hirsutum L.*).Cotton was grown on a clay loam soil having an average of 0.4 mg kg^{-1} B concentration. Nitrogen was applied to the soil at rates of 0, 100, 200 and 300 kg ha^{-1}, and B was applied as foliage in three rates 0, 1 or 2 times for totals of 0, 500 and 1000 gr $B.ha^{-1}$. Data showed that nitrogen application increased boll number, boll weight, seed cotton and lint yield.Leaf blade N concentration was affected by nitrogen application and increased significantly. Data also showed that the highest seed cotton yield was obtained by 200 $kg.ha^{-1}$ N application and resulted in 19.6% increased crop yield compare to control. Data indicated that foliar application of Boron significantly increased boll number, boll weight, seed cotton and lint yield. Foliar applied B significantly increased leaf blade B concentration. Data also demonstrated that the highest seed cotton yield was obtained by application of 1000 $gr.ha^{-1}$ foliar B and resulted in 25% increased crop yield over the control. On the whole, application of 1000 gr ha-1 B as foliar and 200 kg ha^{-1} N resulted in the highest number of bolls, boll weight, seed cotton and fiber. The interaction effects for Nitrogen and boron were not significant for any parameters.

Key words: Cotton, nitrogen, boron, seed cotton.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of foliar spraying with macro elements on qualitative characteristics of saffron stigma

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Abstract

The effect of foliar sprying with macro elements on qualitative characteristics of saffron stigma were studied in a field experiment using a complete randomized block design with three replications. Fertilizers applied were N, P, K, NP, NK, PK, NPK and bulk. The treatments after dissolution in concentration of 5 mg per liter were sprayed at February and March months. After separation stigma of the saffron flower, qualitative characteristics on saffron stigma were measured according to the standard methods of food quality. The rasults showed that there were significant differences between foliar sprying with macro nutrients and qualitative characteristics of saffron stigma. The highest safranal, crocin and picro crocin were observed in k treatments, the lowest safranal and picro crocin in p treatment and the lowest crocin were absorved in NP, N and P treatments.

Key words: Saffron, foliar spraying, macro elements, qualitative characteristics.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of arsenic and nitrogen application on grain yield and some physiological parameters of safflower (*Carthamus tinctorius* L.)

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Abstract

To study the effects of arsenic and nitrogen supply on some agronomy and physiological parametres in safflower, a plot experiment was conducted in a greenhouse at university of Zabol, Iran. The experiment was laid out in a completely randomized factorial design with three replicates. The rate of nitrogen treatment (Urea source) was N_1=75, N_2=150 and N_3=225 kg N ha^{-1}. Safflower was subjected to different arsenic levels A_1=0, A_2=30, A_3=60 and A_4=90 mg/kg soil. Results showed that grain yield of safflower was significantly influenced by the interaction between nitrogen×arsenic. Grain yield until N_2 treatment had positive response to arsenic concentration and the highest grain yield was obtained at the N_2A_3 treatment. Data analysis indicated that application of nitrogen and arsenic had significantly effects on yield components (biological yield and number of seed per plant). However, by increasing arsenic concentration from A_1 to A_4, yield components decreased but application of nitrogen especially until N_2 level, caused increase of these yield components. In this study arsenic and nitrogen significantly affected - carbohydrate content and increased it. Chlorophyll content only was affected by arsenic treatment, and nitrogen had no significantly effect on that. Under arsenic treatment, chlorophyll content in leaf increased.

Key words: Arsenic, nitrogen, agronomy traits, safflower.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Application of Diagnosis and Recommendation Integrated System (DRIS) on growth and yield of lentil by using biochemical fertilizers

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Abstract

Field experiment was conducted at College of Agriculture and Forestry to study the application of bio-chemical fertilizers on growth and yield of lentil using Diagnosis and Recommendation Integrated System (DRIS) regime. The experiment involved three levels of nitrogen fertilizer (0, 40, and 80 kg N/H) added as urea, and five levels of phosphorus [(0, 40, and 80 kg P/H) as super phosphate beside two levels of rock phosphate (40 and 80 kg P/H)]. K was added to all treatments at a rate of 10 kg K/H. A factorial experiment within split plot design was used. All the combinations of fertilizers above was splitted into inoculated by a mixture of the three rhizobial strains *R.leguminosarum* (Le_{719}, Le_{726}, and Le_{735}), and not inoculated. Samples of soils and plants were taken at three interval times (75,105, 137 days) after palnting. The results of this study can be summarized as follows: 1- Successful and activity of using DRIS regime in determining the diagnosis deficiencies and was noticed sharply. The results also showed that nitrogen was the most limited factor. Morever, there were no differences in diagnosis and recommendations at all stages of growth of lentil which give us an indication that DRIS regime has the superiority and elasticity in finding the diagnosis and this may give the farmer enough time a head to eliminate the deficiency of the limited factor that affecting the yield. 2- By application of DIRS regime, it was found that the best treatment was the (inoculated with rhizobia + 80 kg P/H + 80 kg N/H+ 10 kg K/H). 3- The locally norms values which obtained showed the successful application of the DRIS regime during all stages of growth.

Key words: DRIS, bacterial inoculation, chemical fertilizers, lentil.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Climate change and future food security: Assessing the effects of ambient ozone on the growth and yield of mung bean (*Vigna radiate*, MN-98) using ethylene diurea (EDU) as a soil drench in Northern Pakistan

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Abstract

Mung bean (*Vigna radiata,* MN-98) grown in pots and exposed to ambient air at a field-site in Peshawar (Northern Pakistan) was subjected to EDU (ethylene diurea) as a soil drench to assess ozone effects on the yield and quality of this important legume. The experiment – the first of its kind in Northern Pakistan was carried out according to a standardised protocol from March to June, 2011. The objective of the study was to assess the effects of ambient ozone on the growth and yield of mung bean using EDU as a soil drench. Temperature and relative humidity were recorded half-hourly and ozone was measured using passive samplers (double-sampling, four-weekly time steps). Weekly foliar injury assessments were conducted, followed by a final harvest on day 84 of the experiment. The total biomass, seed weight, no. of pods, length of pods and roots were recorded. Passive samplers results revealed that the mean ozone concentration was significantly lower (24.2 ppb) in March and April as compared to May and June (49 ppb). Leaf marginal necrosis were recorded in both EDU and non-EDU treated plants in May and June that might be due to severe exposure to direct sunlight. No ozone visible injury was reported during the entire experiment. However, the number and biomass of pods were significantly reduced in non-EDU treated plants as compared to EDU treated plants. The biomass of shoots, leaves and the root length increased significantly in EDU treated plants. Seed weight was significantly reduced (20%) in non-EDU treated plants. The overall plant biomass was significantly higher (30%) in EDU treated as compared to non-EDU treated plants. It was concluded that a) there was a close positive relationship between the ozone concentration and temperature, b) ozone is a threat to local summer legumes grown in Pakistan, with potentially negative impacts on food security in the region and c) it was proved that further studies on other local crops should be subjected to similar EDU used as a soil drench experiment to assess their sensitivity to ozone pollution in South Asia to secure the future food security.

Key words: Ozone, Mung bean, EDU, passive sampler, Peshawar**.**

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Evaluation of differences in fertilizer consumption of autumn tomato production in greenhouse

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Abstract

In the research; the fertilizing practices, which are done with chemical fertilizers for approximately 5 months by 12 different greenhouse tomato growers from 5 areas around Antalya are recorded according to amounts of chemical fertilizers which are collected from the conversations with the growers. The consumption of fertilizers done by those growers is calculated both on monthly basis and total of 5 months according to active nutrient contents of N, P_2O_5, K_2O, CaO, MgO and SO_3. This essay proves that; though some growers share the same incline in the practice of chemical fertilizing, the amount of chemical fertilizers used is different for each grower. Though it is known that none of the growers had their fields analyzed for chemical fertilization; in the first month of the growing, a minimum of 2.4 Kg N da^{-1} and maximum of 10.595 kg N da^{-1} of chemical fertilizer is applied, while in the second month a minimum of 1.884 kg P_2O_5 da^{-1} and maximum of 22.497 kg P_2O_5 da^{-1} is applied. On the other hand, again in the first month; a minimum of 0.3 kg K_2O da^{-1} and a maximum of 11.580 kg K_2O da^{-1} is applied. It should be also noted that, while some of the growers never applied any fertilizers containing CaO, MgO and SO_3 , other growers applied those fertilizers up to the amount of 4.2 kg da^{-1}, which is a surprisingly high amount compared to other growers. In this essay; common practices and differences on chemical fertilizer application of those 12 different growers are evaluated and recommendations are made according to the inefficient, unbalanced and excessive application chemical fertilizers done by those 12 growers.

Key words: Fertilizing in greenhouse, autumn tomato, fertilizer consumption, chemical fertilizer, fertilizing, production in greenhouse.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of nutrional character on accumulation and fatty acids composition of pumpkin seeds lipids

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Abstract

High nutritional value of pumpkin oil and its beneficial effect on human health indicate great significance for revealing the main factors affecting levels of lipids accumulation and their fatty acids composition in seeds. The aim of the present work was evaluation of the efficiency of organo--mineral fertilizers utilization for obtaining high yield of pumpkin seeds oil and high content of polyunsaturated fatty acids. The object of investigation was *Cucurbita maxima,* Rossianka accession, grown on dernovo-podsol soil with content of humus 2.05%, P_2O_5-450 mg kg^{-1}, K_2O- 354 mg kg^{-1}, pH 6.8. Conditions of vegetation included utilization of: i) no fertilizers (control), ii) manure (15 t/ha), iii) siderate of *Galega officinalis* (9.9 t/ha, dry weight), iv) mineral fertilizers $N_{60}P_{45}K_{60}$, v) manure with NPK and vi) siderate with NPK. It was shown that nutrition character affected the quantity and quality of seeds. The highest seeds production was registered in case of combined organo-mineral fertilizers utilization. Mass of 1000 seeds varied from 206 to 378 g, the highest values being typical for siderate/siderate-NPK utilization, the lowest- to manure application. The ratio of placenta/seeds mass decreased according to the character of fertilizer used: mineral fertilizers>organic ones>combined organo-mineral fertilizers. The level of lipids was affected by nuclear/peel mass ratio ($r = -0.80$; $P<0.005$) being the highest for small (manure) and large (siderate+NPK) seeds (71.7-71.8%). The amount of fatty acids composition of pumpkin seeds lipids was found to depend on the character of nutrition with the highest percentage of unsaturated acids (82%) in seeds lipids of plants grown in conditions of combined (manure+NPK) utilization. On the contrary separate utilization of NPK, manure or siderate increased the level of saturated fatty acids. Thus separate or combined utilization of organic/mineral fertilizers for *Cucurbita maxina* vegetation allowed to change the production level of seeds, lipids content and the ratio of saturated/unsaturated fatty acids. The levels of natural antioxidant selenium in seeds did not correlate with the fatty acids composition of seeds lipids and was the lowest for cases of mineral fertilizers utilization being the highest for *Galega officinalis* introduction.

Key words: Fatty acids, pumpkin seeds oil, organic and mineral nutrition.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of elevated ozone on root biomass, mycorrhizal colonisation and soil properties: a field study of a semi-natural grassland community

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Abstract

Understanding the effects of ozone on below-ground processes is vital to setting realistic threshold doses for ozone, as these processes may be affected by ozone exposure before any above-ground symptoms are detectable. Negative effects of ozone on root biomass and mycorrhizal colonisation are brought about by changes in carbon allocation and symbiosis: when plants are ozone-stressed, carbon allocation to roots from photosynthates is reduced as plants close their stomata under ozone stress to reduce negative O_3 effects which, in turn, reduces photosynthesis. Mycorrhizal colonisation can provide numerous benefits for plants, particularly nutrient uptake. Therefore an ozone-induced change in colonisation rates could have a significant effect on plant growth. In order to assess the effects of ozone, plots (comprising of four $1m^2$ subplots) were used at three ozone treatments in three replicate transects, where a release pipe was used to fumigate a semi-natural grassland *in situ*. Plots experienced ambient ozone in controls and elevated ozone concentrations of approximately 3-10 and 8-24 ppb above ambient at plots 5m and 10m downwind, respectively. Soil cores were removed in April and July 2011 in order to analyse root biomass and mycorrhizal colonisation, in addition to a number of soil properties (pH, NH_4-N, NO_3-N, PO_4-P, bulk density, moisture content and loss on ignition). A nested ANOVA carried out in SPSS 18.0 showed that elevated ozone significantly reduced both root biomass and mycorrhizal colonisation. Furthermore, although there were no effects on soil variables and no overall confounding effects of the transect gradient, a number of soil properties showed different relationships with mycorrhizal colonisation and root biomass depending on the ozone treatment from Pearsons Correlation Coefficient analysis in SPSS 18.0. Since the site is managed under the DEFRA Higher Level Stewardship Scheme which aims to create, restore and maintain biodiversity, there may be management implications associated with below-ground changes as a result of elevated ozone. This study is evidence that semi-natural grasslands may benefit from a higher organic matter content and gravimetric water content in soil when exposed to elevated ozone.

Key words: Arbuscular mycorrhizal fungi, ozone, grassland, species diversity, plant-root-soil interaction

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of levels of supplementary nitrogen and potassium in nutrient solution on growth and yield of tomato

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Abstract

A completely randomized factorial experiment was set up with 12 treatments and three replicates to study the effect of nitrogen and potassium on tomato yield and growth parameters of tomato plant (Shoot and root dry weights, plant height and mean area of leaf) in hydroponically grown tomato in greenhouse of agricultural college of Zanjan University in 2008. In this experiment, tomato speed of RioGrand ug was selected and simple and interaction effect of four levels of N (100, 200, 300 and 400 mg/l) and three levels of K (125, 250 and 375 mg/l) on tomato yield, the growth parameters of tomato plant was investigated. The results of this experiment showed that the effects of nitrogen levels were significant on all measured parameters. The effects of potassium levels were not significant on any measured parameters. The interactive effects of nitrogen and potassium levels were significant on all measured parameters. The greatest and the least tomato yield and root dry weights were obtained from N200K250 and N400K375 treatments, respectively. The highest and the lowest shoot dry weight, plant height and mean area of leaf were observed in N200K250 and N400K375 treatments, respectively.

Key words: Nutrient solution, yield, growth, tomato.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of potassium and boron nutrition on fruit yield and quality in greenhouse tomato in hydroponic culture

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Abstract

The effect of different levels of potassium (125, 250 and 375 mg/l) and boron (0.5, 1.0, 1.5 and 2.0) on tomato yield and quality were investigated in perlit culture using a factorial randomized design with three replications. Different potassium levels had no significant effect on tomato yield and yield components. The effects of potassium levels were significant on Brix, Ec and pH value of fruit juice. The effects of boron levels were significant on tomato yield, yield components, Brix, Ec and pH value of fruit juice. The interactive effects of potassium and boron levels were significant on all measured parameters. The greatest and the least tomato yield, fruit size, fruit number and Brix value of fruit juice were obtained from K250B1.0 and K375B2.0 treatments, respectively. The highest and the lowest Ec value of fruit juice were observed in K375B2.0 and K125B0.5 treatments, respectively. The greatest and the least tomato Ec value of fruit juice were observed in K125B0.5 and K375B2.0 treatments, respectively.

Key words: Hydroponic culture, boron, potassium, tomato.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Phosphate status of common black soil during fertilization

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Abstract

All countries at present seek to improve the existing methods used to identify the availability of soil phosphates and develop new and more efficient methods for that purpose. Thermodynamic methods are increasingly widely employed to assess the soil phosphate status as they allow higher precision in identification of the properties in question. The purpose of this paper is to study the influence of mineral and organic fertilizers on the phosphate status aspects of ordinary black soil in the Lower Don region. Granulometrically, the ground consists of clay soil and light clay soil, base-saturated, neutral, with high total N and P content. Fertilizers were applied prior to the fall plowing using the following dosage: manure (40 t ha^{-1}), and standard superphosphate (60 kg of primary nutrient). Two additional fertilizer applications were also performed: the first one with ammonium nitrate (30 kg of primary nutrient) during the booting stage, the second with urea in the same dosage during the ripening stage. Thermodynamic assessment of soil phosphate status was performed using the sorption-desorption isotherms of phosphate ions in the soil. 0,01 M $CaCl_2$ was used as electrolyte with increasing phosphorus content (0.25 to 20 mg P ml^{-1}) to produce equilibrium solution. Obtained isotherms of the soil were used to identify the properties describing various aspects of its phosphate status: labile phosphorus content, equilibrium phosphorus concentration, phosphate potential, and phosphate buffering capacity.Collected data demonstrated that common calcareous black soil has high and very high phosphate buffering power and therefore good ability to bind the phosphorus introduced with fertilizers. Application of phosphate and organic fertilizers had significant influence on thermodynamic properties of the soil phosphate status. Labile phosphorus content (Plab) in the soils increased drastically as well as equilibrium phosphorus content (Comp). Phosphate potential (PP) decreased at the same time considerably because with the growing P concentration and soil saturation with phosphates the adsorption process involves locations binding phosphate ions less tightly. Thus, thermodynamic examinations of soil solids and soil solution have demonstrated an improvement of phosphate status of common black soil when fertilizers are applied. We have shown that thermodynamic methods can be used in the research of black soil nutrient status as well as their feasibility in combination with traditional methods.

Key words: Common black soil, soil phosphates, mineral fertilizers, thermodynamic assessment, phosphate potential.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Sight of deficiency symptoms of iron plant nutrient element in hazelnut in water culture systems

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Abstract

Knowledge of pre-plant nutrient deficiency is important in order to attain high amounts of quality yield. This study was carried out to determine the deficiency symptoms of plant nutrient element as iron (Fe) in hazelnut in water culture systems. The experiment was arranged according to a completely randomized plot design with three replicates, four doses and five rooted hazelnut plants in each replicate in the water culture system. Fe was prepared in doses of 0.0 mg L^{-1}, 2.0 mg L^{-1}, 4.0 mg L^{-1} and 6.0 mg L^{-1} and was prepared in exact nutrient solution (control). After rooted hazelnut plants had grown during two months, deficiency symptoms of iron was observed. When the iron nutrient elements were not in the solution, deficiency symptoms occurred. Deficiency symptoms decreased depending on the increasing nutrient concentration. During the experiment, plants were analyzed to determine the nutrition level of the Tombul hazelnut in different nutrient concentrations. The results showed that iron nutrient element contents in the Tombul hazelnut increased depending on their increasing concentration.

Key words: Deficiency symptoms, iron, water culture, hazelnut.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Forecasting of winter wheat yield and winter wheat quality on calcareous chernozem of the Lower Don

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Abstract

Aim of the study was to develop a complex system of indicators for the forecasting of winter wheat yield and winter wheat quality. Long-term studies have shown that calcareous chernozem is characterized by great variability of agrochemical parameters (content of humus, labile phosphorus, exchange potassium, pH, etc.). The variation of these parameters increases the heterogeneity of balance of plant nutrition on a large number of macro-and micro elements, with which the volume, quality of the yield and its ecological safety are associated. It was found that the winter wheat is highly responsive to changes in the quality of nutrition yet at early stage of development. A significant dependency of yield on content of chemical elements and their interrelation can be observed, which at early stage of plant development allows for forecasting of their efficiency, estimation of soil fertility using ecologically important interrelation of chemical elements (P/Ca, Fe/Mn, Sr/Ca). As indicators of the growth conditions of winter wheat in calcareous chernozem the following indicators are highly effective: the content and the interrelation of N, P, K, Fe, Zn, Ca in tops of wheat at boot stage; humus content, labile phosphorus in soil and their interrelation, as well as the number of exchange potassium and its interrelation with exchange potassium and the total exchangeable bases. It is shown that forecasting and integrated assessment of the quality of wheat grain in calcareous chernozem shall be carried out with regard to the balance of content of macro-and micro-elements in wheat grain and in tops of the plants at boot stage, and also inclusive of the balance of soil characteristics. It was found that the content of protein, gluten in grains of winter wheat in calcareous chernozem to a large extent depends on the balance of N with Mn, P, Fe, Zn, K in plants at boot stage and the ratio of exchange potassium and humus in the soil.Use of the integrated diagnostic system of plant nutrition increases opportunities of forecasting of winter wheat yield and winter wheat quality on calcareous chernozem.

Key words: Chernozem, winter wheat, chemical composition of plants, protein, gluten, multi-unit diagnostics.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of fertilizer and gibberellic acid (GA_3) on nutritional level in Sultani Cekirdeksiz grape variety

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Abstract

The aim of this research is the examination of mineral nutrition uptake by foliar analyses in Sultani Çekirdeksiz (Sultana) applied of the different doses of fertilizer and gibberellic acid. This study was conducted own rotted Sultani Çekirdeksiz experiment vineyard at Manisa Research Station in Alaşehir province. Five different GA_3 and four different fertilizer doses including controls were applied on Sultani Çekirdeksiz in the completely randomized block design with split plots as three replications. Each replication had 6 vines. Table grape yield and quality values were obtained from 2010 to 2012. The GA_3 applications were 0, 35, 70, 140, 210 ppm and suggested dose for fertilization was determined by the soil analysis. Four doses were formed by multiplication of suggested dose and 0, 0.5, 1, 1.5 coefficients. Leaf samples were taken at flowering, verasion and harvest times. Total N content was obtained by using kjeldahl methods. Phosphorus content was determined in spectrophotometer using the phosphor vanado molibdo phosphoric yellow color in the filtrate attained from nitric–perchloric acid mixture and the wet oxidation method. The amounts of K, Ca, Mg, Fe, Zn, Mn and Cu were measured using the atomic absorption spectrophotometer in the filtrate after wet oxidation. The results were presented as percent (%) for macro nutrition elements and as mg kg^{-1} for micro nutrition elements.

Key words: Sultani cekirdeksiz (sultana), gibberellic acid (GA_3), fertilizer, leaf analysis, macro and micro elements.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of effect salinity (Sodium chlorid and Calcium chlorid) and water stress on P, K and Mg concentration in Spinach root

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Abstract

Salinity and drought stress are regarded as the most important abiotic factors limiting plant growth and agricultural products. In order to study of salinity effect (Sodium Chloride and Calcium Chloride) and drought stress P, K and Mg concentration in Spinach *(Spinacia oleraceae L)* root. The experimental was conducted under greenhouse conditions in Agricultural Faculty of Lorestan University, khoramabad city of Iran in 2013-2014. Experiment was factorial with four replications on base of Completely Randomized Design (CRD). The treatments included salinity stress at different levels of 4 and 8dSm-1 (NaCl) and 4 and 8dSm-1 ($CaCL_2$) and drought stress at two moisture levels of FC (no stress) and moisture in 80-85 percent of FC. The result showed that the effect of salinity stress, on elements concentration such K, Mg, P in root were significant at (P≥1). The result also showed that all measurement elements were affected significantly by water stress. Interaction of two factors had significant (P≥1) effect on elements concentration such K, P in root. Highest elements concentration such K, Mg, P in root were obtained in control treatment (no salinity and water stress) and The lowest it concentration were obtained in treatmen CaCL2 with (EC=8 dS m-1 and moisture in 80-85 %FC). Finally, regarding to results of this study, there was maximum of spinach growth without salinity and water stress conditions which can be suggested as the best treatment.

Key words: Spinach, salinity, drough, elements concentration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Study of effect salinity (Sodium chlorid and Calcium chlorid) and drought stress on Na, Ca and Cl concentration in Spinach root

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Abstract

Salinity and drought stress are regarded as the most important abiotic factors limiting plant growth and agricultural products. In order to study of salinity effect (Sodium Chloride and Calcium Chloride) and drought stress on Na, Ca and Cl concentration in Spinach *(Spinacia oleraceae L)* root. The experimental was conducted under greenhouse conditions in Agricultural Faculty of Lorestan University, Khoramabad city of Iran in 2013-2014. Experiment was factorial with four replications on base of Completely Randomized Design (CRD). The treatments included salinity stress at different levels of 4 and 8dSm^{-1} (NaCl) and 4 and 8dSm^{-1} ($CaCL_2$) and drought stress at two moisture levels of FC (no stress) and moisture in 80-85 percent of FC. The result showed that the effect of salinity stress, on elements concentration such Na, Ca, Cl in root were significant at (P≥1). The result also showed that all measurement elements were affected significantly (P≥1) by water stress .Interaction of two factors had significant (P≥1) effect on elements concentration such Na, Ca and Cl in root. The highest Na concentration in root were obtained in NaCl treatment with (EC=8 dS m^{-1} and moisture at FC) and the highest Ca and Cl concentration were obtained in treatment $CaCL_2$ with (EC=8 dS m^{-1} and moisture at FC). Finally, regarding to results of this study, there was maximum of spinach growth without salinity and water stress conditions which can be suggested as the best treatment.

Key words: Spinach, salinity, drough, elements concentration.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Fertilization level and available nutrients content in arable land of the Czech Republic

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Abstract

After 1990 agriculture in the Czech Republic (ca 3,5 mil. ha of agricultural land) underwent a number of radical changes, including some negative accompanying phenomena. Practically all basic inputs (mainly nutrients) were drastically reduced: (1) inputs of mineral nutrients in form of mineral fertilisers (N, P_2O_5, K_2O, MgO) and limy materials ; (2) inputs of organic matter and next nutrients in organic form into the soil (according to the Czech Statistical Office it was 0.81 livestock unit.ha^{-1} (LU.ha^{-1}) in 1989, while in 2011 only 0.46 LU.ha^{-1}). These factors, including unbalanced ratio of used nutrients, have a negative effect on soil fertility. Some of the selected basic parameters of soil fertility are observed in the Czech Republic in long term system of agrochemical soil testing. The results of determination of soil reaction and contents of available essential nutrients (P, K, Mg, Ca) are available for farmers, because primary interest of every farmer must be the care of the soil (its fertility) and determination of application rates of fertilisers. Based on lower consumption of nutrients (in mineral and organic form) year by year, soil fertility (i.e. soil reaction and content of available nutrients) declines – mainly content of available phosphorus and potassium. Content of available phosphorus and potassium in arable land declined by ca 20%. Simultaneously ca 19% of area of arable land was moved into categories with expressive fertilisation of phosphorus fertilisers and ca 15% into categories with expressive fertilisation of potassium fertilisers (differences between 1990 – 2010).

Key words: Inputs of nutrients, soil testing, phosphorus, potassium, fertilisation

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of long term NPK fertilization and liming on the soluble zinc content of soil and the zinc content of maize

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Abstract

The effect of NPK fertilization and liming on the soluble zinc content of soil and the zinc content of maize was studied in a long-term experiment of Karcag Research Institute. The soluble zinc content of the soil was characterized with two extractants that are the worldwide applied $CaCl_2$-DTPA-TEA solution and the officially used Hungarian KCl-EDTA extractant. Moderate positive correlation was found between KCl-EDTA-Zn and $CaCl_2$-DTPA-TEA –Zn. The KCl-EDTA extractant dissolved more zinc than DTPA solution. Liming decreased the $CaCl_2$-DTPA-TEA soluble zinc content significantly as well as KCl-EDTA soluble zinc content. The $CaCl_2$-DTPA-TEA extractant indicated the effect of liming more sensitively which can be attributed to the different pH of the extractants. The effect of NPK fertilizers cannot be proved on soluble Zn content of soil. But, the influence of P fertilization reflected in the Zn content of maize. Leaf samples of maize were collected twice: the first sampling was at the 6th leaf stage of maturity. The second sampling was at early silk. The greater the P doses. The smaller was the plant Zn content. This tendency could be observed especially by the first sampling. The decreasing effect of liming for plant zinc content was proved statistically at the 2nd sampling.

Key words: Zinc, phosphorus fertilization, liming, long-term experiment

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of grafted seedling on nutritional status of plants in greenhouse

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Abstract

In recent years, the plant production using grafted seedlings has become more important due to the awareness of producers and consumers, the limiting the use of pesticides and fertilizers with the increasing need for environmentally-friendly farming practices. Grafting is a form of reproduction two plant piece which having a similar organic structure providing continuing to grow as a single plant. The purpose of the vegetable grafting may be listed; fight against soil-borne diseases, low temperature resistance, tolerance to adverse soil conditions such as salinity and extreme humidity, stronger development of the plants, environmental protection, as earliness and yield increase. This form of reproduction is another one of the reasons for preference is grafted seedlings compared to seedlings grown on their own roots, better uptake of water and nutrients and to provide more effective use. The studies to seedlings of the grafting process, show that the flow matter and interfere with the absorption of the macro-nutrient phosphorus, nitrogen, calcium and magnesium ions and from micro-nutrients, iron and boron ions. Also preferably one of the most important effects of rootstocks; even at very low temperatures can provide the absorption of ions. Although grafted seedlings have been used in the world since at the begining of 20th century they have been produced by the private seedling firms in our country for the last 20 years. Grafted seedlings are widespread in tomato, eggplant and watermelon plants. Nowadays possibilities to use commercially grafted seedlings of pepper and cucumber are also investigated. In this review, production quantities of grafted seedlings in our country and around the world made using the grafted seedlings in vegetable cultivation will be referred to the study of nutritional status.

Key words: Grafting, grafted seedling, vegetable, plant nutrition.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Yield, quality of the sweet orange and nutrients in soil as influenced by multi-micronutrient application

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Abstract

Field experiment was conducted for two years to evaluate the response of sweet orange orchards of winter production season to multi-micronutrient application in terms of soil and leaf nutritional status, fruit yield, fruit quality, economics of production and orchard health. To study the response of sweet orange orchards to multi-micronutrient trees of sweet orange orchards of 8 years old age were selected. All the selected orchards were demarcated and laid in Randomized Block Design. One treatment was applied for 18 trees, group of three trees was taken as one tree for observations and six replications were taken for observations. The results emerged out during these research projects indicates that the number of fruits per tree increased with the application of balanced dose of NPK along with multi-micronutrient. Similarly, Weight of fruit per tree was significantly increased in the treatment receiving multi-micronutrients through soil. Productivity of sweet orange was also enhanced due to application of multi-micronutrients along with recommended NPK. The quality of the fruits in terms of juice, TSS, fruit girth, ascorbic acid content, reducing and non-reducing sugar increased with the application of multi-micronutrient and NPK either applied through soil or fertigation. Whereas, acidity of the fruit juice was found highest in untreated (control) as compared to treated i.e. with the application of nutrient in balanced form. The major and micronutrient buildup in soil after harvest of crop was noticed maximum in the treatment receiving balanced nutrient through soil application.

Key words: Micronutrients, fertigation, sweet orange.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Nutrient status of peaches and nectarins in the Lapseki of Çanakkale District, Turkey

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Abstract

36885 tonnes of fruit production in the district Lapseki the highest share of the peaches are receiving and 43 400 tonnes and 23 202 hectares in area 63% of the total fruit production. in the province of the total peach production constitutes 72%. respectively. The majority of farming in the county soil alkaline in character and have high levels of lime in fertilization is necessary to pay attention. The majority of producers in the horticulturae with drip irrigation, fertilizer application, fertigation programs. but they do not consciously apply their practices are observed at random. The development of good practices in soil and manure nutrient imbalances in trees leads to. due to fertilizer producers also heavily used and therefore the country's economic losses are thought to be important. This study was conducted in order to assesing the soil properties and nutritional status of nectarine and peach trees grown in Lapseki district. For this purpose soil and leaf samples was taken from 20 different orchards of nectarine and peach. Some soil chemical and physical properties and leaf nutrient levels of soil and leaf samples was determined. The data from plant and soil analysis was compared with the adequate ranges and then sufficiency levels was determined. Face to face interviews with growers who have used the fertilizer they have applied with a survey about their growing techniques was done. The results of the analysis obtained and the producers have applied their training techniques will be developed taking into account the fertigation programs.

Key words: Peach, nectarin, nutrient status, leaf and sol analysis.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Studies on Fe, Mn and Zn Nutrient contents and seasonal element fluctuations of the black fig variety in Bursa area, Turkey

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Abstract

This study was undertaken to determine the seasonal variations in micro nutrient contents (Fe, Zn and Mn) of leaves of the "Bursa Siyahi" fig variety during two years so as to develop our present knowledge about soil and leaf interactions, to learn at different physiological states, seasonal variations in nutrient contents of leaves, their stable periods, and to define the most proper leaf-sampling time. Leaf samples were obtained from 8 different fig orchards. Leaf samples were taken once every month from June till November in both years. The results can be summarized as follows: The most proper sampling period for determining the micro element (Fe, Mn and Zn) nutritional status of Bursa siyahi variety by using leaf samples 10th of July till the 10th of August. When the seasonal trends of micro nutrient contents of leaves were concurrently investigated, it was seen that while Fe and Mn contents of the leaves increased, Zn in the leaves decreased.

Key words: Fig, Fe, Mn, Zn, seasonal fluctuations.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Allelopathic potential of barley varieties (*hordeum vulgare L.)* on seed germination of *Cardaria draba*

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Abstract

Laboratory experiments were conducted to determine 10 barley common genotypes on sensitivity of *cardaria draba. Shoot and root water extract of* ten common varieties (Yoosef, salinity line 4, Nosrat, Abider, Kavir, Reihan, Roodasht, Sahand, Dasht Parvaresh and Fajr 30) was dried and solved in distilled water (10% w/v) and then added to petri dishes containing 25 seeds of *cardaria draba.* The results showed that water extract had significant effect on all of measured traits ($P<0.01$). Mean comparison showed that shoot extract of all varieties had more negative effect on germination percentage, germination rate and all traits related to seedling growth in this weed.

Key words: Allelopathy, weed, germination, seedling growth.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Germination and early seedling growth under salinity and drought conditions in *Echinochloacrus-galli* (Barnyard Grass)

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Abstract

In order to determine effects of salinity and water potential on germination and seedling growth of barnyard grass this study was induced to seven salinity levels (0, 50, 100, 150, 200, 250 and 300 mM NaCl) and seven levels of osmotic stress (0, -2, -4, -6, -8, -10 and -12 bar). The results showed that salinity and drought stress had significant effect on all of measured traits ($P < 0.01$). The highest germination percentage showed in control conditions (distilled water). Increase in salinity and drought concentrations lead to decrease in germination percentage, germination rate, seedling weight and length.

Key words: Salinity, osmotic stress, germination, seedling growth, canola barnyard grass

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The advantageous of microbial fertilizer than chemical fertilizers on melanus in Çukurova Region, Turkey

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Abstract

This study was examined advantageous of microbial fertilizer than chemical fertilizers (N and P) on melon in Çukurova Region, Turkey. The experimental design was randomized block with four replications. There were five different methods: zero doze control application, traditional fertilizing application (30 kg N ha^{-1}, 80 kg P_2O_5 ha^{-1}). The other application were done with three different forms of microbial fertilizer; 3000 cc ha^{-1} Microbial fertilizer + 50 kg ha^{-1} sugar beet molasses, 3000 cc ha^{-1} Microbial fertilizer + 50 kg ha^{-1} sugar beet molasses + high fertilizer 1500 cc ha^{-1} Microbial fertilizer + 20 kg ha^{-1} sugar beet molasses and 3000 cc/ha Microbial fertilizer + % 25 traditional fertilizing application. The highest yield was 36388.9 kg ha^{-1} in 3000 cc ha^{-1} Microbial fertilizer + 50 kg ha^{-1} sugar beet molasses application and the least yield was determined as 31388.9 kg ha^{-1} in traditional fertilizer (160 kg N ha^{-1}+ 80 kg P_2O_5 ha^{-1}) application. The yield was 35972.2 kg ha^{-1} in 3000 cc/ha Microbial fertilizer + 50 kg ha^{-1} sugar beet molasses + high fertilizer 1500 cc ha^{-1} Microbial fertilizer + 20 kg ha^{-1} sugar beet molasses. Also yield was 34861.1 kg ha^{-1} in 3000 cc ha^{-1} Microbial fertilizer + % 25 traditional fertilizing application. The effects of microbial fertilizer on yields were significant at $P<0.05$..

Key words: Melon, microbial fertilizer, chemical fertilizer, yields.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Determining the effects of humic acid applications upon the solubility of rock phosphate and Zn uptake

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Abstract

Low solubility of rock phosphate in soil prevents the plant to benefit from the phosphor it needs in the early period. Similarly, efficacy of zinc (Zn) in lime and alkali reactive soils is low. This research was carried out to determine the effects of humic acid upon the solubility of rock phosphate and efficacy of zinc. In the research, Sele (*Zea mays* L) corn type was used as the herbal source. The 1st study was carried out to determine the effects of humic acid upon the efficacy (0, 60, 120, 180 ppm) of rock phosphate (including 31% P_2O_5). The 2nd experiment was conducted to determine the effects of humic acid applications (0, 60, 120, 180 ppm) upon the efficacy (0, 10, 20, 40 Zn ppm) of Zn use. Other macro and micro elements were administered to plants in order to provide the plant development. Both experiments were carried out in a greenhouse as a pot study as in 4 replications according to randomized complete blocks design. Subsequent to the 60-day development of the corn plant, the plant was harvested. The plants were analyzed in terms of wet weight, dry weight, and macro and micro element concentrations in both stem and leaves. In order to determine P and Zn changes in soil after the experiment, NPK and Zn concentrations were analyzed in soil samples. According to research results, humic acid applications increased the P, N, K and Zn uptake of the plant in both experiments. Significant increases were noticed in wet and dry weights of the plants through the humic acid applications. The increased Zn doses increased Zn concentrations in stem and leaves of the plant, as well.

Key words: Humic acid, rock phosphate, P uptake, Zn uptake.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effects of water stress and different levels of nitrogen on yield, yield components and WUE of sunflower hybrid iroflor

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Abstract

Productivity of sunflower (Helianthus annuus L.) is strongly regulated by the availability of water and nitrogen, greatest yield losses occur when water shortage occurs at flowering. In order to study the effects of water stress, different levels of nitrogen on yield, yield component and water use efficiency of sunflower hybrid Iroflor an experiment was conducted as a split plot Randomize Complete Blok Design. The treatments were composed of three irrigation treatment (I) including I1 (optimum irrigation), I2 (moderate stress) and I3 (severe drought stress) was done after depletion of 30, 40&50 percent of the field capacity, respectively as the main plot and three nitrogen levels N1, N2 and N3 consisting of 80, 140 and 200 Kg N ha-1 respectively were placed as sub plots. Results showed that grain and biological yield, economical and biological water use efficiency, were reduced significantly in response to increasing to drought severity. The effect of nitrogen on grain and biological yield, yield components, economical and biological water use efficiency was significant. The highest water use efficiency was obtained from 200 Kg N.ha-1 under optimum irrigation condition. When available water decreased, positive effect of nitrogen application on these traits decreased significantly.

Key words: Sunflower, drought stress, nitrogen, water use efficiency, yield components.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Influence of crop rotation and fertilization on the microbial activity in rhizospheric soil

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Abstract

Organic matter is the most important source of plant nutrients therefore the Increase of organic matter content in soil is a vital prerequisite for soil fertility and quality. Application of organic fertilizer are essential for the maintanence of soil natural fertility. The aim of this research was to investigate the unfluence of crop rotation and fertilization on soil biological properties. Soil samples for microbiological analises were taken from the following treatment:1. Monoculture of maize (MO), 2. Maize-wheat (without fertilization, NF2), 3. Maize-wheat (with fertilization, F2), 4. Maize-soy-wheat (with fertilization, F3S), 5. Pasture soil (P), 6. Forest soil under oak (F) from three depth: 0-10 cm, 10-20 cm and 20-30 cm in may and october of 2012. Microbiological analyses included the determination of total number of bacteria (TNB), number of fungi (FNG), actinomycetes (ACT), aminoheterotrophs (AMH) and azotobacter (AZB). Comparison of microbiological parameters by depth and different soil usage showed that certain statistically important changes did occur in soil. The number of investigated groups of microorganisms at to the beggining of the plant vegetation period were, in average higher in relation to the end of vegetation period. Crop rotation affected positively the TNB is soil under maize, especially at the beggining of vegetation, while fertilization treatments did not influence significantly the TNB. Statistically significant changes in the number of ACT and FNG were not achieved in maize rhizospheric soil. Crop rotation influenced the number of AZB and AMN. The number of all investigated groups of microorganisms decreased with the increase of soil depth though those changes were not in the range of statistical significance.

Key words: Crop rotation, monoculture, maize, microorganisms.

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

Effect of municipal solid waste compost and sewage sludge on saline soil enzymatic activities and alfalfa growth

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Abstract

Soil salinization and limited availability are important factors contributing to reduced agricultural productivity. The formation of salt-affected soils is considered the main factor leading to soil degradation and yield decline. The application of organic wastes with high organic matter content such as composted urban wastes and sewage sludge to semiarid soils has become a common environmental practice for soil restoration, maintaining soil organic matter, reclaiming degraded soils, and supplying plant nutrients. Pot experiment was conducted to investigate the influence of incorporated composted municipal solid waste as compared to sewage sludge on the enzymatic activities of saline soil cultivated with *Alfalfa* plants. Soil was amended with MSW compost (C_0: 0 g kg^{-1}, C_1:13 g kg^{-1}, C_2: 26 g kg^{-1}) and sewage sludge (SW_0:0 g kg^{-1} SW_1:13 g kg^{-1} and SW_2: 26 g kg^{-1}). Phosphatase, β-glucosidase, Arylsulphatase, catalase and Dehydrogenase activities were measured in three sampling times (T0, T_1: 30 and T_2: 60 days). The results showed oxidoreductase and hydrolase enzyme activities in sabkha soil were significantly enhanced by the addition of MSWC and sewage sludge both at C_1, but decreased by the highest organic dose (C120 SW2 SW3). Variations in enzymatic activities were also observed. Overall, our results have shown that the addition of MSWC to sabkha soil can improve soil quality, increasing soil organic matter content improving soil biochemical and biological properties by increasing plant growth. However, the wide variety of substances such as heavy metals and other potential pollutants in MSWC limits the use of these organic amendments

Key words: Soil salinity, organic wastes, enzymatic activities

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effect of nutrient supply and crop rotation on the yield values of winter wheat

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Abstract

Our field experiments were set at the RISF Látókép Experimental Farm of the Centre for Agricultural and Applied Economic Sciences of the University of Debrecen, on lime-coated chernozem soil. During our studies, we have investigated winter wheat varieties of different genotypes. The preceding crops were sunflower and sweet corn, applying controll, N_{30}+PK, N_{60}+PK, N_{90}+PK, N_{120}+PK és N_{150}+PK fertilizer treatments. As an effect of fertilization, the yield values increased, which were influenced by the difference between the varieties and the forecrops and amount of the fertilizers. According to our results, the lowest yield values were experienced in the control treatment, in the case of both preceding crops. According to our studies we can conclude that crop rotation and fertilizer treatment influenced the yields.

Key words: Winter wheat, crop rotation, nutrient supply, yield**.**

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9th International Soil Science Congress on
"The Soul of Soil and Civilization"
14 - 16 October, 2014
Side, Antalya/ Turkey

The effects of organic and NPK fertilizer applications on yield, morphology, quality and mineral content of Taşköprü garlic (*Allium sativum* L.)

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Abstract

Turkey is one of the major garlic producing country in the world and the significant amount of Turkey's production has been made using a garlic variety called Taşköprü garlic in Kastamonu. In order to improve the quality of garlic production, a field experiment was conducted in March 2013 to evaluate the effects of different levels of leonardite organic fertilizer, chemical fertilizer NPK and the combination of both leonardite and NPK fertilizers on morphological, yield and quality properties and mineral contents of Taşköprü garlic (*Allium sativum* L.). Total plots were 48 (3 replicates x 8 treatments x 2 study sites = 48 plots). The field experiments were carried out in 20 X 20 m plots. Treatments were: control (no fertilizer), three leonardite doses (L_1= 8; L_2= 20 and L_3= 28 kg per plot), NPK chemical fertilizer (CF) (8 kg N + 10 kg K_2O + 4 kg P_2O_5 per plot) and leonardite + NPK chemical fertilizer (L_1CF, L2 CF and L3CF). Some nutritional and technological properties of garlic were measured in developing *Allium sativum* L. bulbs.The bulbs contained crude protein, crude oil, crude fiber, ash and minerals including K, P, Mg, Na, Ca, Fe, Se etc. were analyzed. Technological properties of garlic bulbs such as diameter of whole garlic, mass, length of whole garlic, width, thickness, sphericity, volume and hardness were also measured. The results showed significant differences in the morphology and mineral contents of Tasköprü garlic with different leonardite applications which also improved the soil properties.

Key words: *Allium sativum*, leonardite, NPK, Taşköprü garlic.

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