
2021

ABSTRACT BOOK

# INTERNATIONAL SOIL SCIENCE SYMPOSIUM on

# SOIL SCIENCE & PLANT NUTRITION

(6th International Scientific Meeting)

**18 – 19 December 2021**

**Samsun, Turkey**

**Editors**
Dr.Rıdvan KIZILKAYA
Dr.Coşkun GÜLSER
Dr.Orhan DENGİZ

**Organized by**
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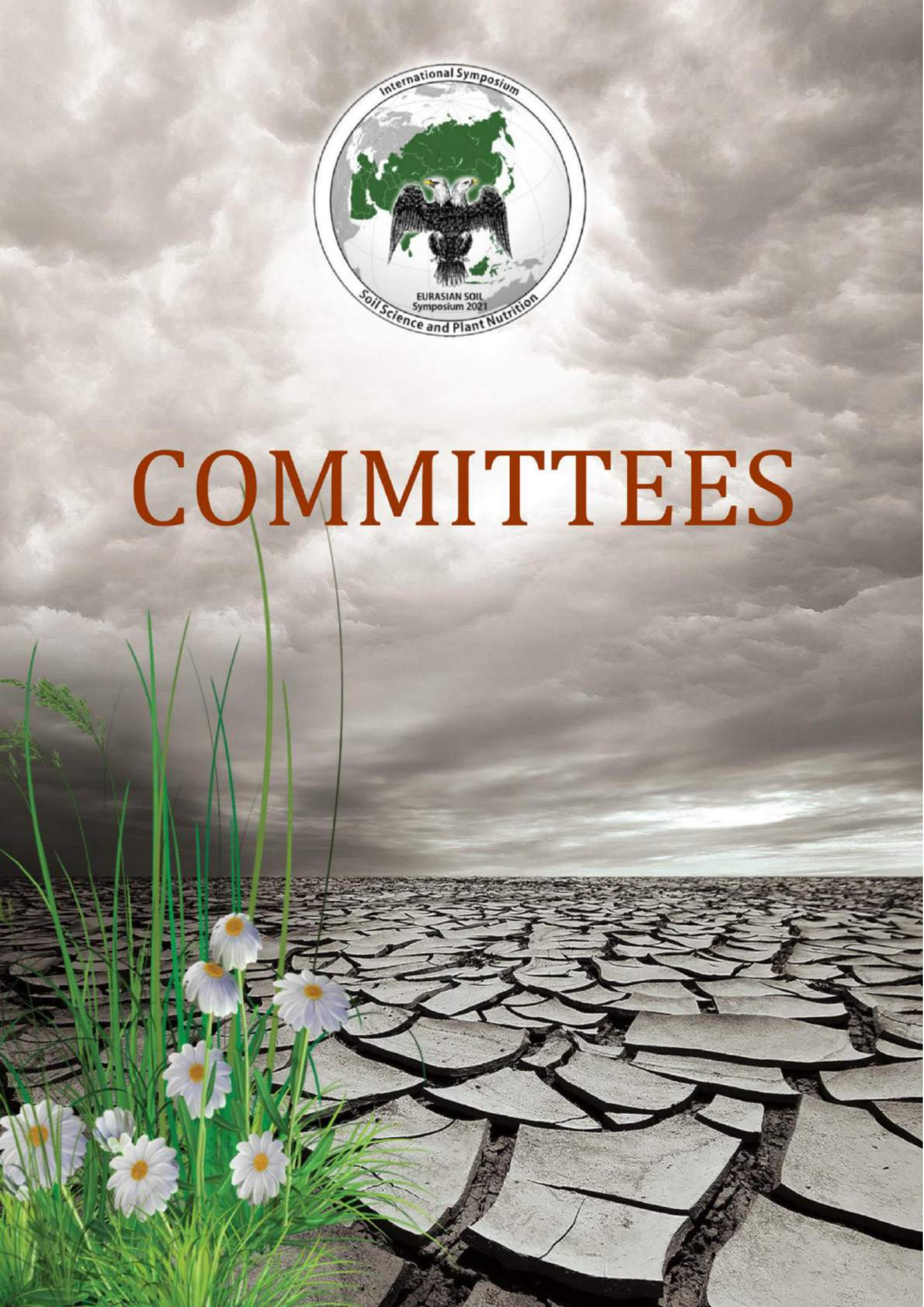
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# Preface I

Dear colleagues,

The Federation of Eurasian Soil Societies (FESSS) and the Erasmus Mundus Soil Science Program (emiSS) welcome you to "Soil Science and Plant Nutrition" (EURASIAN SOIL Symposium 2021). It is a great pleasure for us to see you at this great event. We hope that the speeches that will take place here in the field of soil science will be of great importance. It is a great honor for us to represent our country here.

The symposium "Soil Science and Plant Nutrition" is about applied research and new approaches to integrating soil, plant and environmental aspects across different ecosystems for the integration of scientific data and the physical, chemical and biological properties of soil, plant nutrition. and topics related to fertility mechanisms and processes under study. will cover topics of different scales - from molecular to field - on the diversity of experiences, opinions and scientific knowledge. The symposium will provide a great opportunity to learn and discuss the latest achievements in the field of soil science in general, and to establish contacts and cooperation with various participants. The symposium will focus on a multidisciplinary approach to soil science, with a particular interest in key research, the latest and most technological research. Scientific sessions will also highlight key concepts about land. The symposium will also provide numerous opportunities for interaction between public and private scientists.

Prof.Dr.Garib Mamadov
President, FESSS

# Preface II

Distinguished colleagues and friends,

Good morning and on behalf of Federation of Eurasian Soil Science Societies (FESSS) welcome to this Symposium on the "Soil Science and Plant Nutrition".

Let me begin by thanking our co-organizer, Erasmus Mundus Joint Master Degree in Soil Science Programme (emiSS) and its Coordinator, Dr Coskun Gulser for being here with us. This is the 6th International Scientific Meeting under our federation (FESSS) structure and the first we have co-organised with emiSS. Also, FESSS is the associate partner in emiSS Project. I am pleased to welcome again our colleagues from Southern Federal University in Russia, University of Agriculture in Krakow in Poland, Agricultural University Plovdiv in Bulgaria and participants from many countries participating in the symposium. I believe this event has helped that collaboration develop.

This year we will discuss the importance of Soil Science and Plant Nutrition. The symposium titled "Soil Science and Plant Nutrition" sets up the ambitious goal of integrating scientific background, applied research and novel approaches to link soil, plant and environmental aspects over various ecosystems. Physical, chemical and biological soil properties, plant nutrition and fertility mechanisms and processes studied at different scales - from molecular to field - will feed the diversity of experiences, opinions and scientific knowledge. The symposium will provide a great opportunity to learn and discuss recent advances in the soil science in general and to establish contacts and collaborations with participants from many different parts of the word. The symposium will focus on multidisciplinary approach to soil science, with special interest on basic research, latest and technological developments for soil science and plant nutrition. The scientific sessions will also emphasize basic concepts of soil. The symposium will also provide multiple opportunities for interaction among scientists from public and private institutions.

Federation of Eurasian Soil Science Societies (FESSS) with its unique organization of 8 Member countries, can help in the critical areas of Soil Science and Plant Nutrition. The Federation of Eurasian Soil Science Societies was established by the collaboration of Soil Science Societies of four different countries which are Turkey, Russia, Azerbaijan and Kazakhstan in 2012. After 2016, Romania, Kyrgyzstan, Bosnia & Herzegovina and Serbia Soil Science Societies joined to FESSS. The primary goal of the Federation is to share knowledge on the most dynamic part of earth-soils and to "bridge the gap" between soil science, policy making, and public knowledge both nationally and internationally in the region.

I would like to thank our programme steering committee for arranging an excellent line-up of speakers, and I thank the speakers and moderators for their contribution. Let me also thank all of you the participants. As always, we appreciate your support and look forward to your contribution to the discussion.

I wish you all a most enjoyable and productive symposium.

Thank you

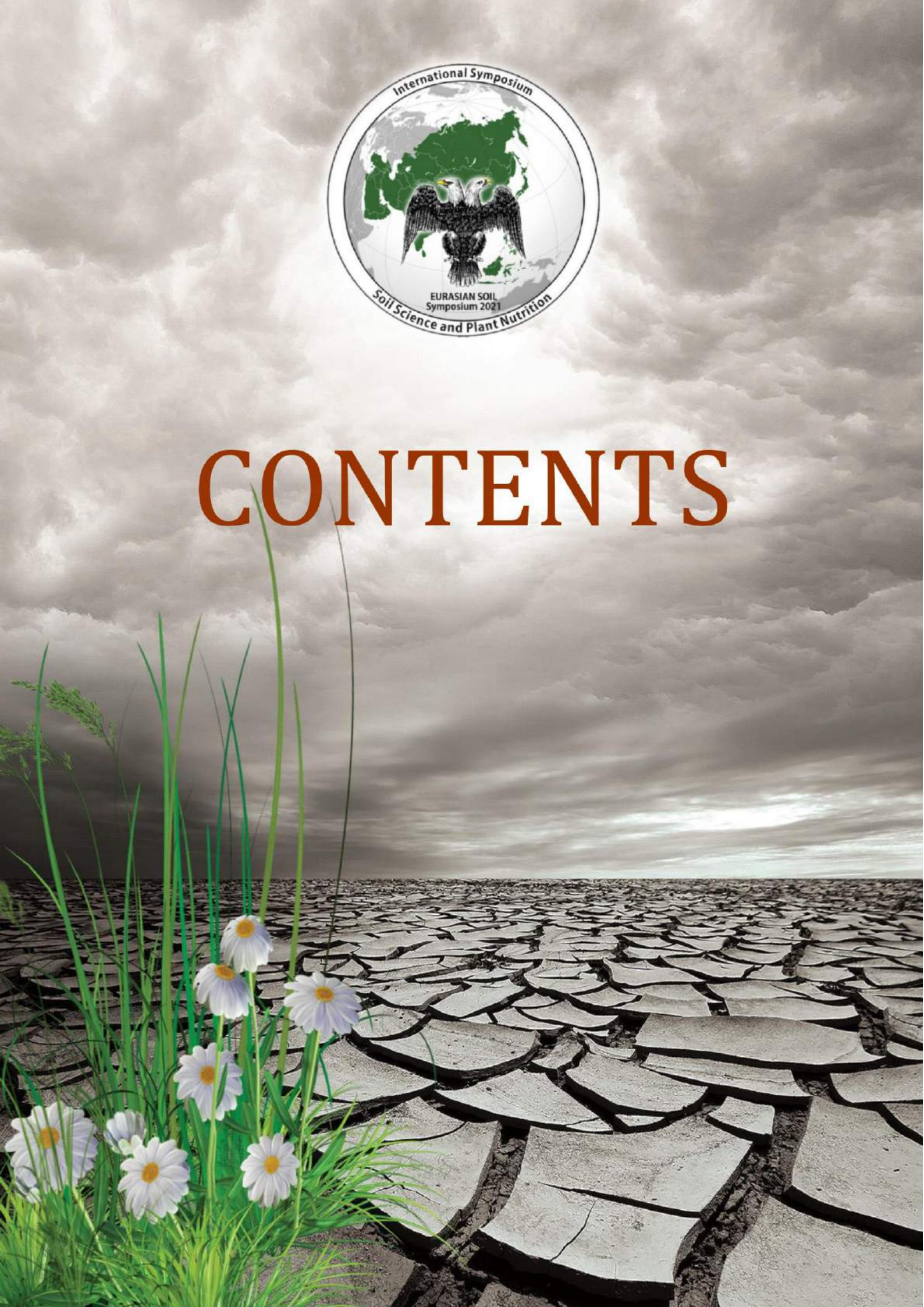
Prof.Dr.Rıdvan Kızılkaya
Chair, Organization Committee

# Preface III

Dear participants,

It is my great pleasure to attend the International Soil Symposium on "Soil Science & Plant Nutrition" as a part of organizing committee. This symposium has been organized by the Federation of Eurasian Soil Science Societies (FESSS) collaborating with ERASMUS MUNDUS Joint Master Degree in Soil Science (emiSS) programme. I would like to express my grateful thanks to FESSS and Prof. Dr. Ridvan Kizilkaya, who is the Chairman of the Symposium, giving us s chance to represent emiSS programme in this International Symposium. The emiSS programme has been founded with the support of the Erasmus+ Programme of the European Union and organized by a consortium of the five Universities: Ondokuz Mayıs University (OMU-Turkey), University of Agriculture in Krakow (UAK-Poland), Agricultural University Plovdiv (AU - Bulgaria), Southern Federal University (SFedU - Russia) and Jordan University of Science and Technology (JUST- Jordan) in 2019. The aim of emiSS programme is to raise and meet the need for qualified and skilled soil scientists at the master level through a higher educational programme under the training in soil science, soil management, soil fertility, soil ecosystem with intercultural competence and language skills. So far, it has 34 international students from the different geographical parts of the World. Some of emiSS students will be among us and make an oral presentation during the Symposium. I think that the mission of the symposium will be successful with sharing novel access that fulfill the needs of applications in soil science and plant nutrition field, and identifying new directions for future researches and developments in soil science area. At the same time, this symposium will give researchers and participants a unique opportunity to share their perspectives with others interested in the various aspects of soil science. I hope this symposium also will be helpful to increase young soil scientists' knowledge and their presentation skills front of the audience. Once more I would like to thank the organizing committee and all participants to their helps and sharing their scientific knowledge in this symposium.

Prof.Dr.Coşkun Gülser
emiSS Coordinator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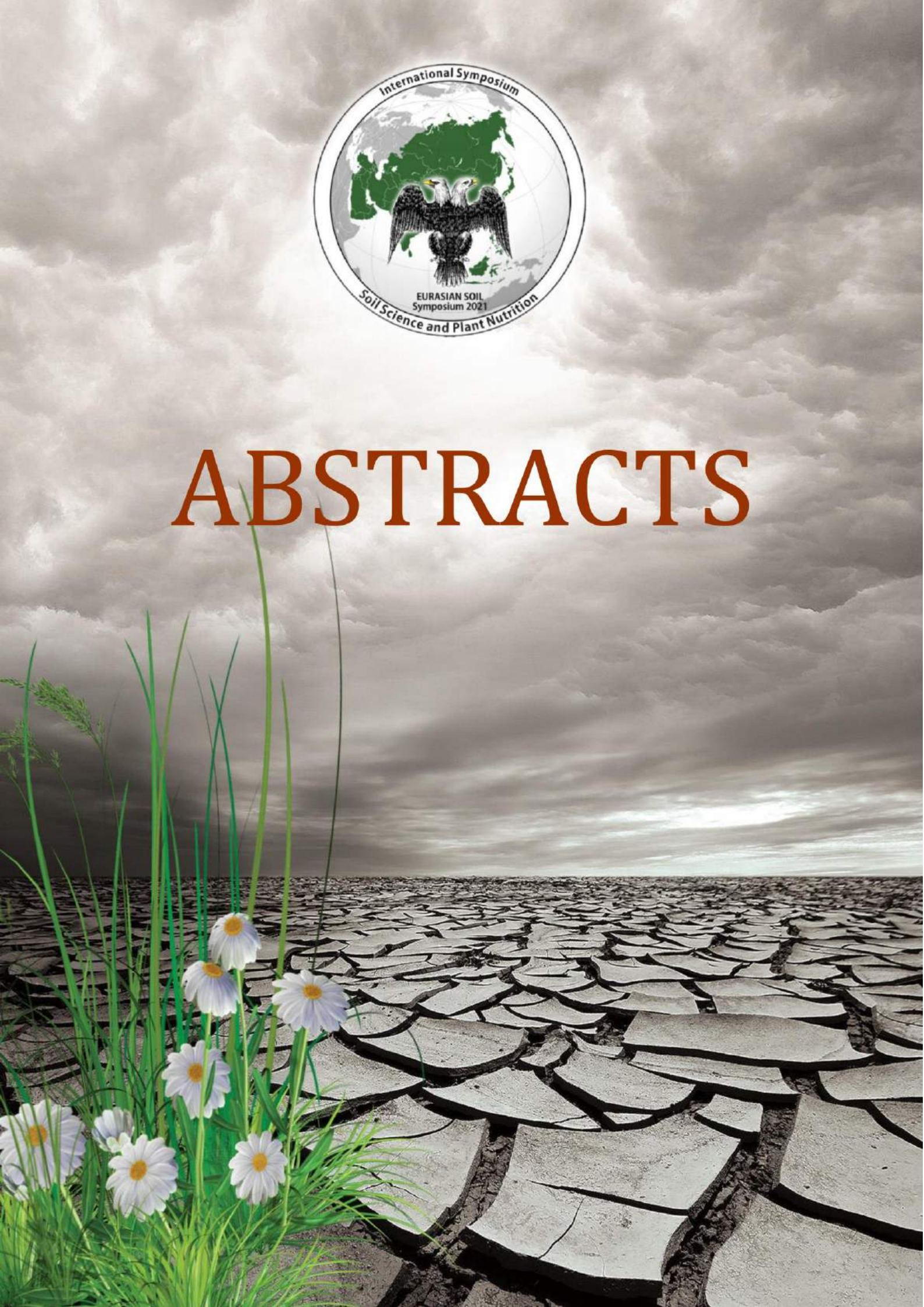
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# ABSTRACTS

International Symposium on "Soil Science and Plant Nutrition"
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# Subtropical Mountainous soil diversity in southern Mexico

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## ABSTRACT

In the subtropical mountainous landscapes of Sierra Madre del Sur (Oaxaca, southern Mexico) coexist three major land uses: coffee agroforestry, maize yields, and forest conservation. Furthermore, the land use management is under control of well-organized local communities. In this way, for sustainable land uses it is necessary the knowledge of soils and their distribution, as well as democratize this information with the local stakeholders as a tool for soil conservation. In the Sierra Madre del Sur – Oaxaca, a complex topography and a high lithological diversity drive continuously soilscape transformations and increase soil diversity. Specifically, the Sierra is constituted by gneiss, squist, granite, limestone, and sandstones. In the plains there are Quaternary non-consolidate sediments as well. Firstly, a rapid assessment in the field were used. The Conditional Latin Hypercube helped in the selection of soil sample sites, using climate and terrain as variables. Out of 40 planned sites, 36 were reached, drilled, and described according to vegetation cover, pH, color, and texture. The main landscapes are narrow V-shape valleys, steep mountains, and hills. Secondly, 12 soil profiles were described. Each profile was classified according to WRB (2015). Seven soils were classified as Phaeozems, the other ones as Arenosol, Cambisol, Leptosol, Luvisol, and Umbrisol. The Colluvic and Stagnic qualifiers were added to most profiles, except in Arenosols. The continuous reactivation of the pedogenic clock –due to transport and deposition of materials– is the main phenomenon of soil genesis. Furthermore, Mollic horizon is associated with litter accumulation in semi-preserved forest, aspect of great importance for environmental functions and coffee agroforestry production. The main conclusion is that stoniness, depth, and stagnic properties could limit the management of the soil diversity. And so on, soils should be evaluated according to these three properties and their land use.

**Key words**: Phaeozems, soil diversity, southern Mexico, stakeholders

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# Soiling Young People: Development of soils-related educational projects to the youth in Latin America

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## ABSTRACT

Since the 2000s, the Latin American soil community has worked on building strategies for sensitizing current and future generations about the soil environmental role through soil education. Furthermore, the International Union of Soil Sciences (IUSS) has opted for generating new educational schemes to bring young people closer to soil science. In this way, events such as the International Soil Judging Contest have begun to materialize this desire since 2014. In Latin America, this effort has bloomed since 2015 in Brazil and 2019 in Spain. The Mexican Soil Judging Contest has been held four times: Texcoco (2018), Aguascalientes (2019), and Mexico City (online, 2020 and 2021). Nevertheless, the COVID-19 worldwide condition urged an imbrication of the Contest, in which it was necessary to transform it into a virtual version for the 2020 and 2021 editions. Additionally, the virtual interactions opened new horizons for the development of the International Soil Judging Workshop (2020 and 2021), the Ibero-American Workshop on Palepedology and Geoarchaeology (2021), and Edafografías (infographics on soil science topics, since 2020). These activities have impacted more than 20 countries, including Latin America, Europe, and the Middle East. Proyecto Suelox, a cooperative project for soil science dissemination in Spanish, has been the principal platform for sharing these contents. Suelox looks for an integrative assessment between marketing campaigns and soil education on social media. Currently, Suelox is developing the "Suelófono: the first podcast of soil science in Spanish", with the support of the IUSS and the National Autonomous University of Mexico. The main objective of Suelox is democratizing knowledge about soils with youth and linking young soil scientists with internationally recognized researchers. The idea emerged from the Youth Action Commission of the Mexican Soil Science Society as a flexible platform. Finally, Suelox invited the National and Regional Soil Science Societies to build and protect atmospheres for young soil scientists and promote this discipline with the next generations.

**Key words**: Soil education, Latin America, Proyecto Suelox, Soil Judging Contest

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# Relationship between soil quality and soil organic carbon

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## ABSTRACT

Soil is one of the main dynamic natural resources which is a non-renewable and are essential for all living creatures for life. To know and follow soil quality of such important natural resource is essential. In addition to that, one of the most important issues nowadays is reduction soil organic carbon which has a vital role for soil quality and terrestrial ecosystem in general. For this reason, it is very important to research on soil organic carbon and its effect for soil quality. This review article will introduce key information about soil quality, soil organic carbon and their relationship.

**Key words**: Soil, soil quality, soil organic carbon, soil organic carbon sequestration

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# Artificial intelligence and remote sensing as a tool for sustainable agricultural: A review

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## ABSTRACT

Artificial Intelligence (AI) and Remote Sensing (RS) applications have become a point of interest in agricultural researches. The current RS research trend on agriculture changed its focus from the land-use/land-cover classifications to evaluating biophysical properties. The advances in spatial and temporal resolutions of sensors, the introduction of UAVs, cloud computing, and machine learning algorithms have caused an exponential growth in the number of scientific reports about the application of RS in agriculture. This study reviewed the current and potential applications of RS and AI in agriculture. Several studies revealed that RS has vital applications to assess and monitor agricultural activities using the spectral response of plants and soils within the visible and Near-Infrared (NIR) spectral regions. The vegetation indices (such as RVI, NDVI, NDWI, PRI) developed based on the difference in spectral responses have been validated to evaluate the soil and crop conditions. According to the review, RS has been successfully used to estimate the nutrient and soil moisture conditions, enabling valuable farm-based nutrient and soil moisture management. The presence of plant pathogens and weeds can also be detected using RS. Despite its potential, the RS application for precision farming is still limited due to several factors. Moreover, AI is an emerging technology that brought a novel revolution in the agriculture industry. AI has various applications in agriculture: weather forecasting, monitoring soil and crop condition, detecting weed and pests, precision farming, automation, and robotics. AI helps producers automate their agriculture and shift to precision farming, promoting maximized output and enhanced quality with low agricultural inputs. In summary, the reviewed reports revealed that RS, along with AI, is redefining the conventional farm model, and their future is increasingly evolving.

**Key words**: Artificial intelligence; crop; precision farming; remote sensing; soil

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# Variability of crust formation under various land use and land cover

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## ABSTRACT

It is one of the indispensable elements in the transportation and industry sectors, as well as the use of soil, agriculture, forest and pasture. With direct or indirect human influence, million tons of soils are destroyed every year, affecting life negatively. Erosion plays an important role in disasters. The soil, which is lost as a result of erosion and transport of its upper layer by the effect of precipitation or wind, also loses its productivity functions. Soil's resistance to abrasion is closely related to its physical and chemical properties as well as to vegetation. This study was carried out in Tekkeköy district of Samsun province, which is located in the Central Black Sea Region. The study covers about 22563 km2, where has been intensively used as agriculture, forest and pasture. Total 328 soil samples were taken from the surface (0-20 cm) at agricultural, forest and pasture lands. After taking laboratory results and field observations, it was produced crust formation map and evaluated relationship between soil crust formation and land cover-land use. Finally, in this study, it was observed that there was no physical deterioration due to the high soil crust formation in 10.98% of the soils, and very severe physical deterioration was observed in 55.79% of them.

**Key words**: Soil crust formation, Land use, Land cover, Tekkeköy district

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# Greenhouse gas emissions intensity of Kazakhstan croplands

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## ABSTRACT

Land resources are already under increasing pressure from anthropogenic impacts exacerbated by climate change. At the same time, keeping global warming well below 2°C can only be achieved by reducing greenhouse gas emissions in all sectors, including land use and the food sector. According to the report of the Intergovernmental Panel on Climate Change (IPCC), it is said that with global warming of 2°C, extreme heat indicators will more often reach critical tolerance thresholds for agriculture and health. The global community's efforts to mitigate climate change are mainly focused on reducing carbon dioxide ($CO_2$) emissions. At the same time, methane ($CH_4$), nitrous oxide ($N_2O$) and other greenhouse gases (non- $CO_2$) emitted during crop and livestock activities also contribute to global warming. Direct and indirect agricultural emissions associated with land use are accounted for in the agriculture, forestry and other land uses (AFOLU) sectors. Collectively, emissions from the AFOLU sector include greenhouse gases produced by agriculture (non- $CO_2$), net $CO_2$ emissions from soils used in agriculture, and net $CO_2$ emissions from deforestation and other land uses (AFOLU). Emissions from the AFOLU sector are increasing as a result of expanding farmland, increasing livestock and increasing soil and fertilizer use. Livestock and especially ruminants are the largest source of direct emissions and the main cause of land-use change. Synthetic fertilizers also contribute greatly to direct emissions from agriculture. Is it possible for agriculture to adapt to climate change? Is it possible to reduce greenhouse gas emissions from the arable agriculture sector without threatening food security and economic development? Such questions inevitably arise when discussing trends in the development of agriculture in the region. In search of answers, we began our research on the study and assessment of greenhouse gas emissions ($CO_2$, $CH_4$ and $N_2O$) and albedo in the arable light brown soils of Kazakhstan in the Almaty region when using fertilizers and applying various types of basic tillage for different crops (corn, soybeans and winter wheat). This study began in 2021 in April and will be conducted until the end of December 2023. The research work is carried out with the support of the grant of the State Financial Service of the Ministry of Education and Science of the Republic of Kazakhstan IRN AP09057853-KC-21. Based on the results of the research, the best version of the scheme of treatment with non-root fertilizers technology will be selected, where all indicators were positive for production using nano-technological methods for the production of foliar green fertilizers at a mini-plant for local increase in the productivity of the agricultural population.

**Key words**: Carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), greenhouse gase emission, cropland, soil, climate change mitigation

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# Investigation of agricultural use potential of liquid fermented products from biogas plants

**Ayten NAMLI, Muhittin Onur AKCA *, Hanife AKCA**

Ankara University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Ankara, Turkey

## ABSTRACT

Although the disposal of organic wastes that threaten environmental health has been achieved as a result of biogas production, especially liquid fermentation waste (LFW), which is formed as a result of the process, emerges as a new problem that should be solved. In this study, a 2-month greenhouse experiment was conducted to demonstrate the usability of biogas power plant LFWs in agricultural areas, and wheat plant was used as a test plant. In the greenhouse experiment, LFW samples were taken from 16 biogas power plants in operation in Turkey and soil samples representing the region where these power plants are located and pathogen tests and content analyzes were carried out before and after pasteurization (70°C). In the greenhouse experiment, LFWs were applied after pasteurization at different doses (0, 1, 2, 5 ton/da), in addition to the control groups with chemical fertilizer and without any LFW or fertilizer. Most of the liquid wastes included in the experiment increased the EC values of the experiment soils compared to the control soils but did not change the salt class. The effect of LFW applications on the infiltration rate was variable. All biogas LFWs increased the organic matter content of the soil and the macro and micro element (Fe, Cu, Zn, Mn) contents of the soil and wheat plant, depending on the increasing application dose. Each liquid waste has a different effect in terms of heavy metal concentration, but in general, their amounts in the soil and plant increase with increasing application dose. The effects of LFW applications on total biological activity ($CO_2$ output), potential microbial activity (Microbial biomass-SIR (substrate induced respiration)) and catalase enzyme activity of the soil differed. All LFW applications increased the Fe, Cu, Zn, and Mn content of plants depending on the increasing application dose, and there was no statistically significant effect on the heavy metal contents. Applications of 16 LFWs at 2 and 5 ton/ha increased the fresh and dry weights of wheat plants compared to the control ($P<0.05$), while the increase in 1 ton/ha applications was not statistically significant. Considering the results of the greenhouse experiment and the relationship of all parameters with each other, it is deemed appropriate to initiate field experiments for the 16 biogas enterprises included in the study and to allow a 1 ton/da/year temporary application dose until these studies are concluded.

**Key words**: Biogas, liquid fermented waste, soil, wheat

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# Combination of fuzzy-AHP and neutrosophic-set and their applications for the multiple-criteria decision analyses

**Nursaç Serda KAYA *, Orhan DENGİZ**

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## ABSTRACT

Many decisions in real life practices needs taken dissimilar criteria into consideration at the same time. Multiple-Criteria Decision Analysis (MCDA) are applied to find a way for the undecided conditions. Further, it's difficult to decide in vague and uncertain conditions with the use of crisp rationality. Therefore, integrated with fuzzy logic, MCDA approaches are mostly used methods. Of late years, new hybrid fuzzy sets have been advanced. Assessing land and soil quality studies, traditional methods are extremely hard owing to necessities such as time, cost and too much workload. Today, with the present techniques like MCDA methods to making rational analysis and assessments can be overcame. MCDA method can be mostly suited to evaluate geographical variations that consist of on a local scale together in the production of erosion risk maps. In this paper, "Neutrosophic Fuzzy Analytical Hierarchy Process" (NF-AHP) which is one of the new hybrid approaches of MCDA methods is presented. NF-AHP is the integration of fuzzy set and neutrosophic set together. Neutrosophic set is better choice comparing the fuzzy sets where indeterminacy conditions are existed.

**Key words**: Fuzzy-AHP, Multi-Criteria Decision Analysis, Neutrosophic Fuzzy Analytical Hierarchy Process, Neutrosophic set

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# Soil properties have more significant effects on the community composition of protists than the rhizosphere effect of rice plants in alkaline paddy field soils

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## ABSTRACT

Protists play important functional roles for soil fertility and agricultural productivity. However, their community composition is poorly understood especially in alkaline paddy fields. Here we focused on the characterisation of alkaline paddy field soils with a particular emphasis on the effects of physicochemical properties of the soils and the rhizosphere effect of rice. Several alkaline paddy fields were selected across three regions that differed in their soil physical and chemical properties along the Kizilirmak River, Turkey, as a model ecosystem. The soils were incubated under submerged conditions with and without rice plants (*Oryza sativa* L.) to understand the rhizosphere effect on protist community composition. The protist communities were analysed with a high throughput sequencing method. The results indicated that Amoebozoa (29.5%) were the most abundant taxonomic group of protists in the paddy fields, followed by Stramenopiles (23.7%), Rhizaria (19.5%), and Alveolata (12.6%). Among the functional groups, consumers were the most dominant protist group (67.7%), followed by autotrophs (21.0%) and pathogens (9.2%). Our results revealed that the soil properties had more significant effects driving the community composition of protists than the rhizosphere effect of rice in the paddy field soils. Among the soil properties, pH, exchangeable Na and Ca, EC, and lime were significantly correlated with the shift in the protist community composition. The rhizosphere effect of rice mainly influenced phagotrophs and plant pathogens, especially *Pythium* sp. A significant negative correlation was observed in the relative abundances between phagotrophic protists and plant pathogens, which indicates that the plant pathogens could be top-down controlled by the phagotrophs. The aim of the participation to the International Symposium on "Soil Science and Plant Nutrition" (EURASIAN SOIL Symposium 2021) was to enhance the widespread impact of this research published in the journal of Soil Biology and Biochemistry, (Volume 161, October 2021, 108397).

**Key words**: Alkaline soil, paddy field, pathogens, phagotrophs, protists, rhizosphere effect

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# The role of activated bentonite in the removed of iron toxicity in rice growing in sand culture media

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## ABSTRACT

In this study, the effect of activated bentonite on the removal of iron (Fe) toxicity in rice plant grown in sand culture and the uptake of some micro elements (Fe, Mn, Zn and Cu) in the plant were investigated. For this purpose, increasing doses of bentonite (0, 1, 2.5, 5, 7.5, 10 and 15%) activated with $Na_2CO_3$ with a dose of 250 ppm Fe (in the form of $FeSO_4{\cdot}7H_2O$) were applied to the pure quartz sand medium, and rice plant (*Oryza sativa* L. cv. Kızılırmak) were grown in this medium in greenhouse. The trial was carried out according to the complete random block trial design with 3 replications for 70 days. According to the analysis of variance results, activated bentonite (AB) applied at increasing doses significantly increased the dry weight and Cu uptake of rice ($p<0.01$), and significantly increased the Zn uptake ($p<0.05$). However, it significantly ($p<0.01$) decreased Fe and Mn uptake. While the highest rice dry weight (1.70 g/pot) and Zn (0.070 mg/pot) and Cu (0.051 mg/pot) uptakes were obtained at the AB10 dose, the highest Fe (7.06 mg/pot) and Mn (1.33 mg/pot) uptakes were obtained at the control dose. At the end of the study, it was found that the application of activated bentonite to the toxic Fe level in the sand culture significantly decreased the Fe and Mn uptake of the rice plant at the AB7.5 dose, and increased the rice dry weight at the AB5 dose. It was found that zinc uptake increased statistically significantly at AB2.5 and Cu uptake at AB5 dose. As a result, AB5 dose was suggested to increase dry weight by removing $Fe^{+2}$ toxicity in water-saturated reducing soil conditions of rice plant.

**Key words**: Rice, Sand media, Iron toxicity, Activated bentonite

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# Evaluating Splintex 2.0 for estimating the soil hydraulic properties in the western Mediterranean Region

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## ABSTRACT

Soil hydraulic properties are very important for the soil-plant-water relationship. Soil water retention curve (SWRC) is a property that is difficult to measure. For this reason, the use of pedotransfer functions (PTFs) in the estimation of moisture constants is quite common. One of the most widely used equations to describe soil hydraulic properties was developed by van Genuchten (1980). Splintex 2.0 is a physically-based computer model developed to estimate the parameters that comprise the van Genuchten's (1980) equations. Splintex 2.0 uses particle size distribution, bulk density, particle density, and optionally one or two points of the SWRC to predict the parameters of SWRC and unsaturated hydraulic conductivity by two simulation options (Simulations A and B). In this study, some soil moisture constant estimation was evaluated using the Splintex 2.0 model in the Western Mediterranean region. In the evaluation made with simulation A and simulation B, the RMSE values obtained in the estimation of the moisture content of the soils at 10 kPa matric suction were respectively 0.056 and 0.097 $cm^3$ $cm^{-3}$. The highest error rate was found at 33 kPa matrix suction moisture content. The RMSE values found at 1500 kPa matric suction were respectively 0.052 and 0.118 $cm^3$ $cm^{-3}$. As a result of the study, the error rate of the moisture constants was lower with Simulation A. It is suggested that the Splintex program can be successfully used for this region.

**Key words**: Moisture constant, pedotransfer function, soil hydraulic properties, van Genuchten

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# Microbial predators regulate plant root microbiome

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## ABSTRACT

The plant-microbe interactions mainly occur in rhizosphere: a narrow zone of soil surrounding roots of living plants. Plant roots deposit chemicals, making the rhizosphere a nutrient-rich habitat for bacteria, which increases bacterial population and diversity in the rhizosphere. Since bacteria are the primary food source of microbial predators, the bacteria-rich rhizosphere attracts the predators creating everlasting prey-predator dynamics. The majority of the plant microbiome (the endophytes) originate from the rhizosphere soil, in which bacterial community composition is altered by microbial predators. However, we lack an understanding of how trophic interaction between microbial predators (protists) and bacteria in the rhizosphere affects endophytic communities. In this study, we hypothesised that protist predation upon bacteria in the rhizosphere would affect endophytic bacterial colonisation and community composition associated with the roots of three rice varieties. Effect of trophic interactions was studied in vitro using an indigenous soil bacterial community in the presence and absence of protists. The bacterial community composition was examined with a high throughput sequencing method (Illumina MiSeq), and their abundance and functionality were examined with culture-dependent and -independent molecular techniques. Here we provided the first line evidence of that the microbial predators significantly altered endophytic community composition and enhanced their population in all plant varieties. Protist regulation on rhizobacterial communities showed consistent patterns with the shifts in the corresponding endophytic communities, which confirmed our hypothesis: the shifts in the endophytic community composition were reflected from the protist predation upon rhizobacteria. We observed plant variety-specific effects of protists on the rhizospheric and endophytic bacterial community compositions. The presence of protists enhanced the rice plant growth, total nitrogen content, and endophytic bacterial genes involved in nitrogen fixation. In conclusion, our results provide a novel insight into underground plant-microbe interactions, where predators control endophytic bacterial communities.

**Key words**: Endophytes, protists, rhizosphere, root community, top-down control, trophic interactions.

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# Soil management assessment framework (SMAF) in assessment soil quality

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## ABSTRACT

Made in order to achieve maximum efficiency from the unit area in agriculture; unsustainable agricultural practices and the problems brought about by the rapid growth of the population; it irreversibly loses its properties, causing the loss of workable agricultural areas. In recent years, scientists who have realized this danger have done many studies in order to understand and protect the soils and have put forward the concepts of soil health and quality. Many scientists from the past to the present have offered different opinions about soil quality and developed different methods to determine this quality and to monitor their differences over the years. The aim of this paper is to introduce SMAF model for soil quality approach.

**Key words**: Soil quality, soil quality methods, SMAF, soil management.

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# The relationships between tobacco quality and yield with engineering properties of Akhisar region soils of Turkey

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## ABSTRACT

The research was carried out in Akhisar environs where tobacco is very popular. Ten fields were selected in 5 different villages which are known to show differences in terms the quality and yield. In this study some basic soil properties and engineering properties of soils were examined and the relationships between tobacco quality and yield and some engineering properties of soil were determined. The positive relationships were found between wilting point of soil and total reducing sugar as statisticaly significant. Negative relationships between reducing sugar and yield with bulk density were also determined, but it was not statisticaly significant.It was found that there were positive correlations between raw ash and total reducing sugar of tobacco and plastic and liquid limit as soil engineering properties. It is recommended that low raw ash and high sugar content are required for tobacco quality.With this content, for the quality of tobacco, it can be recomended that soils for tobacco production should have high liquid limit and plastic limit values. Further studies should be done in several years for having more relationships between tobacco quality and yield with engineering properties of soil.

**Key words**: Tobacco, soil properties, quality, yield, Akhisar.

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# Phyto extraction of nickel using nickel hyperaccumulator in serpentine soils of Bulgaria

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## ABSTRACT

Ultramafic (serpentine) soils, developed upon ultramafic rocks, are widely distributed in different parts of the world. These soils contain high concentrations of Mg and Fe, and also relatively high amounts of Ni, Cr and Co. Serpentine soils, which contain relatively high concentrations of nickel and some other metals, are the preferred substrate for some plants, especially those that accumulate Ni in their tissues. Hyperaccumulation is a mechanism that is believed to allow plant to servive on serpentine soils. The Ni hyperaccumulator Alyssum murale is widely present in ultramafic region and can accumulate upto 1-3% Ni in biomass. Phytoextraction employs metal hyperaccumulator plant species to transport high quantities metal from soil into the harvestable parts of roots and aboveground shoots. Suitable plant species for phytoextraction must meet the following criteria: (1) High biomass yield and (2) High Ni (>1%) in aboveground biomass. The need to manage the Ni polluted soils necessitates the study of the behaviour of hyperaccumulator plant in pot and field conditions. Effective phytoextraction requires both plant genetic ability and the development of optimal agronomic management practices. It has been well documented that modifying soil fertility may affect the efficiency of phytoextraction of heavy metals such as Ni, Zn, Co, Cd with a single crop. In case of phytoextraction, the use of native flora (including local populations of hyperaccumulators) with limited agronomic practices (extensive phytoextraction) could be an alternative to intensively managed crops provided that Ni bio-availability in soils is high and that hyperaccumulator cover is reasonably efficient. However, there is an evident need for amendment and phytoextraction yield improvement to achieve sufficient Ni extraction. Such extensive practices of phytoextraction could be more easily implemented in country such as Bulgaria (small area, limited investment capacity of farmers).

**Key words**: Alyssum murale, hyperaccumulator, nickel, phytoextraction, serpentine soils.

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# The selection of rice genotypes (oryza sativa l.) resistant to zinc deficiency in the sand culture media

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## ABSTRACT

The aim of the study was to determine the paddy varieties (Oryza sativa L.) resistant to Zn deficiency with principal component analysis (PCA). In the study was used eleven characteries that was the stalk dry weight (SDW), stalk relative dry weight (SRDW), stalk Zn content (SZn), stalk relative Zn (SRZn), stalk removed Zn (SRmZn) and stalk relative removed Zn (SRRmZN), leaf chlorophyll value (SPAD) and leaf relative chlorophyll values (RSPAD), and NPK contents of paddy genotypes. The experiment was carried out in pure sand culture medium nutrient solution under greenhouse conditions in randomized factorial plots design with three replications by applying 2 Zn doses (0 and 5 ppm) to 6 paddy genotypes that are Terme incisi (G1), Rekor (G2), Efe (G3), Kızılırmak (G4), Karadeniz (G5) and Romeo (G6). In the study, it was determined that G5 genotype was good cultivars in terms of biological indexes (SDW, SZn, SRZn and SRmZn) under Zn deficiency conditions, while cultivar no 3 was determined to be good cultivars in terms of SRDW and SRRmZn. Similarly, it was determined that cultivar no 1 in terms of SPAD value and G2, G4 and G6 genotypes in terms of RSPAD value were good cultivars. It was determined that G5 and G2 genotypes were better in terms of P and K contents, and G6 genotype in terms of N content. On the other hand, it was determined that G5 genotype was the best cultivar in terms of SDW, SZn, SRmZn leaf chlorophyll SPAD value under the zinc sufficient environmental conditions. As a result, it was determined that Romeo G5 genotype was the most resistant to Zn deficiency in terms of biological indexes, followed by G3 genotype while the most sensitive cultivars were G1, G2, G4 and G6 genotypes outside the group.

**Key words**: Paddy genotyp, dry weight, zinc content, zinc deficiency tolerance, PCA

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# Impact of soil-applied biochar and foliar application of ZnO NPs on plant growth in PAHs contaminated soils

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## ABSTRACT

Polycyclic aromatic hydrocarbons (PAHs) are a resilient class of pollutants, their accumulation on soil surface/sediment caused carcinogenic and mutagenic effects to all living organisms, thereby being considered a global environmental problem. Biochar has shown promising results for PAHs soil amendment, whether through their high adsorptive reactive surface or enhancement of the bacterial degradation to PAHs. As for ZnO nanoparticles, they worked on improving the physiological and biochemical parameters of the plants. Previous studies on ZnO nanoparticles application to plants under biotic or abiotic stress showed high concentrations of antioxidant enzymes synthesis in plants, especially malondialdehyde, superoxide dismutase, Catalase, and peroxidase. ZnO nanoparticles foliar application proved higher Zn concentrations in shoots and roots, in comparison with direct to the soil. For the first time, the action of biochar and zinc oxide nanoparticles (ZnO NPs) foliar application on plants grown in polyaromatic hydrocarbons (PAHs) are assessed both separately and combined. In the study, we expect that the use of biochar and ZnO nanoparticles on plants grown in PAHs contaminated soil will provide an insight into their interactive effect on PAHs in soil and their uptake by plants.

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**Key words**: Biochar, foliar application, polyaromatic hydrocarbons (PAHs), plants, ZnO nanoparticles

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# Effect of organic manures application on soil physicochemical properties of coarse-textured ultisol and okra productivity in Nsukka Southeastern Nigeria

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## ABSTRACT

The greenhouse and field studies were carried out to assess the effect of different rates of poultry manure (PM), pig slurry (PS) and the recommended NPK fertilizer on some soil physicochemical properties and okra yield of coarse-textured Ultisols in Nsukka, southeastern Nigeria. The PM and PS were applied at three different rates (10, 20 and 40 t $ha^{-1}$) as well as no amendment as control and the recommended NPK fertilizer (300 kg/ha) and replicated five times. Soil and agronomic data collected were analyzed for variance (ANOVA) using Genstat 4.0. The PM and PS significantly (p less than 0.05) improved soil pH, soil organic matter, available phosphorous, total nitrogen, aggregate stability, mean weight diameter, bulk density, porosity and saturated hydraulic conductivity in greenhouse and field studies. Significant improvement in CEC was obtained in the field study. The PM and PS significantly (p less than 0.05) improved agronomic parameters e.g. plant height, number of leaves, biomass weight and yield of okra than the control. Poultry manure showed its superiority over other amendments in improving soil and agronomic properties. The study recommended 20 t ha-1 of PM and 40 t ha-1 of PS for sustainable soil and optimum productivity of okra in Nsukka, southeastern Nigeria.

**Key words**: Agronomy, organic manure, productivity

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# Evaluation of indegenous rock phosphate deposits in Turkey in terms of chicken ration: A review

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## ABSTRACT

There are approximately 70,500,000 tons of raw phosphate rock deposits in the Southeastern part of Anatolia that could be used primarily in phosphorus fertilizer production. However, these rock phosphate deposits can also be used in chicken ration. Annual poultry meat production reached over than two million tons in Turkey in recent years. So, supplementing of mineral phosphate need of broiler ration from local sources is very important. The most important obstacle in using raw rock phosphate in chick feed is that it contains high amounts of fluoride which is toxic. It has been known for last decades that direct use of Mazıdağı raw rock phosphate in broiler feed affect performance adversely due to the high fluoride content (3%) of raw rock phosphate. However there are also some studies indicating that local rock phosphate could be evaluated as an broiler feed under given conditions. A study was carried on the possibility of using Mazıdağı raw rock phosphate (fluoride≈3.1%), super phosphate (fluoride≈3%) and bone meal (fluoride≈0.14%) as supplemental phosphorus sources in broiler rations. This study revealed that the three phosphorus sources can be used efficiently in broiler rations to furnish all supplemental phosphorus for till 0- 4 weeks of growing period. It was concluded in another study that Mazıdağı raw rock phosphate can be used as calcium and phosphorus sources in broiler ration, after eliminating fluoride down to ≤ 0.05%. According to research conducted in Pakistan using natural raw rock phosphate, it has been reported that between 25 and 50% of commercial DCP (dicalcium phosphate $CaHPO_4.2H_2O$) can be safely replaced with natural phosphate rock without significantly reducing the growth performance of broiler chickens. Maximum acceptable fluoride level in phosphatic materials is given as 0.2% in the regulation of undesired substances in feed in Turkey. It is suggested that Mazıdağı rock phosphate should be deflorinated down to this level, before using as phosphorus supplement in chicken rations, at the recently privatized EtiBakır Mazıdağı Phosphate Enterprise. In this way, DCP imports can be reduced, contributing to the Turkey's budget

**Key words**: Chicken ration, fluoride, phosphate rock, Turkey

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# Compost and commercial biochar applications may have contrary influences on the low-cost FDR moisture sensor measurements of top-soils: A laboratory experiment

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## ABSTRACT

Soil water content is a fundamental factor in geoecological and agricultural research with many related fields, as it is a key state variable in the soil. Several automated techniques exist for continuous point-scale measurements of soil volumetric water content ($\theta_v$), including the use of Time Domain Reflectometry (TDR) and relatively low-cost Frequency Domain Reflectometry (FDR) sensors. These electromagnetic techniques take advantage of the large difference between the relative dielectric permittivity ($\varepsilon$) of solid soil particles, air, and water to estimate the $\theta_v$. However, not enough attention has been paid to the fact that traditional compost applications and increasing applications of commercial or industrial biochars can lead to changes in the dielectric properties of the liquid phase in the porous system of the top soil. The influence of different sources of soil organic carbon (SOC) on the performance of selected FDR sensors *EC-5* and *5TE* (METER Group, Inc.), was investigated in three conceptual scenarios using different reading devices: in long-term organically amended arable soil as the control (2% SOC), in compost amended soils (4% and 8% SOC), and biochar amended soils (4% and 8% SOC). The electrical conductivity and dry bulk density of soils along with textural properties were also investigated, to distinguish the effect of added organic carbon and its type on the measurements from the possible influences of physicochemical factors. An increase in SOC by the compost application was found to cause an underestimation of $\theta_v$, while biochar applications induced an overestimation. The most significant influences of organic materials were observed in 8% SOC level, while the different levels of $\theta_v$ took a role as an important determinative factor for the mentioned contrasting influences. Furthermore, the *EM-50* datalogger was found to be less susceptible to applications than the *Procheck* and *ECH$_2$O check* handheld readers.

**Key words**: Biochar, compost, frequency domain reflectometry, soil volumetric water content

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# Effect of organic waste and polymer applications on some mechanical parameters of soils

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## ABSTRACT

This study was carried out to determine the effects of wheat straw (WS), hazelnut husk (HH), humic acid (HA) and polyacrylamide (PAM) treatments on some mechanical soil parameters (shrinkage limit (SL) and COLE-clod) in two soils with sandy loam and clayey loam in texture. Soil samples used in the study were taken from two different areas of land (0-20 cm) from Samsun province's Bafra district. WS (0, 2%, 4%), HH (0, 2%, 4%), HA (0, 200 and 1000 ppm) and PAM (0, 30 and 90 ppm) were used in this study that was conducted in a split plots experimental design with three replications. After a five-month incubation period, wheat plants were grown in pots. After the harvest of the wheat plant, analyzes and evaluations were made on some mechanical soil parameters in the soils. According to our evaluation results; organic regulator and polymer applications to the soils mostly increased the shrinkage limit values and of the soils and decreased the COLE-cloud values. The effectiveness of the applications varied according to the soil properties and application doses.

**Key words**: COLE-clod, hazelnut slag, humic acid, PAM, shrinkage limit , wheat straw

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# The use of soybean biomass ash and bacterial inoculums as the treatment in acidic soils to improve soil and barley plant quality

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## ABSTRACT

The purpose of this study was to evaluate the effect of biomass ash from combustion of soybean straw alone or in combination with bacterial inoculums on yield of barley crop, and on soil and plant quality. The greenhouse pot experiment included four treatments and two control soils (control without any amendment - ØØ and control with mineral fertilizer ØØ+CAN, 0.3g CAN/pot). Treatments included soil (3 kg/pot) and biomass ash (30 g/pot) without and with one of three selected bacterial inoculums. Bacterial strains *Streptomyces fulvissimus* CKS7, *Hymenobacter* sp. CKS3 and *Sinorhizobium* (*Ensifer*) *meliloti* 207 were used for three inoculums preparation (CKS7, CKS7+CKS3 and 207). The ash and experimental soil samples, as well as soil and plant samples collected at the stage of crop maturity were tested for: total N, C, S, plant available $P_2O_5$ and $K_2O$ and for the content of potentially toxic and hazardous microelements (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Zn). The results showed that the addition of biomass ash significantly reduced soil acidity and increased content of plant available P and K compared to the controls (in all treatments). Barley yield was almost twice as higher in ash treatment and by 1.56, 1.70 and 1.81 times higher in treatments Ash+CKS7, Ash+CKS7+CKS3 and Ash+207 respectively, compared to control (ØØ). The content of potentially toxic microelements was below the maximum allowed concentrations in the soils and shoots. The use of combinations of ash and bacterial inoculum improved the quality of barley in terms of nitrogen content. This study showed that biomass ash can be used as fertilizer on acidic soils with low nutrient content alone or in combination with applied inoculants and provide an environmentally friendly approach in agriculture to reduce the need for chemical fertilizers and solve the problem of biomass ash disposal.

**Key words**: Biomass ash, bacterial inoculum, soil, barley, nutrient, trace elements.

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# Responses of common bean (Phaseolus Vulgaris L.) to applications of NPSZnB in different combinations in Debub Ari District, Southwestern Ethiopia

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## ABSTRACT

Production and productivity of common bean in Debub Ari District declines mainly due to soil fertility depletion coupled with the use of inappropriate rates of fertilizers. Accordingly, a field experiment was conducted during 2019/2020 to find out the effects of different combinations of NPSZnB fertilizers on yield and yield components of common bean. The experiment consisted of 11 treatments viz. control, NPK (64:46:30 kg $ha^{-1}$), NPKS (42:38:30:7 kg $ha^{-1}$), NPKS (51.5:57:30:10.5 kg $ha^{-1}$), NPKS (61:76:30:14 kg $ha^{-1}$), NPKSB (41.1:36.1:30:6.7:0.71 kg $ha^{-1}$), NPKSB (50.15:54.15:30:10.05:1.07 kg $ha^{-1}$), NPKSB (59.2:72.2:30:13.4:1.42 kg $ha^{-1}$), NPKSBZn (39.9:33.8:30:7.3:0.67:2.23 kg $ha^{-1}$), NPKSBZn (48.35:50.7:30:10.95:1:3.35 kg $ha^{-1}$), and NPKSBZn (56.8:67.6:30:14.6:1.34:4.46 kg $ha^{-1}$) (i.e. in all treatments P is in the form of $P_2O_5$ and K is $K_2O$). Fifty kg $ha^{-1}$ of Muriate of Potash with grade of 0-0-30 was applied at band application in all treatments except the control plot. The experiment was laid out in Randomized Complete Block Design with three replications. Soil samples collected from the experimental field before planting showed sandy loam in texture, slightly acidic in reaction, very low in organic carbon, low in total nitrogen, available P and K and Zn, medium in available B, extractable S, and moderate in CEC. Application of different nutrients significantly ($p < 0.05$) increased most yield and yield parameters of common bean compared to the control plots. The maximum grain yield of 3477.0 kg $ha^{-1}$ and 3397.6 kg $ha^{-1}$ was obtained with rates of 59.2:72.2:30:13.4:1.42 kg $ha^{-1}$ and 50.15:54.15:30:10.05:1.07 kg $ha^{-1}$ of NPKSB application, respectively while the minimum grain yield (1857.9 kg $ha^{-1}$) was obtained from the control. The application of NPKSB with rates of 50.15:54.15:30:10.05:1.07 kg $ha^{-1}$ had maximum and acceptable Marginal rate of return (MRR %) and net benefit. Therefore, NPKSB with rates of 50.15:54.15:30:10.05:1.07 kg $ha^{-1}$) is recommended for common bean production in the study area.

**Key words**: Biomass, Grain Yield, Net Benefit, NPS, NPSB

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# Monitoring of drought severity in Konya closed basin using Standardized Precipitation index and Modis satellite images

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## ABSTRACT

Konya province is one of the important basins for Turkey in terms of its wide plains and agricultural potential. With the effect of climate change, decrease in precipitation and increase in temperature p ut pressure on the production potential of the basin. The monitoring of drought and plant health in t he region with remote sensing techniques is important in terms of due diligence studies and future p rojections. In this study, the changes in the vegetation period (March – August) between 2010 and 20 20 in Konya plain were examined by using Modis satellite images with 250 m spectral resolution the normalized difference of vegetation index (NDVI). In addition, Standardized Precipitation Index (SP), which is widely considered in drought studies, was used. Within the scope of the study, monthly SPI values in the 6-month vegetation period were calculated. The effects of drought on plant health are d iscussed with MODIS NDVI satellite images and SPI drought index. When the data is examined, it can be seen the dry and humid SPI values from time to time, but when we look at the years 2012 and 201 9, extreme dry SPI values emerge. The SPI value of -2.17 in June 2012 indicates extreme drought. Lik ewise, when we examined the SPI value in May 2019, an extreme drought was experienced with -2.7 2. In addition, when we look at the 6-month values in this period, it is clear that a dry period has bee n experienced in general. Moreover, average NDVI values for the same period also give us a relativel y below average result with an average of 0.25 and 0.32 in 2012 and 2019. As a result, although a go od relationship was not demonstrated when comparing the average NDVI and monthly SPI drought i ndex with each other, important inferences can be made in the interpretation of plant health in extre me dry and humid periods.

**Key words**: Drought, modis, remote sensing, standardized precipitation index

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# Total zinc contents of composted and vermicomposted olive pomace waste with manure

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## ABSTRACT

Pomace, olive solid waste, obtained after olive oil production and should not be applied directly to th e soil due to having environmental problems. Composting is one of the methods used for the recover y of agricultural wastes for many years, and many studies have been conducted out on vermicompos ting recently. In this study, organic matter, ash, C/N ratio and total Zn contents of composted and ver micomposted materials obtained from the mixture of pomace with farmyard manure at different rati os were compared. Pomace was mixed with farmyard manure on a dry weight basis of 0%, 25%, 50 % and 75% rates. These mixtures were composted and vermicomposted using Eisenia fetida worm s pecies for eight weeks. The organic C contents varied between 43.43% and 50.66% in compost and 2 2.70% and 35.36% in vermicompost. The total N values varied between 1.32% and 1.73% in the com post material and between 1.49% and 1.95% in the vermicompost. While the C/N ratios of compost materials varied between 27.67 and 38.51, C/N ratios of vermicompost materials varied between 11 .92 and 23.81. While composting and vermicomposting processes slowed down with increasing the r ate of pomace added into manure, the organic matter contents increased and the ash contents decrea sed in the composted and the vermicomposted materials. Therefore, the total Zn contents of the mat erials decreased from 345.56 mg/kg to 117.33 mg/kg in the vermicomposting process and from 317 .5 mg/kg to 186.59 mg/kg in the composting process due to decreasing ash contents. While the high est total Zn content was obtained in vermicompost obtained with farmyard manure, the lowest total Zn content was obtained in the mixture ratio of 75% pomace:25% farmyard manure. The total Zn co ntents of vermicomposted materials with pomace were found to be lower compared to the composte d materials with pomace.

**Key words**: Zinc, olive pomace, manure, C/N ratio

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# Effect of soybean planting and vermicompost application on soil physical properties

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## ABSTRACT

Increasing agricultural productivity of soils is a major task to be achieved if soybean production will be improved. Soil physical properties, which play a crucial role in determining soil suitability and sus tainability, are studied in relation to soybean planting and addition of 2% vermicompost. Greenhous e experiment was carried out using a clay soil with four treatments including soil (S) as a control tre atment, soil+2% vermicompost (SV), soil + planting (SP), and soil+planting+2% vermicompost (SPV) in 10 cm soil depths of cylinders. Physical soil properties bulk density, porosity and saturated hydra ulic conductivity (Ks) were determined after 22 days and 55 days of experiment conducted. Bulk den sity reduced values generally increased from 22 days to 55 days in all treatments while the total por osity and saturated hydraulic conductivity values decreased. The bulk density values in control soil w as almost same (0.99 g/cm3), but the BD values for SP, SV and SPV treatments increased from 22 to 5 5 days as 4.39%, 2.08% and 2.12%, respectively. The total porosity values also decreased in the sam e amount. While the highest Ks value was determined as 1.86 cm/min in SPV treatment at 22 days, t he lowest Ks value was found as 0.23 cm/min in SV treatment at 55 days. The SPV treatments had th e highest Ks value during experiment. The Ks values for S, SP, SV and SPV treatments decreased from 22 to 55 days as 57.3%, 65.5%, 84.9% and 60.2%, respectively. The results showed that soybean pla nting treatment had greater effect on soil measured physical properties than vermicompost alone tr eatment. Addition of vermicompost to soil when planting improves soil permeability in the clay soil.

**Key words**: Soybean, clay soil, vermicompost, soil physical properties

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# An analysis of the responses of different sub-basins with various soil profile in the central rift valley basin in Ethiopia to the impacts of climate change with their water balances, using the SWAT model

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## ABSTRACT

The Central Rift Valley Basin (CRVB) in Ethiopia is a closed basin, where continuous pressure on land and water resources has resulted in over-exploitation of the resources. Climate change together with the impacts of population growth represent a critical challenge which needs to be addressed. This study explores the responses of different sub-basins with various soil profile to the impacts of climate change on the components of the water balance such as runoff (Q), water yield (WY) and evapotranspiration (ET) on the basis of eight different scenarios taking into account a 10% reduction and increase in precipitation, an increase in temperature by 1.5°C and 3.0°C, and their combinations, calculated from the baseline (averaged simulation values from 1984 to 2014). CRVB was divided into three representative sub-basins (Ketar, Meki and Shalla) and the Arc SWAT model was utilized to perform the simulations. The model was calibrated and validated by the SWATCUP-SUFI-2 algorithm using monthly observed flow data from each sub-basin. Although the results of the simulated scenarios show some attributes common to the three sub-basins, the responses to the individual climate scenarios differ. Responses to an increase in temperature showed reductions in Q and WY, while the ET values increased. The highest increase in ET was found to be +8.24% for the scenario combining a 10% increase in precipitation with a 3.0°C increase in temperature in Meki. The increase (reductions) in precipitation showed increases (reductions) in Q and WY with only a small effect on ET (± 2.5% difference). The highest increase in Q (+ 29%) was identified in Shalla for the scenario simulating an increase in precipitation by 10%, and the biggest reduction in WY (-23.5%) was found in Meki for a 10% reduction in precipitation and a 3.0°C increase in temperature. These variabilities are highly associated with soil hydrology profile to generate lateral flow, favor hydraulic conductivity, and to enhance runoff. Based on the results, water management interventions that reflect these water balance sensitivities are proposed.

**Key words**: Climate change, water balance sensitivity, Arc SWAT, soil hydrology profile, climate scenario

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# Composting with microorganisms: to improve available nutrient contents in sustainable soil management

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## ABSTRACT

Achieving zero hunger and food security are considered as two core concerns for a better future, but the enhancement of world population, unplanned urbanization, and multiple climatic pressures have made agriculture practices more challenging. Besides, traditional agronomy systems, injudicious use of chemical fertilizers, and lack of technical expertise have led to soil fertility degradation and increased soil pollution. In this situation, it is indispensable to manage our soil smartly through sustainable and eco-friendly approaches. Beneficial microorganisms can contribute in diverse ways (nitrogen fixation, carbon sequestration, phosphate solubilization, phytohormone, and enzyme production) to soil fertility and crop production improvement. Several types of research on heavy metal and hydrocarbon pollution have shown that some microorganisms are remarkably versatile at catabolizing these recalcitrant compounds. Compost is a big source of microorganisms comprising bacteria, fungus, and actinomycetes, that has the ability to degrade contaminants to innocuous compounds. These microorganisms can also biotransform pollutants into low-toxic substances and hence can lessen pollutant bioavailability. Recently, compost application with selective microorganisms has got much attention to boost the nutrient availability in soil. This review reports on the integrated utilization of compost and microorganisms contributing sustainably to improving soil health by forming positive impacts in both crops and the environment.

**Key words**: Beneficial microorganisms, compost, integrated utilization, nutrient availability, pollution, soil health

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# Different soil management systems and their effects on soil carbon content, aggregate stability and the unsaturated hydraulic conductivity of two different long term experiment fields in Germany

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## ABSTRACT

Long-term field experiments are recommended for the soil management which is an important assumption for sustainable agriculture. Moreover, to extend the soil fertility of various land use systems can be examined on the basis of humus content, aggregate stability and unsaturated water conductivity. This study demonstrates the results from the research area Humboldt-University zu Berlin, Dahlem established in 1923 and Leibniz Centre for Agricultural Landscape Research (ZALF) Müncheberg, established in 1985 from the year 2007. The experimental design for the research areas consists of different tillage depths in sandy soils. The results showed that the higher water stabile aggregates and soil organic carbon were obtained in shallow tillage in Berlin-Dahlem. Corresponding to the relationship between the total carbon content of the soil and the pF functions, there was a tendency towards higher field capacity values at higher soil carbon contents. The effect of shallow tillage in contrast to deep tillage showed in general higher soil water content results. According to the unsaturated hydraulic conductivity (Ku) there were no significant differences observed between each tillage but the van Genuchten function adaption Modell showed always a correlation coefficient above 95 % in these sandy soils. The measured soil water retention curves in different tillage in Dedelow showed irregular scattering, so that it is difficult to show clear effects of these treatments on the water balance of the soil. Differences tend to occur here with slightly higher volume percentages in conventional tillage at a depth of 10-15 cm, where the usable field capacity values compared to the conservative and no-till variants are higher. According to the results, choosing the appropriate tillage method in sandy soils tends to improve the content of soil organic carbon and soil water-stable aggregation which has a positive effect on the soil water holding capacity and therefore a sustainable agriculture.

**Key words**: Aggregate Stability, soil carbon content, soil water storage, unsaturated hydraulic conductivity

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# The effects of different tillage methods and farmyard manure on some physicochemical properties of soils and yield in Aydın, Turkey

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## ABSTRACT

Intensive tillage practices lead to soil degradation so that the essential nutrients and soil water for plants become insufficient. Therefore, there is great benefit in establishing long-term field experiment designs to adapt solutions within each geographical region. For this purpose, a split plot design study was started in 2020 at Aydin Adnan Menderes University Faculty of Agriculture Research and Application Farm lands, Turkey, under the name of 3 different tillage methods (conventional, conservation and no-till), with and without farmyard manure. The aim of this study was to examine some physical and chemical soil properties at 0-15 cm and 15-30 cm soil depths and their effects on plant yield in different tillage managements. According to the first annual results obtained, the pH values vary between 8.5-9.1 in these sandy loam soils. The total salt content of the soils was not found to be at critical level. The $CaCO_3$ % content vary between 3.3 and 6.7 and is in the poor and medium-lime class. The soil organic matter contents changes between 0.9-1.1 % at both depths. The soil penetration measurements using a penetrometer showed values starting with a resistance value of 3.0 MPa to 5.5 MPa beginning at a depth of 20 cm. The highest wheat yield was obtained in the reduced tillage application in both farmyard manure (190 kg da-1) and farmyard manure-free applications (202 kg da-1). The lowest yield values were in conventional tillage, which was around 23 kg $da^{-1}$ more than in the unfertilized variant (153 kg $da^{-1}$ and 176 kg $da^{-1}$). There was no statistical significance between ''with and without manure'' applications but higher yield values were obtained in manure applications generally. The results show that long-term studies should continue to examine the effects of different tillage methods and manure on the soil.

**Key words**: Soil pH, soil penetration resistance, sustainable agriculture, wheat yield

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# Short term dynamics of some soil fertility indices of sandy loam Ultisol amended with varying rates of rice husk biochar

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## ABSTRACT

The generally low fertility status of highly weathered tropical soils offers the opportunity to investigate the potential of biochar as a soil amendment and its mineralisation rate, as it influences nutrients release, the time of peak effects of biochar remains unclear. To this end, the effects of varying rates of rice-husk biochar (RHB) in sandy-loam Ultisols were assessed under different soil-biochar incubation intervals. There were five RHB rates 0, 5, 10, 20 and 40 g per 2-kg potted soil (representing 0, 5, 10, 20 and 40 t $ha^{-1}$, respectively) and their effects were studied simultaneously after 0 (1 day), 2, 4, 8, 12 weeks of incubation (WOI), by batched potting of treatments in the glasshouse. Treatment improved the soil fertility indices at all incubation intervals and highest values were indicated at RHB rates of 20 and 40 t $ha^{-1}$. The RHB increased soil organic carbon, total nitrogen, exchangeable bases and acidity, relative to control by 27.64 – 44.11, 42.86 – 100, 12.9 – 239.58 and 14.29 – 675 %, respectively across all incubation intervals. Relative to increase with increasing incubation intervals; soil pH, cation exchange capacity and base saturation slightly decreased after 8 WOI, with treated soils still showing higher values than control by 8.9 – 29.79, 20.60 – 125.98 and 7.45 – 82.03 % respectively. Available phosphorus decreased with increasing incubation intervals from 1 day (0 WOI) to 12 WOI, but increased with increasing rates by 29.90 – 202.16 %. As an organic amendment, RHB could enhance soil pH and key plant nutrients in coarse-textured tropical soils when applied at 40 t $ha^{-1}$, and these soil fertility restoration effects of RHB are likely to be most pronounced at 8 WOI.

**Key words**: Incubation intervals, organic amendment, rice husk biochar, soil nutrients, ultisol

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# The effect of iron enriched acidified and non-acidified biochars on DTPA extractable iron content of a calcareous soil

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## ABSTRACT

This study was carried out to determine the effects of three different biochar applications (B: original biochar, BFe: iron-enriched biochar and ABFe: acidified+iron-enriched biochar) on some chemical properties of a calcareous soil. The five different application rates (0%, 1%, 2%, 4% and 6% w:w) of biochars were mixed into the soil and incubated for 30 days under laboratory conditions around room temperature (20-24$^0$C). Soil pH increased with increasing the doses of B and BFe treatments and decreased with ABFe treatment. All biochar treatments had significant increments in the soil organic carbon (OC) content. The highest increment in soil OC content was obtained with 6% of B treatment which increased soil OC by 54% over the control. The iron content in soil significantly increased by the all biochar treatments compared to the control. While BFe treatment was more effective at 1% and 2% doses of DTPA extractable iron content in soil, ABFe treatment was more effective at 4% and 6% doses. The highest increments in iron content in soil over the control treatment was determined as 50% by the 4% of ABFe application.

**Key words**: Calcareous soil, iron availability, biochar, acidification, enrichment.

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# Overview of heavy metal contamination in Urban soil and Human Health

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## ABSTRACT

This paper examines heavy metal contamination research, as well as the relationship between urban soil and human health. The results demonstrate that heavy metal (Ni, Cu, Cr, Zn, Pb, Cd) concentrations are higher than their background levels. The level of contamination varies due to pollutants from traffic and industrial regions, as well as unplanned land use schemes. Heavy metal use by ingestion, inhalation, and skin contacts causes both carcinogenic and noncarcinogenic disorders in humans. As a result, adequate urban soil management should be implemented for eco-friendly and sustainable development and consumption.

**Key words**: Cancer and non-cancer risk, heavy metal, policy and management, urban soil.

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# The spacio-temporal dynamics of soil moisture and temperature: A review

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## ABSTRACT

Moisture and temperature influence most of the processes that take place in the soil and also have a great influence on ecosystem functions. Soil moisture content has a direct impact on the hydrogeological cycle, gas exchange with the atmosphere, regulation of the energy available for evaporation and transpiration processes, recharge of subway aquifers, control of surface runoff, availability of water for plants, and distribution of nutrients and pollutants. On the other hand, soil temperature regulates chemical and biological reactions and is directly related to plant nutrition, growth, and development, especially during the germination process. Both moisture and temperature of soil are dynamic parameters in time and space, and their variation is influenced by various factors such as soil and climatic conditions, parent material, land use, relief and pedogenetic processes. Therefore, the characterization and analysis of these parameters on a local/global scale provides the basis for understanding biogeochemical and flow processes, both at the surface and within the soil profile necessary for environmental, and commercial applications in sustainable water resource management and conservation of areas vulnerable to erosion. In consequence, the objective of this review is to provide a theoretical basis for understanding the physical phenomena that mediate soil moisture and temperature dynamics and their role in the provision of ecosystem services.

**Key words**: Ecosystem services, hydro-physical properties, soil water balance, soil water regime.

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# Digital mapping of soil copper contamination: Comparison of Gaussian process regression and random forest models

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## ABSTRACT

Copper (Cu) is a trace element that is important for humans, plants, animals, and micro-organism health. It can be presented in many proteins and enzymes. Soils with low bioavailability of Cu can lead to crop yield losses and symptoms of deficiencies in livestock, especially in intensive farming systems. Digital Soil Mapping (DSM) can be characterized as the development of spatial soil information systems through numerical models inferring the spatial and temporal variations of soil types and soil properties from soil observation and knowledge, as well as related environmental variables. The current study was designed to map and foresee the Cu content by two different data mining techniques: (i) Gaussian Process Regression (GP), and (ii) Random Forest (RF). Collected data (620 observations) from the Tellus project in Northern Ireland were used to develop the models. Some soil characteristics (i.e., pH and Phosphorus), DEM-based topographical attributes, and remotely sensed data (Landsat 8 Satellite Imagery) such as Topographic Wetness Index (TWI), Valley Depth, Band 1, Band 5, and Band 9 were entered as input parameters for prediction and mapping of soil Cu. To evaluate the performance of two various techniques used in this study, statistical indexes including the correlation coefficient (CC) and root mean square error (RMSE) were assessed through 10-fold cross-validation mode. The results of the two models suggested that the RF model with higher CC (0.664) and lower RMSE (11.678 mg/kg) is the best one for the appraisal of soil Cu. This study revealed that machine learning models can be successfully implemented to the rapid prediction and mapping of soil heavy metals using soil properties, topographical attributes, and remotely sensed data. Digital maps may be used to prioritize remediation steps and can be applied to other areas with similar environmental conditions and sources of pollution.

**Key words**: Copper, gaussian process regression, heavy metals, random forest, tellus data.

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# Digital soil mapping of AWC in arable lands: A comparison of different machine learning models

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## ABSTRACT

The available water content (AWC) can be defined as the amount of water retained in the soil resulting from the difference between the field capacity and the permanent wilting point. In semi-arid environments, AWC has large variations in soil due to changing water balances and ongoing changes between water incomes and demand for vegetation type. Digital Soil Mapping (DSM) is a method for the generation of spatial soil information through numerical models which are extracted spatial variations of soil properties from observation and environmental covariates that digitally represent soil formation factors. This study was designed to generate prediction maps for AWC using 3 different machine learning techniques: (i) Multiple Linear Regression (ii) Support Vector Regression (SVR), and (iii) Random Forest. Data collected from the Alluvial plain in Southwest Turkey (91 observations) were used to develop the models. In the estimating and map drawing of AWC, the spectral indices produced from Sentinel 2A images, topographical variables obtained from DEM, and the most recently CORINE land cover classes map were used as input parameters of the models. In the determination of mapping performance of the machine learning techniques for AWC, Lin's concordance correlation coefficient (LCCC) and root mean square error (RMSE) was used for data splitting (70%-30%) and the k-fold cross-validation (n:5, repeated:3) was used. The results of the 3 models showed that the SVR model with higher LCCC (0.19) and lower RMSE (Test set: 2.72; cross-validation: 2.33; %) was the best for AWC prediction. This study revealed that it can be applied by considering the comparative results of machine learning models to quickly predict and mapping of AWC using open-source accessible remotely sensed data. These digital maps can be used practically for monitoring soil water content, prioritizing irrigation schedules, and applied to other areas with similar environmental conditions.

**Key words**: Available water content, digital soil mapping, multiple linear regression, support vector regression, random forest, semi-arid.

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# Research and mapping of the liberated soils of Azerbaijan

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## ABSTRACT

The article describes comparative situation of the soils liberated from occupation. General quality indicators of Karabakh lands were noted. Agroecological features of Karabakh lands and proposals for future use are given. Agro-ecological zoning and ecological assessment were carried out on the basis of geographic information systems. Elevation model, soil maps, assessment and environmental assessment of the Lesser Caucasus have also been developed. In addition to general maps, these maps are compiled for each area.

**Key words**: Bonitet balls, agroecological features, agroecological zoning, ecological assestment, Geographical information, GIS, height model.

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# Effect of PAHs and heavy metal co-contamination on soil microbial communities and their metagenomics studies

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## ABSTRACT

One of the serious challenges the world is facing is environmental pollution and soil is the most critical component of our environment. Soil contamination is a major threat to humanity and it is getting polluted day by day with different anthropogenic sources. Among these notable persistent pollutants are polyaromatic hydrocarbons (PAHs) and heavy metals. These contaminants produce alterations in the metabolic system of microbes, which are considered signals for prevailing contamination in the surrounding ecosystem. Co-existence of PAHs with heavy metals cause to decrease the efficacy of microflora to biodegrade the contaminants. Hence, these chemical mixtures are influencing the whole soil microbial community. Different soil biological properties such as dehydrogenase, urease activity, nitrification, microbial biomass carbon, microbial respiration, metabolic quotient ($qCO_2$), lipase, acid phosphatase and arylsulfatase activity have been observed. Biodiversity indices are good indicators to check the quantity of microbial community and species through different indices such as Shannon-Weaver (H'), evenness index (E) and Simpson's index (D). Recent developments have facilitated researchers to know more about microbial diversity, its composition and structure. New approaches are coming now-a-days and one of the powerful tools is metagenomics, which researchers are using to investigate the soil microbiome. The most common and cheap analysis is 16s rRNA analysis which researchers widely use to explore microbial community and visualize phylum interaction in the presence of co-contamination. Metagenomics studies give an insight into the evolutionary and ecological changes in microorganisms. Different bioinformatics tools are performed on raw data to study biodiversity. This review article includes that how co-contamination is effecting soil community and metagenomic studies are contributing to detect effect in terms of diversity and structure of soil microbiota. Co-contamination decrease some phyla but increase the number of some species which show tolerance under specific heavy metals and degrade PAHs.

**Key words**: Co-contamination, PAHs, heavy metals, soil microbes, microbial community, metagenomics studies

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# The effects of mixing geothermal fluids with irrigation water on strawberry plant

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## ABSTRACT

Region of Aydın is one of the most important agricultural fields because of fertile lands and variety of grown plants. One of the biggest problems of this area is contamination from geothermal plants to irrigation waters and Büyük Menderes river. In this study, it is aimed to investigate the accumulation of geothermal waters which are mixed in certain ratios in the leaves, soil, and fruits of strawberry plants and determine the degree of accumulation. In this context, the study was carried out in the greenhouse in Sultanhisar Atça neighborhood. Rubiygem strawberry, which is one of the most cultivated varieties of farmers in the region, was used as variety. As irrigation water 4 different doses used. (100% well water, 25% geothermal + well water, 50% geothermal + well water, 100% geothermal water).Physical and chemical analyses were performed on soil samples. pH, EC hardness, anions ($CI^-$, $CO_3^-$, $HCO^-$, $SO^{-2}_4$, $NO^-_3$, $N_2O$), cations ($K^+$, $Ca^+$, $Mg^+$, $Na^+$), micro element (Fe, Mn, Zn, Cu and B) and heavy metal (Co, Cr, Ni, Cd, Pb) analyzes are done, P, $K^+$, $Ca^+$, $Mg^+$, $Na^+$, Fe, Mn, Zn, Cu ve B analyses are done on plants and fruits. As a result of the analysis, Ca, Na, B, Co in the soil irrigated with 100% geothermal in the 4th application was found to be the highest values. It was concluded that K, Ca, Na, B, Ni, Cd values increased in parallel with increasing doses and the highest value was in 100% geothermal applied plant.

**Key words**: Geothermal, strawberry, nutrition, toxicity, irrigation, rubiygem

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# Exploring the potential of metal-organic frameworks (MOFs) decorated biochar for the remediation of heavy metal-contaminated media

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## ABSTRACT

Contamination by potentially toxic elements (PTEs) has led to adverse environmental impacts in water and soil. To address this problem, the use of metal-organic frameworks (MOFs) as an emerging class of organic-inorganic hybrid crystalline porous materials has brought a new dimension for remediation purposes of the heavy-metal ions. Among different types of MOFs, this paper focused on iron-based MOFs (Fe-MOFs) due to their high potential, excellent stability, and safe nature. In this context, a general overview of MOFs was presented, along with a deep discussion over the Fe-based MOFs potentials for removing heavy metal ions. Contrary to the well-established usage of the Fe-MOFs in the water, many limitations are awaiting to be addressed to facilitate the usage of the Fe-MOFs in soil practices. Therefore, modifying the Fe-MOFs with biochar was presented as a practical solution. Based on the capacity of biochar as the commonly established soil additive, the corresponding bio-based composite would offer the following advantages: 1) Presenting excellent capacity for immobilizing/adsorbing resulting from a synergistic effect between Fe-MOFs and biochar; 2) Preventing the aggregation of Fe-MOFs in the soil matrix; 3) Increasing long-term stability; 4) Turning the spent additives to bio-fertilizer; 5) Adding the selectivity towards specific types of heavy metal ions, and 6) reducing the overall cost of composite by using the low-cost biochar. Finally, this overview summarized the future directions regarding the fate of the Fe-MOFs in the soil-plant system. Overall, the potential advantages provided by the biochar-Fe-MOFs will open a new direction for research in heavy metal remediation processes.

**Key words**: Biochar, heavy metal ions, metal-organic frameworks, soil remediation

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# The effects of biochar on soil biological properties: A review

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## ABSTRACT

To improve the quality and production of crops, biochar application has been suggested, which is produced by pyrolysis of biomass derived from various sources impacting the physicochemical properties of biochar. It is instituted that biochar affects soil microbial diversity and abundance by improving soil attributes such as water holding capacity, porosity, pH, nutrient cycle etc. Despite the importance of biochar in soil nutrient cycling, little is known about how soil microorganisms respond to biochar inputs. When biochar is added to the soil, it can have many effects on soil: processes, fertility, and the abundance of microbes. However, in contrast to studies suggesting benefits to soil biota many pieces of research highlight biochar's adverse effects as well. This review summarizes the properties of biochar and its interaction with soil microbes both positively and negatively.

**Key words**: Biochar, soil microbes, pyrolysis, nutrient, fertility

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# Organic fertilizers as a source of microelements and potentially toxic elements

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## ABSTRACT

Fertilizers, including those from mineral, synthetic and organic sources, are important and widely used inputs in agriculture helping contribute to global food security, farmer livelihoods and essential human nutrition (FAO, 2019). Input of organic fertilizers to soil is essential agricultural practices due to maintaining and improving the physical, chemical and biological soil properties; and it is source of the essential elements, including microelements, for plant, animal and human nutrition. Microelements are essential for different biochemical and physiological processes in plants; while potentially toxic elements, PTEs (heavy metals and non-metals) represent trace elements, a group of elements that are necessary in small quantities for normal growth and development of plants but if they are present in higher amounts, they can be harmful. The paper outlines concentrations and input of microelements and PTEs to the soil by manure, compost, digestate, industrial organic waste and sewage sludge, in Serbia and other countries. In order to get overview of these materials and assess the potential risk, their concentrations and average annual input by use of 30 t/ha of these materials is shown. The quality of organic fertilizers is very different and depends on the type of material, its characteristics and the way of its management. Generally, the highest concentrations of PTEs are in sewage sludge and in pig manure. It is noticed that digestate contains less Cu than other organic fertilizers. The positive effect of the application of organic fertilizers on the availability of essential elements and improvement of physical, chemical and biological soil properties is well known. However, consequences of improper use of organic materials could be accumulation of PTEs in soil, plants and underground water. In order to avoid environmental contamination by PTEs, the control of organic fertilizer quality is important, as a preventive measure in order to establish sustainable agriculture production.

**Key words**: Organic fertilizers, soil pollution, potentially toxic elements, PTEs, trace elements, heavy metals

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# Effect of water stress related with soil proporties on plant growth

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## ABSTRACT

Stress is an environmental factor that negatively affects the growth and development of plants. The plant takes various plant nutrients from the soil with its roots during the growth and development period, but if there is not enough water in the environment, it becomes difficult for the plant to take the nutrients. Water stress in plants occurs when the amount of water in the soil is low and transpiration is high, and it causes the plant to not be able to fulfill its normal vital functions and to loss of crops. The decrease in water resources due to climate change and the resulting lack of irrigation water negatively affect the development and yield of the plant. However, this may change depending on the type of plant grown and soil characteristics. Soil quality should be increased in order to reduce the negative effects on plant growth due to water stress. Increasing the organic matter content of the soil is one of the most frequently applied methods in improving soil quality. Soil organic matter not only improves the physical and chemical properties of the soil, but also helps to keep the useful water required for the plant in the soil by keeping the water in the soil. In this article, information is given about the effects of organic matter applied to plants grown under water stress conditions on soil quality and yield.

**Key words**: Water stress, soil quality, organic amendments, yield

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# How soil property can be altered with the use of different biodegradable geotextiles? A review

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## ABSTRACT

Geotextiles are thermophilic polymer that is produced from synthetic fibres or biodegradable materials. Geotextiles have been used in different sectors including agriculture and civil engineering. However, in most cases, non-degradable polymers such as polyesters were used for geotextile production. The application of such material can bring soil pollution along with the accumulation of microplastic. Since they are imposing an enormous threat to the environment, the search for green, biodegradable, renewable polymers is of growing interest. Biodegradable geotextile covers a large scope of application in the fields of agriculture and environmental engineering. The geotextile produced from natural fibres can be derived from different sources- Plants, animals, and minerals. Depending on their types, geotextiles have significant effects on the physical and chemical properties of soil. Natural geotextile can be used as an alternative to traditional material in many applications such as crop and livestock protection, erosion control, reinforcement systems on embankments, and so on. Previously they have been used mostly for filtration, separation, permeability, drainage, and stabilization purposes. Not much work has been done to enlighten the application of natural biodegradable geotextiles in soil protection and improve crop productivity. Soil covered with biodegradable textiles is protected from direct exposure to sunlight, wind and raindrop. This paper aims to review the previous studies which investigated the effects of different natural geotextiles on the characteristics of the soil. Additionally, different sources, types, applications, and prospects of geotextile are discussed based on recent data.

**Key words**: Artificial and natural non-woven fabrics, agriculture, erosion, soil nutrients

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# The impact of slope aspect on soil temperature and water content

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## ABSTRACT

Soil is seen as a natural body whose characteristics are defined by the materials from which it was created and the environment in which it has been exposed. Soils are formed through the interaction of five major factors, topography is well known as one of these factors, it has a great impact on microclimatic and meteorological characteristics, which affect soil hydrology and temperature regimes. Soil temperature and moisture play a decisive role in plant communities. Soil temperature depends on the amount of radiation from the sun which reaches the soil surface (insolation). The radiation amount is directly proportional to the soil temperature. yet the general statement can be made that, insolation has more importance than the air temperature. The temperature of the soil is influenced by a number of factors, including meteorological conditions (air temperature and insolation), topography (slope aspect and gradient), and soil water content. Soil moisture is an important component of the earth system, it affects Atmospheric, geomorphic, hydrologic, and biologic processes. Soil moisture is also an essential variable in regional and microclimatic assessments, landscape denudation, runoff generation, and partitioning, mass wasting, and sediment movement due to its dispersive and cohesive properties. The slope aspect is one of the quantitative topographic characteristic factors responsible for the redistribution of water in the landscape, it also has an effect on the pattern and trend of vegetation in mountainous regions. In the northern hemisphere, north-facing slopes receive less direct sunlight (insolation) than south-facing slopes. Sloping lands towards the equator receive a greater amount of solar energy over a longer period of time. Thus, the soil temperature is usually higher on south-facing slopes than on north-facing slopes, and as the temperature of the soil increases the water content decrease so The soil on the north-facing slopes was generally moister than the soil on the south-facing slopes.

**Key words**: Slope aspect, soil moisture, soil temperature, topography.

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# Removal of biogenic elements by corn plants depending on the influence of experimental factors

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## ABSTRACT

For the growth, development and formation of grain corn requires a significant availability of basic nutrients in the soil. Thus, the maximum consumption of nitrogen occurs within 2-3 weeks before the ejection of panicles, phosphorus - in the phase of 4-6 leaves (laying of future inflorescences) and in the phase of grain formation and ripening. Corn plants absorb up to 90% of potassium before the beginning of panicle ejection, and after flowering and in general receipt of this element in a plant stops. The vegetative part of corn plants accumulated 95.8 kg/ha of nitrogen, 29.1 kg / ha of phosphorus, but in grain it was much more - 151.3 kg/ha, 58.4 kg/ha respectively it was investigated. The research results indicates that the vegetative part of corn plants accumulated 197.2 kg/ha of potassium, but in grain it was much less - 41.5 kg/ha. Studies of hybrids of different maturity groups show us that despite the formation of different conditions for the removal of nutrients by a significant accumulation of dry matter by plants per unit area and, accordingly, increases the removal of these elements. Therefore, the determination of the optimal parameters of corn fertilizer systems should be approached carefully, taking into account its biological needs, the availability of nutrients in the soil and the capabilities of different fertilizer systems.

**Key words**: Biogenic elements, corn, fertilizer system, hybrids, plants density, removal.

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# The transition of arbuscular mycorrhizal fungal community composition in plant roots, soil spores, and extraradical hyphal fractions during host growth

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## ABSTRACT

Arbuscular mycorrhizal fungi (AMF) form a symbiotic association with most terrestrial plant roots, elongate hyphae, and form spores in the soil. However, the community composition dynamics in each fraction during host growth have not been revealed. We conducted a small pot experiment to evaluate the transition of AMF community composition in plant roots, soil spores, and extraradical hyphal fractions during host plant growth and to clarify the differences in survival strategies among AMF species. Sand dune regosol from the Niigata University campus forest was used as a source of AMF inoculum, mixed with sterilized soil material (river sand: red cray = 1:1) at a ratio of 1:9. Host roots, soil spores, and extraradical hyphal fractions were collected at 1, 2, 4, and 6 weeks after plantation of white clover, maize, and leek as host plants. DNA was extracted from each fraction, and amplicon sequencing analysis was performed using MiSeq targeting the AMF 18S rRNA gene. The sequences were attributed to operational taxonomic units (OTUs) at 97% sequence similarity. AMF OTUs shared by the three hosts were dominated by Glomeraceae in the root, Gigasporaceae in the hyphal fraction, and Acaulosporaceae and Gigasporaceae in the spore fraction. OTUs, detected in host roots but not in the extraradical hyphal fraction, accounted for 20% of the relative abundance in clover and 45% in maize and leek, indicating parasitic or low contributions to host growth. Comparing the community composition of symbiotic and low contributing OTUs, Gigasporaceae was abundant in symbiotic OTUs, while Glomeraceae was dominant in low contributing OTUs. These results suggest that each AMF species has a different survival strategy in symbiosis with the host and that an increase in AMF diversity in roots does not necessarily lead to an increase in the diversity of hyphal fractions.

**Key words**: Arbuscular mycorrhizal fungi, amplicon sequencing, plant-microbe symbiosis, diversity.

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# Functional evaluation of available up to date pedotransfer functions for estimation of saturated hydraulic conductivity of selected localities in the Czech Republic

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## ABSTRACT

Saturated hydraulic conductivity (Ks), as a fundamental soil property, determines the ease with which pores transmit water within saturated soil profile. It is considered as one of the key parameters in many hydrological simulation models representing the rate of infiltration and surface runoff occurrence. Nowadays, pedotransfer functions (PTF's) are routinely used for its estimation. Large databases of basic soil properties, together with different approaches including high-performance computing are involved to obtain reasonable Ks estimates. The aim of this study was to test the applicability of recently published PTF's based on machine learning approach (Araya and Ghezzehei, 2019) and compare their performance with well-known hierarchical PTF's (ROSETTA by Schaap et al., 2001) for two localities in the Czech Republic (Ruzyně and Strašov), where the predictors and Ks values were measured. Percentage content of clay, silt and sand particles, together with or without information about dry bulk density and organic matter content were used as predictors in both, machine learning approach employing Boosted Regression Trees (BRT) and ROSETTA estimates. The quality of the estimates was determined on the basis of root mean squared error (RMSE) and the correspondence between estimated and measured Ks data was evaluated by the coefficient of determination ($R^2$). The results reflected high Ks variability measured within the study areas; 1–964 cm/day in Strašov and 10– 1261 cm/day in Ruzyně. Relatively high range of RMSE values was observed, especially for high Ks cases caused by the preferential flow which the predictors could not fully comprehend. The best ranking was identified for models using dry bulk density data in addition to the particle size distribution data (BRT for Ruzyně, ROSETTA for Strašov).

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**Key words**: Machine learning approach, pedotransfer functions, ROSETTA, saturated hydraulic conductivity, suitability ranking.

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# Role of metal-based nanomaterials in plant growth

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## ABSTRACT

Food security and sustainable agriculture are major challenges of the current era. As the world population is continuously increasing, and more effort is required to boost agriculture production in a sustainable way to ensure food safety. Heavy metals have shown inhibitory toxic effects on plant growth and their accumulation in edible crops. Scientists have put in a lot of efforts to improve the existing approaches, however, in recent years, nanotechnology has shown promising results to improve food production. A large number of nanoparticles (NPs) were used to enhance plant growth; however, less is explored in stress conditions; especially metal pollution. Thus, in the present experiment, the plants i.e., barley was grown in heavy metal polluted soils. The foliar application ZnO and CuO NPs were applied to the barley. Results showed, the joint application of NPs enhanced plant growth under metal stress, however, less is known on the combined foliar application of these particles. Therefore, in-depth and several experiments are required to conclude that these foliar applications of NPs might be an effective approach to reduce the toxic effects of heavy metals. The results of the present experiment will be the addition of nanotechnological approaches for sustainable agriculture.

**Key words**: CuO and ZnO Foliar, heavy metals, metal-based NPs. spring barley, sustainable agriculture

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# Coping up metal stress (ZnO NPs) in plants by application of various forms of biochar amendments (A review)

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## ABSTRACT

In this project, the use of plants is proposed in order to recover the characteristics of soils that have been exposed to contamination by ZnO in nanoparticle form (NPs) . In adittion, a review of the effects of different doses of biochar in order to treat the stress caused by the nano-form of metal pollution in the plants was investigated. This study approached the effects of how plants response to stress caused by bioaccumulation of heavy metals. It has been reported in several studies that counteracting toxicity due to heavy metals requires complex mechanisms at the molecular, biochemical, physiological, cellular, tissue and plant-wide levels, which could be manifested in terms of improved crop production. Moreover, as plants have developed strategies to adapt to the accumulation of metals, *Hordeum vulgare* was studied as an alternative for bioaccumulation. The changes in plant physiology on both cellular and sub-cellular were analyzed to provide a full mechanism for the impact of biochar application and biochar bioremediation of heavy metals contaminated soils. In addition, the effects caused by the treatment can be consistently traced at all levels of plant organization. The reflection of this treatment process on the plant's physiological parameters especially oxidative enzymes activity, the morphometric characteristics of the plant, photosynthesis parameters along with the ultrastructural changes will be measured to evaluate whether the separate application of biochar into the soil and special amendment with biochar had a positive and negative impact on plant growth and development.

**Key words**: Bioremediation, heavy metals, biochar, barley, soil

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# Soil quality index calculated including the evaluated soil ecological units in central bohemia region in the Czech Republic

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## ABSTRACT

This paper deals with soil quality assessment from the point of view of sustainable soil fertility and ability to fulfill ecosystem services. Five counties from Central Bohemia region were selected as a study area (4290 km$^2$). In total 278 sampling points of the so called „Complex Soil Survey" (1961-1970) were included (only topsoil 30 cm) as well as Evaluated Soil Ecological Units (ESEU) information. Soil Quality Index (SQI) was determined by evaluating 15 parameters, which were divided into three categories; geographic (climatic region, hydrologic soil class, combined class of slope and aspect, combined class of stoniness and soil depth), physical (percentage of clay, silt and sand, field capacity, wilting point) and chemical (organic matter content, saturation of sorption complex, CEC, pH, $P_2O_5$ and $K_2O$ contents) soil properties. Standard scoring functions (More is better, Less is better and Optimum range) were used in data preparation. Analytical hierarchical process was used for assigning weights to parameters by filling the pairwise comparison matrix and finally, linear combination method was used for SQI calculation. Geographic parameters were already classified by ESEU system, thus the standardization process was applied to the available classes. For physical and chemical parameters were used their real values, however, field capacity and wilting point were estimated from soil texture and organic matter content by emplyoing the k-nearest neighbor method from a verified database NearriCZ. SQI was calculated and maps were produced in ArcGIS environment using interpolation of point-based data (RBF-CRS method). Results were compared and discussed with currently used system of soil protection classes and high similarity was found; 28 % of the total area was classified as high and very high quality soils. The proposed method can serve as an alternative to the traditionally used methods for soil evaluation in the Czech Republic.

**Key words**: Analytical hierarchical process, evaluated soil ecological unit, field capacity and wilting point, soil protection classes, soil quality index

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# Zinc and nitrogen fertilization affects mineral composition of wheat grain

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## ABSTRACT

Biofortification of cereals is the main strategy in alleviating the deficiencies of micronutrients in the human diet. The simplest and fastest way to increase the concentration of deficient nutrients in grain is agronomic biofortification, where fertilization increases their concentration in the crop. The aim of the study was to examine the effect foliar application of zinc sulfate on the concentration of zinc in wheat grain and to consider the influence of different doses of nitrogen (N) fertilizers on wheat yield and the content of zinc, iron, manganese and copper in wheat grains. The experiment was set up as two-factorial. The first factor was wheat cultivar, while the second factor was fertilization treatments with nitrogen (as ammonium nitrate) and zinc (as zinc sulphate). In both cultivars, the following fertilization treatments were tested: 1. 65 kg N $ha^{-1}$; 2. 130 kg N $ha^{-1}$; 3. 65 kg N $ha^{-1}$ + foliar application of 1.5 kg Zn $ha^{-1}$; 4. 130 kg N $ha^{-1}$ + foliar application of 1.5 kg Zn $ha^{-1}$. Foliar application of zinc sulfate led to a significant increase in the concentration of zinc in wheat grain, whereas the interactions between fertilizer treatment and cultivar were not statistically significant. The increase in zinc concentration in wheat grain due to foliar application of Zn fertilizer was 19.62% (lower dose of N) and 25.71% mg Zn $kg^{-1}$ (higher dose of N). Also, application of zinc and a higher dose of N fertilizer led to an increase in iron concentration in grain. Fertilization treatments did not affect the manganese and copper concentration in grain. The results suggest that foliar application of zinc sulphate is a suitable method for biofortification of wheat with zinc, and that the application of zinc and nitrogen can have a positive effect on the concentration of iron in wheat grain.

**Key words**: Biofortification, micronutrients, mineral composition

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# The effect of good agricultural practices in Hazelnut Orchard on soil properties and yield

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## ABSTRACT

Humans, like all other living things, must feed to survive. The use of natural resources to meet food needs and the gradual depletion of resources simultaneously with the ever-increasing population and the growth of nutritional needs have made all humanity agree on the effective use of existing natural resources and the effective regulation and use of the value chain created by agriculture. At this point, in the production process, methods and techniques called "Good Agricultural Practices" have been developed and adopted. A sustainable future and food security are aimed at the quality, health, and protection of the soil, which is the main factor in production, of the production model adopted with good agricultural practices. This study, it is aimed to determine the physical, chemical, biological properties of the soil and what changes occur in the yield of hazelnut orchards after this application, and the effect of good agricultural practices on yield in practice has been examined.

**Key words**: Good agricultural practices, hazelnut, soil properties

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# The efficiency of application of humic preparation geoorganics to enhance plant development

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## ABSTRACT

Agricultural production is nearly impossible without the usage of synthetic chemical fertilizers and pesticides in the contemporary stage of society's development. However, it has become obvious that their usage pollutes the soil as well as other aspects of the environment (air, water), resulting in soil degradation and crop contamination. The adoption of organic food products, along with other actions made in this sector, contributes to the sustainable growth of agriculture by reducing or eliminating the use of mineral fertilizers and pesticides. As a result, instead of synthetic, inorganic fertilizers, global scientists and producers are focusing on the use of environmentally friendly, organic fertilizers including humus or bacteria. The study's goal was to determine the biological activity of an ecologically clean, biofertilizer Geoorganics (in Turkey known as OBLIGA ORGANICS www.kirazgrope.com ) manufactured by GeoFert Ltd. in Georgia, as well as to investigate its biological efficiency and to select an effective dose of it based on plant bio-ecological characteristics. The investigation includes 10 humic preparations of various origins to test the effectivnost of GeoOrganic. The biological activity of humic preparations was studed using the methodology GOST-54221-2012 (Humic compounds from brown coals, lignites, and oxidized coals. Test procedures), which we slightly modified. According to the research, OBLIGA ORGANICS is the best biofertilizer with experimental humic substantions for seedling development. Experimental studies have shown that GeoOrganics, among other experimental humic substances, have a very high biological activity in terms of seedling leaf surface area (426.6), mass (181.8) and stem length (147.68). It was determined that a solution of 0.15% promotes seed germination and seedlings development the most from the 0.05, 0.1, 0.15, 0.2, and 0.3% concentrations. Because of research, we recommend a 0.15% solution of GeoOrganics for use in the biological production of agricultural crops as a biofertilizer that stimulates ecologically pure agricultural crops production.

**Key words**: BioOrganic, biological activity, humic preparation, plant development

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# Soil microbial activities under different management practices in mountain meadows: A Review

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## ABSTRACT

Despite the wide range of aesthetic, economic and ecosystem services and functions of meadows. Semi-natural meadows in the Carpathians were not given much attention compared to other ecosystems. However, because of climate change, land use changes particularly agricultural intensification, abandonment, and urbanization has been reported to be the major drivers of declines and degradation of meadows in Europe. Novel management/conservation technologies are required to curtail and further restore threatens and degraded meadows more especially its biodiversity. In recent years there have been increasing attempts to assess soil biodiversity under different management options. We reviewed studies conducted in the past two decades in European meadows with emphasis on Carpathians meadow of central and Eastern Europe. We identified the main factors leading to the declines or degradation of meadows in Europe and Carpathians. We also consider the restoration and protection policies at national and international level. We identify most widely used management or conservation options and the challenges. We further highlighted the soil microbial activities under those management/conservation options from the literatures and the analytical methods (direct and indirect) mostly adopted. In the phase of urgent transition to more sustainable management for the climate change adaptation and mitigation suggestions for future research are outlined.

**Key words**: Biodiversity, Carpathians, grassland, sustainable management

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# Detection of different agricultural crops on the same land parcel with soil moisture analysis by using remote sensing in part of central Bohemia Region, Czech Republic

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## ABSTRACT

Agricultural land in the Czech Republic was significantly affected by collectivization after the WW II. Within the process of uniting the farmland were removed landscape elements such as balks, shrubberies etc. Thus the Czech Republic has one of the largest land parcels in Europe. As a consequence, the ecological stability has been disrupted, the landscape has become vulnerable and this problem persists in terms of susceptibility to water erosion, loss of organic matter, influence on microclimate and biodiversity. Currently a new standard of good agricultural and environmental conditions related to the Cross Compliance has been applied by the Czech Ministry of Agriculture, which constraints a continuous area of single crop up to 30 ha since 2020. In other words, when the land parcel is physically larger than 30 ha, the farmer has to virtually divide the parcel by growing different crops. Rapid development of satellite technologies provides many advantages of application in observing the Earth and getting reliable information faster than from field measurements by remote sensing (RS). Also, distinguishing different agricultural crops from each other can be easily detected by RS satellites which have skills to detect electromagnetic energy at different wavelengths on spectrum. In this study, the application of the new standard was examined by RS data analysis, with focus on water and temperature regime of the land. Landsat_8 Level_1 combining RS data with 30 m spatial resolution for operational land imager and 100 m spatial resolution for thermal infrared sensor was used to discriminate different crop types on the same land parcel by calculating land surface temperature and soil moisture values which play an important role in understanding the soil water regime. Time ranges of satellite images were decided in Junes between 2018 to 2021 in part of the central Bohemia region and preliminary results are presented.

**Key words**: Land surface temperature, soil moisture, vegetation index, water index

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# The effect of two iron fertilizers on DTPA extractable micronutrient contents of a calcareous soil

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## ABSTRACT

This study was carried out to determine the effects of two iron fertilizers that contain 6% of Fe (F1: 4.8% rate of Fe chelated and F2: all Fe chelated) on the micronutrients content of a sandy loam calcareous soil. The fertilizers were applied as 15 ppm doses to each pot with three replicates and incubated for 20 and 40 days under the laboratory conditions around room temperature (20-25$^0$C). After each incubation period, fertilization increased the DTPA extractable micronutrient contents of the soil samples over the control treatment. While DTPA extractable Fe, Cu, Mn and Zn contents increased as 54%, 15%, 32% and 11% by F1 application at 20 days, they increased as 44%, 4%, 14% and 6% at 40 days, respectively. Similarly, while DTPA extractable Fe, Cu, Mn and Zn contents increased as 51%, 13%, 28% and 10% by F2 application at 20 days, they increased as 43%, 2%, 14% and 2% at 40 days, respectively. The effects of both fertilizers on soil micronutrient contents were found to be higher at 20 days than 40 days. Generally, F1 application was more effective to increase DTPA extractable micronutrient contents of the soil. According to results, application of Fe chelated fertilizers into a calcareous soil generally increased micronutrient levels in the following order Fe>Mn>Cu>Zn.

**Key words**: Calcareous soil, EDDHA chelate, iron fertilizer, micronutrients.

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# Relationship between chemical & organic fertilization practices and global warming

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## ABSTRACT

Fertilization is one of the main elements of agriculture. More than 90% of fertilization practices in all over the world consist of nitrogen fertilization. In addition, soils always need the addition of nitrogen, which is a macro plant nutrient, from the outside. The need for nitrogen in agricultural areas is continuous, because of the element that plants remove the most from the soil is nitrogen and the mobility of nitrogen in the soil. However, nitrate leaching, and denitrification are constantly present in the nitrogen cycle in nature. Therefore, unconscious fertilization and accompanying unconscious tillage, nitrogen is washed away and progresses as a pollutant to the underground waters and the oceans in a chain manner, in addition, the nitrogen that is denitrified from soils in unfavorable conditions under reducing conditions is mixed into the atmosphere as nitrous oxides (nitrogen protoxide). Although natural fertilization is quite innocent compared to chemical fertilization, unconscious composting processes also contribute negatively to nitrate accumulation and nitrate leaching in the soil. Of course, nitrogenous gases emitted from chemical fertilizer factories, which are the dominant element of this fertilization, should not be ignored. Although the emission of nitrous oxides in greenhouse gases is proportionally less than $CO_2$, its effect is 300 times higher. The unitary increases of nitrous oxides contribute 10% to the total greenhouse effect caused by $CO_2$. Global warming has turned into a cycle that affects agricultural practices, and agricultural practices affect global warming. With a holistic approach, considering global warming, new fertilization programs should be made, which includes a conscious chemical fertilization and a correct organic fertilization that can reduce the percentage of chemical fertilization, and alternative organic fertilizers. In this article, recent studies on the relationship between chemical and organic fertilization and global warming are included and the results are evaluated.

**Key words**: Fertilization, nitrous oxide, plant nutrition, soil health.

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# Change of composition, mineralization and depth of subsoil water in the experimental area of the Shirvan plain, Azerbaijan

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## ABSTRACT

While learning problems as an amount of salts and depth of subsoil water, dynamics of their mineralization change, reasons of the salinization process formation, their prevention, efficiency of the available drainage and irrigation systems in the research zone, the scientific principles is based on the extensive research of academician V.R.Volobuyev and professor M.R.Abduyev. Generally, While learning a regime of subsoil water in the soil, one of the main problems is to determine the annual amplitude of changes in their level of location While studying the change of subsoil water mineralization in their researches, based on the soil-climate conditions of the area, they paid special attention to composition and mineralization of irrigative water, change on their seasons. A level of subsoil water in the soil of the Kurdamir sort-test station was 2,82-3,15m and their mineralization was 2,60-3,63 g/l in 2012, but the same index was 2,92-3,15m and 2,59-3,59g/l in 2013; 2,90-3,15m and 2,53-3,54g/l in 2014; 2,75-3,00m and 2,45-3,54g/l in 2015. These indicators in the soil of Ujar Support Station were 2,60-3,00m and 2,62-3,94g/l in 2012; 2,53-3,00m and 2,54-3,87g/l in 2013; 2,65-3,00m and 2,92-3,88g/l in 2014; 2,50-2,80m and 2,26-3,88g/l in 2015. Generally, the researches show that difference between mineralization and level change of subsoil water is little in the soil of the experimental area. The elevation of subsoil water mineralization and nearness of their location level states the surface are observed in micro-depressions. This is due to the lack of agromeliorative measures and weakness of water permeability, failure to provide irrigation in accordance with plant needs in the same zones recently. Therefore the agromeliorative and agro-technical measures must be performed; new progressive irrigation systems must be applied in both experimental areas.

**Key words**: Agromeliorative, mineralization, micro-depressions, soil, subsoil water, irrigation.

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# Applicability of a mathematical approach to evaluate of soil temperature in the plant root zone

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## ABSTRACT

Plant growth, along with other soil properties, is strongly related to optimum soil temperature in the plant-root zone. In this research, the theoretical expression obtained based on the conservation of energy for soil heat flow and the Fourier law was used to evaluate the temperature in the plant-root zone. It has been shown that the temperature values in the spherical soil area surrounding the plant root medium depend on the separated heat flux, the conductivity coefficient, the average surface temperature of the spherical medium, and the radius of the root zone. When compared with the average surface temperature, a decrease in temperature values towards the center of the plant-root zone and an increase in distances greater than the radius were determined. The surface heat flux of the spherical soil medium surrounding the root zone is shown in the form of an expression of the law of energy conservation.

**Key words**: Spherical soil media, heat flux, soil temperature, energy conservation, Fourier's law.

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# Phytomining of Ni by Alyssum murale on an ultramafic soils

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## ABSTRACT

Ni phytomining is a promising technology for Ni recovery from ultramafic soils. Ultramafic soils are usually marginal in macronutrients (nitrogen (N), phosphorus (P), potassium (K), and calcium (Ca)) for the growth of plants. Commercial nickel phytomining is dependent on attaining high yield and high Ni concentration in harvestable biomass of Ni hyperaccumulator species. However, many of these plants produce low biomass, which makes the use of agronomic techniques for improving their growth necessary. Metal-hyperaccumulators are good candidates for phytomining due to their extraordinary capacity for Ni accumulation. Alyssum murale is a native plant to Mediterranean serpentine soils. In this review study, was evaluated the phytoextraction efficiency of Ni hyperaccumulator Alyssum murale from Ni-rich serpentine soils. Effects of soil inorganic fertilization (NPK) and soil organic amendment addition (compost and biochar) on plant growth, biomass production, and Ni accumulation were evaluated. All soil treatments greatly improved plant growth, but the highest biomass production was generally found after the addition of 2.5 or 5% compost (w/w). Total Ni phytoextracted from soils was significantly improved using both soil treatments (inorganic and organic), despite the decrease observed in soil Ni availability and shoot Ni concentrations in compost amended soils. The most promising results were found using an intermediate amount of compost, indicating that these types of organic amendments can be incorporated into phytomining systems.

**Key words**: Biomass production, inorganic fertilisation, hyperaccumulator plants, organic amendments, phytomining, serpentine soils

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# Effects of olive pomace application on some soil properties

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## ABSTRACT

In many studies, olive pomace (prina) was applied directly to the soil in order to determine the effects of olive oil factory wastes on soil some soil physical and chemical properties. It has been determined that application of prina, which is olive oil factory waste, into soils having low organic matter content showed positive effects on some soil physical and chemical properties. While the bulk density values are decreased, total porosity and aggregate stability of soils are increased with prina applications. Prina application to soils also increases electrical conductivity, organic matter, total nitrogen, available phosphorus and potassium contents of soils and decreases soil reaction (pH) values. Olive pomace application also significantly increases soil water holding capacity with increasing field capacity and available moisture content. According to the researches, Cu, Ni and Pb toxicity should be considered in olive waste applications.

**Key words**: Prina, organic waste, soil physical and chemical properties

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# Molecular characterization of *Beet virus Q* isolates in sugar beet production areas of Turkey based on coat protein gene

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## ABSTRACT

Sugar beet (*Beta vulgaris* var. *saccharifera* L.) is widely grown in Turkey as a raw material for the sugar industry. The beet plant is infected by some soil-borne viruses belong to the genus pomovirus within the family *Virgaviridae* transmitted by the plasmodiophorid vector *Polymyxa betae*. Of the members of the genus Pomovirus, *Beet soil-borne virus* (BSBV) and *Beet virus Q* (BVQ) can only infect sugar beet. BVQ in Turkey was the first reported of these viruses in 2017 and it was very common (88.4%) in the sugar beet fields sampled in our previous study. In the current study, 14 BVQ-infested soil samples were randomly selected according to their geographic origin and the isolates derived from the soil samples were molecularly analyzed based on the coat protein (CP) gene. RT-PCR analysis with BVQ-CP specific primers, PCR products of the expected size (501 bp) were obtained for all tested samples and sequenced. The CP regions in all Turkish BVQ isolates consisted of 501 nucleotides and 166 aa residues. Interestingly, 13 BVQ isolates obtained from different locations were similar at the nucleotide and aa level when each isolate was compared. However, the isolate KNY-319 had differences only at the 429 and 444 nucleotide positions of CP region comparing with other Turkish isolates. Phylogenetic analysis of 32 BVQ isolates (14 from this study and 18 retrieved from GenBank) showed that all isolates clustered in two main groups. Turkish isolates belonging to group I alongside isolates from Poland (EU785968, EU785969 and EU785979) and Germany (AJ810290). To our knowledge, this is the first molecular characterisation of BVQ in Turkey.

**Key words**: Soilborne virus, sugar beet, RT-PCR, sequencing.

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# Responses of plant growth stimulators in strawberry (*Fragaria Ananassa*) to zinc application

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## ABSTRACT

The aim of this study was to determine effects of iron and zinc applications on levels of trans-Zeatin, and Giberallic acid (GA3) hormones in cytokinin group in strawberry (Fragaria ananassa). This study was carried out at the Experimental Field of Agricultural Faulty of Van Yüzüncü Yil University, Van-Turkey. Four different doses (0, 75, 150 and 225 mg per plot having 15 plants) of Zintrac (7% Zn) were applied to soil in a randomized factorial experimental design with three replications. Gibberellic acid levels in plants increased with Zn2 and Zn3 application doses. While the highest gibberellic acid level was determined as 354 mg/kg in Zn2 dose, the lowest level was 244 mg/kg in Zn1 dose. Zn application doses leaded an unregulated increase in zeatin levels. While the highest zeatin level was obtained as 47 mg/kg in Zn2 dose, the lowest zeatin level was determined as 18 mg/kg in the control. As a result Zn application increased zeatin and gibberellic acid levels of strawberry plant.

**Key words**: Zinc, fertilization, plant hormone, strawberry.

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# Assessment of soil erodibility factor (K-factor) for steppe area (Volgograd region, Russia)

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## ABSTRACT

Water erosion is one of the most widespread degradation processes on the globe. There are many models for modeling this process. One of the most used is the RUSLE-2 model, a modified version of the Universal Soil Loss Equation (USLE) model. One of the important parameters of this model, the K-factor is the soil erodibility factor, which reflects the resistance of the soil to the manifestation of erosion processes. It represents the relationship of such soil parameters as granulometric composition, organic matter content, permeability, and soil structure of the soil. Within the framework of this work, the K-factor values were calculated for 289 points located in the steppe province of Russia (Volgograd region). The Empirical Bayesian Kriging regression prediction method was used to correlate spatial data such as soil maps and parent rock, digital elevation model (DEM), length and steepness factor of soil erosion (LS-factor), map of landscapes to develop a high-resolution K-factor map. Average number K-factor was estimated 0,573 t ha h $ha^{-1}$ $MJ^{-1}$ $mm^{-1}$ with standard deviation 0,088 t ha h $ha^{-1}$ $MJ^{-1}$ $mm^{-1}$.

**Key words**: RUSLE-2, soil erosion, modelling, soil erodibility, K-factor.

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# Influence of slope and management practices on top-soils fertility status of compound farms in Nsukka Campus

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## ABSTRACT

The study was carried out to assess the influence of slope and management practices on top-soils fertility status of compound farms in the University of Nigeria Nsukka (UNN) campus, Enugu state Nigeria. Top soil samples (0-20 cm depth) were collected from twenty compound farms, ten each from the upper (Ikejiani street and Ezenwaeze street) and lower (Mbanefo street) slopes' compound farms. The elevation of the upper slopes compound farms ranged from 458 to 447 m while lower slopes compound farms ranged from 415 to 423 m above the sea level. The soil samples were analyzed in the UNN Department of Soil Science Laboratory. The results showed that slopes and management practices influenced top-soils fertility status of compound farms. The upper slope compound farms were more fertile relative to the lower slopes compound farms. Slopes affected soil fertility parameters such as organic matter content, total nitrogen, exchangeable calcium, cation exchange capacity, and effective cation exchange capacity. The combined application of organic and inorganic manures had a greater effect on soil fertility status compared to a single application of organic or inorganic fertilizer. The combined application of organic and inorganic fertilizers should be adopted to enhance soil fertility status of compound farms in both slopes. Periodic assessment of the fertility status of soils in compound farms is very important for adequate nutrient application and for adoption of sustainable management practice in order to buffer negative effects of slope and achieve optimum crop productivity.

**Key words**: Compound farms, management practices, slopes, soil fertility.

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# Details of particle-size distribution of Calcic Chernozem by the Regional Soil-Geographic database (on the example of the Rostov region)

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## ABSTRACT

The analysis of the archival data on the particle-size distribution of Calcic Chernozem was carried out with the involvement of the funds of the soil data center of the department of Soil Science and Land Resources Evaluation. It showed that the chernozems of the investigated area of the Rostov region belong mainly to the variety of silty loamy and clay soils. Work is under way to solve the problem of data comparability. In future editions, more attention should be drawn to problems of harmonize and standardize the use of particle-size distribution data, making use of the experiences achieved in this field by our and other scientific communities. The findings of the experiment were found that within each of the varieties there is a tendency for the amount of physical clay to shift to the boundary separating silty loamy and clay. Most of the samples fall within the range of 55–60%, within the silty loamy variety and 60–65% within the clay variety. The use of GIS technology allows a multidisciplinary approach to soil science.

The research was financially supported by the "Priority 2030" program of the Ministry of Science and Education of the Russian Federation, project no. SP02/S4_0708 Priority_01/SP02/S4_0706 Priority_01.

**Key words**: Geo-information system, particle-size distribution, soil, silt loam, silt.

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# The pH changes of the soil with the introduced biochar during the adsorption of Cu and Zn

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## ABSTRACT

In order to assess the differences in the adsorption of Cu(II) and Zn(II) by the soil (Haplic Chernozem) with the introduced biochar and to identify possible mechanisms of interaction of metals with them, during the adsorption experiment, the pH values of equilibrium and corresponding initial solutions of heavy metals were additionally determined by the potentiometric method. When dissolving $Cu(NO_3)_2$, $Zn(NO_3)_2$ salts there is a change in the pH of the initial solutions due to hydrolysis processes. The introduction of easily soluble salts of heavy metals in the form of nitrates into the studied samples with the introduced biochar reduces the pH of equilibrium solutions in the range from 7.4 to 6.6 (Cu), from 7.5 to 7.1 (Zn). According to the effect on the acid-base equilibrium, metals form the following decreasing series: Cu(II) > Zn(II). Consequently, among the metals under consideration, the studied soil with the introduced biochar exhibits greater buffering when it is contaminated with Cu(II) nitric acid salts.

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**Key words**: Heavy metals, biochar, Haplic Chernozem, adsorption, potentiometric method.

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# Spatial variability of fertility of Calcic Chernozem during the cultivation of winter wheat using no-till technology

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## ABSTRACT

Soil fertility is one of the main factors affecting the productivity of agricultural crops and the stable functioning of agrocenoses. Agricultural land use can both reduce the spatial heterogeneity of soil fertility and enhance it. The paper presents an assessment of the spatial variability of nutrients and reserves of productive moisture in the Calcic Chernozem during the cultivation of winter wheat using the no-till technology. Significant variations in the content of nitrate nitrogen and mobile phosphorus in the soil were found between the surveyed fields (n = 131). The coefficient of variation (V) is more than 40%. The spatial variability of the reserves of productive moisture is less (V = 5.0–17.0%) than the content of mobile forms of the main nutrients. Perhaps this is due to the positive effect of no-till technology on the water regime of the soil. The spatial variability of growing conditions strongly affects the yield of winter wheat. The average value of the yield of winter wheat for two years of research is 82.0 centner/per hectare with the minimum and maximum values of 36.0 and 115.0 centner/per hectare, respectively. The yield variability in the studied fields was 23.0%. The dependence of the crop yield on the reserves of productive moisture before sowing (r = 0.80) and in the phase of entering the tube (r = 0.34), as well as on the content of nitrate nitrogen (r = 0.34) and mobile phosphorus in the soil before sowing (r = 0.30). The results obtained indicate the need to adjust the doses of nitrogen and phosphorus fertilizers in the fields of an agricultural enterprise. At the same time, the effectiveness of various agrotechnical methods is determined by the moisture supply before sowing and in the phase of entering the tube.

The research was financially supported by the "Priority 2030" program of the Ministry of Science and Education of the Russian Federation, project no. SP02/S4_0708 Priority_01/SP02/S4_0706 Priority_01.

**Key words**: Calcic Chernozem, winter wheat, no-till technology, nutrient content, productive moisture, variation.

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# Biological diagnosis of soils after exposure to smoke from fires

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## ABSTRACT

Fires have a significant impact on the soil environment. Smoke as one of the pyrogenic factors strongly transforms soil and its biota. However, the effects of gaseous substances on the biological activity of soils and fauna are poorly studied. In order to detect changes, it is necessary to carry out biological diagnostics of soils using biochemical indicators and biotesting. As a result of researches change of fermentative activity (catalase, peroxidase, polyphenol oxidase, invertase) of soils is revealed, thus dependence of enzyme activity inhibition intensity on time of smoke influence (30-120 minutes) is traced. The depth of penetration of gaseous products of combustion into soil, with maximum effect in the layer 0-1 cm, was determined. Moistened soil was more susceptible to combustion products due to their absorption by water. There was a change in the hydrogen index (pH) of the soil solution and water salinity. The dynamics of enzymatic activity recovery after smoke exposure with and without biopreparations was traced. Soil biotesting was also carried out using earthworms and cockroaches as test objects. The results obtained indicate a significant impact of smoke on soil and its fauna.

The research was financially supported by the "Priority 2030" program of the Ministry of Science and Education of the Russian Federation, project no. SP02/S4_0708 Priority_01/SP02/S4_0706 Priority_01

**Key words**: Pyrogenic effects, Combustion products, Biological activity, Soil enzymes, Biotesting.

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# Nitrification processes in the soils of the coal waste dump near the city of Shakhty (Rostov region, Russia)

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## ABSTRACT

This paper examines the influence of soil pollution on the nitrification processes in the soils adjacent to the coal waste dump near the city of Shakhty (Rostov region, Russia). The coal industry has significant impacts on adjacent ecosystems. Despite the fact that the undesirable effects of mechanized coal mining on soil and vegetation have been actively studied since the 1980s, there are still few studies that are devoted to the effects on microbiological processes. Changes in the processes of the biogeochemical nitrogen cycle in the soils of coal waste heaps have been especially poorly studied. Low activity of nitrification processes was found in a sample with a high coal dust content and low pH, which is unfavorable for ammonium oxidation processes. The fact that nitrification is positively correlated with pH is supported by many previous studies. In soils with higher moisture content, nitrification processes are less active than in heavy metals polluted soil, since the level of aeration in the soil is most important for ammonium oxidation. The following pattern can be observed: with increasing distance from the waste heap, the nitrification activity increases. Thus, the highest nitrite oxidation activity was recorded in the most distant sampling plot. Correlation analysis showed the absence of reliable correlations between metal concentrations and nitrifying activity. However, it should be noted that with increasing distance from the waste heap, the activity increases, while the level of contamination with mobile forms of metals decreases. The elevated activity can also be explained by assuming that the amount of fine coal in the soil decreases with distance from the waste heap. Coal dust pollution has a stronger effect on nitrifying activity than heavy metals.

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**Key words**: Heavy metals, mine coal soils, nitrification.

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# Assessment of the influence of modern microbiological preparations on the biology activity of chernozem

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## ABSTRACT

Soil pollution with pesticides is an environmental problem that has negative consequences for the environment and worsens human health. The economic benefits of using these substances in agriculture are of higher priority for producers than soil safety in the future. Pollution and subsequent suppression of the biological activity of soils due to the use of pesticides prompts scientists to look for new methods of safe ecological farming. An alternative to pesticides can be biopreparations - substances created on the basis of living microorganisms. Were studied new biological products Altasol and Metabacterin in concentrations: 0,01; 0,05; 0,1; 1; 10 mg.kg$^{-1}$. To assess the biology activity of soils, a study of the activity of invertase, urease, phosphatase, catalase was carried out. The object of the study was the Haplic Chernozem Loamic Botanical Gardens of the Southern Federal University. Such soils are widespread in the steppe zone of Russia. The enzyme activity of soils is an important indicator of ecological balance and stability. It also reflects the soilfertility. Depending on the selected dose of biopreparations, various indicators of enzyme activity were recorded: the highest value of the invertase was shown by the drug Metabacterin 10 mg.kg$^{-1}$ (201% of the control), and the lowest value was shown by the drug Altasol 10 mg.kg$^{-1}$ (46% of the control). The optimal concentration of biopreparations has been established: concentrations of Metabacterin from 0.1 to 10 mg.kg$^{-1}$ are safe. In almost all variants, a negative effect of Altasol on enzym activity and phytotoxicity in high doses was observed, from which it can be concluded that it is necessary to use this biopreparation at a concentration of 0.01 - 0.05 mg.kg$^{-1}$.

The research was financially supported by the "Priority 2030" program of the Ministry of Science and Education of the Russian Federation, project no. SP02/S4_0708 Priority_01/SP02/S4_0706 Priority_01

**Key words**: Biopreparations, soil enzymes, ecologic safety, bioindication.

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# Post-fire changes in the enzymatic activity of soils

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## ABSTRACT

All over the world, regular fires cause great damage to natural ecosystems. One of the informative biological indicators used in the diagnosis of the state of soils after anthropogenic disturbances is soil enzymes. Enzymatic activity affects the most important repetitive transformations in the biochemical cycles of carbon, nitrogen and other compounds. The post-pyrogenic Cambisols of the Utrish reserve were studied immediately after the fire and a year later. The reserve's forest ecosystems were destroyed by a massive fire in August 2020. The areas affected by fire in a weak, medium and strong degree have been studied. Laboratory analyzes were carried out to determine the activity of invertase, urease, phosphatase, as well as catalase and peroxidase. Different enzyme reactions were observed depending on the degree of post-pyrogenic disturbance. Inhibition and, in some cases, stimulation of the activity of enzymes from the class of hydrolases and oxidoreductases has been established.

The research was financially supported by the "Priority 2030" program of the Ministry of Science and Education of the Russian Federation, project no. SP02/S4_0708 Priority_01/SP02/S4_0706 Priority_01

**Key words**: Wildfire, cambisols, soil enzymes, pyrogenic effect, bioindication.

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# Effects of Zinc oxide nanoparticles on the content of proline in spring barley

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## ABSTRACT

Reactive oxygen species (ROS) are produced in small quantities by peroxisomes, chloroplasts, and mitochondria under favorable conditions for plants. The balance between ROS release and removal is controlled by the plant's antioxidant system. However, under stress conditions, ROS starts to accumulate in the vital components of the cell leading to its death, s. Commonly, plants subjected to abiotic stress have a high concentration of anti-oxidative enzymes such as proline, glycine, betaine, and choline. Proline is an amino acid that is part of protein structures, acts as a component of ROS detoxification. The mechanism of its accumulation in plants or its parts under stress has been poorly studied. It is assumed that this is due to a decrease in the activity of the electron transport system. As a result of the studies carried out, the regularity of the distribution of proline in the leaves and roots of spring barley was clarified. It was found that NP ZnO promotes an increase in proline production. This is directly related to its function of suppressing oxidative stress.

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**Key words**: Proline, Oxidative stress, Reactive oxygen species, Spring barley, ZnO Nanoparticles.

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# Big data analysis for ecological risks evaluation and pollutants' redistribution research

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## ABSTRACT

The modern approach to data operating has been formed due to breakthroughs in technologies for collecting soil, vegetation, landscape data, which led to the accumulation of huge amounts of data. Big data analysis based on machine learning allows us to facilitate and expedite the processing of information significantly. There are three main ways for artificial intelligence use in soil science and agriculture: predictive crop mathematical modeling; existing databases' processing for retrieving statistical data based on a large number of units; integration of monitoring databases with geographical ones for creating maps and other visual and spatial materials. An ecological risks forecast is required for polluted areas such as Atamanskoe lake (Rostov Region, Russian Federation). For this purpose, was started the creation of a pollutants ratio database. The database allows receiving exact information about dynamic pollutant ratio quickly with using the modern approach for data operating by machine learning artificial intelligence. As a result of the whole work is a forecast of pollutants moving from Atamanskoe lake to open and underground water sources. Geographic information systems (GIS) in the ecological risks forecast play roles in summarizing data unit and developing pollution maps.

The research was financially supported by the Ministry of Science and Higher Education of the Russian Federation project on the development of the Young Scientist Laboratory (no. LabNOTs-21-01AB) and by the "Priority 2030" programme, project no. SP02/S4_0708 Priority_01/SP02/S4_0706 Priority_01.

**Key words**: Big data, artificial intelligence, geographic information systems.

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# Biosorption of copper (II) from an aqueous solution by Bacillus mycoides cells isolated from anthropogenically contaminated soils under various environmental conditions

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## ABSTRACT

Strengthening of The growing anthropogenic influence leads to entails an increase in the load on the environment and particularly, the soils. One of the factors affecting ecosystems is the emission of heavy metals from heavy industry enterprises and other sources. There are several types of promising approaches to the remediation of contaminated soils is, including biosorption. To select an effective biosorption agent When selecting a sorbent, it is necessary to take into account the optimal conditions of the medium for each bacterial strain separately. The optimal pH for biosorption by Bacillus mycoides strain was established as, using a number of buffers with different pH, the optimal acidity of the medium was established at a level of 5.0. After that, the, using a number of solutions with different equilibrium concentrations of metal ions were used and the Langmuir model was calculated. A high affinity of the studied biosorbent and to copper (II) ions was established. The maximum sorption capacity of this strain was also determined established.

The research was financially supported by the "Priority 2030" program of the Ministry of Science and Education of the Russian Federation, project no. SP02/S4_0708 Priority_01/SP02/S4_0706 Priority_01.

**Key words**: Biosobration, sorbents, heavy metals, langmuir model.

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# The effect of different types of tillage on the fractional content of mineral phosphates in Calcic Chernozem

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## ABSTRACT

The content of phosphorus (P) and distribution of its forms in soils has a zonal and subzonal character. This is related both to geological processes and the transformation of modern soils under the influence of various factors, including anthropogenic. The content of P, and especially its availability to plants significantly determines the level of soil fertility. Therefore, creating of optimal P level in soils providing high and sustainable crop yields is one of the main tasks for solving the Food Security problem. It was found that the Calcic Chernozem is characterized by a rather high potential of phosphorus supplies to plant nutrition. Before sowing winter wheat, the content of the total phosphorus varied from 0.17 to 0.19 %. Mineral phosphates in the top layer of Calcic Chernozem carbonate was about 42.0-43.0 % of total phosphorus during chiseling and discing and 32.0 % of total phosphorus during moldboard ploughing. During the booting stage, their amount decreased slightly due to intensive use by plants. The most part of mineral phosphates in Calcic Chernozem, regardless of the tillage method, is represented by high-basic calcium phosphates (Ca-$P_{III}$), due to genetic features of the soil. The solubility of calcium phosphates decreased with depth. No-tillage methods (discing and chiseling) increased the content and availability of mineral phosphates for plants in Calcic Chernozem in comparison with ploughing.

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**Key words**: Calcic Chernozem, fractional composition of mineral phosphates, winter wheat, moldboard ploughing, discing, chiseling.

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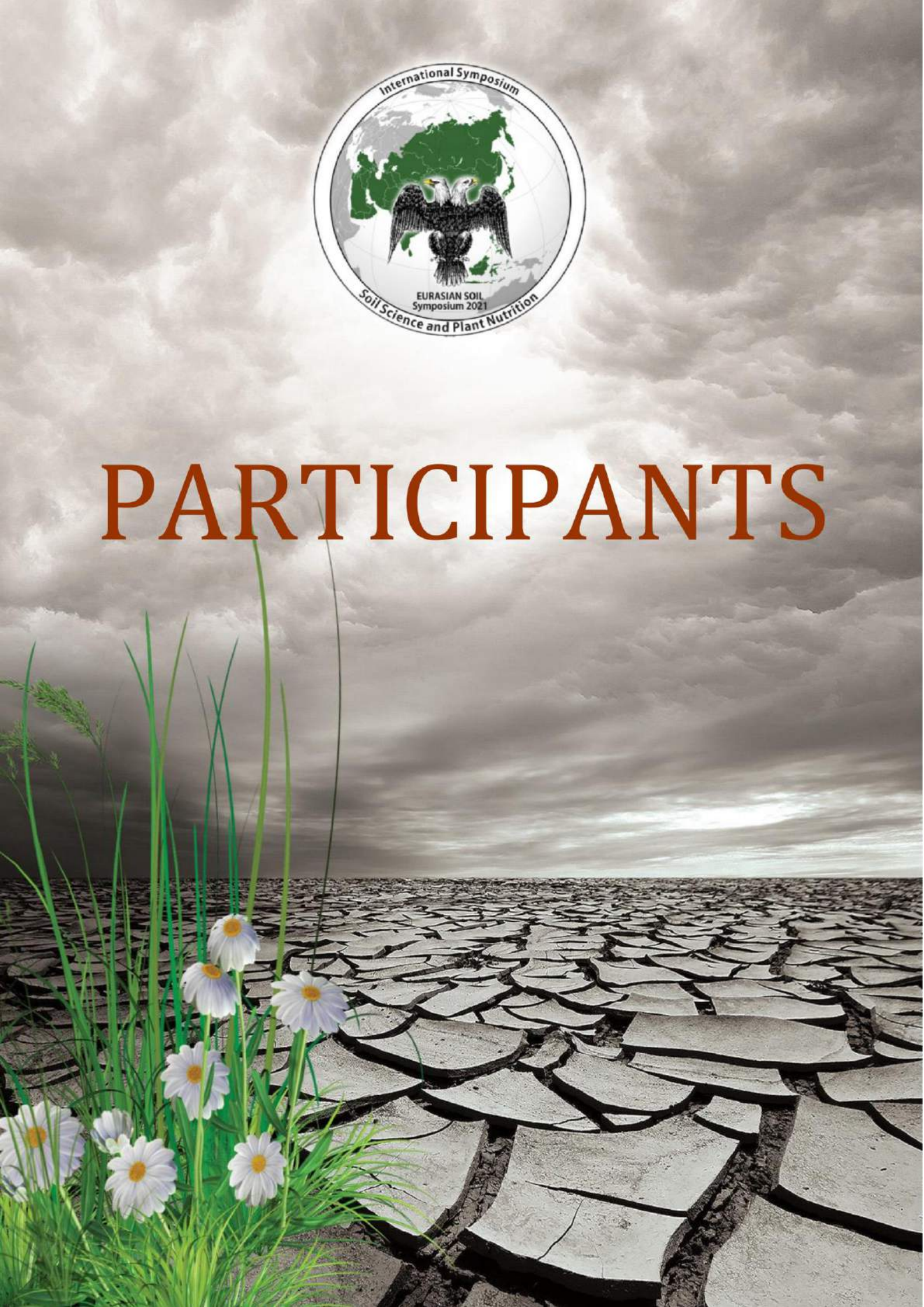


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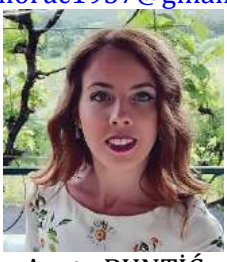

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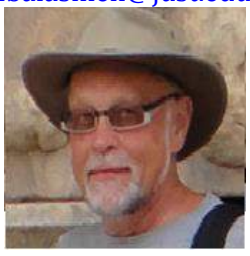

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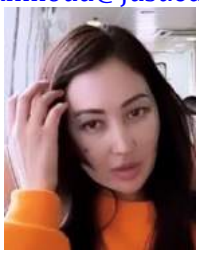

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# International Soil Science Symposium on "SOIL SCIENCE & PLANT NUTRITION"

18 – 19 December 2021 / Samsun, Turkey

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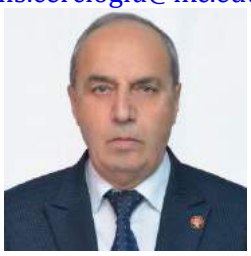

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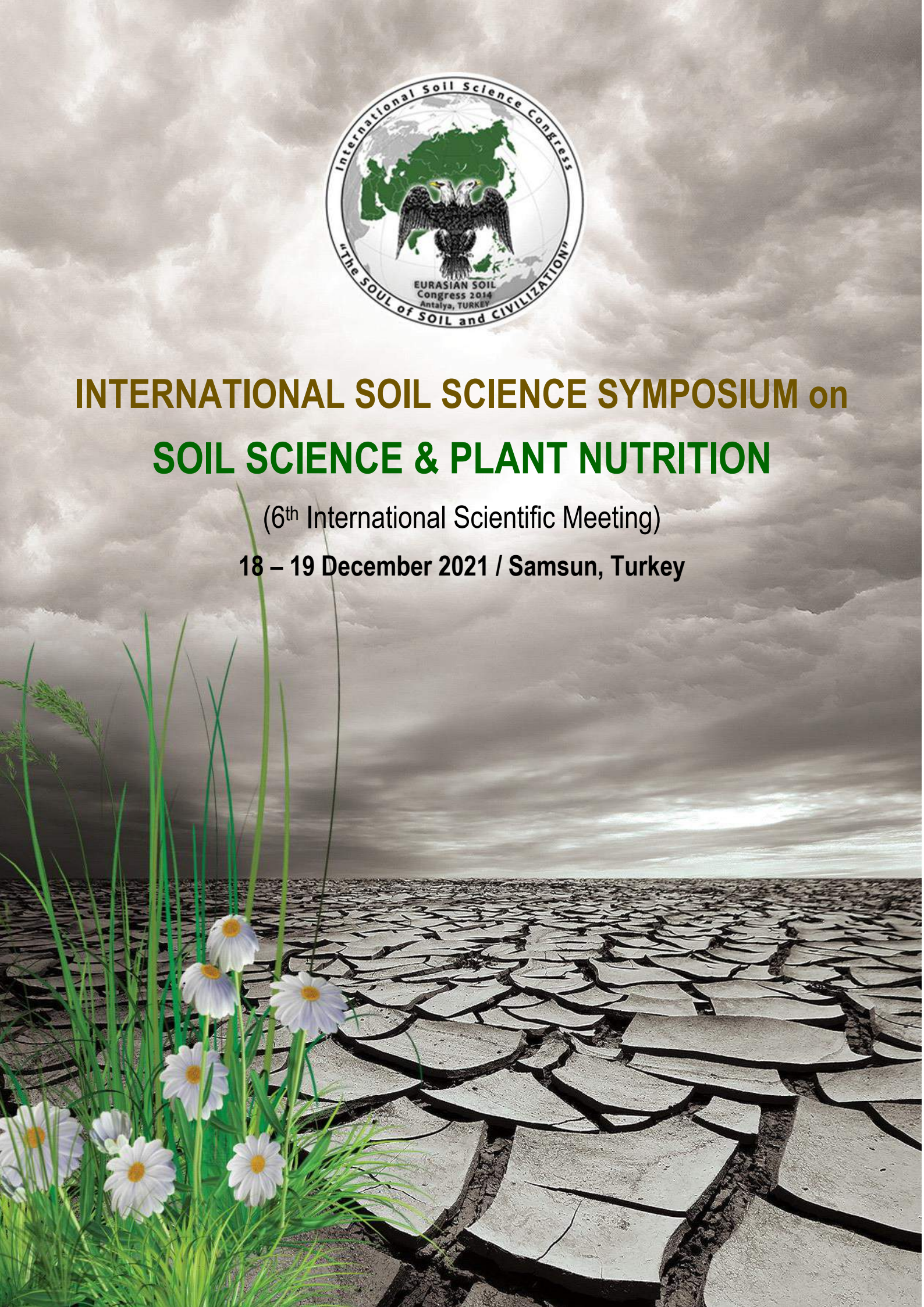


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