ABSTRACT BOOK

10th International Congress on "The Soil Resources and Environment Conservation"

Soil Science Society of Kazakhstan Cooperation with the Federation of Eurasian Soil Science Societies

17 - 19 October 2018, Almaty, Kazakhstan

Editors:

Abdulla SAPAROV
U.U. Uspanov Kazakh Research Institute of Soil Science and Agrochemistry, Kazakhstan

Ridvan KIZILKAYA,
Ondokuz Mayis University, Turkey

Mustafa MUSTAFAYEV
Institute of Soil Science and Agrochemistry NANA, Azerbaijan

ABSTRACT BOOK

10th International Soil Science Congress on "Environment and Soil Resources Conservation"

Soil Science Society of Kazakhstan Cooperation with the Federation of Eurasian Soil Science Societies

17–19 October, 2018. Almaty, KAZAKHSTAN

UDK 631.4
ББК
К

The Proceedings of the 10th International Soil Science Congress on "Environment and Soil Resources Conservation"

Editors:
Abdulla SAPAROV, U.U. Uspanov Kazakh Research Institute of Soil Science and Agrochemistry, Kazakhstan
Ridvan KIZILKAYA, Ondokuz Mayis University, Turkey
Mustafa MUSTAFAYEV, Institute of Soil Science Agrochemistry NANA, Azerbaijan

International Standard Book Number - ISBN (print)

Annotation. The materials of the 10th International Congress are related to the theme of environmental protection and soil resources. The Congress will provide an opportunity to exchange views on a wide range of issues of modern soil science and prospects of its development. Leading scientists of the world will share innovations that have positive impact on ecology of soil surface. The proceedings present the material of current progress in soil science, the development of a new methodology based on new concepts and achievements, modern methods of soil analysis that will change the future in soil science, as well as our attitude to the environment and agriculture, will facilitate rapid transfer of knowledge on soil science to the welfare of the society and the environment.

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

Publication date : 1 October 2018

Press
Visit the Congress web site at http://www.soil2018.com/
Visit the Federation of Eurasian Soil Science Societies web site at http://www.fesss.org
Visit U.U. Uspanov Kazakh Research Institute of Soil Science and Agrochemistry of Kazakhstan web site at http://soil.kz/

CONTENT

Soil Pollution & Remediation

FOREWORD

The world food issue is one of the most acute global problems which the humanity is facing. The solution of this issue which is a challenge, and in fact a tragedy of modern civilization which has many achievements in the field of science and technology, the level of productive forces development, the possibilities of food production, has been in the focus of attention of the world community for several decades.

Healthy soils are not only the basis for production of food, fuel, fibers and medical products, but also play a key role in the carbon cycle, storage and filtration of water and increased resistance to floods and droughts. However, FAO estimates that 33% of global land resources have already degraded, while human impact on soil is increasing and often reaching critical levels. Land degradation occurs in various forms, including erosion, compaction, sealing and salinization of soil, washing out its organic and nutrient substances, acidification, pollution and other processes associated with unstable land management practices. FAO calls for the joint international efforts aimed to preserve fertile soils for present and future generations.

The aim of the 10th International Soil Congress (3rd EURASIAN SOIL CONGRESS 2018) under the scientific motto "Protection of soil resources and the environment" is to raise the awareness and importance of soils for food security and critical ecosystem functions, as well as promote rational methods of soil use.

The world researchers in their research results shared with recent innovations in relevant fields. The raised and discussed issues of soil scientists are diverse, much attention is paid to the possibilities of natural resource management that affect soil quality, they offer specific solutions to theoretical and practical methods, as well as their influence on the development of soil science.

The results of the researches are presented in the relevant areas of soil science: soil genesis, classification and cartography, geostatistics, remote sensing and GIS; soil physics, erosion and conservation, management of soil fertility; chemical composition and soil contamination; soil biology and biochemistry, soil health and quality; plant nutrition and soil ecology, which give reason to judge not only on the current state, but also the prospects for further development of soil science, which has a scientific and practical interest.

We are confident that the collection of published articles will supplement the series of publications on the most important issue - preservation of soil fertility, protection of soil resources and the environment.

Academician of the AAS RK,
Corresponding Member of NAS RK
Doctor of agricultural sciences, professor,
President of the Congress A.S. Saparov

Taxonomic distance as a tool for finding correlation between soil taxonomy and world reference base classification systems, in calcareous, gypsiferous and saline soils

Ali Asghar Jafarzadeh [1], V. Montakhabi Kalajahi [1], S. Oustan [1], F. Shahbazi [1], R. Arabi Belaghi [2]

[1] *University of Tabriz, Faculty of Agriculture, Department of Soil Science, Tabriz, Iran*
[2] *University of Tabriz, Faculty of Agriculture, Department of Statistics, Tabriz, Iran*

Nowadays, Soil Taxonomy (ST) and World Reference Base (WRB) are the most popular soil classification systems in the world. Finding correlation between ST and WRB is important to achieve a comprehensive and universal soil classification system especially in salt affected soils. For this, 40 pedons of calcareous, gypsiferous and saline soils in 10 regions of East and West-Azerbaijan provinces in Iran were selected, described and sampled. In addition, physicochemical and semi-quantitative clay mineralogical analysis (in B-horizons) were carried out. Thereafter, soil classification was performed using ST and WRB systems, and Taxonomic distance between soil units, calculated by concept-based (using dominant identifiers) and centroid-based (using physicochemical characteristics) approaches, to obtain the similarities and differences or general relationships between suborders of Salids, Calcids, Gypsids, Xerolls, Aquolls, Xerepts, xerrerts, and Argids and reference soil groups (RSGs) of Solonchaks, Solonetzs, Calcisols, Gypsisols, Kastanozems, Gleysols, Vertisols, and Luvisols. The foundation of both methods was Mahalanobis distance, calculated by the R software. Remarkably, the concept and centroid-based results showed that Calcids were closest suborder to Kastanozem, Gleysols, Solonetzs and Vertisols RSGs rather than Calcisols, but the first closest group to Gypsids were Gypsisols. Also, the both methods referred to the closest RSGs of Solonchaks and Solonetzs for Salids. It can be concluded that the expert based, the concept- and the centroid based methods does not always give the same or predictable results.

Key words: correlation, salt affected soils, soil taxonomy, taxonomic distance, world reference base.

***Corresponding author:** Ali Asghar Jafarzadeh,
E-mail: jafarzadeh1396@yahoo.com

The factors and processes of the spatial differentiation of the soil cover of postglacial terrains in the forest area

Aparin B.F.[2,1], Sukhacheva E.Ye.[1,2*]

[1]The Dokuchaev Central Soil Science Museum, Saint-Petersburg, Russia
[2]The Saint-Petersburg State University, Saint-Petersburg, Russia

Creation of digital soil maps is based on the knowledge of the laws of the Spatial Differentiation of the soil cover (SC) and their relationship with soil formation factors. The purpose of the paper is to characterize the factors and processes of the natural soil cover organization of postglacial terrains in the forest area. According to formula SCP=f(LF, OF, CLF, HF FF) T, factors of the spatial differentiation of the soil cover are lithogenic, orogenic, climatogenic, hydrogenic, and phytogenic fields and field interaction time. Hereinafter, fields mean spatial and temporal variability of the spatial differentiation of the soil cover factors. In the territory of the postglacial terrains, the main SCP formation factors are orogenic, lithogenic, and hydrogenic fields. The orogenic fields are represented by the following genetic forms of the terrain: hill (ridge)-moraine, aqueoglacial, (old)lake ice plains, sea dunes, beach ridges, as well as protrusions of bedrock. The orogenic field parameters are important factors in the formation of the water exchange structure. Lithogenic fields are different in terms of their granulometric, chemical, and mineralogical composition, as well as water physical properties, which creates a great diversity of the SC component composition. Climatogenic fields have no significant impact on the SCP within of the postglacial terrains in the forest area. Hydrogen fields have been formed under the influence of the depression of the base level of erosion, which led to the SC differentiation in terms of the water exchange intensity.

Key words: Soil formation factors, soil cover patterns (SCP), postglacial terrains.

***Corresponding author:** Sukhacheva E.Ye., E-mail: lenasoil@mail.ru

Identification of suitable micro catchments for organic agriculture using GIS and remote sensing in East part of the Black Sea region

Betül Bayrakli [1,*], Orhan Dengiz[2], Elif Öztürk [1], Serkan Iç [1], Emel Kesim [1], Aylin Erkoçak [1], Nalan Kars [1], Murat Birol [1]

[1]Republic of Turkey Ministry of Food Agriculture and Livestock, Black Sea Agricultural Research Institute, Samsun, Turkey
[2]Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

In recent decades, degradation of environmental quality and decreasing food safety concerns due to excess use of fertilizers and pollutions promoted the organic farming. In addition, organic agriculture has developed rapidly in the world and global organic food market has been growing. Organic farming has a great scope in the Artvin Province because of its climatic and environmental conditions. The main crops are hazelnut and tea plant cultivation in Artvin province. The purpose of this study was to determine suitable micro catchments for organic farming by using GIS and Remote sensing techniques in Artvin Province located at the east part of the Black Sea of Turkey. Remote sensing and GIS can play an important role in the identification of the suitable zones for the development of organic farming in more facile manner. Total 140 micro catchments were determined in Artvin Province using DEM by means of Hydrology Tools. After removing forest, pasture, bare lands and, also artificial areas such as settlement, road, industrial area and so on, 18 micro catchments were selected by taking into consideration of their arable land size. From arable lands located in selected catchments, total 242 soil maples were collected from surface (0-20 cm) and subsurface (20-40 cm) depths to determine their physical, chemical, nutrient element status and heavy metal content. According to results, micro catchments coded as 1, 6, 7, 12 located around Ardanuç and Şavşat Districts were determined nickel concentration which is over the threshold in both depths due to volcanic parent material. In addition to that, high cupper heavy metal content was found in some micro catchments coded as 4 and 5 located around Borçka District due to strong acid condition. On the other hand, other micro catchments located around Arhavi, Yusufeli and Şavşat such as 2, 3, 10, 11, 13, 14, 15, 16, 17 and 18 were detected as suitable micro catchments for organic agriculture activity.

Key words: organic agriculture, micro catchment, GIS and RS, Artvin.

***Corresponding author:** Betül Bayrakli, E-mail: bbetul25@gmail.com

The assessment of resource potential of agro-landscapes with use of geo-information systems on the basis of soil cover structure

Chervan Aliaksandr*

Institute of Soil Science and Agrochemistry of National Academy of Sciences of Belarus, Minsk, Belarus

A variety of soil-land resources requires a differentiated approach to recording and evaluating its modern environmentally safe and economically efficient state. Rational use of soil and land resources necessarily implies consideration of all of their distribution and overall assessment. As a result of research the methodological approaches to determining the resource potential of agro-landscapes were developed and their approbation by the example of concrete objects was performed. The possibility of typing soil combinations and characterizing by their unity of properties and features of agricultural landscapes can treat them as types of land. The basis for the selection of some soil combination, in addition to the shape of the structure of soil cover, is the specificity of the four environmental conditions: orographic, geomorphological, lithological, hypsometric ones. Remote sensing data – aero photomaps and satellite imagery – can give additional material for verification of geo-systems. As the result, an unified legend for maps of soil cover structure made for the whole territory of Belarus and combines 50 types of soil combinations, or types of land distributed differently everywhere. The foundation of the information component of the rational use of soil-land resources is a systematic inventory of the natural conditions of agro-landscapes based on soil cover structure within the boundaries of invariant units – land types. The possibility of using geo-information systems in the inventory of natural and anthropogenic environment with an estimate of resource potential was determined. The dependence of the production cost of agricultural production on the value of the resource potential of agricultural organizations was established and the suggestions for rational use of land erosion and wetland agro-landscapes was developed.

Key words: soil combination, land types, agrolandscape, system approach, digital soil mapping.

***Corresponding author:** Chervan' Aliaksandr, e-mail: chervanalex@mail.ru

Initial soil formation in post-exploited areas: a study of abandoned gravel mine

Damian Chmura [1,*], Tadeusz Molenda [2], Joanna Kidawa [2]

[1] *University of Bielsko-Biala, Willowa 2, 43-309 Bielsko-Biała, Poland*
[2] *University of Silesia, Będzińska 60, 41-200 Sosnowiec, Poland*

The exploitation of gravel deposits in mineral aggregate mines lead to creation of a significant amount of waste. Usually, these are fine-grained mineral fractions (clays, dusts, sands) that arise during sifting and washing of the output. The waste can be transported in the form of water pulp to settling tanks, which after desiccation are dried and closed. The fine-grained material deposited on the settling tank is extracted from it and causes an increase in dustiness in the area. Reclamation of this type of objects is very difficult due to unfavorable conditions for development of vegetation: the substrate is deprived of organic matter and biogenic elements and the lack of groundwater. There also no beneficial factors for soil formation due to character of substrate and lack of supply of nutrients by plant decomposition. The area of the "Wójcice" gravel mine (50° 27 '24.47"N; 17° 13' 8.6" E) in southern part of Poland, was chosen for the purpose of this research, where no reclamation was carried out, and no plants were sown or planted. Hydrological investigations of reservoirs in the mine, soil sampling and botanical studies of vegetation growing on the bottom of settlers as well as on heaps made by sand were carried out. The colony of Black locust Robinia pseudoacacia L. was observed, the species that in Europe has status of an invasive plant. R. pseudoacacia appears there on the surface of the settlers, but it is replaced by shrubs and trees of the willow Salix genus, while on heaps of sand, over time, it achieves a dominant role. Three stages of succession can be distinguished: the initiating stage with the Saponaria offcinalis, the intermediate stage of biogroup with Black locust, the subsequent stage of shrubs and the final stage is the R. pseudoacacia woodland. Estimated time for the forest to be developed due to primary succession is about 25 years (based on information from mine employees). In total 32 study plots (4 m^2) were placed on a sand heap, 8 in each stage. The soil was analyzed in terms of chemical and physical properties. The content of nutrients such as nitrogen, potassium and phosphorus in all plots was not recorded or it was below possibilities of laboratory determination. There were traces of organic matter, manifested in loss on ignition ranging from 0.46 to 0.98%. The floatable parts varied between 1.4 till 5.8%. The Friedman test (chi-square = 17.25, df = 3, $p < 0.001$) showed a significant difference in the loss of ignition among the stages of succession, the medians range from 0.48% in the initial stage to 0.89% in the final stage. Differences also were found for pH KCl, (22.95, $p < 0.001$), which at the initial stage is 4.53, and in Black locust thickets and in the R. pseudoacacia woodland, respectively 5.77 and 5.55. It can be inferred that in such sites only members of Fabaceae family can exist. Black locust despite that it is invasive tree species and is capable to overcompete and replace native species, can play positive role. As a plant which is in symbiosis with bacteria that fix atmospheric nitrogen, it can enrich the initial soil in

nitrogen in degraded areas, and stabilize the substrate and through shading it creates conditions for shade and shade-loving plants. The possible use of Black locust in reclamation of post-industrial areas, especially nitrogen-poor sites, should be accompanied by monitoring and control of the population. No special treatments of soil rehabilitation are needed. During the course of spontaneous vegetation content of organic matter in substrate increases and conditions for plant colonization become more favorable.

Key words: initial soil, sand soil, primary succession, plant invasion.

***Corresponding author:** Damian Chmura, E-mail: dchmura@ath.bielsko.pl

Creation of a cartographic model of the terrain for planning soil treatment technologies in field cultivation

N. Dobrotvorskaya[1],*, A. Rudchikov[2]

[1] Siberian Federal Scientific Research Center of Agrobiotechnology of Russian Academy of Science, Laboratory of Rational Land Use, Krasnoobsk, Novosibirsk, Russia
[2] "Unmanned aerial vehicle technologies", Novosibirsk, Russia

One of the most important natural factors of rational land management is the terrain, especially its relief. It must be taken into attention when choosing the field configuration. In addition, the speed and direction of water currents and of migration nutrients depends on the magnitude and direction of the surface slopes. The object of the research was selected part of the territory, located in the foothill plain of Altai. The relief of the investigated territory is characterized by a considerable dissection with a predominance of surfaces with an inclination angle of 1.5 ... 3.0 °. The area of the plot is 1920 hectares. Coordinates from 50.9 to 50.95 ° N and from 81.55 to 81.63 ° E. The research method included a survey of the terrain using a Supercam-250 unmanned aerial vehicle equipped with a Sony Alpha 6000 24.3 mP camera, a high-precision on-board receiver JAVAD TRE-G3TAJT, creating a relief map and, after that, a field soil survey, creating a soil map and an integrated map of agro-ecological land types. The accuracy of the soil survey significantly increases when using the Digital Elevation Model (DEM). In this work, DEM was created using digital aerial photography from a UAV with a resolution of 9 cm per pixel, using marked reference and control points. The accuracy of the DTM was about 25 cm in height, which corresponds to the requirements for the height of the relief section of 1 m. The construction of the DTM and DTP (digital topographic plan) was carried out using the programs Photoscan (Agisoft, Russia) and GIS Panorama. DTM was presented in two versions: 1) the altitude part of the DTP scale 1: 2000 in the form of pickets and horizontals through 1 meter, superimposed on the orthophoto. In this variant, the basic forms of the mesorelief are presented, 2) the matrix of heights, in which each pixel corresponds to a square on a surface measuring 0.5 x 0.5 m. This version of DEM allows you to detail the features of the surface, including the level of microrelief - surface shapes and elements of a size of one and tens of meters, even with slight variations in heights. The specified cartographic model allows to calculate and visualize such characteristics as surface slope in degrees, direction of surface runoff and erosion, describe relief elements, indicating slope and exposure of the slope, create longitudinal and transverse profiles of surface areas, etc. Based on the results of soil surveys and on the basis of the relief map data, a rational method of using land, choosing crops and types of soil conservation treatment of soils is determined.

Key words: digital elevation model (DEM), soil survey, digital agroecological model of the land.

***Corresponding author:** Nadezda Dobrotvorskaya,
E-mail: dobrotvorskaya@mail.ru

A study on the positional accuracies of GPS measurements in terms of GIS spatial data precision

Ekrem Tusat *, Ismail Aktas, Nurullah Adiguzel, Ugur Kutat

Selcuk University, Engineering Faculty, Department of Geomatics Engineering, Konya, Turkey

The most fundamental requirement for Geographical Information Systems (GIS) is spatial data. There are various different methods to obtain spatial data and, of these, GPS technique is the most essential data collection means. It is possible to obtain spatial data of varying accuracies using different techniques in the GPS technique. This study aimed to investigate positional accuracies of different GPS measurement methods. To this end, a test network was created in the Bosna Hersek neighbourhood of Konya province in Turkey. Of the GPS measurement techniques, absolute point positioning through code measurements and of the relative point positioning techniques, static point positioning and Real Time Kinematic (RTK) point positioning technique were used. The coordinates obtained as a result of static observations made at the same points and of the code measurements, the coordinates obtained from absolute point positioning and RTK measurements were compared and contrasted. The findings were assessed within the scope of the accuracies expected of the GIS positional purposive measurements. Spatial data and measurement methods were compared and contrasted in terms of durations of measurements, repeatability and accuracies. Usability of the obtained results for GIS applications of different purposes was interpreted.

Key words: GIS, GPS, spatial data, absolute point positioning, relative point positioning, RTK.

***Corresponding author:** Ekrem Tusat, E-mail: etusat@selcuk.edu.tr

Mathematical rationale of central images of agrogenic soils of the arid steppe of the Altai region

Ye.V. Konontseva, Ye.G. Pivovarova*, K.R. Vepryntseva, J.G. Khludenzov

Altai State Agricultural University, Barnaul, Russia

According to the concept of I.A. Sokolova (2004) on the central images of soils, their classification neighbors, and the taxonomic weight of features in the basic classification, the working hypothesis consisted in the mathematical rationale of these notions in terms of information-logical analysis (Puzachenko, et al., 1970). The research targets were agrogenic soils of the arid steppe (Classification ..., 2004). The data of the last round of a large-scale soil survey were used (Altai NIIGiprozem) – a sample multitude of 390 objects. The taxonomic weight of each feature was determined by the value of information transfer efficiency coefficient (Ceff). The results indicate that most of the features have a small taxonomic weight in both plow and sub-surface horizons. The decrease of the taxonomic weight of the features in the plow horizon is probably due to its homogenization caused by agricultural use of soils. In agrogenic soils, the humus horizon thickness has the greatest taxonomic weight; the measure of significance of other features (pH_{H2O} in the plow horizon, the total exchangeable bases in the sub-surface horizon S, the content of active forms of phosphorus and potassium in the sub-surface horizon) is much lower the same as in the soils of the natural genesis of the arid steppe (Vepryntseva, Pivovarova, 2018). Specific conditions of soil features were calculated for each central image. A suite of specific conditions of soil features may serve as the central image of agrogenic soils of a given region (regional standard). The information-logical model of the zonal standard of agrogenic soils (agrochernozems, agrozems, agroabrozems) was developed to take into account the taxonomic weight of the features. To make information analysis of the relationship, the qualitative features (soil subtypes) were converted into quantitative ones: the agrogenic soils were arranged as a genetically conjugate series reflecting the intensity of the main (sod-forming) and accompanying (degradation) soil-forming processes in accordance with the rank number. The obtained models may be used for diagnosis of soils and monitoring of their agroecological status.

Key words: soil classification, central images of soils, taxonomic weight of features, information-logical model, agrogenic soils.

***Corresponding author:** Elena Pivovarova, E-mail: pilegri@mail.ru

Biomarkers as paleoecological indicators in mountain soils of Eurasia

N.O Kovaleva [1], E.M. Stolpnikova [1,2], I.V. Kovalev [1*]

[1] *Lomonosov Moscow State University, Soil Science Faculty, Russia*
[2] *A.N. Severtsov Institute of Ecology and Evolution RAS, Russia*

It has been shown by the methods of biochemistry, nuclear magnetic resonance, and isotope geochemistry that the proportions of lignin phenols, n-alkanes, amino sugars may be used as molecular traces of paleovegetation and paleobiota. The information role of biomarker has been tested at the reconstruction of paleovegetation in the Caucasus and Tien Shan, an upward shift of the forest boundary has been recorded on the Northern Caucasus; the hypothesis about the steppe period of landscape development in the Tien Shan mountain valleys during the middle Holocene has been confirmed, and molecular traces of tropical flora have been revealed in the buried soils of Pleistocene age in Crimea, the earliest stage of the allochthonous carbonate accumulation in the area dated to approximately 20 ka cal BP was established in the Lesser Caucasus. The representativeness of information has been increased using the isotope analysis (δ13C); a new parameteres - the composition of lignin phenols and n-alkanes - have been introduced in the existed system of biomarkers.

Key words: paleosoils, biomarkers, mountain soils, carbon isotope composition.

***Corresponding author:** I.V. Kovalev, E-mail: kovalevmsu@mail.ru

Numerical method in rationale of central images and diagnostics of soils in the arid steppe of the Altai territory

Ksenia Vepryntseva*, Elena Pivovarova

Altai State Agricultural University, Russia

Under the intensive agricultural usage of soils, main features of their upper horizons arable(A) and sub-plow(AB) have changed. As a result, it became complicated to classify genetically close soils even by type and subtype. The aim of research was to create the objective way to classify soils most accurately and to demarcate soils with similar features. Objects of research were zonal soils of the arid steppe of Altai region (Sokolov I.A., 2004) - southern chernozems; chernozem-meadow; meadow chernozem and meadow soils. The materials of the last large-scale soil survey have been used; data set consists of 390 objects. In our opinion, the most appropriate method for solving this kind of problem is informative-logical analysis (Puzachenko, Karpachevsky, Vznuzdaev, 1970). It allows to estimate the role of the main soil features (such as pH, content of humus, total nitrogen, mobile phosphorus P_2O_5, exchange potassium K_2O, the sum of the absorbed bases(Ca+Mg) and high of humus horizon(A+AB)) in forming of soil taxon and to define specific states for each zonal soil. A set of specific states of soil features can serve as a virtual (central) image of a certain taxonomic type (subtype) of soils of a given region (regional standard). During the research, central images were identified and an informative-logical model was developed. Such models can be used to diagnose soils and monitor their agroecological status.

Key words: soil classification, central image soil, chernozems, informative-logical analysis.

***Corresponding author:** Ksenia Vepryntseva, E-mail: ks.ad8astra@gmail.com

A 3-D pattern of soil salinity at the young coastal plains of the Caspian Sea (the case studies in Russia and Iran)

Maria Konyushkova[1*], S. Alavipanah[2], A. Abdollahi[2], T. Chernov[3], S. Hamzeh[2], A. Heidari[2], M. Lebedeva[3], I. Semenkov[1]

[1] Lomonosov Moscow State University, 119991 Moscow, Russia
[2] University of Tehran, Tehran, Iran
[3] V.V. Dokuchaev Soil Science Institute, 119017 Moscow, Russia

The Caspian Sea is a dynamic water body subjected to constant sea level changes. During the last centuries, the vast areas of dry lands appeared due to this phenomenon. The study and monitoring of the recently formed dry land is a key to understanding of the ways and mechanisms of the evolution of the Caspian landscapes after marine regressions. The goal of our study was to catch the first signs of differentiation of soil cover and to track them on the basis of the detailed soil salinity survey at the key sites of different ages (4 years - 60-70 years – 150-300 years - ~1300 years old). The key sites are located at the low-angle coasts of Russia (northern Dagestan) and Iran (northwestern Golestan) and are mainly represented by former lagoons and marshes with loamy and clayey deposits. The soils are solonchaks. The ground water level ranges from 1 to 5 m. The detailed soil sampling from one-meter -deep boreholes (40 to 60 boreholes at each study site) was performed in the field and electrical conductivity in soil samples (1:2.5 soil-to-water ratio) was measured in the lab. The 3-D maps of soil salinity were compiled using SkyScan software which can build and visualize the 3-D images from standard 2-D maps. The results showed that the differentiation of soils by their salinity starts at the first decades after desiccation and the pattern stays quite stable further on despite the processes of seasonal salination/desalination.

Key words: primary soil formation, 3-D soil mapping, electrical conductivity, spatial structure, lagoon, marsh, sea level change.

***Corresponding author:** Maria Konyushkova, E-mail: mkon@inbox.ru

Transformation of microstructure of soils with different genesis in the composition of soil constructions with different structure in the conditions of Moscow

Maria Suslenkova [*], Aminat Umarova, Marina Butylkina

Lomonosov Moscow State University. Faculty of Soil Science, Moscow, Russia

The transformation of soil microstructure in soil constructions was reviewed in this work. The studies were conducted during a 4-year experiment on the territory of Lomonosov Moscow State University (from 2012 to 2016). The method of rheology and scanning electron microscopy were used in this investigation. The object of the study were three variants of soil constructions with different structure of the profiles: 1) variant 1 (control) – its upper part is consisted of a homogenized A arable horizon; 2) variant 2 – layered construction, consisted of a series of layers: A arable horizon, peat, sand, A arable horizon; 3) variant 3 – a mixture of the above mentioned horizons. Scanning electron microscopy revealed an increase in the differentiation of the pore space of the upper A arable horizons of variants 1 and 2, the appearance of large associated microstructures in the peat layer of variant 2 and the microstructuring of the upper layer of variant 3. Changes in the spatial organization of the solid phase of soils are reflected in their rheological behavior. Gradual increase of the stability of structural relationships in the A arable horizon (variant 1) was discovered during investigation. The influence of the underlying layer of peat on the shape of the rheological curves of the A arable horizon in variant 2 and the transformation of the strength properties of the mixture with the formation of the characteristic rheological behavior of flowing bodies, which is typical for arable humus horizons, also were discovered.

Keywords: soil constructions, physical properties of soils, soil structure, scanning electron microscopy, pore space of soils, rheological characteristics of soils, solid phase of soils.

***Corresponding author:** Maria Suslenkova, E-mail: suslenkovamaria@gmail.com

Acknowledgements: This research was financially supported by Russian Foundation of Basic Research (the project No. 16-04-01851).

Micromorphological diagnostics of pedogenesis in Pleistocene paleosols and Holocene polygenetic arid soils on loesslike loams in Eurasia

Marina Lebedeva[1], Alexander Makeev[2], Alexey Rusakov[3], Redzhep Kurbanov[2], Andrey Ivanov[1], Tatyana Romanis[1]

[1]Dokuchaev Soil Science Institute, Moscow, 119017 Russia
[2]Lomonosov Moscow State University, Moscow, 119991 Russia
[3]St. Petersburg State University, 199034 Russia

For the first time, detailed micromorphological studies were performed for pedosediment sequences on terraces of the Akhtuba and Volga rivers in the Caspian Lowland, southern Russia. The reconstruction of the paleoenvironmental conditions of pedogenesis was based on comparison of micromorphological characteristics of the Pleistocene (MIS3 and MIS5) paleosols with those of (a) *Holocene polygenetic semidesert soils* of Solonetzic soil complexes on loesslike loams in the Caspian Lowland with contrasting soil and (b) *Holocene desert soils on loess sediments in the Dzungarian (China) and Ili (Kazakhstan) depression*s. The intensity of pedogenesis was also estimated via comparing data on soils with data on typical "non-pedogenic" loess layers. A comparison of micromorphological data on the modern and Late Pleistocene soils showed that the buried paleosols of different ages bear microfeatures of different types of pedogenesis: (1) *Arid pedogenesis* — low humus content, somewhat coarser aggregates (20–40 μm) and denser packing of intraped particles than in proper loess, and the presence of gypsum and carbonate pedofeatures; (2) *Steppe pedogenesis* — well-shaped clayey–humus aggregates, biogenic aggregates, diverse carbonate pedofeatures, krotivinas, and microfeatures of clay mobility; (3) *Hydromorphic pedogenesis* — gley mottling and Fe–Mn nodules; and (4) *Cryogenic pedogenesis* — syngenetic (MIS3) and epigenetic (MIS5) — with frost cracking, ring-shaped orientation of quartz grains, and specific ooidal aggregation.
Acknowledgment. The study of desert soils was supported by the Russian Science Foundation, project no. 14-27-00133; the study of paleosols was supported by the Russian Foundation for Basic Research, project no. 18-04-00638.

Key words: micromorphology, paleoenvironmental conditions, Pleistocene paleosols, Holocene polygenetic arid soils, loess.

***Corresponding author:** Marina Lebedeva, E-mail : m_verba@mail.ru

Information assessment of contemporary evolution alterations of soils at the South of Western Siberia

Mikheeva I.V.

Institute of Soil Science and Agrochemistry of SB RAS, Novosibirsk, Russia

Contemporary evolution of soil (CES) is considered as the process of changes of conditions of soil with time intervals from ten to hundred years. Assessment of changes of soil properties at fields is important for drawing conclusions about the CES happening in soils caused by anthropogenic influence and climate changes. When carrying out spatial soil monitoring, points of approbation in space don't coincide at different time, so it is necessary to use probabilistic models for assessment of states and changes of soils. The set of probabilistic-statistical distribution (PSD) of n soil properties in k soil horizons within the studied object is the model of a condition of the soil cover. We have offered to use probabilistic and information indicators for assessment of condition of soils and their changes. For condition of soil, besides the PSD functions of soil properties the information entropy is used. Values of information divergence of soil properties are used for assessment of changes of soils. The entered characteristics allow estimating extent of influence for the soil forming factors and anthropogenic impacts on probabilistic structure of values of soil properties and its stability. The case studies have been conducted in the big territory at the south of Western Siberia. It has been shown that CES occurs under the anthropogenic influences and natural processes caused by climatic trend of warming and by cycles on moistening. It is revealed by changes of probabilistic structure of values of properties of the soil. On data of archive records the probabilistic and information assessment of changes of soils during 60-90 years of the 20th century has been executed. In fact, the received models and estimates are statistical standards of condition of soils which should be used for comparison with the current and future results in the explored and neighboring territories.

Key words: soil processes; probabilistic models; information evaluation, statistical standard.

***Corresponding author:** Mikheeva I.V., E-mail: pulya80@ngs.ru

Cadastral valuation of Irkutsk regional lands, transferred from the category of agricultural areas: Theoretical and methodological aspects

Natalia Granina*

Irkutsk State University, Irkutsk, Russia

The land's structure of Irkutsk region is presented by categories. The distribution of agricultural lands of municipalities is shown, and the trends of their change are considered. The information has been analyzed about the creation of land's redistribution Fund by registration of unclaimed agricultural land' shares into the ownership of municipalities. The reasons for the withdrawal of arable land from agricultural turnover have been determined. The necessity of inventory of agricultural lands, accounting and conducting of soil-environmental researches under the land transfer from agricultural farmlands to another categories. Materials of this research can be used for modern making management decisions, which are aimed at ensuring of rational and effective using and protection of lands.

Key words: Land's cadastral evaluation, agricultural lands, land turnover.

***Corresponding author:** Natalia Granina, E-mail: Granina_n@list.ru

The serozem mineralogical composition of the Zhetysu ridge foothill plains

A.N Omirzakova*, K.M. Pachikin

The Kazakh Research Institute of Soil and Agrochemistry named after U.U. Uspanov, Almaty, Kazakhstan

The mineralogical composition of fine-grained soils of the Zhetysu ridge foothill plains was for the first time studied under the assessment of fertility and present state of agricultural lands in the South-East Kazakhstan. Basically, the soils forming here are zonal: dark and light chestnut soils, sierozem and intrazonal soils, namely, meadow sierozems, meadow soil, meadow-marshy soils, and bog soils. The current paper contains the statistical data obtained upon the mineralogical research of the northern and meadowy-sierozems of the Zhetysu ridge (the Dzungarian Alatau) thus being published for the first time. The following regional soils were in the focus of this study of sludgy fractions' mineralogical composition: sierozems northern common irrigable sandy loam in the section 06/C15, and the meadowy-sierozem nonsaline sandy loam on loessoid loams in the section 12/C15. The diffraction analysis was carried out with use of the automatic X-rays diffractometer DRON-3. The bulk analysis of the sludgy fraction was implemented using the X-ray spectrum microanalysis using the electronic probing microanalyzer "Superprobe 733", JEOL (Japan). The first ever studies of the sierozem's sludgy fraction of the northern soils revealed the following mineralogical composition: mixed-layered illite-smectite formations, hydromica, kaolinite, chlorite, lizardite, and non-argillaceous minerals of the fine-grained quartz and feldspar; meadowy-sierozem contained mixed-layered formations, magnesioarfvedsonite, kaolinite, lysortite, mica, chlorite, quartz and feldspar. The considered soils are characterised by significant amount of potassium of potential and near reserve, conditioned by the hydromical nature of fine-grained minerals and presence of feldspar. The results of the studies allow establishing the checkout of the content and change in vegetation's main nutrient elements, connected with land use planning for the sustainable development of the area.

Key words: northern sierozem, fine-grained mineralogy, hydromica, mixed-layered formations, kaolinite, chlorite, quartz.

***Corresponding author**: Aliya Omirzakova, e-mail: alnomir@mail.ru

Salt-affected soils in the Devonian Basin of Staraya Russa (Novgorodskaya region, Northwestern Russia): genesis, properties, classification

Uo.V. Simonova*, A.V. Rusakov

Saint Petersburg State University, St. Petersburg, Russia

The mineral springs of Staraya Russa (Novgorodskaya region, Northwestern Russia) and the conjugated elements of the landscape are the subject of research by hydrogeologists, archaeologists and represent a unique interest in the aspect of genetic soil science as the distribution areas of salt-affected soils in a humid climate. While in southern regions of Russia within the semi-desert, dry steppe, steppe and forest steppe zones, salt-affected soils are widespread, in the northern regions they are locally distributed. The origin of Staraya Russa mineral water was stated to be a result of tectonic faults in the crystalline basement which could cause the movement of sedimentary cover. As the water rises from the lower aquifers through the system of faults and joints it is saturated with salts. The soil salinization phenomenon considered is caused by the accumulation of saline water in zones of active groundwater seepage, and these are the places where groundwaters contact with brines of Devonian salt deposits. Being constantly under the influence of mineral waters discharged, soil profiles, however, undergo continual changes caused by humid climate conditions.

Key words: mineral springs, Devonian brines, Staraya Russa, salt-affected soils.

***Corresponding Author:** Julia Simonova, E-mail: uvsim@yandex.ru

Spatio-temporal development of deltaic landscape in the Kapchagai reservoir and methods of its study

Starodubtsev V.M[1]., Kussainova M.[2*]

[1]National University of Life and Environmental Sciences of Ukraine, Kiev, Ukraine
[2]KazNAU AgriTech Hub Almaty, Kazakhstan

The article considers the dynamics of the formation of the delta Kapchagai reservoir and the formation of hydromorphic landscapes. Based on the satellite images LANDSAT-5,7,8 period 1979-2017, the main hydrological characteristics of the reservoir and the parameters of the total water balance of the "river-reservoir" system are determined Deciphering of space images with the help of specialized software allows to determine the areas of newly formed landscapes and to diagnose the soil and vegetation of the object, which are specified by ground monitoring. The formation of new deltas of large reservoirs is considered as characteristic of the arid zone process. The formation of the delta in the Kapchagai reservoir over a 40-year period with an average speed of more than 200 hectares per year is indicative of the scale and universality of this process. Newly formed landscapes are of great ecological importance as reserves of biodiversity, as well as objects of recreational and economic development. Therefore, further cosmic and ground monitoring of such unique landscapes is an important task.

Key words: delta, Kapchagai reservoir, landscape, space image.

[*]**Corresponding author:** Kussainova M., E-mail: madgu@inbox.ru

Analyzing and mapping soil parameters as indicator of soil quality

Štefan Koco[1,2*], Jozef Vilček[1,2], Stanislav Torma[1]

[1] National Agricultural and Food Centre, Soil Science and Conservation Research Institute, Slovak Republic
[2] Department of Geography and Regional Development, Faculty of Humanities and Natural Sciences, University of Prešov, Slovak Republic

An evaluation of soil quality in terms of its benefits to society is the basis for the formulation of land use strategies, especially for agriculture land, and regional development because soil can be included among capability factors for development. On the basis of existing spatial databases and maps of soil parameters relating to production, environmental parameters and soil threat, indices of agricultural soil quality in Slovakia were developed and their distribution shown on maps. The final integrated index of soil quality was created in the GIS environment by the intersection of the above-mentioned partial indices, while preserving an equivalence rule – that is, all rated parameters had the same weight. The results show that in Slovakia 1.0% of agricultural soils are of very high quality, 30.3% are of high quality, 37.9% are of medium quality, 30.5% are of low quality and 0.3% are of very low quality. Most high-quality soils are in the lowlands and basins, which are mostly in the south of Slovakia. The result maps allow the identification of the partial indexes as well as the soil quality index for whole agricultural soil in Slovak Republic. The results are useful for agrarian landscape planning at specific sites as well as for the landscape structure management and optimization. The practical output from this result is the ability to obtain information about the quality of each agricultural soil in Slovakia.

Key words: soil; soil quality; GIS; soil maps.

***Corresponding author:** Štefan Koco, E-mail: s.koco@vupop.sk

A map of soil texture for the Ferghana Valley

Stulina Galina*, Rusiev Islom, Solodkiy Georgiy

Interstate Coordination Water Commission, Scientific - Information Center, SIC ICWC Tashkent, Republic of Uzbekistan

The objective was to generate a GIS-based map of soil texture. The Ferghana Valley is a depression surrounded by mountain ranges on three sides. The central part of the depression is a valley of the Syr Darya River formed by the junction of the Naryn River and the Karadarya River. Geomorphologically, the territory is comprised of thick alluvial cones, interconal sinks, terraces above flood-plains and adyrs. Such variety of landscapes causes heterogeneous soil cover attributed to various reliefs, geological structures, and mother rocks. The soil cover is comprised of light, typical dark sierozem, sierozem-meadow soil, and alkaline soil (*solonchak*). The major part, more than 70 % of the Valley, of irrigated land refers to the Uzbekistan's territory. Water requirements that form the basis of a water use plan are calculated by the CROPWAT model and its modified version, REQWAT. The soil texture is the key in calculating water requirements. However, it is somewhat problematic to assess soil texture as boundaries of soil fractions in local and most international classifications used in the models for calculation of water requirements are different. Conversion of data classes from one classification to another one was made by a Macrobook model developed on the base of an integral curve of grain-size distribution. Based on huge sampling of soil profiles for soil fractions, the study area was ranked in terms of classes. Finally, the soil texture maps were produced on the base of soil maps scale 1:200 000 and 1:100 000 for province and district levels and using the maps of 1:20 000 and 1:10 000 for Water User Association level. All information is represented in GIS as programming for calculation of water requirements is made in graphical environment. This work is of practical relevance as it is included in the recommendations on crop irrigation scheduling and used in planning water use by Basin Irrigation System Administrations (e.g., Syrdarya-Sokh Basin Administration).

Key words: soil, soil texture, GIS, water requirements, Ferghana Valley.

***Corresponding author:** Stulina Galina, E-mail: galina_stulina@mail.ru

Micromorphology of mountain-forest dark-colored soils of north Tien Shan

G.Tokseitova

U.U. Uspanov Kazakh Research Institute for Soil Science and Agricultural Chemistry, Almaty, Kazakhstan

The purpose of micromorphological studies of mountain-forest dark-colored soils was to study their microstructure in thin sections of an undisturbed soil matter. These soils are formed in the upper screen of the forest-meadow-steppe zone under forests of the Tien Shan spruce in conditions of strongly dissected relief on the steep slopes of the Northern, North-Eastern and North-Western exposures. Micromorphologically, the upper part of the mountain forest dark-colored soils consists of coprolites of earthworms and composite soil aggregates consolidated by the humus. This structure has a well-developed network of pore space which gives the soil loose and spongy microcomposition to provide a high soil aeration. Organic matter consists of plant residues of various degrees of decay, excrements of soil meso- and microfauna completed by finely dispersed humus. Among plant tissues there are mushroom hyphae and spores of bacteria which play an important role in their decomposition as the formation of finely dispersed humus. The humus exists in dark-colored, brownish-colored, clotted and flaky forms. In the middle part of the soil profile, the first signs of the process of illuviation-illimerization in the forms of clay kutasn illuviation on the walls of pores, thin streams of clay materials in the pores was indicated. Below there have been shown layered deposits in the pores, often with dense humus and dust particles, ferruginous material and clay aggregates with complete optical orientation. This may evidence in favour of a relatively intensive migration of substances and growing movement of finely dispersed clay material without signs of its destruction. The iron accumulation has been detected in the form of concretions and nodules of small dimensions with close parking. Carbonates appear in the lower subsoil. There are three main microforms of calcite. Needle calcite (lublinite) is concentrated in large angular pores. Fine-grained calcite with a dense layer of the wall of isolated pores. Microcrystalline calcite fills fine pores. Sometimes in the same pore co-located microcrystalline and acicular calcite. The mineral skeleton has been determined to be formed by grains of feldspars, quartz, and biotite plates with pronounced signs of weathering.

Key words: microstructure, aggregates, plant residues, humus, carbonates.

***Corresponding author:** G.Tokseitova, E-mail: tokseitova-2011@mail.ru

Time as a factor of soil formation and evolution of soils

Tskhovrebov V.S., Faizova V.I. Nikiforova A.M.

Stavropol State Agrarian University, Department of Soil Science, Stavropol, Russia

Time, as a factor of soil formation, has been poorly studied. Soil formation is the unity of two polar opposites, living and inert matter. Live plant formations and microorganisms meeting their nutritional needs destroy minerals and rocks. The driving force of this destruction is the supply of hydrogen protons to the soil environment together with active organic and inorganic compounds of acidic nature of biological origin. During the preparation of the article, the research of the Department of Soil Science of the Stavropol Agrarian University was used. Based on the study of Cuban soils on various rocks and buried soils of burial mounds in the burial grounds of the Stavropol Territory, conducted together with archaeologists. Archaeological excavations were carried out in the arid zone of the edge on chestnut soils and in a relatively humid zone on chernozems. A model of soil evolution under wet conditions is given. It can be assumed that in evolutionary development the soils consistently pass from birth on the rock to a mature state, and then aging and their natural death (neo-breed). The longest stage is the aging of the soil, the shortest stages are the beginning of soil formation and death. The increase in fertility is guaranteed by the processes of weathering of minerals and the transfer of inaccessible forms of nutrients into accessible, accumulation of organic matter, improvement of physical, physico-chemical, water, air (etc.) soil properties, and increased microbiological activity. Degradation of fertility is also caused by the weathering of minerals, but at later stages of soil formation, when significant differences between soils and rocks are observed, a decrease in the content of organic matter and nutrients, and significant acidification of the soil solution.

Key words: stages of soil formation, beginning of soil formation, maturation of soils, soil aging, fertility.

***Corresponding author:** Tskhovrebov V.S., E-mail: tshovrebov@mail.ru

Mapping and evaluation based on modelling of soil fertility using GIS and interpolation methods

Orhan Dengiz *, Coşkun Gülser, Rıdvan Kızılkaya

Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

This study, The Ilıcak and Kum Stream, which covers an area of 16.64 km2 in the Gediz Basin of the Aegean Region, was conducted in two adjacent micro basins by taking into consideration of different land uses. Soil fertility changes of land resources were investigated and distributed maps were created by using the soil fertility model by means of interpolation models and Geographic Information System techniques in the study area. In the study, 15 parameters (physical, chemical and productivity soil properties) in the Soil Fertility Index (SFI) model were determined surface (0-30 cm) to estimate soil fertility. The study area was divided into 700 x 700 m grid squares. A total of 319 soil samples were collected from the surface (0-30 cm) of each grid intersection point. The proportional values of all the factors considered for determining the soil fertility index (SFI) value of each soil sampling point were used and the soil fertility was calculated through a parametric approach. After this step, soil fertility distributions and mapping processes were carried out using interpolation methods and Geographic Information System (GIS) techniques. 58% of the total area has good (S1) and moderately fertile (S2) soil and 30.70 % (S3) of the study area's soil is poor fertile soil when the soil fertility of the surface area of the study area is evaluated. Only a very small area (11.30 %) has non fertile (N) soil. In addition, CORINE land use and land cover classification were performed in order to determine land use-land cover distribution of the study area.

Key words: Soil fertility index, geographic information systems, land use, alluvial areas.

***Corresponding author:** Orhan Dengiz, E-mail: odengiz@omu.edu.tr

MPSIAC model evaluation by check dams data in west Azerbaijan

Abbas Ahmadi[1,*], Reza Sokuti Oskuie[2], Mazyar Usefi Niakan[1]

[1] University of Tabriz, Faculty of Agriculture, Tabriz, Iran
[2] Agricultural and Natural Resources Research Center of West Azerbaijan, Uremia, Iran

In this study the accuracy of MPSIAC model was investigated by comparing its estimates with collected sediment at the behind of check dams which are located at 14 small watersheds in West Azerbaijan province. For this reason 116 check dams were selected for the study. Then the total volume of sediments which deposited behind of each check dams was measured by volumetric method and the mean annual sediment yield was calculated by dividing of the total sediment yield into check dams' lifetime. Then difference between measured and estimated sediment yield was compared statistically by paired sample t- test. Results showed that there are significant correlations between specific sediment yields, channel erosion, upland erosion, surface geology and land cover factors scores. Moreover results showed that there is no significant difference between mean of the measured and estimated values ($p<0.05$). As well as relative root mean squares error (RMSE) and model efficiency (ME) criteria showed that model had a high performance in soil erosion and sediment yield estimation at studied watersheds. The MPSIAC model could estimate sediment yield in the study area with a reasonable accuracy. But estimations of this model in watersheds with low and high specific sediment yield likely will be higher and lower than the real specific sediment yield, respectively. Results also showed that, in the west Azerbaijan, surface formation is the most important factor in controlling of soil erosion.

Key words: empirical models, Bulk density, sediment generation, soil erosion.

***Corresponding author:** Abbas Ahmadi, E-mail: a_ahmadi@tabrizu.ac.ir

Development of pedotransfer functions for estimating of soil moisture at FC and PWP conditions using fractal dimensions

Abbas Ahmadi [1], Mojtaba Alimohammadi [2], Shokerollah Asghari [2]

[1] University of Tabriz, Faculty of Agriculture, Department of Soil Science, Tabriz, Iran
[2] University of Mohaghegh Ardabili, Faculty of Agriculture and Natural Resource, Department of Soil Science and Engineering, Iran

The purpose of this study were development of pedotransfer functions (PTFs) for estimating of soil moisture content at field capacity (FC) and permanent wilting point (PWP) conditions by artificial neural networks system (ANN) and multivariate regression method and investigation effects of using fractal dimensions of soil components as a predictor for increasing the accuracy and reliability of these PTFs. For this reason 90 soil samples were collected from Ardabil province and some of their properties were measured. Regression-PTFs of FC and PWP were developed once by using and once without using of the fractal dimensions (primary particles, aggregates and porosity fractal dimensions) as independent variables. The predictors of Regression-PTFs, Once again was used for development of the ANNs-PTFs. Results showed that when fractal dimensions used as independent variables for estimating of FC and PWP, three variables (bulk density (ρ_b), particles density (ρ_p) and fractal dimension of soil pores (D_s)) included as a predictor in PTFs. But when fractal dimensions don't used in modeling, FC- PTFs were developed with four predictors (ρ_b, ρ_p, d_g and σ_g), and PWP- PTFs were developed with two predictors (ρ_b and ρ_p). Results showed that when fractal dimensions used as independent variables, accuracy of the ANN-PTF were increased.

Key words: fractal theory, modeling, pressure plates, soil moisture coefficients, soil pores.

***Corresponding author:** Abbas Ahmadi, E-mail : a_ahmadi@tabrizu.ac.ir

The impact of multiple freeze–thaw cycles on the microstructure of aggregates from a soddy-podzolic soil

K.N. Abrosimov[1,*], K.A. Romanenko[1, 2], E.B. Skvortsova[1], E.V. Shein[1, 2], A.V. Yudina[1], V.V. Klyueva[1], D.D. Khaidapova[2], V.V. Rogov[2]

[1] Dokuchaev Soil Science Institute, per. Pyzhevskii 7, Moscow, 119017 Russia
[2] Lomonosov Moscow State University, Leninskie gory, Moscow, 119991 Russia

With the help of computed X-ray microtomography with a resolution of 2.75 μm, changes in the microstructure and pore space of aggregates of 3 mm in diameter from the virgin soddy-podzolic soil (Glossic Retisol (Loamic)) in the air-dry, capillary-moistened, and frozen states after five freeze–thaw cycles were studied in a laboratory experiment. The freezing of the samples was performed at their capillary moistening. The laboratory experiment showed that the initial air-dry aggregates of 3 mm in diameter isolated from the major genetic horizons of the virgin soddy-podzolic soil are subjected to significant transformation of their inner microstructure and pore space under the impact of capillary moistening and subsequent five freeze–thaw cycles. The capillary moistening of the aggregates from the AY, EL, and BT1 horizons leads to the development of the platy, fine vesicular, and angular blocky microstructures, respectively. This is accompanied by the increase in the volume of tomographically visible pores by 1.3, 2.2, and 3.4 times, respectively. After the subsequence five freeze–thaw cycles, frozen aggregates partly preserve the features of structural arrangement formed during capillary moistening of the samples. However, the total tomographic porosity in the frozen aggregate from the humus (AY) horizon decreases to the initial level in the air-dry aggregate, whereas the frozen aggregate from the EL horizon retains the high total porosity value owing to the development of large vesicular pores. The experiments demonstrated different stability of the shape of the aggregates towards the soil moistening and temperature fluctuations. Thus, the aggregate from the EL horizon completely lost its original configuration by the end of the experiment. The aggregate from the AY horizon after five freeze–thaw cycles displayed certain changes in its configuration and general guttering, and the aggregate from the BT1 horizon preserved its original configuration during all the stages of the experiment. This difference in the stability of the aggregates is in agreements with differences in their mechanical strength, water stability, particlesize distribution, and humus content of the soil mass.

Key words: x-ray microtomography, soddy-podzolic soil, microstructure, freeze–thaw cycles.

[*]**Corresponding Author:** Konstantin N. Abrosimov,
E-mail: abrosimov_kn@esoil.eu

Acknowledgements: This study was supported by the Russian Foundation for Basic Research (project nos. 16-04-00949 and 16-04-01111) and be the Presidium of the

Determining relationships between soil penetration resistance and some soil physical properties

Aktan Hangişi, Bülent Turgut*

Artvin Çoruh University, Department of Soil Science and Ecology, Artvin, Turkey

Reorientation of the soil particles because of the deterioration of the natural structure of the soil system under the influence of precipitation and mechanical forces is defined as soil compaction. The Atterberg limits are the term used to describe the effect of the water in the soil system on the mechanical behaviour of the soil. The water entering the soil system causes changes in the mechanical behaviour of the soil depending on the grain size distribution especially on the clay content of the soil. The aim of this study was determining the relationships between Atterberg limits and soil penetration resistance. For this purpose, a natural pasture was determined as a study area. In this area, 20 sample points were established and both penetration resistance were measured and soil samples were taken at three soil depths (0-25cm, 25-50cm, 50-75cm) for physical analysis such as grain size distribution, Atterberg limits, and moisture content. The results showed that all properties varied along the soil layers as well as correlations between soil penetration resistance and soil physical properties were statically significance.

Key words: Penetration resistance, atterberg limits, soil moisture.

***Corresponding author:** Bülent Turgut, E-mail: bturgut@artvin.edu.tr

Water regime modeling of soil constructions with different structure

Anastasia Gasina*, Aminat Umarova, Anastasia Vaigel, Maria Suslenkova

Lomonosov Moscow State University, Soil Science Faculty, Moscow, Russia

The problem of formation of lawn coverings for improvement of environmental conditions in cities is particularly acute. The important characteristic of megalopolises is using of a large number of the soil constructions which are formed by various soil layers. Since any adding of soil on the soil surface forms pronounced differentiation of the top part of soil profile, practically in all cases layered soil constructions are formed. Successful growth and development of plants requires providing of optimum conditions including the propitious water regime of soils. The success of soil constructions' activity is defined by duration of its steady functioning. Now in soil hydrophysics mathematical modeling of processes of incoming and redistribution of water in the soil is used more often, that allows to carry out the prediction of the water regime of soils. The aim of our research is prediction of the water regime of soils with different structure of the top part of soil profile by mathematical modeling. Results of modeling have demonstrated presence of the difference in the water regime of soil constructions with a different structure of soil profile both at the time of making of these soil constructions and its change in 2-year period of their functioning. This research was financially supported by RFBR (Grant № 16-04-01851).

Key words: Soil constructions, mathematical modeling, water regime of soils.

***Corresponding author:** Anastasia Gasina, E-mail: anastasiagasina@gmail.com

Influence on some soil characterization of hazelnut shell biochar in different particle size

Damla Bender Özenç, Funda Irmak Yilmaz, Ceyhan Tarakçioğlu, Sezen Kulaç, Selahattin Aygün*

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

Hazelnut shell is a good biochar material with high carbon content and organic matter content. There is not enough research about the use as soil improvement of biochar produced from hazelnut shell. In this study, the biochar produced from the hazelnut shell was separated into different fractions (1-2-4 mm) and then mixed to the soil at different doses (0-3-6 ton da^{-1}) and left to incubate (30-60-90-120 days). Several physical and chemical parameters in the soil were examined. The significant physical properties and EC and pH of the soil increased depending on incubation time and biochar doses. Higher saturation percentage (63.07%), aeration capacity (17.00%), hydraulic conductivity (15.72 cm h^{-1}), EC (370µS cm^{-1}) and pH (8.22) was found in 120 days-3 and 6 ton da^{-1} applications. The easily available water content (11.24%) and aggregate stability (27.28%) were the highest value at 90 and 60 days incubation time, respectively; 3 tons of da^{-1} have been sufficient. On the other hand, Zn and Cu contents of soil decreased as the incubation time and biochar dose increased. Bulk density of the soil increased as particle size decreased. Both organic matter and the available macro-micro element concentrations were significantly higher in 2mm fraction size, except Fe content. Soil organic matter (1.52%), total N (0.11%), phosphorus (7.24 mg kg^{-1}), and potassium (59.21 mg kg^{-1}) contents reached maximum values at 120, 60 and 90 days incubation time, respectively; 3 ton application have been sufficient.

Key words: Biochar, particle sizes, incubation, physical-chemical properties.

***Corresponding author:** Selahattin Aygün, E-mail: selahattin_555@hotmail.com

Acknowledgements: This article supported by Scientific Research unit (project number: AP-1711) from Ordu University

Imaging spectroscopy in assessment of heterogeneity of soil properties on arable land

Frantisek Zemek*, Miroslav Pikl

Global Change Research Institute, CAS, Brno 603 00, Czech Republic

The study aims at identification of spatial heterogeneity of soil properties in field blocks of arable land and, based on that, a proposal of management zones in each part of the field in accordance with its soil fertility. We used three types of airborne data acquired in different (non)vegetation periods in two years, all supported with ground and laboratory measurements: 1) reflectance imaging spectroscopy data in the VNIR and the SWIR regions (CASI and SASI sensors, 380-2450 nm); 2) hyperspectral thermal infrared data (TASI, 8-11,5 μm); 3) LiDAR data (Riegl - Q780) with point density of 5p/m^2. We analysed orographic features from DEM created from the LiDAR data. The contents of soil organic carbon (SOC) and clay minerals in soils of the study area (320 km^2) was mapped from the HS data of the bare soil, calibrated by ground spectral measurements and physical-chemical properties of sampled soil. Vegetation indices (REP, NDVI) characterized homogeneity of green wheat biomass within each field as an answer of vegetation on soil conditions and properties. Maps of yield distribution in each field were prepared from the yield monitoring system data. The results show statistically significant agreement in spatial variability between: 1) the SOC and green biomass (VIs); 2) green biomass and a crop yield. Soil emissivity needs more attention because of high sensitivity of the TIR data to atmospheric correction and selected algorithm.

Key word: remote sensing, soil management zones.

***Corresponding author:** Frantisek Zemek, E-mail: zemek.f@czechglobe.cz

Determination of hydraulic conductivity in soil: A case study in an irrigated areas

Hande Sagir[1,*], Mahmut Cetin[2], M. Said Golpinar[2], Mert Acar[1], Hayriye Ibrikci[1]

[1]*Soil Science and Plant Nutrition Department, Cukurova University, Adana, Turkey*
[2]*Agricultural Structures and Irrigation Department, Cukurova University, Adana, Turkey*

Soil is a key factor for a sustainable ecosystem along with changing conditions such as agricultural practices, climate, topography, time, etc. In this study we determined soil Hydraulic Conductivity, which is among the physical characteristics, in most of the soil series. Hydraulic conductivity is a parameter of how easily water can pass through soil layers, high values indicate permeable layer through which water can pass easily with leaching plant nutrition elemens such as nitrate.This study was carried out in Akarsu Irrigation District (AID, 9495 ha), located in the Mediterranean coastal region of Turkey. AID provides producers with a wide range of use for all Mediterranean crops with agricultural and irrigation practices. The soils are mostly alluvial, deep and high in clay, calcium carbonate and pH, but low in organic matter, and have wide cracks during the dry summer months. The soils of Akarsu were comprised in 11 different soil series. Only the data of the most expanded six soil series-Arikli (29.5%), Incirlik (25.3%), and Yenice (12.2%) series cover 67% of the entire study area were used. These soils are under heavy tillage operations, and have environmentally hazardous applications as farmers' habit such as burning the leftover straws after cereal harvest. These practices showed that determination of hydraulic conductivity is important to know for keeping water and nutrients such as nitrate in subsoil. Since the area is under heavy irrigation and fertilization practices, knowing the hydraulic conductivity will be critical for agricultural sustainability.

Key words: hydraulic conductivity, soil series, leaching.

***Corresponding author:** Hande Sagir, E-mail: handesagir88@gmail.com

Effects of ten-year conventional and conservational tillage practices on resistance to physical degradation function

İsmail Çelik[1], Hikmet Günal[2], Mert Acar[1]*, Zeliha Bereket Barut[3], Nurullah Acir[4]

[1] Çukurova University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Adana, Turkey

[2] Gaziosmanpaşa University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Tokat, Turkey

[3] Çukurova University, Faculty of Agriculture, Department of Agriculture Machinery and Technologies Engineering, Adana, Turkey

[4] Ahi Evran University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Kırşehir, Turkey

Soil quality assessment requires a more comprehensive approach that goes beyond measuring individual soil properties or indicators by integrating the effects of sensitive physical, chemical and biological indicators. We investigated the effects of long-term (10 years) tillage systems on resistance to physical degradation function (RPD). A long-term (2006-2016) tillage experiment was conducted in eastern Mediterranean Region, Turkey including moldboard plow with stubbles (CT-1), moldboard plow with stubbles burnt (CT-2), heavy disc harrow with residue (RT-1), rotary tillage with residue (RT-2), heavy disc harrow zero soil tillage (RT-3), no till (NT) and strategic tillage (ST). In November 2015, half of no-till plots were divided into two sections, and half was plowed by a moldboard plow that was defined as ST. Soil samplings from 0-10, 10-20 and 20-30 cm were carried out in November 2016 following the harvest of soybean. Tillage type clearly affected the RPD function of soils in the wheat-soybean-corn rotation system, and strategic tillage helped to improve RPD of soils. The RPD functions in 10-20 cm and 20-30 cm depths under the CT-1 and in 10 -20 cm under ST were higher compared to surface layer, while the RPD function decreased with depth in all other tillage treatments. The RPD function scores with depth differed significantly ($p<0.01$) in RT-2 and NT applications, while in the other five applications, the change remained statistically insignificant. The results showed that strategic tillage of soil previously under long-term no-tillage significantly improved physical soil conditions for crop growth, air and water movement.

Key words: no-till, soil quality, physical degradation, SMAF, conventional tillage.

***Corresponding Author:** Mert Acar, E-mail: macar@cu.edu.tr

Acknowledgements: This study was supported by TUBITAK (TOVAG 115O353)

Aromatic Lignin as a precursor of humic in soils (according to ^{13}C NMR spectroscopy)

I.V. Kovalev, N.O. Kovaleva

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

A characteristic feature of lignin structures are their tendency to condensation reactions, which can lead to the formation of new stable C-C bonds. This lignin property with its high resistance to degradation divide it from other natural polymers and largely determines its action in biochemical processes, including the formation of humic acids. Lignin, perfoming protection function in plants, must provide different effects on the properties of humic substances, which are defined by phylogenetic origin of plants. Therefore humus substances have a different protection effect in different ecological conditions. The determination of lignin in plants, soils and humus acids involved the alkaline oxidation with copper oxide at 170^0C under pressure in nitrogen environment. The quantitative analysis of lignin phenols and ^{13}C-NMR spectroscopy proved that the lignin in higher plants was involved in the formation of specific compounds of soil humus, including aliphatic (peaks at 56 ppm) and aromatic (peaks at 147 ppm) molecular fragments. In the humus acids of Greyzems Haplic and alpine Leptosols Umbric the peak areas of lignin structures are mostly in the aliphatic part of ^{13}C-NMR spectrum. Correlation between the lignin content (VSC) in the humus horizons of humid landscapes soils and peak area of the lignin origin at 56 ppm is about 0,94 (P=0,95). In the humic acids of Chernozems, the contribution of aromatic lignin fragments to the nuclear part of the molecule is double that in the peripheral part of the molecule. In the buried horizons, the peak areas of lignin compounds in the nuclear fragments of humic acid molecules are larger than their halos for humic acids of the surface horizons by 5 times. The peak areas of lignin structures in the aromatic and aliphatic fragments are similar for the humic acids from Fe-Mn concretions and Gleysols Mollic of accumulation landscape positions. Comparison of ^{13}C-NMR spectra of native lignin preparations, isolated from different species of tree and herbaceous plants, with a spectrum of humic acid diagnosed that, the number of peaks at 102, 115, 119, 131, 152, 166 ppm also have a lignin genesis. Secondly, heterogeneous set of peaks in the spectra of different plants and, consequently, in the molecules of humic acids of different soils, must also be different. Thirdly, lignin of southern taiga trees is the source of more advanced in space molecules of humic acid with developed aliphatic part. Cinnamilic phenols from steppe plants form a spatially compact structure of Chernozem humic acids.
Financial Support: RSF №17-14-01120.

Key words: humic, lignin, soil.

***Corresponding author:** I.V. Kovalev, E-mail: kovalevmsu@mail.ru

Spatial variation chemical and physical properties of virgin and arable soils

A.A. Kozlova[1*], Ch. G. Gulalyev[2]

[1]Faculty of Biology and Soil Science, Irkutsk State University, Irkutsk, Russia
[2]Institute of Geography of the NAS of Azerbaijan, Baku, Azerbaijan

The article discusses the features of the morphological structure, the spatial distribution of the chemical and physical properties of typical neighborhoods Irkutsk virgin and arable gray forest soils. Based on the findings made their diagnosis and classification of positions with substantively-genetic approach. For the first time in the region investigated resistivity soils. Found that the electrical parameters have certain differences in the genetic horizons of the soil profile and are dependent on the degree of differentiation of the soil profile and learn. Knowledge of these characteristics provides additional understanding of the migration processes of soil moisture and substances dissolved in it, leading to the differentiation of the soil profile on the genetic horizons and influences the chemical and physical properties, diagnostics and sample belonging soils. Application of methods of mapping the electrical resistance in the form kriking revealed a significant decrease in electrical resistance and leveling the profile of arable soil.

Key words: gray forest soils, substantively-genetic approach topoizoplety, kriking, electrical sounding and profiling.

[*]**Corresponding author:** A.A. Kozlova, Email: allak2008@mail.ru

Impact of soil physical parameters on respiration in ley and wheat agroecosytems

Ligita Baležentienė, Ovidijus Mikša

Aleksandras Stulginskis University Ligita Baležentienė Institute of Environment and Ecology
Aleksandras Stulginskis University Studentų 11, Kaunas distr., Lithuania

Soil CO_2 emissions comprise the biggest part of the global C-cycle increasing the anthropogenic CO_2 emissions into the atmosphere. Therefore the correct choice of agro technologies and crops contributing to the mitigation of the climate change is becoming an important challenge for the agro sector. The comparison of both farming type, i.e. organic (OF) and conventional (CF), and environmental impact on carbon exchange in ley (G) and winter wheat (W) agroecosystems were carried out at the Training farm of the Aleksandras Stulginskis University in 2014 – 2015. This research revealed that both organic and conventional agriculture has the potential to emit respiratory carbon dioxide (CO_2), making croplands important in terrestrial carbon (C) cycles, where they dominate in the anthropogenized landscape. It was found that respirational emissions altered depending on the vegetation period, particular month, and changing environmental conditions in both farming types. Regardless of the crop species a strong positive correlation between respiration CO_2 emissions and soil temperature ($r = 0.8$, $p = 0.25$), strong negative with soil moisture content ($r = -0.7$, $p = 0.04$) and medium with soil electrical conductivity ($r = 0.3$, $p = 0.47$) was found. Organic farming technologies decreased mean soil respiration by 9% ($p = 0.31$) and 16% ($p = 0.55$) in ley and wheat agroecosystems, respectively, comparing to the conventional farming. Strong positive correlation between soil respiration and temperature ($r = 0.8$, $p = 0.25$), moisture content ($r = -0.7$, $p = 0.04$), electrical conductivity ($r = 0.3$, $p = 0.47$) confirmed the impact of soil physical parameters on CO_2 emissions from soil to atmosphere. As soil respirational emissions differed between the assessed agroecosystems, thus it can be controlled by means of optimizing sustainable agrotechnologies or choice of crop species in rotation systems.

Key words: soil respiration, crops, temperature, moisture, el. conductivity.

***Corresponding author:** Ligita Baležentienė, e-mail: ligita. balezentiene@asu.lt

Evaluation of basic kinetic and thermodynamic parameters of catalase in soil (Province of Konya, Turkey)

Maira Kussainova[1,*], Fatih Er[2], Fariz Mikailsoy[3]

[1]Kazakh National Agrarian University, AgriTech Hub Kazakhstan, Almaty, Kazakhstan
[2]Selçuk University, Faculty of Engineering, Department of Environmental Engineering, Konya, Turkey
[3]Iğdır University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Iğdir, Turkey

Numerous studies have been carried out on the evaluation of the kinetic parameters of enzymatic processes in soils. In these studies, the kinetic parameters V_{max}, K_{Mx} and V_{max} / K_M are determined using the Michaelis-Menten equation. Here, as the values of the reaction rate is generally used a reaction enzyme activity values, or (rarely) the values of the initial speed in a short period of time from the start of the reaction. In the latter case, a graphical method is often used. In contrast to these studies, we used analytical methods to determine the initial rate of the enzymatic reaction. Further, based on these values, analytical methods are also used to determine the kinetic parameters of V_{max} and K_M. Calculations are made for determining the values of the initial velocity and kinetic parameters of the enzyme catalase in the soil. To understand the mechanism of action of soil enzymes, in particular when identifying the causes of their high activity and specificity, it is necessary to study the values of enthalpy (ΔH), entropy (ΔS) and free energy (ΔG). In various studies, to study the thermodynamic parameters of enzymatic processes of soils, the Arrhenius equations are used, which is derived for non-enzymatic reactions and accordingly obtain incorrect results, conclusions and interpretations. In contrast to these studies, we carried out analyzes in various temperature regimes and calculated the corresponding thermodynamic parameters, without using the Arrhenius equation. In other words, on the basis of the kinetic parameters, the values of these thermodynamic parameters were calculated. The importance of finding these thermodynamic parameters lies in the fact that they are determined by the specific molecular forces of formation and decomposition of enzyme-substrate complexes (ESC). In the soil studied for the catalase reaction, changes in the formation of ESC are positive values and, consequently, the formation of ESC is endothermic (because ΔH >0) and accompanied by a marked loosening of the structure of the active site or dehydration (because ΔS > 0). Thus, the kinetic and thermodynamic parameters obtained provide useful information about the nature, direction and intensity of enzymatic reactions in soils and are one of the main diagnostic indicators of soils.

Keywords: soil, enzyme, catalase, kinetic and thermodynamic parameters.

***Corresponding author:** Maira Kussainova, E-mail: madgu@inbox.ru

Hydrophysical properties of biochar treated soils in a laboratory study

Markéta Miháliková*, Svatopluk Matula, Kamila Folaufová, Adam Dziadula

Department of Water Resources, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, 16500 Prague, Czech Republic

Biochar is an organic, carbon-rich material that has proven its potential for soil quality enhancement by practical applications. Aim of this research was to examine the ability of biochar (produced from mixture of silage maize resting in a biogas station and wheat straw) admixture to enhance the saturated hydraulic conductivity (Ks) and soil water retention curve (SWRC) of several soils from the Czech Republic. The study was conducted under controlled laboratory conditions on repacked soil core samples with specific attention to maintaining the dry bulk density of the soils in order to reduce the natural soil heterogeneity and thus allow a comparison of the effects of various biochar admixtures on the selected soils. The chosen soils were; (1) a standard fine silica sand, (2) a light cambisol, (3) a silty-loam chernozem, and (4) a clay-loam luvisol. All of these soil types vary in physical and other soil properties. The biochar treatments applied to the samples were as follows; (1) no biochar admixture (control), (2) addition of 0.001 g/g, and (3) 0.01 g/g of biochar, corresponding to application rates roughly of 3 t/ha and 30 t/ha respectively. Each level of treatment was carried out in several replicates. The samples were measured immediately after repacking. Results provided important information for practical use: statistically significant decrease of Ks in case of light soils and increase in the case of heavier soils and small increase of water retention (up to approx. 3.5% vol.). Improvement of plant water availability is one of the main reasons why biochar is applied into the soils while biochar amended soils could also reduce the amount of irrigation water required by crops, or help to the crops to overcome drought periods in rainfed agriculture. Therefore, adding biochar into soil can positively affect crop yield.

Key words: saturated hydraulic conductivity, soil water retention curve, bulk density, homogenized soil sample, falling head permeameter, Hyprop.

***Corresponding author:** Markéta Miháliková, E-mail : mihalikova@af.czu.cz

Interconnection between activity of soil microbiota and content of organic matter, temperature and moisture in arable soil level

Mazirov M.A., Matyuk N.S., Savoskina O.A., Polin V.D., Arefieva V.A.

Department of Soil Management and Experimental Design, Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Russia

Changes in structure and physiological statute of soil microbial community that are caused by natural and anthropogenic exposures to the different ecosystems (agroecosystems and bioecosystems) are presented. The above changes are registered with the parameter of microbial metabolic coefficient which could characterize the soil resistance while competitive assessment of different agrotechnical operations (soil treatment, placement of herbicides and fertilizers). It was defined that the stability of the microbial community changed both during the years of the crop rotations and the vegetation season in the different phases of crops growth and development and depended on the intensity of the mechanical treatment of the arable soil level while soil processing. In the conditions of sufficient and high level of agroecological system energy supplies the intensity of the microbial community, and hence the carbon content accumulated by microbial biomass, was determined by soil temperature and moisture. Based on the values of the coefficient of stability in the seasonal period it was defined that the natural cenoses are less environmentally sustainable in comparison with anthropogenic agrocenoses. It is explained by the different rates of mineralization process of organic residues and release of carbon and nitrogen as the main nutrition resources of nutrition for various forms of microorganisms.

Key words: organic matter, soil microbiota, resistance coefficient.

***Corresponding author:** Arefieva V.A., E-mail: pttcmoscow@bk.ru

Phosphate-mobilizing microorganisms as bioagents for managing phosphorus deficiency in kashtanozems

Merkusheva M.G.*, Ubugunov L.L.

Institute of General and Experimental Biology, Siberian Branch of the Russian Academy of Sciences, 6, Sakhyanovoi Str., Ulan-Ude, Russia

The purpose of the study was to increase the availability of arable kashtanozems with accessible nutrients, especially mobile phosphorus, by phosphate-mobilizing microorganisms applying. The amount of phosphate-mobilizing microorganisms in kashtanozems of Transbaikalia is relatively low, 2-3 thousand per soil gram, but they are of increased biological activity than in other soil-climatic zones. The amount of phosphate-mobilizing microorganisms that can dissolve mineral phosphates and decompose organic phosphates is expressed in a ratio of 10:1. This is due to the predominance of the mineral phosphates of Ca-P fractions and low content of organic matter in this type of the soil. The object of the investigation is deflated sandy loamy arable kashtanozem (0-20 cm layer), with 0.95% humus content, low and very low availability of mobile phosphorus, nitrate and exchange potassium. Zeolites saturated with phosphate-mobilizing microorganisms, isolated from kashtanozem soil, and activated substandard phosphorites (P_2O_5 3-5%), as well as their mixtures were used as natural fertilizers. Zeolite, saturated with microorganisms, is of high biocatalytic and prolonging properties: it increases the number of microorganisms many times and their phosphatase activity; fosters the formation of accessible compounds of phosphorus, nitrogen and, to a less extent, potassium in soils. But the maximum effect is achieved when the saturated zeolite apply together with substandard activated phosphorites, superior to the superphosphate effect, even when it is inoculated with phosphate-mobilizing microorganisms. It should be noted that fertilizers with biological activators were less effective on the soils of the forest-steppe zone. Thus, the characteristics of the phosphate-mobilizing microorganisms should correspond to the ecological parameters of the soils where they function. Biotechnology for the fertilizers obtaining is protected by the patents of the Russian Federation.

Key words: phosphate-mobilizing microorganisms, phosphorites, zeolites, kashtanozems, supply regimes.

***Corresponding author:** Merkusheva M.G., E-mail: merkusheva48@mail.ru

Soil water response to conventional, reduced and no-till systems in eastern mediterranean region of Turkey

Mert Acar[1*], İsmail Çelik[1], Hikmet Günal[2], Zeliha Bereket Barut[3], Nurullah Acir[4]

[1] Çukurova University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Adana, Turkey

[2] Gaziosmanpaşa University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Tokat, Turkey

[3] Çukurova University, Faculty of Agriculture, Department of Agriculture Machinery and Technologies Engineering, Adana, Turkey

[4] Ahi Evran University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Kırşehir, Turkey

The objective of study was to evaluate the effect of seven long-term tillage practices; two conventional (CT-1/CT-2), three reduced (RT-1/RT-2/RT-3), no-till (NT) and strategic tillage (ST) on porosity and available water content (AWC). Nine-year old undisturbed NT plots were divided into two categories, half of each plot was plowed by a moldboard plow in November 2015 and defined as ST while remaining half of plots left undisturbed. The study was conducted in Adana, Turkey in 2006 with a winter wheat (*Triticum aestivum L.*)-soybean (*Glycine max. L.*)-grain maize (*Zea mays L.*) rotation. Disturbed and undisturbed soil samples were collected from three soil depths (0-10, 10-20 and 20-30 cm) in November 2017. Water content at field capacity (FC), permanent wilting point (PWP), AWC, macro (MaP), micro (MiP) and total porosity (TP) were determined. All attributes were significantly affected by tillage, though tillage x depth interaction showed that changes in MaP and TP were non-significant. AWC in RT and NT were significantly lower compared to CT and ST due to higher water retention at PWP. ST significantly increased AWC in all three depths. ST also increased TP from 0.52 to 0.53 cm^3cm^{-3} in 0-10 cm, from 0.49 to 0.52 cm^3cm^{-3} in 10-20 cm and 0.49 to 0.51 cm^3cm^{-3} in 20-30 cm depths, respectively. Although called "conservational tillage practices", 11 years of continues RT and NT practices did not improve soil water retention compared to intensively tilled CT practices. However, deep tillage after nine years of NT improved soil water retention in NT plots.

Key words: conventional tillage, no-till, strategic tillage, soil water, porosity.

[*]**Corresponding author:** Mert Acar, E-mail: macar@cu.edu.tr

Acknowledgements: This study was supported by TUBITAK (TOVAG 115O353)

The content of natural radionuclides (^{226}Ra, ^{232}Th, ^{40}K) and technogenic ^{137}Cs in the soils of the Southern coast of Crimea

Mingareeva E.V.*

The Dokuchaev Central Soil Science Museum, Russian Research Institute of Radiology and Agroecology, 6 Birzhevoy Proezd, Saint Petersburg, 199034, Russia

One of the urgent environmental problems is the radiation contamination of soils. The purpose of this paper is to study the content of natural radionuclides (^{226}Ra, ^{232}Th, ^{40}K) and technogenic ^{137}Cs in two types of soils at the southern coast of Crimea (SCC). The objects of the study were brown soil and burozem. Soils which were selected in the territory of the Yalta Mountain Forest Natural Reserve (Ai-Petri Yayla), the Crimean Nature Reserve, the Nikitsky Botanic Garden (Cape Martyan), and the urban district of Sudak. The specific activity (R_A) of radionuclides was determined in the Russian Research Institute of Radiology and Agroecology. R_A ^{226}Ra in all soils varies within the range of 21.6–53.3 Bq/kg (ΔX = 34.5±10.9 Bq/kg), ^{232}Th – 25.6 – 58.0 Bq/kg (ΔX = 48.5 ±9.6 Bq/kg), and ^{40}K – 350 – 790 Bq/kg (ΔX = 588.1±133.1 Bq/kg). There is no significant difference in the content of natural radionuclides (NR) in both types of soils. ^{137}Cs was found in all soils. The heaviest pollution with ^{137}Cs was recorded in 2 soils: burozem (Ai-Petri Yayla) and brown soil (Cape Martyan). Conclusion. The content of NR and ^{137}Cs in two types of soils at the SCC. There was no significant difference in the R_A of radionuclides in the two types of soils. We determined the content of natural radionuclides in two types of parent rocks: limestone eluvium and carbonate clayey deposits. The difference in the specific activity of radionuclides in the parent rock material was found only for radium-226 and potassium-40.

Key words: the Southern Coast of Crimea, reserves, radionuclides, soil-forming rocks.

***Corresponding author:** Mingareeva E.V., E-mail: Elena.mingareeva@yandex.ru

Spectral characteristics in estimation of physical and biochemical properties of soil

Miroslav Pikl*, Frantisek Zemek

Global Change Research Institute, CAS, 60300 Brno, Czech Republic

Soil fertility is a dynamic complex and some of its properties can be quantified from physical and biochemical analyses of soil samples typically representative only for the place of sampling. New approaches are required to get information on soil properties in form of continuous field. The objective of the study is to document potential of airborne imaging spectroscopy, supported with laboratory and field spectroscopy, in estimation of selected soil properties related to typical agronomical soil sample analyses. We used reflectance (VNIR, SWIR) and thermal infrared (TIR) (non) imaging spectroscopy data from several fields to get link between laboratory, field and airborne spectral characteristics, and those from agronomical sample analyses. The results bring statistically significant ($p<0,01$) agreement between contents of soil organic carbon (SOC) from agro analyses and that of spectral features from lab spectroscopy ($R^2=0,76$), and between agro analyses and airborne imagery spectral characteristics ($R^2=0,46$). Less pronounced, but still statistically significant relationships, we obtained for clay minerals. Moreover, the above relationships were preserved for data acquired in different years.

Key words: remote sensing, spectroscopy.

***Corresponding author:** Miroslav Pikl, E-mail: pikl.m@czechglobe.cz

Computation of integral water capacity using leaf temperature at different soil compaction levels

Mohammad Reza Neyshabouri [1] , Z. Kazemi [1], O. Milani [2], D. Zareh Haghi [1]

[1] University of Tabriz, Faculty of Agriculture, Department of Soil Science, Tabriz, Iran
[2] Agricultural Research Center of East Azarbaijan, Iran

Integral water capacity (IWC) is the integral of differential water capacity function in the range of 0 to ∞ soil matric potential multiplied by weighting functions each takes into account the effect of particular soil physical limitation that may develop at a given soil matric potential domain and restrict soil water availability to plant roots. The domains selected for development of weighting functions in most studies have seldom been plant response based but rather arbitrary. The purpose of this study was implementing midday green leaf temperature (T_L) as a plant response based variable to compute integral water capacity. For this purpose, a sandy clay loam soil passed through 4.76 mm sieve was evenly compacted to three bulk densities of 1.35, 1.55 and 1.75 g cm^{-3}, each replicated thrice, in PVC tubes (called pots hereafter) with 30 cm diameter and 70 cm height. Sunflower (*Helianthus Annuus* L.) seedlings were planted in the pots and after their full establishment, two periods of wetting and drying cycles were imposed. By monitoring daily soil moisture content at the three depths in the pots and converting them to soil moisture suctions along with the midday T_L measurements, a plant response based weighting function was developed and integral water capacity (IWC_P) was computed. Integral water capacity (designated as IWC_G) was also computed by adopting the weighting functions proposed by Groenevelt et al. (2001). IWC_P and IWC_G in D1 treatment were obtained 0.187 and 0.229 cm^3/cm^3. At the highly compacted D3 treatment the corresponding values diminished to 0.152 and .038, respectively, which is equivalent to 19% and 84% reduction in soil water availability and reflects the dominant effect of soil compaction on water availability. Averaged over the three compaction levels, IWC_P and IWC_G were 0.169 and 0.14 cm^3/cm^3 indicating that water availability determined on the plant response basis is 17% greater than that predicted by IWC_G. This difference and over susceptibility (84%) of IWC_G to soil compaction imply that the soil suction domains proposed for the various soil physical limitations and the experimental relations employed in Groenevelt et al. approach to quantify their restricting effects as weighing functions need to be modified according to each particular plant needs or response.

Key words: differential water capacity, plant response, sunflower, weighting function.

***Corresponding author:** Mohammad Reza Neyshabouri,
E-mail : neyshmr@hotmail.com

Hg in surface layer of hydrogenic soils in protected areas of the Northern and Central Mongolia

Monika Mętrak*, Piotr Chibowski, Altan Gantumur, Katarzyna Chmielińska, Małgorzata Suska-Malawska

Biological and Chemical Research Centre, Faculty of Biology, University of Warsaw, Poland

Soil contamination with Hg is an important problem in Mongolia, mostly due to human activities such as gold mining and fossil fuel burning. Moreover, with advancing climate changes, an increase in methylmercury is observed in soils from permafrost regions, which results from microbial activity altered by thawing of ground ice. To determine content of Hg in Mongolian soils, we collected 138 samples of top 10 cm of soils from three different protected areas (Tarvagatai Nuruu, Orkhon, Khan Khentii) and two unprotected areas (Nukht River, Huiten Lake). Apart from Hg content, we analyzed moisture, salinity and C and N content in the samples. After statistical analysis of the obtained data, we found no significant differences in Hg content between protected and unprotected sites; and 10 samples with the highest observed Hg content (109-160 μg/kg d.w.) came from the Tarvagatai Nuruu Protected Area. Moreover, proximity of legal gold mines seemingly had no influence on Hg content in the soils. Yet, we need to keep in mind that we had not sampled areas in immediate vicinity of these mines. Hg content showed great affinity to soil organic matter (SOM, SOC, TC, TN, TP) with statistically significant Spearman correlation coefficients above +0.7. Contrastingly, it correlated negatively with soil pH (r^2=-0.42), partially probably due to the fact that soils with higher content of organic matter, are simultaneously characterized by lower pH values.

Key words: mercury, hydrogenic soils, Mongolia.

***Corresponding author:** Monika Mętrak, E-mail: mmetrak@biol.uw.edu.pl

The role of natural compounds for agrochemical practice

Morachevskaya E.V.*, Voronina L.P., Kesler K.

Lomonosov Moscow State University, Faculty of Soil Science, Department of Agrochemistry and Plant Biochemistry, Moscow, Russia

Plant growth regulators (PGR) are necessary to use during vegetation in addition to plant nutrition. PGR have a directed action: stimulate the growth, increase the stress resistance, regulate the target development (regulators of specific action), plant protection products and as retardants. The complex of such products (firm "ECO-NEST M") was used in field and green pot experiments with barley (*Hordeum vulgare* L). In the field experiment, the effectiveness of the product "Siliplant" was studied. The active substances of this product are Si with concentration 78mg /ml and salicylic acid (SA), the concentration– 10^{-8}M. Field experiment was carried out on well cultivated, medium-loamy sod-podzolic soils. Variants of experiment: control, SA, SA+Si, Si. During the vegetation season in the tillering phase the foliar treatment was carried out. The weight of grain and straw, the biological crop when using SA in combination with Si fertilizer significantly increased. The efficiency of natural product "Hardy" and its application on barley were investigated in the green pot experiment. Synthetic retardant CCC (chlorthalidone) was the reference standard. "Hardy" is obtained on the basis of o-diphenols and epibrassinolide. The raw material for the production of o-diphenols is Echinacea purpurea Moench. The concentration of active substances is 250 mg /l. In the experiment, the retardant effect of "Hardy" was observed: plant height decreased significantly, the mass of unproductive parts of the plant increased, indicating prolongation processes of maturation of the grain in experimental form.

Key words: plant growth regulators, salicylic acid, silicon, retardants.

***Corresponding author:** Morachevskaya E.V., E-mail: agrosoil@mail.ru

Vertical and spatial distribution of major and trace elements in the catena with Albeluvisols at the Central Forest nature reserve

Nikolay Kasimov*

Lomonosov Moscow State University, Moscow, Russia

In 2017 and 2018, we investigated the vertical and lateral distribution of major and trace elements in four cross-sections of Albeluvisols within a typical catena for the Central Forest Nature Reserve. We measured in 90 soil samples total organic carbon, pH value, granulometric composition, total concentration of Co, Cr, Cu, Fe, Mn, Ni, Pb, Sr, Ti, Zn, Zr and concentration its mobile fraction (exchangeable, bound to organic matter and bound to Fe and Mn hidroxides). In an A-horizon average total concentration for Fe is 1,2%, Ti – 0,33%, Mn – 482 ppm, Zr – 292 ppm, Sr – 90 ppm, Zn – 39 ppm, Cr – 21 ppm, Pb – 21 ppm, Ni – 9 ppm, Cu 8 – ppm. Metals form a series according to concentration of exchangeable fraction Fe> Mn> Sr> Zn, Pb> Ti, Cr, Ni, Cu, Co, Zr; bound to organic matter fraction Fe> Mn>> Ti, Zr, Pb> Co> Ni, Cu, Zn> Cr, Sr and bound to Fe and Mn hydroxides fraction Fe> Mn> Ti> Zn, Sr, Pb> Cr> Cu, Ni, Co> Zr. In all studied Albeluvisols total Pb and Zr, exchangeable fraction of Co, Fe, Mn, Pb and Zn, bound to organic matter fraction of Cu, Fe, Pb and Zn, bound to Fe and Mn hydroxides fraction of Pb accumulates in top -soil horizons. For total concentration of Co, Fe, Ni, Sr and Zn, exchangeable fraction of Co, Cr, Cu, Mn, Pb, Zn and Zr, bound to organic matter fraction of Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn and Zr, bound to Fe and Mn hydroxides fraction of Co, Cr, Cu, Ti, Zn and Zr is typical leaching from E-horizon and/or accumulation in B-horizon. Total concentration of all elements studied increases in A-horizon at a slope. In A-horizon at a slope and a gully bottom concentration of exchangeable fraction of Ni, Cu, Sr and Zr, bound to organic matter fraction of Ni, Cu and Zn increases, and concentration of exchangeable fraction of Co, Cr, Pb, Ti and Zn, bound to organic matter fraction of Cr, Ti and Co, bound to Fe and Mn hydroxides fraction of Mn, Ni, Zn, Pb, Zr decreases.

Key words: catena, Albeluvisols, trace elements, iron, manganese, vertical distribution.

***Corresponding author:** Nikolay Kasimov,
E-mail: ivan.from.murygino@yandex.ru

Effects of NaCl salinity and waterlogging on availability of copper, iron, manganese and zinc in two different soils

Nosratollah Najafi*, Elmira Sarhangzadeh, Shahin Oustan

Soil Science Department, Faculty of Agriculture, University of Tabriz, Tabriz, Iran

Waterlogging and salinity are wide spread problems in irrigated as well as in non-irrigated areas and threatening the sustainabilty of agricultural production. Micronutrients mobility and solubility in soils are of environmental significance due to their potential deficiency and toxicity to plants, humans and animals. In a factorial experiment based on completely randomized design with two replications, the effects of soil waterlogging duration at six levels (0, 1, 3, 7, 15, 30 days) and soil saturate extract salinity at three levels (0.11, 4, 8 dS/m) on the DTPA-extractable of copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) in two different soils (one alkaline loamy sand soil and one acidic clay soil) were studied. The results showed that the main and interactive effects of waterlogging and salinity on the DTPA-extractable Zn, Fe, Cu and Mn were significant. The DTPA-extractable Mn was increased by increasing the duration of soil waterlogging in non-saline conditions in both soils but it was decreased in saline conditions and amount of this decrease in acidic clay soil was greater than alkaline loamy sand soil. In loamy sand soil, by increasing the duration of soil waterlogging, the DTPA-extractable Fe was increased in non-saline conditions but in saline conditions it was decreased after an initial increase. In acidic clay soil, the DTPA-extractable Fe was increased by increasing the duration of soil waterlogging. By increasing the duration of soil waterlogging, the DTPA-extractable Cu and Zn in both soils were significantly decreased after an initial increase and the amount of the decrease in acidic clay soil was greater than alkaline loamy sand soil. The DTPA-extractable Cu and Fe in both soils, and the DTPA-extractable Mn in acidic clay soil were significantly decreased with increasing soil salinity level, while the DTPA-extractable Mn in loamy sand soil was increased with increasing soil salinity level at early stages of waterlogging and then decreased. The effect of NaCl salinity level on the DTPA-extractable Zn was dependent on the soil type and the duration of soil waterlogging. By increasing the NaCl salinity level, the pH of soil solution and the reduction rate of Fe and Mn were decreased during the waterlogging periods. There were significant regression equations between the duration of soil waterlogging and concentrations of the DTPA-extractable Cu, Fe, Mn, and Zn in both soils. These models can be used for estimation of the DTPA-extractable Cu, Fe, Mn, and Zn concentrations at different waterlogging periods.

Key words: Availability, Micronutrients, Salinity, Soil pH, Submergence.

***Corresponding author:** Nosratollah Najafi, E-mail: n-najafi@tabrizu.ac.ir

Effects of phosphate-loaded LDH-Biochar and LDH-Hydrochar on soil pH, EC and available-P, and maize dry matter and P uptake in a calcareous soil

Nosratollah Najafi[1*], Yaser Azimzadeh[1], Adel Reyhanitabar[1], Shahin Oustan[1], Alireza Khataee[2]

[1] University of Tabriz, Faculty of Agriculture, Soil Science Department, Tabriz, Iran
[2] University of Tabriz, Faculty of Chemistry, Department of Applied Chemistry, Research Laboratory of Advanced Water and Wastewater Treatment Processes, Tabriz, Iran

It is necessary to develop adsorbents that remove phosphorus (P) from contaminated water and then be used as P-fertilizer for surmounting the eutrophication and P-fertilizer exhausting challenges. In the present study, Mg/Al-LDH and Mg/Al-LDH functionalized apple wood biochar and hydrochar were prepared to remove of phosphate from aqueous solution and then to use as P-fertilizer in soil. The adsorbents were synthesized using co-precipitation method and their adsorption-desorption characteristics for P were examined. Moreover, the effect of the spent adsorbents as P-fertilizer on soil available-P and maize growth was investigated in a greenhouse experiment. Based on the results, the phosphate adsorption and desorption by the all three studied adsorbents were best described by the Langmuir and Freundlich models, respectively. The LDH, LDH-Biochar and LDH-Hydrochar desorbed 18, 22 and 27% of adsorbed P after 5 desorption cycles in a 0.03 M KCl solution. On the other hand, 46 and 58% of P adsorbed by LDH, 56 and 62% of P adsorbed by LDH-Biochar and 62 and 65% of P adsorbed by LDH-Hydrochar were desorbed in pH 3 and 10, respectively. Also, 52, 63, and 66% of P adsorbed by LDH, LDH-Biochar and LDH-Hydrochar was desorbed in a 0.1 M Na_2CO_3 solution, respectively. The results of the pot experiment revealed an antagonistic relationship between monocalcium phosphate and P-loaded composites on soil available-P and maize total dry weight and total P uptake. The P-loaded LDH-Biochar and LDH-Hydrochar increased soil available-P and solution EC, and maize total dry matter and total P uptake as compared with control. The LDH-Biochar and LDH-Hydrochar composites as promising environmentally friendly, cost-effective and efficient adsorbents suggest alternative carbon-based composites for removal of P from aquatic environments and reuse as P-fertilizer.

Key words: biochar, composite, desorption, fertilizer, hydrochar, layered double hydroxide.

***Corresponding author:** Nosratollah Najafi, E-mail: n-najafi@tabrizu.ac.ir

Modeling of phosphate removal by Mg/Al-LDH functionalized biochar and hydrochar from aqueous solutions

Nosratollah Najafi[1*], Yaser Azimzadeh[1], Adel Reyhanitabar[1], Shahin Oustan[1], Alireza Khataee[2]

[1] University of Tabriz, Faculty of Agriculture, Soil Science Department, Tabriz, Iran
[2] University of Tabriz, Faculty of Chemistry, Department of Applied Chemistry, Research Laboratory of Advanced Water and Wastewater Treatment Processes, Tabriz, Iran

High porosity and specific surface area as well as excellent stability confirm that biochar and hydrochar can be used as matrices for stabilizing LDH flakes and creating LDH-biochar and LDH-hydrochar composites. Mg/Al-LDH functionalized biochar and hydrochar composites are environmentally friendly and low-cost adsorbents for removal of phosphorus (P) from aqueous solutions which can subsequently be used as P-fertilizer. In the present study, Mg/Al-LDH functionalized apple wood biochar and hydrochar were prepared using co-precipitation method and their adsorption characteristics for P were examined through batch experiments. Moreover, important factors affecting adsorption including contact time (5-120 min), initial P concentration (25-200 mg/L), pH (3-10), ionic strength (deionized water and 0.001, 0.01, and 0.1 mol/L KCl) and adsorbent dosage (1, 2, 3, and 4 g/L) were investigated. Based on results, the P adsorption by Mg/Al-LDH modified biochar and hydrochar were comparable with Mg/Al-LDH and were greater than biochar and hydrochar. The pseudo-second-order model best described the adsorption kinetics of P for Mg/Al-LDH, Mg/Al-LDH-biochar, and Mg/Al-LDH-hydrochar with equilibration times of 30, 60 and 30 min, respectively. As expected, P adsorption decreased with increasing pH and ionic strength. The highest P removal was attained at pH 4, adsorbent dosage of 4 g/L and in the presence of deionized water as a background solution. There were no significant differences between phosphate removal efficiency of Mg/Al-LDH, Mg/Al-LDH-biochar and Mg/Al-LDH-hydrochar in studied conditions. Adsorption characteristics of the adsorbents revealed that phosphate adsorption mechanism involved a combination of interlayer anion exchange, electrostatic attraction and formation of surface inner-sphere complexes. The Mg/Al-LDH modified biochar and hydrochar composites as cost-effective and efficient adsorbents suggest alternative biochar- and hydrochar-based composites for removal of P from water that could be used as P-fertilizers.

Key words: adsorption, biochar, composite, hydrochar, layered double hydroxide, phosphate.

***Corresponding author:** Nosratollah Najafi, E-mail: n-najafi@tabrizu.ac.ir

Soil testing system in the Czech Republic – upgrade for agricultural practice

Pavel Čermák[1*], Gabriela Mühlbachová[1], Tomáš Lošák[2], Jaroslav Hlušek[2]

[1]Crop Research Institute in Prague, Prague 6, Czech Republic
[2]Mendel University in Brno, Brno, Czech Republic

Regular soil testing system is running since the 1960s in the Czech Republic. The extraction procedure Mehlich 3 is the official analytical method currently used in this soil testing system for the determination of available macronutrients (P, K, Mg, Ca). The advantage of the simple and easy Mehlich 3 analytical procedures is their uniformity and suitability for determination of several other elements, i.e. extension of the applicability of the method Mehlich 3 for micronutrients (Cu, Zn, Mn, Fe, B) determination. Simultaneously, more accurate corrections for phosphorus determination in carbonate soils by method Mehlich 3 were made. All results from the determination of the above-mentioned soil properties (content of macro and micro nutrients in soil) can be used for determining the most suitable application rates of nutrients for best nutrient management – i.e. rates for high yields and production quality while at the same time being friendly to the environment. All results from this testing system are stored in the Land Parcel Information System (LPIS) – (a system based on the actual use of land in a geographic information database) and the results are disseminated free of charge for users (farmers, state administrative bodies).

Key words: soil testing, plant nutrition, macronutrients, micronutrients, Mehlich 3, LPIS.

***Corresponding author:** Pavel Čermák, E-mail: pavel.cermak@vurv.cz

Structure dynamic of chernozem aggregate in multiple wetting-drying cycles

K.A. Romanenko[1,2]*, K.N. Abrosimov[1], D.S. Fomin[1,2], A.V. Yudina[1,2], E.B. Skvortsova[1]

[1] Dokuchaev Soil Science Institute, Moscow, Russia
[2] Lomonosov Moscow State University. Faculty of Soil Science, Moscow, Russia

We studied structure dynamics of Chernozem aggregates from Kursk Region in wetting-drying cycles with Bruker Skyscan 1172 computer microtomograph. Chernozem aggregate 7-10 mm diameter was capillary saturated and dried on air. We made 5 cycles of wetting-drying. Tomographic scanning in dry and wet condition was performed with 6.97μm/pix resolution, than tomographic 3D data was proceeded in CTan software. Porosity increased after cases of wetting and in some cases of drying. Closed porosity always decreased after wetting and decreased after each cycle. Also was defined structure thickness distribution for solid phase particles and structure separation distribution for pore space of the aggregate. Mean diameter of solid phase particles decreases after wetting and slowly decreases after each cycle. Mean diameter of pore space increase after wetting and increase in each cycle. Tomographic images show that small fissures appears inside the aggregate after wetting and enlarge after drying. Totally, the aggregate structure perishes during multiple wetting-drying and doesn't come back to original condition.

Key words: soil structure, soil tomography, swelling, shrinkage, degradation.

***Corresponding author:** Konstantin Romanenko, E-mail: lusterammisho@mail.ru

Soil cohesion of two similar silt loam soils

Selen Deviren Saygin [1,*], Chi Hua Huang [2], Dennis C. Flanagan [2], Gunay Erpul [1]

[1]Ankara University, Faculty of Agriculture, Department of Soil Science & Plant Nutrition, Ankara, Turkey
[2] USDA-ARS National Soil Erosion Research Laboratory, Purdue University, West Lafayette, USA

Soil cohesion is a measure of the external forces necessary to separate soil particles and aggregates, hence it is an indicator of the inherent soil strength against erosive forces. Mechanical soil cohesion measurements were performed in two similarly textured soils (Palouse and Nansene) with a fluidized bed approach in order to investigate the variations and soil cohesion under saturation condition which is identified as one of the most important deficiencies of in process-based water erosion assessments. The fluidized bed approach is based on the principle of applying a gradually increased hydrostatic pressure at the bottom of a soil mass until the point when the soil mass fluidizes, i.e., the upward fluid stress on the soil particles or aggregates overcomes the weight of the soil and cohesion that holds the particle/aggregate together. The study was conducted in the United States National Soil Erosion Research Laboratory and assessed the validity of the method on two silt loam soils. Findings indicate that the Palouse soil has a cohesion value about 5.5 times higher than the Nansene soil. This difference may be attributed to the difference in soil organic carbon as the Palouse soil is much higher (3.91%) then the Nansene soil (1.93%), although these two soils have very similar textural composition. Results showed that soil organic matter have very important implications on mechanical soil cohesion development and fragmentation mechanics against external forces.

Key words: Mechanical soil cohesion, fluidized bed approach, soil erosion, aggregate stability, soil organic matter.

***Corresponding author:** Selen Deviren Saygin,
E-mail: sdeviren@agri.ankara.edu.tr

Phosphorus aging impacts on sorption-desorption features of lead (Pb) in soils

Shahin Oustan*, Leila Mohammadzadeh Ghazijahani, Nosratollah Najafi, Adel Reyhanitabar

Soil Science Department, Faculty of Agriculture, University of Tabriz

This research examined the artificially aging effects of phosphorus-amended soils on sorption-desorption characteristics of lead (Pb). Nine soil samples covering a wide range of relevant properties were collected from north and north-west of Iran. The soils were treated with 0, 50 and 500 mg P kg^{-1} from $Ca(H_2PO_4)_2.H_2O$ at field capacity and incubated for one day at 25±0.3° C and for 30 days at 35 ± 0.3° C. Thereafter, sorption experiments were performed using a series of 0.01 M KNO_3 solutions containing different concentrations (1-5mM) of Pb (as $Pb(NO_3)_2$).The desorption experiments were performed immediately following the sorption completion. Results showed a huge impact of soil native pH (ranging from 3.7 to 8.9) on all features of Pb sorption-desorption reactions. The acceleration of equilibrium establishment following phosphorus application disappeared with decreasing soil pH. Phosphorus treatment increased both sorption parameters of Freundlich model (K_F and N) only at high P level. The K_F parameter increased but the N parameter decreased by aging of phosphorus in the acid soils, while the reverse was observed for the alkaline and near-neutral soils. Soil pH and organic carbon content showed strong positive correlations with K_F parameter in all treatments. Aging process significantly decreased the hysteresis index values ($HI=N_{sor}/N_{des}$) for the acid and particularly calcareous soils, while increased that of a near-neutral soil. Moreover, this process decreased the influence of contact time between soil and Pb. The affinity of Pb to soil increased after changing the source of phosphorus from $Ca(H_2PO_4)_2.H_2O$ to KH_2PO_4 and performing aging treatment.

Key words: contact time, Freundlich model, hysteresis index, soil pH.

***Corresponding author:** Shahin Oustan, Email: oustan@hotmail.com

Modern devices and methods for physical properties of soils investigation

E.V. Shein[1], E.Yu. Milanovsky[1], E.B. Skvortsova[2], A.V. Dembovetsky[1], K.N. Abrosimov[2], K.A. Romanenko[2], T.G. Kalnin[1]

[1]Lomonosov Moscow State University. Faculty of Soil Science, Department Soil Physics and Reclamation, Moscow, Russia
[2]Dokuchaev Soil Science Institute, Moscow, Russia

In soil science, new methods and instruments are widely used to measure the physical properties of soils (granulometric composition), pore space in 3D images (tomography), contact angle of wetting, rheological characteristics, etc. These properties and parameters should find their application in modern soil research . The data on the relevant soil parameters obtained on the new equipment are analyzed, comparing them with traditional soil studies. New devices and methods require a lot of methodological work to establish and identify the limits of their applicability, optimal ranges, measurement conditions and, in general, standardize procedures for experimental determination. Such sections of soil physics as the study of the granulometric composition by sedimentometric and laser diffraction methods, the analysis of porous space by tovographic methods, the determination of the contact angle of wetting, and the use of the results of these methods in modern soil physics are considered.

Key words: physical properties, laser diffraction, tomographic methods.

***Corresponding author:** Evgeny Shein, E-mail: evgeny.shein@gmail.com

Actual evapotranspiration at a typical standard weather station measured by a smart field lysimeter

Svatopluk Matula*, Markéta Miháliková, Rebeca Hernández-Gomis, Mukhitdin Gulamov, František Doležal

Department of Water Resources, Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, 16500 Prague, Czech Republic

Evapotranspiration can be measured by using lysimeters. In this research, actual evapotranspiration of typical standard weather station with non-irrigated and unfertilized grass was measured by a weighing lysimeter SFL-300 (diameter 0.3 m, depth 0.3 m). The suction pressure at its bottom was maintained at the same level as in the native soil nearby. Research area was located in a warm region of the Czech Republic on a modal chernozem soil with loamy texture. From the available data, 585 rainless days with regular records were selected for the analysis of daily differences. The actual evapotranspiration *ETa* measured by the lysimeter was smaller than the Penman-Monteith FAO 56 reference crop evapotranspiration ET_0 on most days. FAO 56 can estimate well the reference crop evapotranspiration on non/mildly stressed sites. The ET_a/ET_0 ratio (crop coefficient) and the canopy surface resistance r_s depend on the soil water content and suction pressure measured at 5 cm. These graphs break down into horizontal non-stressed parts and declining (for ET_a/ET_0) or inclining (for r_s) water-stressed parts. The annual curve of the non-stressed crop coefficient has a sine shape. The ratio ET_a/ET_0 is about 85 % and r_s is about 250 s m^{-1} when the grass is not under water stress. The results provide parameters of evapotranspiration for a canopy that can be found on many standard weather stations and demonstrate that high-quality research of evapotranspiration of low, dense and shallow-rooting crops is possible with small lysimeters of this type.

Key words: FAO56 Penman-Monteith equation, smart field lysimeter, water stress, reference crop, crop coefficient.

***Corresponding author:** Svatopluk Matula, E-mail: matula@af.czu.cz

Benzo[a]pyrene (BaP) biodegradation level and bioaccumulation features by spring barley

Svetlana Sushkova[1,*], Tatiana Minkina[1], Irina Deryabkina[1], Elena Antonenko[1], Tatiana Bauer[1], Saglara Mandzhieva[1], Vishnu Rajput[1], Rıdvan Kızılkaya[2]

[1] Southern Federal University, Rostov-on-Don, Russia
[2]Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

The tendencies of benzo[a]pyrene (BaP) bioaccumulation was studied to assess the toxic effects of soil contamination by polycyclic aromatic hydrocarbons (PAHs). The most popular agricultural crop in the south of Russia spring barley was used for determination of negative effect for chernozem soil contaminated with benzo[a] pyrene (BaP) the most carcirogenic and mutagenic of PAHs. Studies were conducted on the soils of carbonate heavy loamy chernozem (Haplic Chernozem), virgin, the 0-20 cm topsoil of the State Soil Preserve "Persianovsky reserved steppe", Rostov region (South of Russian Federation) located far from possible contamination sources. The new method of subcritical water extraction based on subcritical water properties was used for extraction of BaP from soil and plant samples. As a plant sample for developing the method of subcritical water extraction was used the whole plants of the barley which were grown up in the control background soil in the conditions described below. The features of PAHs accumulation by soil was determined in model experiment with soil spiking by BaP (spiked doses associated with technogenic pressure level in studied area, 0-800 μg/kg dry wt). The main tendencies of BaP accumulation was dose of pollutant inoculation, that provided sorption of aromatic BaP molecules by aluminosilicate molecular lattice and next migration through the soil profile that influenced on the retention strength and availability of free BaP to plants.

Key words: aggregate content, heavy metals, particle size distribution, plasticity, soil, solid phase density, structural status.

***Corresponding author:** Svetlana Sushkova, E-mail: snsushkova@sfedu.ru

Acknowledgement: This research was supported by Ministry of Education and Science of Russia, no. 5.948.2017/PP, RFBR no. 16-35-60051, Grant of President of Russian Federation no. MK-3476.2017.5.

Soil structural quality, compaction and land management in the Republic of Moldova

Tamara Leah

Institute of Soil Science, Agrochemistry and Soil Protection "Nicolae Dimo," Chisinau, Moldova

Soil degradation as a result of the compaction process and structural deterioration comprised the entire surface of agricultural soils, becoming an acute problem in Moldova. Soil compaction is one of the most aggressive factors of anthropogenic influence on the soil physical properties with immediate effects on the agricultural management. The physical quality assessment was carried out for zonal soils included in the Moldova's Soil Quality Monitoring. The results showed that chernozems virgin are characterized by an excellent hydrostatic structure (aggregates of 1-5 mm - 80-85%); aggregates >10 mm (agronomical unfavorable) make up 1-2%. In the 0-25 cm layer of arable chernozems dominate the fraction >10 mm (40-70%); the 25-35 cm layer is characterized by a massive structure, this layer has not been tilling in the last period, its destructurized, lost compaction resistance and is very compacted and impermeable to water and plant roots. Compaction of chernozems is also enhanced by the low flow of organic matter in the arable layer (dehumification), the frequent passage of heavy machinery, the abandonment of soil. This has led to the ecological degradation of compacted soils, loss of fertility and their economic value. Compaction can be reduced, and soil restored by special tillage measures, where scarification at a depth of 10-20 cm is of the greatest importance. The tillage can be supplemented with organic fertilizers (manure) and green fertilizers (vetch) or mulch. Soil compaction monitoring should become a component part of farmland management.

Key words: compaction, land management, soil degradation, structural quality.

***Corresponding author:** Tamara Leah, E-mail: tamaraleah09@gmail.com

The effects of hazelnut husk compost application on some soil chemical properties at different sampling periods

Tayfun Aşkın, Selahattin Aygun*

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

In this study we investigate the effects of hazelnut husk compost prepared by bio-technologic techniques on some soil chemical properties (soil organic matter content, total N, pH, EC, Ca, Mg, Na and K). Hazelnut husk compost (HHC) was used to increase of soil organic matter content as 0, % 0.5 (1.25 ton da^{-1}), % 1 (2.5 ton da^{-1}), % 2 (5 ton da^{-1}), % 3 (7.5 ton da^{-1}) and % 4 (10 ton da^{-1}) with three replications. The hazelnut husk compost was applied to Cumhuriyet (sandy loam soil) and Akçatepe (clay loam soil) hazelnut orchard at the 23 November 2012 with using an anchor in the province of Ordu. The soil samples were taken at the four different time (I, 31 March 2013; II, 30 June 2013; III, 01 October 2013 and IV, 31 December 2013) to determine of some soil chemical properties. At the end of the study soil pH, soil organic matter content, exchangeable Na, K and Mg content has increased with hazelnut husk compost application compared to control in two soil (CL and SL). According to results soil EC, pH, soil organic matter and total nitrogen content decreased from the first sampling time to the fourth sampling time. Soil changeable calcium content were not significantly affected the statistically from soil hazelnut husk compost applications.

Key words: hazelnut husk compost, soil organic matter, soil chemical properties.

***Corresponding author:** Selahattin Aygun, E-mail: selahattin_555@hotmail.com

Monitoring of soil lime content (LC) by kriging in Merzifon, Turkey

Tayfun Aşkın [1,*], Ferhat Türkmen [1], Coşkun Gülser [2], Rıdvan Kızılkaya [2]

[1]Ordu University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Ordu, Turkey
[2]Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

Information on soil lime content (LC) used to determine soil chemical characteristics are very important for soil quality and productivity. Soil LC may be evaluated statistically due to application of geostatistical techniques such as kriging to soil science. In present study, geostatistical technique such as kriging was applied to assess monitoring of soil LC in the tillaged layer in Merzifon/Amasya District, Middle part of Blacksea Region of Turkey. Although the Merzifon has a surface area of 93600 ha, study area was approximately 70468 ha where was sampled as randomly with including 2850 sampling points from 0-0.2 m in depth. The soil LC had varied from 0.04 to 38.3% with mean value was 10.6±4.7 as $CaCO_3$ content equivalent. An isotropic spherical model was the best fitted sevivariogram model for the study area with the greatest range of influence (42300 m) occurred for soil LC.

Key words: soil lime content, site specific management, kriging, geostatistics.

***Corresponding author:** Tayfun Aşkın, E-mail: tayfuna@odu.edu.tr

Changes in the soil phosphorus content after triple superphosphate application into alkaline chernozem and the effect on yields of barley biomass

Tomáš Lošák[1*], Jaroslav Hlušek[1], Pavel Čermák[2], Gabriela Mühlbachová[2]

[1]Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic
[2]Crop Research Institute, Drnovská 507/73, 161 06 Prague 6, Czech Republic

In 2017 a pot experiment with 4 treatments (incl. unfertilized control treatment) was established with spring barley, variety KWS Irina, in the outdoor vegetation hall of Mendel university in Brno, Czech republic. Chernozem (with a low supply of phosphorus and alkaline pH – 7.37) was used for this trial. The rates of phosphorus (0.3 – 0.6 – 1.2 g P per pot = 5 kg of soil) were increased by using the triple superphosphate fertiliser (45% P_2O_5), treatments 2 – 4. Nitrogen was applied in the form of CAN (27% N) at a rate of 1 g N per pot in all the treatments incl. the control. The content of post-harvest soil phosphorus increased significantly with the applied rate (41 – 73 – 117 – 166 mg P/kg). Dry matter yields of the aboveground biomass increased significantly in all fertilised treatments as against the control (31.75 – 39.25 – 45.66 – 48.50 g DM per pot), without significant differences between the two highest rates of P-fertiliser. Triple superphosphate is a suitable P-fertilizer for increasing of soil P-content on alkaline soils with a joint effect on yield.

Key words: phosphorus, fertilisation, barley, soil, supply, aboveground biomass.

***Corresponding author:** Tomáš Lošák, E-mail: tomas.losak@mendelu.cz

Soil constructions: their functioning, transformation and natural analogs

Umarova A.B., Butylkina M.A., Gasina A.I., Ezhelev Z.S., Suslenkova M.V.

Moscow State University, Moscow, Russia

The modern soil science is characterized by emergence of a large number of artificially created soils from layers of non-native soils. Requirement of soil construction formation is caused by anthropogenic influence on the territory that destroys a soil cover or makes impossible to use it. Layers usually used for creation of soil constructions have sharply contrast physical and chemical properties and are united in the general system. It inevitably leads to gradual transformation of the soil constructions' properties. The high demand of creation of similar objects, specifics of their structure, clear target orientation lead to requirement of studying of their stability under new conditions and opportunities of performing of soil functions in the present and future. The aim of this research was to study features of functioning and transformation of different soil constructions depending on their structure and to compare them with natural analogs. Objects of the research were the soils created under remediation of the oil-contaminated tundra gley soils of the North of Russia (the Komi Republic), under remediation of an iron ore pit of the Kursk Magnetic Anomaly (the Belgorod Region) and the soil constructions with different structure located in Moscow. The general characteristic of these soil constructions distinguishing them from natural analogs was existence of the layered profile that leads to specificity of their hydrological regime, transformation of properties of solid phase and pore space of soils.

Key words: soil constructions, remediation, functioning and transformation of soils, hydrological regime of soils, pore space.

***Corresponding author:** Umarova A.B., E-mail: a.umarova@gmail.com

Acknowledgement: This research was financially supported by Russian Foundation for Basic Research (Project № 16-04-01851

Content and distribution of non-silicate iron forms in hydrogenic soils of the Eastern Pamir (Tajikistan)

Witold Gałka, Monika Mętrak, Piotr Chibowski, Marcin Sulwiński, Małgorzata Suska-Malawska*

Faculty of Biology, Biological and Chemical Research Centre, Department of Plant Ecology and Environmental Protection, University of Warsaw, Żwirki i Wigury 101, 02-089 Warsaw, Poland

Consequences of specific climatic conditions affecting the development of hydrogenic soils of Eastern Pamir are: presence of long-term permafrost soils, intensive cryogenic processes, predominance of physical weathering over chemical processes, and slow mineralization of organic material. In high-mountainous soils, cryogenic processes take place in parallel with pedogenic processes. They shape the water ratios, and above all, the different forms of soil surface typical for this zone. Cryogenic processes, lead to the segregation of weathered materials, to the surface skeletal parts and development of geomorphological forms such as polygons, nets, wreaths and others. The subject of the study is the evaluation of non-silicate forms of iron in the hydrogenic soils developed in grasslands of the Eastern Pamir. Their general characteristics against the background of the soil-forming environment were based mainly on the results of our own field work and laboratory analyses. The content and distribution of non-silicate iron forms (F_{ed}) in the profile is mainly related to the type of parent rock, soil moistures and the soil types. The amorphous iron oxides released by the weathering of minerals undergo crystallization over time. The place of this process depends on the type of the soil (decarbonisation processes) and on climatic and soil conditions.

Key words: hydrogenic soils, cryogenic processes, Eastern Pamir.

***Corresponding author:** Małgorzata Suska-Malawska,
E-mail: malma@biol.uw.edu.pl

Soil penetration resistance in cultivated different type soils

Orhan Dengiz, Coşkun Gülser *, Rıdvan Kızılkaya

Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

Penetration resistance (PR) indicates soil compaction and it is essential for soil workability in sustainable agricultural management. The objective of this study was to determine the soil compaction and its spatial variability on different soil orders under dry farming cultivation conditions located in 396.4 ha area of Kavak- Samsun, Turkey. A total number of 120 soil samples and PR readings were taken by grid system from the study area. Penetration resistance was measured at 5 cm depth intervals between 0 and 40 cm soil depth, and gravimetric water content, field capacity and soil texture were also determined for 0–20 cm and 20–40 cm soil depths. Some interpolation models and GIS techniques were used in order to generate spatial distribution maps for PR. Penetration resistance values in some parts of the area were higher than the critical value of 2 MPa for root growth limitation, the mean PR values at all depths were considerably lower than the critical value despite a relative increase in PR with soil depth. The areas with values greater than 3.0 MPa, except for 0–5 cm, were generally located in the fields with high sand content, and compacted or formed hard pan especially in Entisol and Vertisol orders. In contrast, for 0–5 cm, the areas with PR greater than 3.0 MPa, were usually located in the northeast of the study area and had high clay content.

Key words: Penetration, interpolation models, soil orders, cultivation.

***Corresponding author:** Coşkun Gülser, E-mail: cgulser@omu.edu.tr

High-resolution XRF scanning records of eolian dust variability in Eastern Central Asia

Zong Xiulan[1,2], Song Yougui[1], Li Yue[1,2]

[1]State Key Laboratory of Loess and Quaternary Geology, Institute of Earth Environment, Chinese Academy of Sciences, Xi'an 710061, China
[2]University of the Chinese Academy of Sciences, Beijing 100049, China

Central Asia, located in the center of Eurasia, is characterized by comparatively patchy piedmont loess with varying thickness, in contrast to other regions of the world. Unlike in the Chinese Loess Plateau (CLP) in the east and the European loess region in the west, where the loess sequences have been intensively studied with respect to paleoclimatic reconstruction, continuous loess-paleosol sequences in Central Asia still lack full investigations, despite the reliable archives for reconstructing environmental and climatic change in a regional scale. Geochemical elements of eolian sediments have great potential for identifying the provenance of sediments and their transport pathways, and recording the post-depositional weathering, however, systematic studies about that for the Central Asia loess are scarce. Here, we present the XRF scanning data of a 25.8-m-thick drill core. This core, named JMSE, comes from Jimusar County, Xinjiang Province, situating in the southeastern margin of the Jungger Basin and eastern end of the northern piedmonts of Tianshan Mountain. High-resolution XRF core-scanner was applied to continuously obtain the elemental intensities of the drill core, in a scanning interval of 2 cm. The results suggest that main component elements of the core, in increasing order of abundance, are Ca, Fe, Si, K, Ti, Sr, Zr, Al, Rb and Ba. Since correlations between different elements is controlled by the geochemical behavior in the epigenetic environment, intimate relationship indicates that there are extremely consistent occurrence conditions and similar sources between the elements. The ten elements are further divided into two types based on the correlation analysis: Type I includes Si, Fe, K, Ti, Rb, Zr, Ba, Al, with correlation coefficients (r^2) of >0.6 (n=1292). They are immobile elements during weathering and sedimentary recycling. High silica reflects a high quartz composition; Fe mainly exists in iron oxides minerals, including detrital and pedogenic iron minerals such as magnetite, maghemite, hematite and goethite; potassium indicates K-feldspar, muscovite and illite; zirconium is associated with weathering resistant mineral, zircon; barium and rubidium, the typical lithophile elements, are highly correlated with potassium, with r^2 = 0.688 and 0.716 respectively, which indicates that Ba and Rb exists in K-feldspar in form of isomorphism.; titanium usually indicates rutile and/or ilmenite; alumina appears mostly in the form of aluminosilicate minerals, and is generally weathered into clay minerals, like potassium, being enriched. The Zr/Rb ratio can reflect original eolian grain size, based on study of the CLP loess. In this scenario, the ratio serves as a reliable index of the strength of transport agent. Zr/Rb ratios in JMSE core exhibit the decreasing trends with insignificant fluctuations upwards, which we preliminarily deduce, may be related to uplift of the Pamirs and Tibetan Plateau and resulting changes of the pathway of the westerlies. Ti/Al ratio is the provenance indicator independent of grain-size sorting. The ratios keep little variation in the core, implying that JMSE loess have the identical source areas since deposition. Type II

includes Ca, Sr. Sr and Ca present similar geochemical behaviors due to the parallel ionic radius. Hence, Sr is frequently hosted in calcic aluminosilicate and calcium carbonate minerals. Ca is mainly associated with calcium carbonate in loess deposits. Therefore, the weak correlation (r^2<0.6, n=1292) between them suggests that Sr probably scatter in the calcic aluminosilicate minerals, such as plagioclase, amphibole and pyroxene. The significance of Rb/Sr ratio which is usually considered to be a powerful proxy to indicate rainfall strength is not as obvious as the CLP, likely due to the drier climate of our study area. As a result, Ca doesn't show large amplitude of variation. Study of the JMSE core can contribute to improve and supplement the Central Asia loess records, provide an insights into the climate changes in the eastern Central Asia, and trace the evolutionary history of Gurbantunggut Desert within the Junggar Basin.

Key words： JMSE drilling core; XRF core scanning; element geochemistry; climate change.

***Corresponding author:** Zong Xiulan, E-mail: 18893795686@163.com

Efficacy of using microelements under cotton in meadow-gray soils in the Mugan steppe

Akhundova A.B., Salimova Sh.J., Ahmadova A.Sh.

Institute of Soil Science and Agrochemistry, Str. M. Rahim 5, Baku, 1073, Azerbaijan

The article is devoted to the study of the application and influence of microelements (Mn, Zn, Cu) on the growth and development of cotton on meadow-gray soils of the cotton zone of Azerbaijan. Meadow-gray soils are fairly widespread in the cotton zone of Azerbaijan. The development of these soils takes place underground moistening conditions, which occur at depths of groundwater from 2,5 to 3,0 m, depending on the water-physical properties of these soils and on the nature of the soil-forming rocks. The process of humus formation in meadow-gray soils is very intensive. The humus content is 1.8-2.2%. The reaction of the soil medium is neutral or strongly alkaline. The pH varies from 7,2 to 8,2. The profile of the soils described by the granulometric composition is well differentiated. The soils described are heavily clayey or clayey. The results of soil analyzes on the agrochemical characteristics of the experimental section show that the content of humus in them varies from 1,85-2,0%, as well as total nitrogen 0,16-0,18%, absorbed ammonia 12.07-7231 mg/kg, mobile phosphorus 32,5-41,2 mg/kg, exchangeable potassium 114-155,4 mg/kg. Accor-ding to the agrochemical characteristics of the soils of the experimental area, it can be noted that they differ in lower fertility, both in the reserves of the humus and in the content of nutrients.As microfertilizers, Mn, Zn and Cu are taken. To avoid leaching of trace elements by irrigation and atmospheric precipitation, microfertilizers were introduced into the cotton budding phase together with nitrogen and phosphorus fertilizers, i.e. - into the first fertilizing.Based on the data obtained, we can say that the introduction of manganese, zinc and copper against nitrogen, phos-phorus, and potassium promotes not only an increase in the yield of raw cotton, but also an improvement in the nutrient regime of the soil.

Key words: microelement, macroelement, microfertilizer, soil, cotton, fertilizer, nutrient.

***Corresponding author:** Akhundova A.B., axundova41@mail.ru

Change of the humus state of fallow soils

Albina Albertovna Valeeva*, Kamil Gashikovich Giniyatullin, Elena Vasilyevna Smirnova

Kazan Federal University, Department of Soil Science, Kazan, Russia

The aim of the research was to study the humus state of the different-aged (2 years and 70-75 years) fallow soils (Luvisols) by IR spectroscopy and stepwise oxidation according to Chan. The feature of the studied different - aged fallow soils is the presence of a series of absorption bands characteristic of aliphatic esters. Probably they are the most stable and permanent structural units of soil organic matter (OM). In the fallow soil (70-75 years and 2 years) from the surface and up to a depth of 15 cm the increase in the absorption intensity in the region of about 3000 cm^{-1} is observed which correspond to the stretching vibrations of the CH_2 and CH_3 groups. The increase in their intensity with depth can be associated with the increase in the chain length of saturated hydrocarbons. In the upper 10 cm layer of fallow soils are detected absorption bands of the peroxide group which may be due to the auto-oxidation of organic and organometallic compounds with air oxygen. In the fallow soil of the age of 2 years were found series of bands of silicic oxygen stretching vibrations which is probably associated with the insignificant accumulation of secondary humus. The results of stepwise oxidation of fallow soils OM showed that in the upper layers (0-10 cm) of the old plow horizon there is the accumulation of easily-oxidized and medium -oxidized fractions of OM. In fallow soils of the age more than 70 years this process is significantly stronger. Thus, when old-arable soils are found in the fallow state for decades accumulated low-humified plant residues which will quickly mineralize when the fallow soils return to arable land.

Key words: Fallow soils, soil organic matter, humus.

***Corresponding author:** Albina Albertovna Valeeva, E-mail: valeyabc@mail.ru

The method of soil fertility management in the rainfed conditions of North Kazakhstan

Valentina Chernenok

S.Seifullin Kazakh Agrotechnical University, Astana, Kazakhstan

North Kazakhstan is located in a zone of risky agriculture with insufficient and unstable moisture (from 130 to 450 mm per agricultural year). In the conditions of extensive farming, soils lost up to 1/3 of humus, which led to their degradation and depletion. Soils are in dire need of restoration and increase of fertility. But how and to what level should it be raised? An increase in soil fertility should guarantee an increase in the productive capacity -the productivity of crops. It has been established that with relatively favorable physical and chemical properties and high potassium, about 70% of the soils are characterized by a high deficit of mobile forms of nitrogen and phosphorus and need fertilization. But how much fertilizer should it be applied in each specific case, taking into account variegated fertility and individual requirements of crops? The existing methods of diagnosis do not give an answer.The aim of the research is to develop fundamentally new approaches to the soil fertility management system and crop productivity. The problem was solved using mathematical methods of analysis of long-term experimental data on the establishment of basic agrochemical indicators of soil fertility, which determine the productivity of crops and their responsiveness to fertilizers, as the main factor that can quickly and effectively correct the shortcomings of the soil. The paper presents the results of the development of fundamentally new methods for diagnosing and assessing the conditions of soil nutrition of crops, the ways to manage this process on the basis of determining the quantitative relationship of fertility indicators to productivity, determining their optimal parameters that ensure the maximum productivity of crops and how to achieve them. A fundamentally new approach is proposed for the restoration and purposeful management of soil fertility. The method guarantees high accuracy, economy and environmental safety.

Key words: fertility, soil properties, productivity, fertilizers, interrelation, optimal parameters of factors, ways of achieving.

***Corresponding author:** Valentina Chernenok, E-mail: Chernenok2@mail.ru

Spatial variability of soil organic matter content in a cultivated field

Coşkun Gülser *

Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

The aim of soil cultivation is generally to form a homogeneous media to supply optimum growth conditions for seeds and plants. In this study, spatial variability of soil organic matter content (SOM) in a cultivated field was determined by geostatistical method. Conventional tillage was used with a mouldboard plough at a depth of 15 cm in a field. A total number of 49 soil samples were taken from a square grid at 5 m spacing of a 30 x 30 m^2 plot selected in the center of field. SOM contents of the samples varied between 2.03 % and 2.98 %. Clay content (31.48 to 43.97 %), bulk density (BD) (1.12 to 1.41 g/cm^3), total porosity (F) (46.79 to 57.73 %), volumetric water content (θ) (19.64 to 43.86%), soil pH (6.47 to 7.40) and electrical conductivity (EC) (0.31 to 0.80 dS/m) values also showed variations among the sampling points. In kriging interpolation for the spatial variability of SOM, the biggest r^2 (0.766) and the smallest RSS (0.0013) values were determined with Gaussian model. Spatial dependences of the SOM was strong in the field with 6.4 of nugget/sill ratio. The semivariogram of SOM showed spatial dependence with a range of 157.61 m. SOM had significant positive correlations with clay (0.365**), F (0.287*) and significant negative correlations with BD (-0.286*), θ (-0.362*) and Si (-0.429**) content. This study showed that spatial variability of SOM in arable fields can be predicted for precision agricultural practices and monitoring organic carbon in global warming researches.

Key words: Soil organic matter, cultivation, soil properties, spatial variability, kriging.

***Corresponding author:** Coşkun Gülser, E-mail : cgulser@omu.edu.tr

Determining the temporal variability of the soil quality index in the afforestation areas

Emre Çomakli [1], Bülent Turgut [2,*], Taşkın Öztaş [1]

[1]*Atatürk University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Erzurum, Turkey*
[2]*Artvin Çoruh University, Department of Soil Science and Ecology, Artvin, Turkey*

The aim of this study was to determine the soil quality index (SQI) in the afforestation areas established in different times for erosion control in Erzurum, Turkey. For this purpose, four afforestation areas was selected as plots due to their establishing times (>40 years old, 20-30 years old, 10-20 years old, and <10 years old) and 20 soil samples were taken in each plots. A total of 80 soil samples were taken for analysis that included clay content (CC), silt content (SC), sand content (SaC), mean weight diameter (MWD), aggregate stability (AS), pH, electrical conductivity (EC), total nitrogen (TN), total carbon (TC), and total sulphur (TS). These properties were used as indicators, and the Analytic Hierarchy Process (AHP) and factor analysis were used for weighting the indicators. Indicators were scored using the linear score functions "more is better" and "optimum value". For determining SQI, the additive method (SQI_A), the weighted method with AHP (SQI_{AHP}), and the weighted method with factor analysis (SQI_{FA}) were used. The SQI scores of the plots showed statistically significant differences.

Key words: afforestation, soil quality index, erosion control.

***Corresponding author:** Bülent Turgut, E-mail: bturgut@artvin.edu.tr

Multilingual implementation of Soil data conceptual and object model

O.M.Golozubov*[1], V.M.Kolesnikova[1], I.V.Morozov[2]

[1] *Lomonosov Moscow State University, Faculty of Soil Science, Moscow, Russia*
[2] *Southern Federal University, Department of Soil Science, Rostov-on-Don, Russia*

Soil information exchange at the international level requires joint activities of national data centers to ensure compatibility of data obtained from different sources. The main issue in harmonization of heterogeneous soil information involved in data exchange is the choice of standard. Modern standards – analogues of ISO28258 represent the hierarchical system of standards at various levels in their chronological sequence. The standard is considered as unity of a) conceptual model (involves project organization in soil data creation, storage, transformation and transferring from process to process in a distributed heterogeneous structure of soil data centers), b) hierarchical object model. By systematization of governmental, ministerial standards and registries, comparison with the FAO list of objects and analysis of geographic primitives and attribute data used in practice the list-classifier of objects created. Conceptual model of soil description at most Euro-Asian Soil Partnership countries inherits from former Soviet Union soil science school and modern FAO recomendations for soil descriptions. While the data exchange at international level is realized in the form of XML-structures in English, national Soil Information Institutes need localized national standards for internal soil data exchange. Most part of legacy soil data and big part of actual soil information described in Russian or local language. Described here developed implementation permits to set reciprocal conformation between terms, definitions, methods, features, measurements, etc, expressed in local, Russian and English languages. According to this approach soil information standardization for exchange at the international level considered as two-stage process – first, in terms expressed in Russian or national language and complied with national standard, and the second, transformation from national standard into some international with corresponding translating in English. Current status in implementation of the model is described with examples for each aspect.

Key words: soil data, description standards, information exchange, multilingual soil data.

***Corresponding author:** Oleg.M.Golozubov, E-mail: oleggolozubov@soil.msu.ru

Importance of crop yield calibration process for SWAT model in a man-made Aaea under Mediterranean conditions

Hande Sagir[1*], Matjaz Glavan[2], Mahmut Cetin[3], M. Said Golpinar[3], Farida Dechmi[4], Hayriye Ibrikci[1], Ebru Karnez[5]

[1]Soil Science and Plant Nutrition Department, Cukurova University, Adana, Turkey
[2]Department for Agronomy, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia
[3]Agricultural Structures and Irrigation Department, Cukurova University, Adana, Turkey
[4]Soil and Irrigation Department (EEAD-CSIC Associated Unit), Agrifood Research and Technology Centre of Aragón, Zaragoza, Spain
[5]Karaisali Vocational School, Cukurova University, Karaisali, Adana, Turkey

Irrigation and fertilization are the both essential practices to improve crop productivity to ensure crop quality and nonpoint source pollution. Modelling tools have been proposed to understand and interpret ecosystem services in an easiest and cheapest way. Soil and water assessment tool (SWAT) model is one of the tools designed and developed to predict water and nutrient dynamics especially for agricultural areas. The study area (Akarsu Irrigation District, AID) is located in the Mediterranean coastal region of Turkey. In the man-made AID, hydrologic water dynamics such as inflows, outflows, and the whole water balance are well defined since 2006. The objective of this study is to investigate various types of Mediterranean agricultural practices and crop harvest and yield by utilizing the capability of SWAT model. Among the model's main components are hydrology, nutrient and crop growth and agricultural management. For this study measured streamflow data, daily nitrate loads and surveyed agricultural information were run in the model. SWAT was calibrated with daily values over a 3-year period from 2010 to 2012 for hydrology part and used monthly values for nitrogen. The 3-year time period from 2014 to 2016 was used for validation process of the model outputs. The quantitative statistics of calibration and validation results indicated that SWAT model provides an opportunity for a realistic approach for intensively cropped and man-made areas.

Key words: SWAT, crop calibration, man-made area.

***Corresponding author:** Hande Sagir, E-mail: handesagir88@gmail.com

The impact of tillage on soil organic carbon accumulation in clay loam in Lithuania

Inga Liaudanskiene[1*], Aleksandras Velykis[2], Antanas Satkus [2], Tomas Zukaitis[1]

[1]*Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry (LRCAF), Lithuania*
[2]*Joniskelis Experimental Station of LRCAF, Joniskelis, Lithuania*

The research was carried out at the Joniskelis Experimental Station (56°21′ N, 24°10′ E) on a clay loam in the experiment, established in 2006, in order to evaluate the long-term effect of tillage intensity as well as its combinations with practices for soil improvement on SOC in different soil layers. The following tillage systems were investigated: deep mouldboard ploughing (DP); ploughless tillage (PT); ploughless tillage with lime sludge incorporation (PT+LS); cover crop for mulch without autumn tillage (PT+M). Compared to DP, the applied reduced tillage systems have led to an increase in SOC content in the 0–10 cm layer, but the trend of SOC declining was observed in deeper layers; also a higher content of clay fraction C was found in 0–20 cm layer, which indicates an increase in SOC stability due to reduction of tillage intensity. The significantly higher water-extractable organic carbon content in the 0–20 cm layer in PT and PT+M systems shows that reduced tillage maintains soil productivity. The use of lime sludge led to accumulation of SOC in the form of humic substances bounded with calcium in 0–20 cm layer, while the use of PT and PT+M had the opposite effect. More than 50% of humified SOC was accumulated in the fraction strongly bound with soil clay minerals, and tillage did not have an appreciable impact on this soil quality indicator.

Key words: Reduced tillage, humified carbon, mobile humic substances, water-extractable organic carbon, clay fraction.

***Corresponding author:** Inga Liaudanskiene,
E-mail: inga.liaudanskiene@lammc.lt

Acknowledgements : The research findings were obtained through the project "The influence of long-term contrasting intensity resources management on genesis of different soils and on other agro-ecosystems components" (SIT-9/2015) funded by the Research Council of Lithuania. Part of this study was conducted under the research programme "Productivity and sustainability of agricultural and forest soils" implemented by LRCAF.

Meliorative techniques of the development of saline sodic soils in green zone of Astana city

Kan V.M[1], Saparov A.S[1], Rakhimjanov A.N[2], Titov I.N[3]

[1]Kazakh Institute of Soil Science and Agrochemistry named after U.U. Uspanov, MA RK, RK, Almaty, Kazakhstan
[2] Republican State Enterprise "Zhasyl Aimak," RK, Astana, Kazakhstan
[3]Vladimir State University named after A.G. and N.G. Stoletov, Russia

As a result of application of technology of reclamation of soda-salted saline by experimental studies proved the effectiveness of reclamation of soda-salted saline on the experimental plot of land EPU-2012 RSE "Zhasyl Aimak" near Astana and shows the possibility of scaling this technology for reclamation of soda-saline in the North of the Republic of Kazakhstan. High levels of alkaline salts in the EPU-2012 and exchangeable sodium of the soil-absorbing complex (40-70 %) required for reclamation of high doses of meliorants. Two variants of meliorants application were included in the scheme of experiments: half of the calculated dose of phosphogypsum (30 t/ha) + ash of Shakhtinsk sity during coal combustion of the Karaganda mine (15 t/ha) and the total calculated dose of phosphogypsum (60 t/ha) + ash (30 t/ha) against the background of agrotechnical soil treatment. As a result of such treatment, the solonets of this area were transformed into dark chestnut medium-saline soils for the third year after the precipitation. In both variants of experiments, there was a decrease in salinity of the arable reclamation horizon due to the change of toxic salts of bicarbonate and normal carbonates to non-toxic salts of sodium and calcium sulphates. The main technical and operational indicators of this technology are high speeds and levels of reclamation effect. Laboratory model experiments were carried out and pilot tests on reclamation of soda-salted saline were laid.

Key words: soda-salted saline soils, meliorants, phosphogypsum, ash

***Corresponding author:** Kan V.M., E-mail: kangsoil@mail.ru

Biotechnological method of production and application of biomineral fertilizer "biomineco" in increasing the fertility of soils of the Republic of Kazakhstan

Kan V.M[1], Saparov A.S[1], Titov I.N[2]

[1]Kazakh Institute of Soil Science and Agrochemistry named after U.U. Uspanov, MA RK, Almaty, Al-Farabi ave., 75 B; Kazakhstan
[2]Vladimir State University named after A.G. and N.G. Stoletov, Russia

The method of modification of natural zeolite in order to obtain on its basis of biomineral fertilizers of a new type of prolonged action. For the modification of zeolite was used baseline a two-component solutions of fertilizer type nitroammophosphate, humic and microbial preparations and stimulants of the new generation. The matrix of modified zeolite at different levels of redistribution from 1 to 5 is more productive (3-7.5 times) and functional as a result of optimization of life activity of nitrogen-fixing microorganisms on water supply and nutrition. In vegetation experiments the greatest number of nitrogen fixators was found out at use of the modified zeolites processed by humic and microbial biopreparations. When using biopreparations MERS, Gumi, Gumi-30 and Nanobiosensor G significantly increased the number of microorganisms in several times. Economically justified doses of biomineral fertilizers based on modified zeolite for the soil of grain, vegetable crop rotation is the norm of 1-2 t / ha. Modified natural zeolites in the treatment of various nitrogen, bioorganic fertilizers and cultures of nitrogen-fixing microorganisms increase the effective productivity of soils up to 100%. Modification products have optimal physical and chemical parameters, are technological and economical when used for rice, vegetable and industrial crops. On the methods of obtaining biomineral fertilizers on the basis of modified zeolite obtained patents of the Republic of Kazakhstan № 20621, № 27379, № 31348.

Key words: zeolite, biomineral fertilizers, fertility of soils.

***Corresponding author:** Kan V.M., E-mail: kangsoil@mail.ru

Ecoethic problems of saline and salty soils in Azerbaijan

Garib Mammadov

Academician of Azerbaijan National Academy of Sciences, President of Azerbaijan Soil Science Society, Azerbaijan, Institute of soil Science and Agrochemistry of ANAS, Baku, Azerbaijan

Salinization of plain soils in our Republic has a special place within the ecoethic problems. Saline soils spread widely in Azerbaijan. Approximately about 60% of the Kur-Araz lowland soils whose total area is 2.2 million hectares, became medium and strongly saline soils. In addition, saline soils are spread in Siyazan-Sumgait, Jeyranchol areas, in the Nakhchivan Autonomous Republic and other areas of Azerbaijan. In general, moderate and intensive saline soils in the territory of our Republic consist of 1.3 million hectare total area. About 670 thousand hectares of irrigated soils in the country (46.4%) are situated in Kur-Araz lowland. The irrigation herein has an ancient history. In Mill plain and in the south of Mughan plain the traces of irrigation canals are found and remain even today. The main issue of sail washing is removal of salts from soil where plant roots spread. Plant roots spread layer implies one me-ter upper layer of the soil as most of the agricultural crops or their root systems are in whole or partially spread under one meter. Light and medium mechanical composition soils are easy to clean as their water-leakage ability is great. The soils with weak water leakage have some typical features like poor water absorption capacity, unstructured condition, crusting over, difficulty in water and salt secretion. The existence of these features makes the melioration of soils more difficult; for preparation of soils with heavy granulometric composition for sowing; additional ameliorative measures are required, unlike light soils. The main objective on application of agro-biological complex in melioration of saline soils is to attract calcium salts to planting layer of soil and loosen hardened edges of the saline layer. In this case, the gaps increased in all soil profile, arises in good conditions increasing the depth of precipitation and irrigation water absorption, increases moisture reserves in soil, physical and chemical processes are accelerated and melioration of hazardous sub-stances from soil with washing process easily.

Key words: salinity soils, mineralization, granulometric composition, soil fertility, humus

***Corresponding author:** Garib Mammadov, E-mail: garibmammadov1@gmail.com

Change of groundwater mineralization and location in irrigated soils in Mugan-Salyan massif

Mustafayev M.G.*

Institute of Soil Science and Agrochemistry of ANAS, Azerbaijan

The study of the depth of groundwater and their mineralization in the research areas is one of the factors required for determining the meliorative regime in those areas. Studies show that the average price of groundwater in the vegetation period in calcareous soils varies between 3.0-5.0 g/l and their optimum depth is between 2.5-3.0 m. In general, ground water is mainly deposited at a depth of 1-5 m above the ground surface and at a depth of >10.0 m in the mountainous part. In the intensively irrigated areas, the amplitude of their level varies between 1.0-1.5 m in the season and sometimes It is observed to be 2-2-2.5m. If the ground water is deep, its amplitude is 0.5-1.0 m; the river breaks down to 1.0-3,0m in alluvial depths. The cost of their minerals in the shingles is 0.5-1.0 g/l, near the river and large irrigation canals - 2.0-5.0 g/l to varying degrees. Their price starts to rise to the center of the plains and from there to the Caspian Sea. Their low mineral content is 10-50 g/l and in some places is 100g/l, and their prices are slightly lower. The main types of ground water are divided into three main types: hydrocarbonate, sulphate and chlorine. Hydrocarbonate waters are mainly concentrated in plains, along the Kur-Araz rivers and large irrigation canals (10g/l).Sulfate waters are located in the mountainous part of the plain, their minerality is slightly higher and varies between 10-20 g/l. Chlorinated waters are distributed in the central and eastern part of the Mugan-Salyan massif and their mineral content is 20-25 g/l and more. In areas where sodium and calcium-carbonate waters are frequently encountered. Sodium and calcium sulphate are less common. The reason for this is the high concentration of salts in the soil, the high level of drainage water, groundwater levels, their close proximity to the ground surface and the lack of existing drainage systems.

Key words: salinity soils, ground water, mineralization, granulometric composition, volume weight of soil, pH, humus.

***Corresponding author:** Mustafayev M.G., E-Mail: meliorasiya58@mail.ru

Ecological conditions of the grapes growing in Ganja-Gazakh Region of Azerbaijan

Narmina Abelgizi Sadigova[1], Mahluga Mailgizi Yusifova[1,*], Kamala Gulamgizi Nuriyeva[2]

[1]Faculty of Ecology and Soil Science, Baku State University, Baku, Azerbaijan
[2]Institute of Soil Science and Agrochemistry of ANAS, Baku, Azerbaijan

Azerbaijan is one of the ancient countries which is busy with grapes growing and its conversion. The vine-growing and wine-making agrarian branches possesses a special place, assume importance for the country economy on side economic rationality and additional value formation. The researches in a direction of the corresponding degree to an ecological requirement for the grape plant were performed by us in the Ganja-Gazakh region. According to the research purpose a mathematic-statistical scientific analysis was performed over the soil, climate and relief parameters and bonitet scores were found on the basis of the country soils fertility indices by gathering the latest research materials. The special evaluation scales were prepared according to the appearance degrees of the separate signs according to the ecological need of the grape plant on the basis of the methodical instructions over an ecological appraisal and over 20 types and subtypes of the soils good for grapes in the country zone an ecological evaluation was performed by applying these scales. Summarizing the researches we can say that the investigated zone possesses a high perspective to develop vine-growing and vine-making according to the zone ecological condition. The most favourable conditions for grape growing possess low mountainous and foothill zone of Ganja-Gazakh region of the republic, but the best soils for growing wine grapes are mountain-grey-brown dark (92 scores) and grey-brown dark (94 scores) soils.

Key words: Ecological estimation, ecological mark, fertility indicators, limiting factors.

***Corresponding author:** Mahluga Mailgizi Yusifova,
E-mail: mehluqe_yusifli@mail.ru

Regulation of agrophysical condition of irrigated soils of Uzbekistan

Rahmontoy Kurvantoev[1], Maxmuda Dadamhamedova[2]

[1]Republic of Uzbekistan State Committee of Land Resources the State Institute Soil Science and Agrochemistry, Uzbekistan
[2] Economical University, Uzbekistan

On irrigating takir, meadow and grey earth-meadow soil, by application of new technology of preparation of grounds to crop cotton on ridges and crests between rows 90 cm. were created and the optimum density of addition were supported. And also favorable water, air, thermal, nutritious modes and biological activity soil, promoting to increase of productivity cotton on 3-6 s/ga. Is established, that mulching new irrigated of grey earth-meadow ground at come way of showing by a transparent polyethylene film, with dung, with lignin optimum density of addition (l,25-1,40 g/sm). General on regularity (47-50 %), waterproof of units, improving structural - modular structure, inserting on 2-9 %, waterproofing in l,5-2 times, increasing the sum of active temperatures from 133 up to 316 C. Liquidates deficiency of heat ground and soil scab, reduces physical evaporation, stimulates intensive growth and development and, thus, provides maximal use of a soil moisture and nutritious elements. Creation of optimum water-physical, temperature and nutritious modes soil of crests at mulching improve ecological conditions at the expense of reduction negative influence organic and industrial wastes on an environment. Roved intensive growth, development, maturing and increase of productivity with high technological qualities of a fiber cotton at use a film - on 8,2 /ga, dung - 5,1 s/ga, lignin - on 5,2 s/ga.

Key words: soil, agro physical, mulching, irrigated, growth, structural, cotton, agricultural, technology, water-physical, biological, air properties, temperature, ecological, cultivation, melioration.

***Corresponding author:** Rahmontoy Kurvantoev, E-mail: kurvontoev@mail.ru

Changes in some soil properties under different soil management practices at the end of the first harvest

Recep Gundogan[1], Tugrul Yakupoglu [2,*], Turgay Dindaroglu[3]

[1]Harran University, Faculty of Agriculture, Sanliurfa, Turkey
[2]Bozok University, Faculty of Agriculture, Yozgat, Turkey
[3]Kahramanmaras Sutcu Imam University, Faculty of Forestry, Kahramanmaras, Turkey

It is known that many dynamic soil properties have changed with in-field applications. However, the direction and severity of this change varies depending on the management practice, plant variety and time. In addition, the course of change rooted from the same management practice may vary between the territories. For this reason, determination of different management practices on soil quality characteristics is of great importance in terms of sustainable agricultural activities and protection of natural resources. The aim of this study is to investigate how different soil tillage systems will change some soil properties at different depths of the parcels under the vegetative grain and forage crops grown on the Mediterranean climate belt. For this purpose, 24 parcels constructed in size of 50 x 6 m (length and width) in experiment location were processed with traditional and reduced tillage techniques. In October, wheat and sainfoin were planted in the parcels and each parcel was treated as a control by leaving a parcel against the parcels. Each application was repeated in 3 parcels. The harvest was carried out in June, then total organic matter (SOM), soil reaction (pH), total salt (SLT), field capacity (FC), permanent wilting point (PWP) wet aggregate stability (WAS), bulk density (BD) and hydraulic conductivity in saturated conditions (K_{sat}) properties were measured in two soil depths for each parcel. The findings were compared with the initial characteristics of the parcels. In addition, the effect of tillage type and plant type on measured variables was examined. According to the results obtained, there was the effect of sampling time on all variables measured except for K_{sat}. In other words, the differences between the initially measured values and the values obtained after the first harvest were statistically significant at different levels for both depths. The soil tillage affected statistically the BD only at 0-30 cm ($P < 0.05$). The change that the plant variety brings about the measured variables was not statistically significant at both depths. On the other hand, significant correlations were found between WAS and OM (linear, $R^2 = 0.80$) and K_{sat} and BD (polynomial $R^2 = 0.64$) at 0-30 cm soil depth.

Key words: fallow, organic matter, sainfoin, tillage, wheat

[*]**Corresponding author:** Tugrul Yakupoglu, E-mail: tugrul.yakupoglu@bozok.edu.tr

Acknowledgements: This study financially supported by The Scientific and Technological Research Council of Turkey (TUBITAK, Project No: 114R052). In addition, this project is under COST action which is briefly called Connecteur (COST Action Code: ES1306). We would like to thank the aforementioned institutions and organizations.

Condition, protection and reproduction of soil fertility in Ukraine

Sviatoslav Baliuk, Maryna Zakharova*, Ludmila Vorotyntseva

National Scientific Center «Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky», Kharkiv, Ukraine

At state level in many countries worldwide (and Ukraine as well) are coming up to understanding a necessity of undertaking all-planetary urgent actions to prevent the global environmental crisis resulting from destruction, pollution and degradation of soils. The specific feature of Ukrainian soil cover is its diversity (asbout 40 types and over 800 subtypes) and heterogeneity. Soil-degradation processes, such as dehumification, nutrients-contents-reduction, overcompaction, structure-loss, erosion, pollution etc. appear in a wide scope. According to calculation various agencies, total area of degraded and poorly-productive lands in Ukraine amounts to 5-6 to 10-12 million ha. Agropotential of arable lands productivity allows to receive 40-50 million tons of grain due to natural fertility and 70-80 million tons due to resource supply - fertilization, irrigation, chemical melioration and other methods. Realization of soil cover potential is hampered by moisture deficit (up to 80% of the territory), imbalance of land use, degradation processes. The main activities for the protection and reproduction of the Ukrainian soils resource potential are aimed at eliminating to: nonoptimal correlation of land-plots and structurization of cultivated areas; low-resource input (low doses of organic and mineral fertilizers' application and supply of chemical ameliorant); inadequate level of State management of land resources; absence of State, territorial and regional soil-protection programs; insufficiency of legislative-regulatory and technical-normative provisions to manage using and protection of land resources.

Key words: degradation, fertility, soil, soil protection.

***Corresponding author:** Maryna Zakharova, E-mail: oroshenie@ukr.net

Content of labile organic matter in irrigated lugovo-chernozem soils as an indicator of their agroecological state

Yulia Aksenova

Omsk State Agrarian University, Omsk, Russia

The labile pool of soil organic matter is an informative indicator of an agroecological state of soils of agro-landscapes at their intensive use in agriculture. Labile humus substances are a direct source of nutrition and energy for living organisms, participates in the formation of water-soluble aggregates and have a protective function in respect of a conservative part of organic matter. The aim of the study was to determine the level of content of labile organic matter in continuous irrigated lugovo-chernozem soils, used in vegetable and grain-grass crop rotations, to assess the degree of their depletion and resistance to anthropogenic loads. Under conditions of continuous irrigation the content of labile organic matter (LOM) and energy reserve accumulated in it increase in the row: vegetable crops – cereals – annual grasses – perennial grasses. Minimum reserve of energy, very low and low content of labile humus substances establish in the soil, intended for the cultivation of vegetable crops. With the development of the grain-grass crop rotation, the amount of LOM in the soil increased to the middle and high values, and reserves of energy – to low and middle values. The regular application of mineral fertilizers against the background of irrigation contributes to the increase in the LOM content and energy reserves in it.

Key words: labile organic matter, irrigation, humic acids, fulvic acids, reserves of energy.

[*]**Corresponding author:** Yulia Aksenova, E-mail: axsenovajulia@gmail.com

Assessment and management of saline and sodic soils in the eastern part of Georgia

Zaur Chankseliani[1], Ekaterine Sanadze[2]; Giorgi Ormotsadze[1], Aleksandre Megrelidze[1], Giorgi Gventsadze[1], Leo Gorbenadze[3], Tamar Kvrivishvili[4], Giorgi Ghambashidze[1]

[1]LEPL Scientific-Research Center of Agriculture, Georgia
[2]Ministry of Environmental protection and Agriculture of Georgia, Georgia
[3]Mikheil Sabashvili Institute of Soil Science, Agrochemistry and Melioration, Georgia
[4]Agricultural University of Georgia, Georgia

In Georgia, the agriculture sector faces numerous problems and challenges. An output is extremely low. Tough socio-economic conditions are closely linked to land degradation, being a significant ecological problem for Georgia, which is an agrarian country with limited agricultural land resources. The forms of land degradation are numerous among those soil salinization is one of the major issues. According to the recent data of the Ministry of Environmental protection and Agriculture of Georgia, the low-yield agricultural lands occupy rather large areas. Saline and sodic soils account approximately 205 thousand hectares. The most of those salt-affected lands are favourable for agricultural production in terms of location, relief, a sum of active temperatures, etc., and may have a significant input in agricultural production if their potential is used accordingly. The study was aimed to monitor the current status of salinity of soils from 1600 ha of arable land in the south-eastern part of Georgia and to assess the changes since 1965 when the last study was conducted. The results have shown some negative changes in soil properties caused by improper agricultural practices and use of saline groundwater for irrigation purpose. Those negative changes adversely affect agricultural productivity and reduce the income of farmers owning or renting land in this area. The mapping of salinity and sodicity of soils in the study area shows non-uniform spatial distribution pattern, distributed having natural and anthropogenic causes. Therefore, it requires a plot-based approach in order to apply a suitable and an economically feasible rehabilitation or adaptation measures to improve soils, increase crop diversity and an amount and quality of a produce.

Key words: soil salinity, soil sodicity, management of salt-effected soils.

***Corresponding author:** Ekaterine Sanadze, E-mail: Ekaterine.Sanadze@mepa.gov.ge

Financial Support: The study was funded by the LEPL Scientific-Research Centre of Agriculture and Ministry of Environmental protection and Agriculture of Georgia

Zoning of wind erosion potential and dust events in Iran

Abbas Ahmadi *, Panh Mohammadi

University of Tabriz, Faculty of Agriculture, Department of Soil Science, Tabriz, Iran

This study was conducted for zoning of wind erosion potential and dust events in the Iran. For this reason daily and monthly temperature and precipitation data were used for zoning of the wind erosion potential at 2010 year. As well as, dust data extracted from 84 stations data for 1975 to 2010 years and dust zoning map was drawn and finally this map compared with wind erosion potential map and analyzed. Results showed that southern provinces, South east and north east of Iran (Sistan-Baluchestan, Kerman, South Khorasan, Yazd and Hormozgan) are the most sensitive regions to wind erosion and north and north west of the country (Lorestan, Kordestan, Kermanshah and south of West Azerbaijan) are the least sensitive regions to wind erosion. Based on the derived dusty day's maps, Ahvaz station had the highest number of dusty days (104 days) and then Khorramabad and Bushehr stations with 99 and 93 dusty days have ranked the in second and third place. Comparing of two maps showed that despite the eastern half of the country has more potential to wind erosion, but based on the zoning map of dusty days, West and South West of the country was more involved in dust phenomenon. It can be due to external sources of dust and entering of dust to this area by transitional flows.

Key words: drought, dust storms, wind data, rainfall data.

***Corresponding author:** Abbas Ahmadi, E-mail : a_ahmadi@tabrizu.ac.ir

Analysis of spatial heterogeneity of soil organic carbon and pH for ecological and economic rationale of land-use in the Stavropol Region

Alexey Sorokin[1*], Ilshat Husniev[2], Alina Kireeva[2]

[1]ECFS, Lomonosov Moscow State University, Moscow, Russia
[2]Faculty of Soil Science, Lomonosov Moscow State University, Moscow, Russia

The introduction of precision farming systems in practice requires detailed information in the field scale. Spatial heterogeneity of soil and agrochemical parameters should be documented and related to the yield. The considered problem requires scientific and methodological justification taking into account local conditions of farming: soil, environment, crop rotation, processing technology. Another challenge is identification of degraded soils and land, i.e., separating anthropogenic soil degradation from natural variation of soil properties in space. One of the hypotheses of this study was that in the natural environment everything is distributed unevenly; any soil property has a variation within one soil contour in agricultural systems, so it is incorrect to consider soil degradation or improving, comparing the average values. As a result, soil organic matter stocks on the investigated field showed the improving dynamics. On the field within the contour of Kastanozems, located in the Northern part of the Stavropol territory, there is uncertainty in determining the quality of land due to the natural variation of soil properties in space: the amount of the damage comparing the average value with the natural soil value, more than 3 times higher in absolute value than the amount of the damage comparing the interpolated data by kriging with the natural soil values. In the transition from an intensive to landscape-adaptive approach to agriculture, it is necessary to take into account the models of fertility of agroecosystems – to assess fertility it should be taking into account the spatial heterogeneity of soil properties. The study was performed with a financial support of the project No. 2018-14-588-0004-014 of the Federal Target Program «Research and development on priority directions of development of the scientific and technological complex of Russia for 2014 - 2020» and subsidy of the Government of Russian Federation to the Eurasian Center for Food Security (directive No. 24448-r).

Key words: data bases, field scale, Kastanozems, sustainable soil management.

***Corresponding author:** Alexey Sorokin, E-mail: alexey.sorokin@ecfs.msu.ru

The analysis of the regularities of crop formation and environmental assessment of soils in Kur-Araz lowland of the Azerbaijan

Asgarova Matanat Mahmud gizi*

Faculty of History and Geography, Azerbaijan State Pedagogical University, Baku, Azerbaijan

On the basis of the analysis of the laws of crop formation, the study of climate elements and a comprehensive study of soil fertility's agroecological factors affecting formation of the crop environmental assessment of soils under the cotton crop in the Kur-Araz lowland. For control factors of fertility on the basis of its modelling, collecting, systematization and the establishment of the bank of agronomic important statistically reliable data. Research allows agricultural specialists to plan effective agricultural activities with scientifically justified use of crop rotations, mineral and organic fertilizers, various types of soil treatment, agricultural land reclamation, irrigation of various protection measure the plants.The models of fertility with its expanded reproduction for cotton crop's conditions rotation of the Kur-Araz lowland on irrigated chestnut, grey, grey-meadow and meadow-grey soils were created. Environmental assessment soils of the region have put forward the task of developing basic model parameters of fertility, evaluation of soil assessment points, soil and environmental index and economic significance, developed recommendations for production, soil fertility management and soil conservation the soil fertility model was studied under cotton standard model and actual levels. Brown, gray, gray-meadow and meadow-gray soils of the Kur-Araz lowland developed under the cotton crop rotation by the environmental assessment of its reproduction and protection of soils from agricultural depletion of a structure model of fertility, revealed distinctive parameters models for irrigated chestnut, grey, grey-meadow and meadow-grey soils. Based on the model of fertility is composed of a scale and a chart with the capability of cartogram prices soil, developed tricks management of soil processes and increase of soil fertility. The object of research was irrigated chestnut, grey, grey - meadow, meadow-grey soils in Kur-Araz lowland and on the properties of irrigated grey-meadow soil that we have taken as standard and rated 10 points. Results of studies are processed by the method of mathematical statistics.

Key words: ecological assessment of soils, soil-ecological index, fertility models.

***Corresponding author:** Asgarova Matanat Mahmud gizi,
E-mail: matanat_askerova@mail.ru

Tools of reduction of heavy metals uptake by plants

Azimbay Otarov[1,2], *A*.Vyrahmanova[1], M.Polatova[1]

[1]U.U. Uspanov Kazakh Research Institute of Soil Science and Agrochemistry, Almaty, Republic of Kazakhstan
[2]Research Center for Ecology and Environment of Central Asia (Almaty) Almaty, Republic of Kazakhstan

At present, soils and irrigation water pollution becomes an important factor resulting in reduction of irrigated soils fertility and deterioration of product quality. A special place among polluters of agricultural lands is occupied by heavy metals. The subject of the study - the soils of the Shaulder irrigation area. At the first stage of work, heavy metals were identified as priority for the Shaulder irrigation area by carrying out soil and environmental surveys. They were nickel and partially lead, the hazard ratios of which were respectively 2.0 ± 0.029 and 0.9 ± 0.017. Therefore, to conduct an experiment to develop tools of reduction of nickel uptake by the leading crop of the area - corn for grain, the soil in this area which is contaminated with this metal was used. For the laboratory experiment, the artificially obtained carbon sorbent and natural mineral sorbent bentonite clay were used as detoxicants. Before the experiment, the sorbents were mixed with soil contaminated with nickel. Laboratory experiments were conducted in vessels with a capacity of 0.5 liters. Repeatability of the experiment is 3-fold. Corn hybrid of Pioneer company (USA) was sown in the vessels. 20-day seedlings of corn have been analyzed for nickel concentration. It was determined that all tested doses of carbon sorbent enable reduction of nickel uptake by corn seedlings starting from a small dose of 113 mg / vessel (a decrease was 31.9%). The maximum decrease of 65.7% occurred at a dose of a carbon sorbent of 457 mg/vessel. The patterns of decrease in the uptake of nickel by sprouts from the impact of bentonite are similar to the effect of char sorbent. But bentonite differs from char sorbent by a fairly high maximum (83.3%) of decrease in the uptake of nickel by corn seedlings. At the next stage of the work, a field vegetation experiment was conducted to check the effect of the selected doses of bentonite clay - 21.8 and 29.1 g/vessel. The experiments were conducted in the vessels with capacity of 20 liters with an open bottom, which provides a hydro-modular drain. The vessels were placed directly in production conditions on the irrigated field, i. e. maintenance of rice crops, irrigation regime, fertilizer application system fully corresponds to production conditions. As a result of the experiment, it was found that bentonite clay, depending on the applied dose, reduces the uptake of nickel by the most valuable part of corn-grain by 15.8-26.3%. Similar pattern is a characteristic of other corn organs - stems and leaves. Therefore, in irrigated soils of the Shaulder irrigation area in case of soil contamination with nickel we recommend to use bentonite clay to reduce its uptake by corn plants.

Key words: irrigated soils, nickel, corn, carbon sorbent, bentonite clay, reduction tools.

***Corresponding author:** Azimbay Otarov, E-mail: azimbay@bk.ru

Heavy metals in permafrost meadow-chernozem soils of the Transbaikal region

Chimitdorzhieva G. D., Korsunova Ts. D-Ts

Institute of General and Experimental Biology SB RAS, 670047 Ulan-Ude, 6 Sakhyanovoi str., Russia

The objects of research are meadow-chernozem permafrost soils. Meadow-chernozem permafrost soils are located on the territory of the Eravninskaya depression. Accumulation of Cu, Cr, Ni in permafrost-affected meadow-chernozem soils of the Transbaikal region were studied. It is shown that the content of these elements in the soil correspond the level of the rock; low amount of Ni in the soil compared to the rock is probably caused by its adsorption by minerals and its inactivity with neutral and alkaline pH. It is established that microelements up to 15% of their total content in organic horizons are bound by humus substances, most actively by fulvic acids. Thus, humus substances carry out barrier functions preventing the translocation of elements from the soil to plants, especially to their aboveground part.

Key words: trace elements, nickel, chromium, copper, rock, soil, Transbaikal region.

***Corresponding author:** Ts. D-Ts. Korsunova, zinakor23@yandex.ru

Expeditionary research was carried out at the expense of the budget for the topic № АААА-А 17-117011810038-7; analytical work with financial support under the гранта РФФИ №16-04-01297.

Salt content in soils under saxaul plantation on the dried bottom of the Aral Sea

Dosbergenov S.N., Nazanova G.K., Yegemova S.S.

Kazakh U.Uspanov Research Institute of Soil Science and Agricultural Chemistry, Almaty, Kazakhstan

The desiccation of the Aral Sea is one of the most tragic events of the present century, which spawned a complex of environmental and economic problems. The purpose of the study was to study the salinity of soils under forest reclamation plantations of saxaul of the drained bottom of the Aral Sea of the Kazalinsky district of Kyzylorda oblast. To determine the soil-ecological problems associated with the desiccation of the sea, as well as the influence of forest meliorative protective plantations on soil formation in 2015-2016, soil studies were carried out according to the following scheme:
A strip of afforestation with a width of 5 m
Between rows: 35 m
Soils: sandy, takyr-like and coastal saline soils
Experiment Options:
1 variant - Open field
2 variant - 5-year plantings (saxaul)
3 variant - 7-year plantings (saxaul)
4 variant - 10-year plantings (saxaul)
5 variant - Inter-row strip 35 m (5-7 years)
6 variant - Inter-row strip 35 m (7-10 years)
On the territory there are 5-year, 7-year and 10-year plantings of saxaul trees. The state of the soil cover of forest plantations of different years of planting was studied. The results of the analysis of water extract under various presings of planting saxaul have shown the values of the content of readily soluble salts, the degree of salinity and the species composition of the salts. The degree of salinity varies along the soil profile from the slightly saline in the surface horizon to medium- and heavily, even very strongly saline, and deep in profile has a maximum in the section for 10 years of saxaul plantation in the horizon of 70-100 cm. A more favorable situation was formed in the section (P-3) on the strip between 7 and 10 summer saxaul plantations. Here, up to 35 cm of the soil layer is non-saline, then deep into the stratum of soils passes into the category of medium saline. In soils under the 5-year-old plantation of saxaul, a favorable situation developed in the upper half-meter layer, and in the second half-meter layer it passes into highly saline. A favorable situation for the growth and development of saxaul was formed on the strip between the 5 and 7 summer plantings of saxaul. The degree of salinity varies from un-saline in the upper horizons and to a medium-saline deeper. On the open field the situation became much more complicated. The degree of salinity varies from a medium saline in the upper 0-20 cm, to a highly saline further into the depth of the soil. According to the results of the chemical analysis of aqueous extract, it is possible to judge the

the Aral Sea. The general stocks of salts, stocks of chlorides and sulphates on settlement layers, on variants are calculated. The highest reserves of salts are found in the soil profiles under the 10-year planting of saxaul. In the 1-meter layer of soil, the reserves of salts are - 128.10 t / ha, of which chloride is 21.00 t / ha, and sulphates - 65.10 t / hectare. The maximum value of salts was noted in soils under the 7-year planting of saxaul - 138,60 t / ha, of which chlorides - 11,45, and sulphates - 91,20 t / ha. The lowest value of salt reserves was recorded in soil bands between 7 and 10 summer saxaul plantations and amounted to 46.13 t / ha, of which chlorides make up 5.67 t / ha, and sulphates account for 25.82 t / ha. Favorable conditions for the growth of saxaul are created under the 5-year planting of saxaul, as well as in the strip between 5 and 7-year-old plantings of saxaul. Salt reserves are 50.65 t / ha and 52.50 t / ha, respectively. In the field profile of the open field, the salt reserves are - 81.90 t / ha. The largest reserves of chlorides are contained in this version - 25.24 t / ha. In conclusion, the degree of salinity varies along the soil profile from the slightly saline in the surface horizon and to the medium- and heavily even very saline into the soil stratum. In strongly saline soils, toxic salts are predominant, and non-toxic salts prevail for weakly saline soils. There is a decrease in salt reserves in soils under saxaul plantings in comparison with fields not occupied by saxaul plantations.

Key words: soil profiles, forest cover, toxic salts, salt reserves, water extract, degree of salinity, chlorides, sulfates.

***Corresponding author:** Dosbergenov S.N., E-mail: nazanova.gulmira@mail.ru

The ecological evaluations of steppe and semi desert soils in conditions of oil contamination (Stavropol region)

Ekaterina Kovaleva[1, 2*], Alexander Yakovlev[1]

[1]*Soil Science Faculty, Lomonosov Moscow State University, Moscow, Russia*
[2]*Ecoterra Autonomous Non-Commercial Organization, Moscow, Russia*

Increasing oil extraction activity in Russia made the soil contamination a critical environmental issue. Stavropol region is one of the oldest oil producing regions of Russia. The objectives of this study were to evaluate a set of selected characteristics typical of steppe and semidesert soils under petroleum impact. We focus on assessing qualitatively the total petroleum hydrocarbons (TPH) contaminated soils and seek to find the acceptable norms, allowing a soil system to perform its ecological functions, using biological parameters. Catalase activity significantly correlated with the TPH dose in soils studied ($R^2 = 0.8$, $p < 0.01$) and is a sensitive parameter for assessment. No correlation was revealed between urease activity and TPH content as well as phosphatase activity. The significant correlation between CO_2 emission and TPH content was found only in Haplic Kastanozems Sodic soils, then how correlation between respiration intensity and water-soluble salt content in soils was significant ($R^2 = 0.7$, $p < 0.01$). The germination, viability and biomass parameters of canola and alfalfa were also sensitive to TPH different dose. Biological parameters confirmed that the TPH limit was 1 and 3 g TPH kg^{-1} for Endosalic Gleysols Sodic and Luvic Chernozems Sodic respectively. The threshold TPH level was 4 and 5 g kg^{-1} in Chernozems Pachic and Haplic Kastanozems Sodic soils respectively. The results obtained proved that the combination of biological parameters could be viable indicators for soil assessment in TPH contaminated environment.

Key words: oil contamination, soil assessment, Enzyme and respiration activities, phytoassay, steppe and semidesert soils, Stavropol region.

***Corresponding author:** Ekaterina Kovaleva, E-mail: katekov@mail.ru

Modelling of soil organic carbon dynamics in Kazakhstan

Elena Valkama[1*], Marco Acutis[2], Gulya Kunypiyaeva[3], Rauan Zhapayev[3], Muratbek Karabayev[4]

[1]Natural Resources Institute Finland, Itäinen Pitkäkatu 4 A, 20520 Turku, Finland
[2]University of Milan, Via Celoria 2, 20133 Milan, Italy
[3]CIMMYT-Kazakhstan, Office #502, Zhandosov str., 51, Almaty, 050035, Kazakhstan
[4]CIMMYT-Kazakhstan, Office #7, B.Maylin str., 10, Astana, 010000, Kazakhstan

Traditional farming systems, involving intensive tillage, returning little organic matter to the field and frequently monoculture, lead to decrease in soil organic carbon (SOC) and land degradation. In contrast, conservation agriculture (CA) has a large potential for carbon sequestration. CA implies minimum soil disturbance, permanent soil cover with crop residues and crop rotation. In Americas, CA occupies more than 50% of agricultural land. In Kazakhstan, the areas under no-till have been increasing from virtually none in 2000 to 2.5 million ha in 2016 that is, however, only about 1.1% of agricultural lands. Therefore, FAO consider Kazakhstan as "high" in terms of potential area for further spread of CA. The objective of this study is to assess a potential of CA for soil C sequestration in Kazakhstan. We performed a comparative assessment of SOC changes during 20 years under CA and traditional cropping systems in Almaty region by using a dynamic simulation model ARMOSA (Perego et al., 2013). The results showed that traditional agriculture decreased SOC by 400 and 800 kg $ha^{-1}y^{-1}$ under maize and wheat production, respectively. In contrast, no-tillage has a large positive impact on SOC increase, equal to 800 and 2000 kg $ha^{-1}y^{-1}$ for maize and wheat production, respectively. In conclusion, no-tillage has a large potential for C sequestration in Kazakhstan, but its extent depends on cultivated crops.

Key words: conservation agriculture; soil organic carbon; wheat; maize; modeling.

***Corresponding author:** Elena Valkama, E-mail: elena.valkama@luke.fi

Visions and innovations for sustainable use of soils in Eurasia

Frank Eulenstein[1,5,8], Lothar Mueller[1,5,8], Abdulla Saparov[2,8], Mekhlis Suleimenov[3,8], Konstantin Pachikin[2,8], Azimbay Otarov[2,8], Askhad K. Sheudshen[4,5,8], Ludmila Onishenko[5,8], Victor G. Sychev[6,8], Olga Rukhovich[6,8], Vladimir Romanenkov[6,8], Sergey Lukin[7,8], Alexander S. Chumbaev[8], Nadezhda M. Tchebakova[9], Volker Hennings[10], Uwe Schindler[1,5,8], Ralf Dannowski[1], Wilfried Mirschel[1], Roger Funk[1], Katharina Helming[1], Axel Behrendt[1,8]

[1] Leibniz Centre for Agricultural Landscape Research (ZALF), Muencheberg, Germany
[2] U.U. Uspanov Kazakh Research Institute of Soil Science and Agrochemistry, Almaty, Kazakhstan
[3] Scientific Production Center of Grain Farming named after A.I. Barayev, Shortandy Kazakhstan
[4] Russian Scientific Research Institute of Rice, Krasnodar, Russia
[5] Kuban State Agricultural University, Krasnodar, Russia
[6] Pryanishnikov All-Russian Research Institute of Agrochemistry, Moscow, Russia
[7] Institute for Organic Fertilization and Peat (VNIIOU), Vyatkino Russia
[8] Mitscherlich Akademie für Bodenfruchtbarkeit, (MITAK), Paulinenaue, Germany
[9] V.N. Sukachev Institute of Forest, Russian Academy of Sciences, Siberian Branch (SIF SB RAS) Krasnoyarsk, Russia
[10] Strousbergstraße 9, Hannover. Germany

The paper aims to initiate a sustainable use of soils in Eurasia by the application and transfer of novel scientific methods. We share the visions of the originator of the modern soil science V.V Dokuchaev and the great innovators of agrochemistry J v. Liebig, E.A Mitscherlich, D.N Pryanishnikov, U.U Uspanov and others. Their visions were to eliminate hunger and poverty of the population by stable crop yields based on innovative site-adapted soil management and farming. In the post-war period of the 20th century great progress in science and agricultural practice enabled to make these visions reality in Europe and in the whole Soviet Union. Crop yields increased and hunger was eliminated. However, some progress achieved was on costs of sustainability. Soil degradation and loss of biodiversity became significant. In the 21st century the global struggle for resources, land and water included, and man-made climate change have created new threats for soils, ecosystems and inhabitants of rural areas. Thus, food security is not stable in Eurasia whilst the status of soils and water bodies remains endangered and not adequately monitored. Science and technology may help to find solutions for sustainable use of soils. The awareness about limited and degrading natural resources have fired the energy and creativity of responsible and innovative people to develop and install monitoring systems and countermeasures. However, the access to modern monitoring systems and agri-environmental technologies is different over regions of Eurasia. Some regions of Central Asia and Asian Russia require modern monitoring systems for their land and water resources in order to avoid their accelerating degradation and maintain their productivity function and ecosystem services for the population. Tailored solutions have to be based on detailed analyses and data.

We start with an extended analysis of water and land resources, characterising the natural conditions of North and Central Asian landscapes, their ecosystems, crucial processes, and human impacts on soil and water quality. The status of research and monitoring is also characterised, pointing both on substantial progress achieved during the past decades, but also on gaps in our knowledge. Following our analysis, rural landscapes in North and Central Asia have great potential for economically and ecologically viable business activities, but are currently characterized by inefficient and unsustainable land and water management practices, industrial pollution and the decay of the rural infrastructure. The land and water resources of Central Asia are in a particular critical state. Some keywords are: grassland degradation, humus loss and wind erosion on cropping land, salinisation of irrigated land, low agricultural productivity and water use efficiency, water scarcity, water pollution. Sustainable practices should be introduced soon, and this must be based on modern monitoring and management technologies. To promote this, we offer an array of methods of measuring, assessing, forecasting, utilizing and controlling processes in agricultural landscapes. These are laboratory and field measurement methods, methods of resource evaluation, functional mapping and risk assessment, and remote sensing methods for monitoring and modelling large areas. Novel methods of data analysis and ecosystem modelling, of bioremediation of soil and water, field monitoring of soils, and methods and technologies for optimizing land use systems have been developed as well. We depict some highlights which could (a) lead to a significant knowledge shift, (b) initiate sustainable soil resource use and (c) trigger substantial improvement of the ecosystem status, provided they are introduced into landscapes of North and Central Asia or applied there very soon on a wide scale. These are (1) soil and hydrological laboratory measurement methods, (2) process-based field measurement and evaluation methods of land and water quality, (3) remote sensing and GIS technology-based landscape monitoring methods, (4) process and ecosystem modelling approaches, (5) methods of resource and process evaluation and functional soil mapping, and (6) tools for controlling agricultural land use systems such as nutrient balancing methods, conservation agriculture and their technologies. More than 15 concrete monitoring and management tools could immediately be introduced into research and practice, some of them without monetary investment. Agri-environmental research projects should have high priority as gaps in our knowledge are particular high, and a particularly large amount of novel measurement, evaluation, modelling and management tools are available. Various tools are ready for immediate introduction into North and Central Asian landscapes in the framework of mutual pilot projects: state-of-the-science field monitoring technologies for soil and forest hydrology (EEM-HYPROP, virtual and real lysimeters) and groundwater quality (direct push sampling, multi-level wells), agro-ecological models and decision support systems (MONICA, LandCare-DSS), soil and land quality classification and evaluation tools (WRB 2014, Muencheberg Soil Quality Rating), nutrient balancing tools, irrigation control systems, grassland evaluation methods, wind erosion monitoring systems and technologies of conservation agriculture. We conclude that strengthening international and national research cooperation in these fields will be key for making novel methods operational.

The role of internationally linked monitoring capacities is particularly emphasised, with some existing stations established in the vast agri-environmental monitoring network and others to be newly built in remote regions of Asia, and supported by the latest remote sensing technologies. More information about methodologies and innovations is given in two monographies. The books „Novel Measurement and Assessment Tools for Monitoring and Management of Land and Water Resources in Agricultural Landscapes of Central Asia“ (Новые Измерительные и Оценочные Методы для Мониторинга и Управления Земельными и Водными Ресурсами Агроландшафтов Центральной Азии) (Springer 2014), and „Novel Methods for Monitoring and Managing of Land and Water Resources in Siberia” (Новые Методы для Мониторинга и Управления Земельных и Водных Ресурсов в Сибири) (Springer 2015, in print) provide details. The book contributors represent an immense innovation network which should be employed to achieve both significant disciplinary and synergetic outreach effects. This should be imbedded into more sustainable strategies aiming at research cooperation between partners from EU countries, the Russian Federation and countries of Central Asia. Pilot projects, permanent think tanks, Scientific-Technical Education Centres, and Schools of Environment and Natural Resources are possible promoters who can carry novel methods into the heads and hearts of people in Eurasia. Significant progress towards food security over Eurasia and maintaining the functions of great landscapes for future human generations will be the reward of those efforts.

Key words: land, soil, water, ecosystems, sustainability, research cooperation, monitoring, methods, soil quality, crop yield, Central Asia, Siberia.

[*]**Corresponding author:** Konstantin Pachikin, E-mail: kpachikin@yahoo.com

Influence of polyacrylamide application on structure stability of Ethiopian Soils

Fujimaki H., Kawai T., Mamedov A.I.*

Arid Land Research Center, Tottori University, 680-0001 Tottori, Japan

The study aimed to examine the contribution of small rate of polyacrylamide (PAM 50 mg L^{-1}) application on structure stability of four degraded clayey soils (acidic, low base saturation and organic matter) from Abagerima watershed, Ethiopia using high-energy moisture characteristics (HEMC) method. The water retention curves of soil samples were characterized by a modified VG model that provides (i) parameters α and *n* (the location of the inflection point and the steepness), and (ii) a structure index, SI =VDP/MS (VDP-volume of drainable pores, MS-modal suction). Soil type-clay mineralogy and PAM treatments had significantly effects on the shape of the water retention curves (e.g. pore and apparent aggregate size, 60-2000 μm), thus model parameters and stability indices. Application of PAM increased the soil SI and α (1.8-2.3 and 1.1-1.3 time), and decreased MS and *n* (1.0-1.3 time). Relative to control, the order of PAM efficiency (Regosols < Luvisols ≤ Leptosols < Cambisols) on structure stability were related to factors associated with the basic processes of the structural breakdown (slaking, dispersion), critical in particle detachment, transport and surface crust formation of the studied soils. The results indicate that for sustaining soil quality and erosion control, along with conservation practices, PAM + amendments (gypsum, lime) use can be considered as an alternative management to alleviate soil Ca deficiency and enhance flocculation and structure stability with regard of soil type and condition. Mechanisms of treatments influence on soil macropore stabilization, structure stability induces and model parameters, and soil quality indexes, and the relationship between them is discussed in the paper.

Key words: structure stability, water retention, soil conservation, amendments, PAM.

***Corresponding author:** Mamedov A.I., E-mail: mamedov@tottori-u.ac.jp

The effects of selenium application on germination parameters in pumpkin (cucurbita pepo l.) some soil properties of growth media under drought conditions

Füsun Gülser[1,*], Coşkun Gülser[2], Tuğba Hasibe Gökkaya[1]

[1] Van Yüzüncü Yıl University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Van, Turkey
[2]Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

The objective of this study was to investigate the effects of selenium application on germination parameters in pumpkin (Cucurbita pepo L.) some soil properties of growth media under drought conditions. The study was carried out according to factorial experimental design with three replication in a chamber room under controlled conditions. The plastic pots having 2 kg soil were used as growing media with adding the basic fertilization of 250 mg kg^{-1} N, 32.75 mg kg^{-1} P and 82.65 mg kg^{-1} K into each pot. Two different variety of pumpkin were used in this study. The irrigation was made in three different levels of available water at 30 %, 60 % and 100 % rates. The four doses of selenium (0 mg kg^{-1} Se, 1 mg kg^{-1} Se, 2 mg kg^{-1} Se ve 4 mg kg^{-1} Se) solutions as natrium selenat (Na_2SeO_4) form were applied when seeds were sown. The experiment was ended after seven weeks. In this study germination rate and plant length significantly ($p<0.01$) decreased while EC_D, P_{SWD} and osmotic potential (OP) values significantly ($p<0.01$) increased by increasing drought levels. The highest germination percentage, germination rate, plant length, EC and OP_D means were found as 100%, 6.61 day, 29.28 cm, 2.71 dS cm^{-1} and 5.9 atm respectively. Effects of selenium application on EC and P_{SS} were found significant at 0.01 level while EC_D, P_{SWD} and OP_D were significantly influenced at 0.05 level by selenium application. The highest EC, P_{SS}, EC_D, P_{SWD} and OP_D means were obtained as 2.80 dS cm^{-1}, 0.1934 %, 14.42 dS cm^{-1}, 0.93 % and 5.19 atm respectively. The increases in osmotic potential and salinity caused decreases in germination parameters and plant length.

Key words: drought stress, selenium, germination, osmotic potantial, salinity.

***Corresponding author:** Füsun Gülser, E-mail: gulserf@yahoo.com

Ecological risk assessment of soil contamination by trace elements around open mine and tailing dump of the Akhtala ore processing combine

Ghazaryan Karen[1*], Khachatryan Hrant[2]

[1]Yerevan State University, Alex Manoogian st. 1, 0025 Yerevan, Republic of Armenia
[2]Armenian National Agrarian University, Teryan st. 74, 0009 Yerevan, Armenia

The main objective of this study is the assessment of the soils pollution level of the open mine and tailing dump of the surrounding territories of Akhtala ore processing combine by heavy metals. The soils of two riskiest sites of this region were studied: surroundings of open mine near the Shamlugh town and surroundings of the Chochkan active tailing dam. The mountain cambisol was the main soil type in the study sites. To classify soil pollution level contamination indices like Contamination factors (*Cf*), Degree of contamination (*Cd*), Pollution load index (PLI) and Geo-accumulation index (I-geo) are calculated. The distribution pattern of trace metals in the soil profile dueto *I geo, Cf* and *Cd* values shows that the soil is very polluted. The PLI values for the 19 sites were >1, which indicates deterioration of site quality. The significant correlation between some of the heavy metals showed that the pollution of soils by heavy metals in the studied territory was directly due to human activities, particularly mining and smelting industry. The variation of high pollution with Cu and some heavy metals near the open mine and the surroundings of Chochkan active tailing dam was due to the character of industrial activities, the moving direction of airstreams as well as the physicochemical peculiarities of soils.

Key words: Heavy metals, soil contamination, Environmental risk assessment, Armenia.

***Corresponding author:** Ghazaryan Karen, E-mail: kghazaryan@ysu.am

The effect of a landfill on total macro and micro element content of agricultural soils in Çorlu (Tekirdağ-Turkey)

Hüseyin Sari, Orhan Yüksel*

Tekirdağ Namık Kemal University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Tekirdağ, Turkey

This study was conducted for the purpose of determining the effect of a landfill on agricultural areas. Çorlu landfill, which is the largest landfill of the region, where the wastes of the industrial areas such as Çorlu and Çerkezköy was collected, has been selected for this purpose. Çorlu and Çerkezköy are among the largest industrial centers of Turkey and dry farming is carried out around the landfill. In the study, 66 soil samples were taken from 22 points and 3 different depths (0-30; 30-60; 60-90 cm) to represent agricultural areas close to the landfill and total macro and micro element analyzes were performed in addition to some physical and chemical analyzes. The research area is generally slightly acid (pH: 5-6) and unsalted ((EC: 0,028-0,69 $dS.m^{-1}$) average EC: 0,126 $dS.m^{-1}$)). Texture class of the research area soils generally differ but it is in general sandy clay loam (SCL). The highest Mg, K and Na contents of the soils were found at point 16, Ca and P contents at point 18, and the lowest K and Mg contents were found at point 22, and Na content at point 7. Fe and Mn contents of the soils were found at point 16, Zn content at point 1 and Cu content at point 18. The lowest Fe and Cu contents were found at point 22, and Mn and Zn contents at point 7. According to the results of the analysis, no relation has been determined between the landfill and the total macro and micro element contents of the soils in terms of distance. The values at points with high clay content were found to be generally high. In lands with sloping topography and generally having coarse texture, macro and micro elements are estimated to have been washed in the soil as a result of the slope.

Key words: soil, landfill, macro elements, micro elements, agriculture.

***Corresponding Author:** Orhan Yüksel, E-mail: oyuksel@nku.edu.tr

Determining the degree of pollution in the agricultural areas around the open dumpsites in the Çorlu district of the Tekirdag province and evaluating it by GIS

Hüseyin Sarı*, Orhan Yüksel

Tekirdag Namık Kemal University, Faculty of Agriculture, Department of Soil Sciences and Plant Nutrition Tekirdag, Turkey

This study aims to reveal the effect of hazardous waste storage areas on environment over soil and plant. To this end, the hazardous waste storage area in the Corlu district of Tekirdag province, which has the largest area and volume in the region, was chosen as the study area. Corlu is one the important centers of the region with its industry. In addition, this storage area is used for the waste of the surrounding districts, especially the industrially developed districts such as Cerkezkoy. For this reason, it may be expected that polluted materials are excessive in the hazardous waste storage area of the district and pollute the environment relatively more. Moreover, the preliminary surveys carried out indicated the existence of agricultural areas around the dumpsite, which also caused this area to be selected as the study area. In this regard, heavy metal element analyses were made over 66 soil samples extracted from 22 points and 14 plant samples extracted from the points where agricultural activities and planting (wheat) are performed. According to the results of the analyses on the soil and plant samples, there is no relationship between the storage area and the heavy metal content of the soil and plant samples. However, there is a relationship between the textures of the soils and the heavy metal content. It can be said that the sloping nature of the area exposed to sampling decreases the heavy metal concentration of the water flowing in the soil, especially of rain water. It is believed that the Corlu stream, which has the longest distance to the dumpsite where the slope ends in the study area, serves as a drainage channel for this land, and the heavy metals washed in the soil as a result of rain are drained to the Corlu stream.

Key words: dumpsite, pollution, GIS, Tekirdag, waste.

***Corresponding author:** Hüseyin Sarı, E-mail: hsari@nku.edu.tr

The effect of *Melia volkensii* agroforestry system on soil - water dynamics, Maize growth and biomass

Joshua Belle Okello*

Simbikam & Partners Consultants, P. O. Box 80078-80100 Mombasa, Kenya

Melia volkensii (Gurke) is a tree with a grey bark in the family meliaceae and indigenous to Eastern Africa; found in sandy soils and produces several useful products. The objectives of the study was to determine the effect of distance and lopping of Melia volkensii on Soil water balance, growth and biomass yield of maize within an agro forestry land use system. The study was conducted in Mbeere County Kenya using 7 experimental treatments in a randomized split-plot design. Results indicated that soils in the sites were Sandy clay loam, Nitorhodic Ferralsols and Cambisols alkaline, with low N, K, C, Na content, high in P, low in CEC and EC. Maize height increased in all the sites. However, drought had a significant height effect. Height growth was higher in the lopped sites due to increased light penetration and photosynthetic activity. There was no significant effect of distance on height growth; however biomass production was highest in the lopped site, and soil hydraulic conductivity increased with distance indicating distance significantly affected hydraulic conductivity. Soil moisture content was higher in the unlopped site compared to the lopped site, while, distance did not affect soil moisture content. Soil bulk density increased with distance in the lopped site. Generally, bulk density was low in all the sites. In conclusion, applying fertilizers (organic and inorganic) and lopping is an appropriate tree management initiative. Further, distances affect soil water storage, and soil moisture content is enhanced at sites with adequate tree cover.

Key words: Melia volkensii, agro forestry, hydraulic conductivity, bulk density, moisture content, biomass and growth of Maize (Zea Mayas).

***Corresponding author:** Joshua Belle Okello, E-mail: simbikam@gmail.com

Production and environmental parameters of agricultural soils in Slovakia

Jozef Vilček [1,2*], Štefan Koco [1,2], Stanislav Torma [1]

[1] National Agricultural and Food Centre, Soil Science and Conservation Research Institute, regional work place Prešov, Slovak Republic
[2]Department of Geography and Regional Development, Faculty of Humanities and Natural Sciences, University of Prešov, Slovak Republic

Mainly due to stronger pressures on agricultural land loss, it is necessary to inform the general public about the irreplaceable status and importance of soil in the Earth's ecosystems. Nowadays, it is more than obvious that land, in addition to production functions, provides a whole range of other tasks that are necessary for life conservation. Although the situation in land use and protection in Slovakia is relatively good, it is important, especially for the new generations, at least to keep the current state of soils, both in quantity and quality. The agricultural land of Slovakia is currently able to feed its inhabitants, and even a part of it can be used for non-food purposes. It does not mean, however, that such land is some free capital with which we can gamble in the future. Here too, the rules of good agricultural practice for soil fertility must be applied. The aim of this paper is to quantify and analyse the potential of agricultural land in Slovakia, both in terms of their sufficiency as well as production, energy, economic and environmental parameters. Correlation environmental parameters with the map of the soil production potential is very strong and the average value (weighted average) of environmental indexes of Slovak soils (55.3 points) is very similar to the average value of the soil production potential (53.9 points). The value of agricultural soil ability to meet ecological functions is 1.42 €.m^{-2} (production functions 0.13 €).

Key words: Productive soil potential, soil parameters, food sufficiency, energetic soil potential, extra-productive soil potential, Slovakia.

[*]**Corresponding author:** Jozef Vilček, E-mail: j.vilcek@vupop.sk

Agroecosystems' contribution to seasonal carbon exchange in temperate climate of Central Lithuania

Ligita Baležentienė *, Ovidijus Mikša

Aleksandras Stulginskis University, Akademija, Lithuania

The increasing anthropogenic CO_2 emissions into atmosphere force the choice of grown crops aimed at their mitigation the climate change. For this reason, investigations of seasonal carbon exchange were carried out in 2013–2016 at the Training Farm of Aleksandras Stulginskis University, Lithuania. The aim was to investigate and compare carbon exchange rate of different crops, *viz*., maize, ley, winter wheat, spring rapeseed and barley of conventional farming. This study comprised carbon exchange rate, specifically, measurement of emitted and absorbed CO_2 fluxes applying static chamber method. The biomass measurement and leaf area index (LAI) calculation at different plant growth stages were used to evaluate carbon exchange in different agro-ecosystems. The differences in photosynthetically assimilated CO_2 rates were significantly impacted by leaf area index ($p = 0.04$) during plant vegetation period. A significant ($p < 0.50$) strong correlation ($r = 0.6$ and 0.7) was established between soil respiration and LAI. Soil respiration contributed to only 21% of agroecosystem carbon exchange. Plant respiration ranged between 0.034 and 3.613 μmol m^{-2} s^{-1} during the vegetation period thus accounting for a minor share (16%) of carbon exchange. Generally, respiration emissions were completely recovered by crops gross primary production (GPP). Therefore the ecosystems were acting as atmospheric CO_2 sink. Barley assimilated the lowest mean GPP 12.77 μmol m^{-2} s^{-1} whereas the highest was determined for ley (14.28 μmol m^{-2} s^{-1}) and maize (15.68 μmol m^{-2} s^{-1}) due to the biggest LAI and particular plant characteristics. Due to the highest net ecosystems production NEP, ley (12.66 μmol m^{-2} s^{-1}) and maize (12.76 μmol m^{-2} s^{-1}) agro-ecosystems sank the highest C rates from the atmosphere, and thus they might be considered the most sustainable between crops. Consequently, appropriate choice of crops and their area in crop rotation systems may reduce CO_2 emissions to atmosphere and their impact on the environment and climate change.

Key words: CO_2 fluxes, plant parameters, environment, crops.

***Corresponding author:** Ligita Baležentienė, E-mail: ligita.balezentiene@asu.lt

Possibility of using land components for estimation of soil erosion : a case study of a watershed of the second urban phase, Mashhad, Khorasan Province

Maryam Pourkarimi [1*], Shahla Mahmoudi [2], Mohamadhasan Masihabadi[3], Ebrahim Pazira [1], Abolfazl Moeini [4]

[1] Department of Soil Science, Science and Research Branch, Islamic Azad University, Tehran, Iran
[2] Department of Soil Science, Tehran University, Tehran, Iran
[3] Research Assistant at Soil and water Research Institute of Tehran, Iran
[4] Department of watershed management, Science and Research Branch, Islamic Azad University, Tehran, Iran

In most parts of Iran, due to population growth, deforestation, over-grazing of pastures and other factors, soil erosion is more than the world's average and increases incredibly by time. Therefore, its correct evaluation is very important. The Mashhad-Chenaran is the biggest and most important sub-basin of Khorasan, with an extension of about 223989.7 ac. Hence, it was chosen for this study in the present investigation. Two models, the MPSIAC and the Gavrilovic method (EPM), used for evaluation of sediment amounts and soil erosion stations showed 2.74 t/ha per year. However, the MPSIAC model showed 1.56 t/ha, whereas the EPM model showed larger amounts of 5.73 t/ha per year. In soil erosion studies in watersheds, researchers have often introduced hydrological units of work. In this research, factors (geological factors, soil type, vegetation, slope etc) were utilized in the erosion estimation models used in addition to the hydrological units in the land components. In view of the availability of maps of land units and their components in many regions of Iran, the present study attempted to measure the erosion and sediment in hydrological units (sub-basins) and land components. The accuracy of estimates of erosion were tested; in order to ensure that the accuracy of the results or possibly the superiority of the homogeneous units to the hydrological units is ensured, it can be used in the same areas in the future.

Key words: Erosion, Gavrilovic method (EPM), Land components, MPSIAC,Sediment.

***Corresponding author:** Maryam Pourkarimi, E-mail: pourkarimi.m@gmail.com

Use of MPSIAC and EPM to estimate sediment yeild and erosion : A case study of a watershed of the second urban phase, Mashhad, Khorasan Province

Maryam Pourkarimi [1*], Shahla Mahmoudi [2], Mohamadhasan Masihabadi[3], Ebrahim Pazira [1], Abolfazl Moeini [4]

[1] Department of Soil Science, Science and Research Branch, Islamic Azad University, Tehran, Iran
[2] Department of Soil Science, Tehran University, Tehran, Iran
[3] Research Assistant at Soil and water Research Institute of Tehran, Iran
[4] Department of watershed management, Science and Research Branch, Islamic Azad University, Tehran, Iran

The study area of Mashhad-Chenaran, measuring 223989.7 acres, is the largest and most important subbasin of Kashafrood. This area consists mostly of mountains and plains with variable slopes. The study area is an uneven land type and thus prone to soil erosion. Various practical methods have been developed to study soil erosion both qualitatively and quantitatively, but most of them do not accurately process information regarding soil erosion. Therefore, it is essential to confirm the credibility of these methods by investigating the results yielded by examinations compared with measured quantities taken from watersheds of Iran. The importance of the practical role of soil maps in evaluating erosion and sedimentation must also be considered. In this study, both MPSIAC and EPM were used to estimate erosion and sediment yield. Sediment measuring stations showed a rate of 2.74 t/ha per year; however, the MPSIAC model showed a rate of 1.56 t/ha per year and the EPM model showed a rate of 5.73 t/ha per year. Both the EPM and MPSIAC models were created in countries with climates and geology attributes that differ from those of Iran. Hence, the coefficients and factors affecting erosion do not correspond precisely to the conditions in Iran.

Key words: Erosion, Gavrilovic method (EPM), MPSIAC, Qualitatively, Quantitatively, Sediment.

***Corresponding author:** Maryam Pourkarimi, E-mail: pourkarimi.m@gmail.com

Assesment of liquefaction eventuality of wetland sands of Lagos, south-western Nigeria, using geophysical and geotechnical methods

Oyedele, K. Festus[1*], Oladunjoye, H. Titilope[2]

[1]Department of Geosciences, University of Lagos, Nigeria
[2]Department of Physics, Olabisi Onabanjo University, Ago-Iwoye, Ogun State, Nigeria

Perpetual collapse of engineering structures in the wetland part of Lagos, Nigeria, has become a menace that seems to defy all solutions probably because of wrong approach to unravel the real cause of the problem. Several authors have attributed this incidence to poor supervision, inferior construction materials, presence of clay/peat and bad design. Customarily, sand is taken to be competent engineering material prior to the liquefaction phenomenon that occurred simultaneously in California (USA) and Nagata Japan) where sandy soil lose its bearing capacity due to sudden earth shaken. The primary aim was to delineate probable areas that were prone to induced seismicity. Multi-channel analysis of surface waves (MASW), Cone penetration test (CPT) and Standard penetration test (SPT) were employed to study the subsurface geology conditions of the area. The MASW of seismic method were used to generate the shear wave velocity (V_S) of the near surface soil while the CPT and SPT were employed to infer the penetration resistance and the blow count in the assessment of the stress-based liquefaction potential of these soils respectively. Seismic imager and liquefaction assessment software (known as Cliq) were used to process both the MASW and CPT data respectively. The values of shear wave velocity generated for most sands in the study areas range from 120m/s -200m/s. These values fell within potentially liquefiable sands. From the CPT results, 41.67% of Ikoyi data showed a very high risk to liquefaction while 37% of Badore data indicated severe liquefaction potential. The factors of safety (F.S) against liquefaction potential obtained from the plot of cyclic stress ratio (CSR) against s-wave velocity (Vs) was less than 1. This study has shown the presence of liquefiable sands within the study areas. It has significantly created awareness for inhabitants in the wetland areas of Lagos against liquefaction occurrence.

Key words: wetland, seismic imager, liquefaction, penetration resistance.

[*]**Corresponding author:** Oyedele, K. Festus, E-mail: koyedele@unilag.edu.ng

The concept of agricultural resource potential

Pavel Sukhanov, Andrey Komarov*

Agrophysical Research Institute, 14 Grazhdanskiy pr., Saint-Petersburg, Russia

The paper presents the concept of the agricultural resource potential (ARP), which includes the substantiation of the basic factors (agrobiological resources, agroclimatic resources, soil and land resources), as well as the structural basis, the functional organization of the ARP, and approaches to its assessment and management. ARP is considered as a functioning system. The concept is based on the priority recognition of crops as the main factor of food supply. Agroclimatic conditions are considered as a factor determining the possibilities of using land for agricultural production, and soil and land resources as a basic factor providing the possibility of the realization of the crop productive potential in specific agro-climatic conditions. Also, the paper proposes approaches to assessing the agro-resource potential of the region. The efficiency of the use of ARP is demonstrated on the example of the municipal districts of the Leningrad region with various soil-land and agroclimatic conditions. It is found that improvement of the efficiency of soil and land resources use (precision farming techniques) and the operational management of the crop production process in the system of precision plant growing are the basis for increasing the ARP. There are several types of ARP. The actual agricultural resource potential (AARP) is the actual volume of crop production obtained by an economic entity (region, area, agricultural enterprise, etc.) from a certain area of agricultural lands at the actual crop structure and actual weather and climatic conditions in a certain year. The estimated agricultural resource potential (EARP) is the estimated value of the crop production volume that can be obtained from the agricultural lands of the region (district, agricultural enterprise) or any given area. Soils with known value of fertility, weather and climatic conditions according to average long-term (or predictable) indicators, the optimal structure of crops, material, technical and scientific support are accepted as standards. A comparative assessment of the actual and estimated ARP characterizes the efficiency of the crop industry, while a comparative assessment of the actual and prospective ARP reflects the prospects of its growth.

Key words: agricultural resource potential, crop production, agroclimatic and agrobiological resources.

***Corresponding author:** Andrey Komarov**,** E-mail: zelenydar@mail.ru

Pedological drought hazard assessment: A case study for local administrative units in Romania

Petru Ignat*, Sorina Dumitru, Victoria Mocanu, Valentina Voicu, Cătălin Simota

National Research and Development Institute for Soil Science, Agro-Chemistry and Environment, Bucharest, Romania

The paper presents a methodology for assessing pedological drought hazard using meteorological and soil data. Pedological drought, also known as agricultural drought, is usually described on the basis of the soil water deficit, which has a direct impact on the crop growth and production. The drought phenomenon in Romania is a specific characteristic in the circumstances of a temperate-continental climate with continental -excessive influences with high deviations from the normal values of the climatic, agro-climatic, hydrological, and pedological parameters. A pedological drought hazard index (PDHI) was developed based on the conceptual model proposed by Hungsoo Kim et al., South Korea, 2015. The PDHI is using calculated daily actual evopotranspiration based on soil hydro-physical indicators, daily precipitation and potential evapotranspiration values. For hazard assessment the intensity and probability of occurrence of pedological drought were incorporated into the model. The methodology developed herein emphasizes the combined role of severity and frequency of drought in assessing the hazard and uses pedo-climatic data to map the pedological drought hazard for 3186 local administrative units across Romania. The results indicates a very high drought hazard in the east and south part of the country overlapping the climate with continental excessive influences and demonstrates the effectiveness of the methodology for assessing and understanding the further potential risk of pedological drought in Romania.

Key words: drought, hazard, soil, Romania.

***Corresponding author**: Petru Ignat, E-mail: petru.ignat@icpa.ro

Assessing the wind erosion risk by the sand blasting technique

Selen Deviren Saygin[1*], Chi Hua Huang[2]

[1]Ankara University, Faculty of Agriculture, Department of Soil Science & Plant Nutrition, Ankara, Turkey
[2] USDA-ARS National Soil Erosion Research Laboratory, Purdue University, West Lafayette, USA

Wind erosion is one of the dominant degradation processes in arid, semi-arid and semi-humid regions of the world that are vulnerable to erosion and land degradation. Availability of a simple procedure to measure the strength of dried soil crust provides the benefits of implementing more effective precautions to the risk of wind erosion for these fragile ecosystems. The aim of this study is to test a practical tool and approach designed in the National Soil Erosion Research Laboratory (USA) that directly measures the susceptibility of the soil to wind erosion processes. The technique is basically using a conventional sand blasting tool that blasts a dried soil crust for different times, ranging from 2 to 60 seconds, and the amount of soil detached by the impacting sand is recorded. In the initial tests, we measured soil detachment under a vertical blasting. Nevertheless, the impacting angle can be adjusted to simulating different saltation processes. The response, the amount of soil loss at different blasting time, indicates the structure of soil crust and a measure of the crust strength or erodibility against wind erosion. For crust formation, soil samples are exposed under a simulated rainfall for 30 min at 10 mm h^{-1}. The soil samples are air dried for at least one week before sand blasting. We tested two soils from US Pacific Northwest that are vulnerable to wind erosion. We found the technique very sensitive to cropping and management history despite the bulk soil properties are very similar. The method is considered to be useful both for evaluating soil crust strength against wind erosion processes.

Key words: wind erosion, sand blasting, structural crust, rainfall simulation.

***Corresponding author:** Selen D. Saygin, E-mail:sdeviren@agri.ankara.edu.tr

Chernozems of Krasnoyarsk territory: modern state and direction of evolution

A. Shpedt [1,2,*], V. Kratasyuk [1,3], N. Rimatskaya [1], E. Kolosova [1]

[1]Siberian Federal University, 660041, Krasnoyarsk, Pr. Svobodny, 79, Russia
[2]Krasnoyarsk Research Institute of Agriculture, Siberian Branch of the Russian Academy of Sciences, Krasnoyarsk, Russia
[3]Institute of Biophysics, Siberian Branch of the Russian Academy of Sciences, Krasnoyarsk, Russia

The article reflects the genesis, properties and fertility of the chernozems in the Krasnoyarsk Territory. Modern estimates of the state of chernozems and their transformation under conditions of intensive use are given. The aim of the work is to assess the agricultural chernozems of the Krasnoyarsk Territory on the basis of soil-ecological indices (SEI). The resulting SEI, as the final value, is determined through the product of soil, climatic and agrochemical indices. Calculation of the indices is carried out using an automated electronic system (AES) developed on the basis of Microsoft Excel. The total area of chernozems in the Krasnoyarsk Territory is 4.1 million hectares, with the following dominating types: clay-illuvial chernozem (Luvic Chernozems) (60.2%) and chernozem (Chernozems) (38.0%). They do not form pronounced soil belts and are represented by different genera, species and varieties: from infertile, small, slightly humified, carbon-bearing, to highly fertile, medium-deep and deep, rich soils. These soils have good physical, water-physical, physico-chemical and agrochemical properties. A strict temperature regime determines a number of provincial features of soils: a shortened humus horizon, increased humus content, low biological activity, pockets, signs of permafrost gleying, layered texture. These soils form the basis of arable land in the region. The average weighted value of the SEI of agricultural chernozems in the region is 47.4 points. The SEI of agricultural chernozems varies from 47.7 to 30.7 points and decreases in the series: clay-illuvial agricultural chernozem - agricultural chernozem - texture-carbonate agricultural chernozem (Calcic Chernozems). The development of middle degree erosion and deflation in agricultural chernozems lowers the value of SEI, respectively, by 15 and 4-5 points. The value of the final soil-ecological index is largely determined by the values of the soil index.

Key words: Soil, soil properties, erosion, soil estimation.

***Corresponding author:** Alexandr Shpedt, E-mail: shpedtaleksandr@rambler.ru

Determination of some soil properties and heavy metal contents at different soil depth of forage fields on the roadside of Van, Turkey

Siyami Karaca[1,*], Füsun Gülser[1], Ahmet Tekeli[2], Tuğba Hasibe Gökkaya[1]

[1] Van Yüzüncü Yıl University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Van, Turkey
[2] Osmangazi University, Faculty of Agriculture, Department of Animal Science, Eskişehir, Turkey

This study was carried out to determine some soil properties and heavy metal contents at the fields of alfalfa and trefoil around the main road between Van and Bitlis. Roadside was accepted as the beginning point and soil samples were taken from depth of 0-20 cm and 20-40 cm at 5 m, 25 m and 50 m away from roadside with five replications. Organic matter, lime content, pH and heavy metal contents (Fe, Cu, Zn, Mn, Ni, Cd, Cr, Pb and Hg) determined in the soil samples changed with distance from the roadside of soil sampling positions. pH levels did not significant change depend on soil sampling depth. pH levels were found range of 8.52-8.09 Whereas organic matter content decreased toward from top soil layer to sub soil layer while lime content increased depend on increasing soil depth. The highest organic matter content and lime content means were found as 2.55 % and 17.28 % respectively. The highest Fe, Cu, Zn, Mn, Ni, Cd, Cr and Pb contents for alfalfa fields were determined as 29.13 mg kg^{-1}, 3.35 mg kg^{-1}, 2.19 mg kg^{-1}, 23.64 mg kg^{-1},182.55 mg kg^{-1}, 3.67 mg kg^{-1}, 2.08 mg kg^{-1} and 49 mg kg^{-1} in the soil samples taken from depth of 0-20 cm within 5 m from the roadside in Dokuzagac Village, respectively. Similarly, the highest Fe, Cu, Zn, Mn, Ni, Cd, Cr and Pb contents for trefoil fields were determined as 49.72 mg kg^{-1}, 2.06 mg kg^{-1}, 0.54 mg kg^{-1}, 17.74 mg kg^{-1},243.60 mg kg^{-1}, 1.79 mg kg^{-1}, 1.78 mg kg^{-1} and 16.45 mg kg^{-1} in the samples taken from depth of 0-20cm within 5 m from the roadside in Atalan Village, respectively. The heavy metal contents of the soil samples generally decreased from the sampling position of 5 m to 50 m away to roadside.

Key words: soil properties, soil depth, heavy metal, roadside, forage fields.

***Corresponding author:** Siyami Karaca, E-mail: skaraca@yyu.edu.tr

The soil cover patterns of anthropogenically transformed terrains

Sukhacheva E.Ye.[1,2*], Aparin B.F.[2,1]

[1]The Dokuchaev Central Soil Science Museum, Saint-Petersburg, Russia
[2]The Saint-Petersburg State University, Saint-Petersburg, Russia

Effect of human activities entails changes in the soil cover patterns (SCP), the manifestations of which vary from slight fluctuations in its characteristics (parameters of complexity, contrast, irregularity of borders, etc.) until restructuring the intra-terrain SCP, a complete destruction of SC patterns, and creating fundamentally new forms of soil space organization having no analogues in the natural environment. The natural SC is always a continuous formation. This continuity has only physical breaks (such as rock outcrops, water areas), which are "special cases" (Fridland). Given the scale of human impact in recent decades, such "special cases" become widespread in the modern SC. Motorways, railway tracks, drainage channels, mounds, quarries, and structures rupture the genetic bonds between components of soil cover, which leads to the SC transformation from a continuous natural formation into a discrete one. The analysis of updated data on the SC in the Leningrad Region showed that, virtually in all terrains, there are significant areas with anthropogenically transformed SC, components of which, along with natural ones, are man-influenced soils, man-changed soils, man-made soils and non-soil formations. The typology of anthropogenically transformed and anthropogenically created SCP was built taking into account the types of impact, the degree and types of the natural SC transformation, the performance of environmental functions by anthropogenic SC. We have identified and characterized the following types of the SCP in anthropogenically transformed terrains: technogenic-forest, recreational-forest, agrogenic (postagrogenic), agro-industrial, agro-ameliorative, agro-urbanized, urbanized, industrial, motorway ones.
V.M.Fridland, Soil Cover Patterns (Moscow,1972)

Key words: soil cover (SC), man-influenced soils, man-changed soils, man-made soils.

***Corresponding author:** Sukhacheva E.Ye., E-mail: lenasoil@mail.ru

Salt affected soils under cotton-based irrigation agriculture in Southern Kazakhstan

S.I. Tanirbergenov[1,*], B.U. Suleimenov[1], A.S. Saparov[1], D.Cakmak[2], E.Saljnikov[2]

[1]U.U.Uspanov Kazakh Research Institute of Soil Science and Agrochemistry, Almaty, Kazakhstan
[2]Institute of Soil Science, Belgrade, 11000 Serbia

The study investigated soil salinity of the irrigated Light Grey soils in a cotton farm of Southern Kazakhstan under the vertical drainage, which would provide necessary background for the reconstruction of the collection-drainage system of the whole region, thus contributing to the increasing the net yield and the quality of the row cotton, as well as preventing soil deterioration. Main objectives were studying the dynamics of salts changes seasonally and timely under the vertical drainage and, studying the spatial distribution of salts in cotton-based farm. The experimental data obtained for 2012-2014 were plotted for the development of the map of soil salinity (1:10 000) seasonally (spring, autumn, winter) and vertically (0-20, 20-50 and 50-100 cm) using MapInfo Professional software. The results showed that an in 2014 there was recorded a positive dynamic of changes comparing to 2012. In spring 2014 the area under medium saline soil in 0-20 cm layer decreased from 79.5 to 57.7%; the area of weakly saline soils increased from 20.5 to 34.6%. In autumn and winter periods the area of strongly saline soils decreased from 25.6 to 14.1%. The area of non-saline soils was recorded 7.7%. The results showed that changes in the ions amount, both vertically and seasonally, occur with transport of salts along soil profile under the influence of temperature gradients and the level of ground water, i.e., in spring from up to down, and in autumn and winter, contrary from down to up.

Key words: cotton; irrigation; soil salinity; spatial distribution; seasonal distribution; vertical drainage.

[*]**Corresponding author:** S.I. Tanirbergenov, E-mail: tanir_sem@mail.ru

Soils of the river floodplains of the Central Asian inner basin (Mongolia) and ways of their rational use

Ubugunov L.L.*, Ubugunova V.I.

Institute of General and Experimental Biology, Siberian Branch of the Russian Academy of Sciences, 6, Sakhyanovoi Str., Ulan-Ude, Russia

The goal is to study the diversity, properties and use of the soils in floodplains of the rivers of the inner undrained basin of the Central Asia within Mongolia: Khovd, Zavkhan, Baidrag, Tuine-Gol, Ongiin-Gol. Analysis of the morphology, physical and chemical properties allowed diagnosing eight soil types. Alluvial light-humus soils and solonchaks predominate on this arid territory. An aeolian factor contributes to the formation of stratified subtypes of alluvial soils and stratozems, and a near level of groundwater in the upper and lower reaches of the rivers - alluvial dark-humus gley soils. Alluvial light-humus soils are diagnosed by low humus content, sandy loam texture, alkaline reaction, low salinity level, very low values of the cation exchange capacity. Alluvial dark-humus soils are characterized by a relatively high humus and nitrogen content, a light loamy texture, a slightly alkaline pH. Solonchaks are predominantly sandy loamy and loamy, of strongly alkaline reaction, low humus content and high – easily soluble salts. The availability of the root layers with readily hydrolyzable nitrogen, mobile phosphorus, exchange potassium, mobile forms of microelements, according to agrochemical gradations, in alluvial dark-humus soils is medium and low, in light-humus and solonchaks - very low and low. With the agricultural development of the river floodplains under the study, it is recommended to use dark-humus and, if necessary, light-humus soils under arable land, preferably with irrigation. Light-humus and stratified-alluvial soils, stratozems and solonchaks are more suitable for use under pastures. Alluvial dark-humus gley soils of floodplain-delta areas should be preserved as the unique natural objects for recreation, tourism, scientific purposes, nature reserves, etc.

Key words: floodplain, soil diversity, rational use, Mongolia.

***Corresponding author:** Ubugunov L.L., E-mail: l-ulze@mail.ru

Processes of transformation of the soil cover of the Northern Aral Sea area under anthropogenic impact

Valeriya Permitina*

RSE «Institute of Botany and Phytointroduction» Science committee-Ministry of Education and Science of the RK, Almaty, Kazakhstan

The factors of anthropogenic impact on the desert soils of the Northern Aral Sea area, associated with measures directed to improve quality of pasture lands and reduce pasture digression were studied. The results of investigations of soil cover and soils with signs of mechanical disturbance during the destruction of vegetation are presented. The degree and nature of anthropogenically caused disturbances was determined by a complex of morphogenetic features and properties of soils, as well as by the processes taking place in them. Studies of the processes occurring during various disturbances in the soil cover were carried out on plowed brown desert soils, and on meadow-brown soils and on the desert solonetzes, which are affected by overgrazing. It was revealed that the improvement of pastures quality with the use of plowing, led to a violation of the integrity of the upper layer of the humus horizon of natural soils. Currently, the development of long-term fallow lands has reached an intermediate stage of the recovery of soils and late-stage development of vegetation. The soil profile is characterized by the differentiation of the ploughable horizon with the isolation of the humus-accumulative horizon, with a poorly formed structure, a densified composition. The chemical composition data analysis shows decreasing in humus content, exchange capacity and a change in the ratio of mechanical fractions (sanding), which characterize the level of soil fertility. Transformation of soils under pasture pressure is characterized by the over-consolidation or destruction of the integrity of the surface horizons, their structure and composition, removal of fine-grained soil material, a decrease in the thickness of the humus horizon and the content of humus in it during the destruction of vegetation and the manifestation of erosion processes. The disturbance of the soil cover caused by plowing up of soils and overgrazing leads to irreversible changes in the soil-forming processes and it is assessed as degradation in a very strong degree. The duration of the stages of soil restoration is determined by bioclimatic conditions and depends from the degree of their transformation.

Key words: desert soils, anthropogenic influence, soil transformation, fallow lands, pasture, recovery processes.

***Corresponding author:** Valeriya Permitina, E-mail: v.permitina@mail.ru

The influence of heavy metals in soils on early stages of seedlings development

Wiłkomirski Bogusław*

Department of Environmental Protection and Modeling, The Jan Kochanowski University in Kielce, Poland

Plant - soil interactions play a fundamental role in many important processes including climate change, human health and food production. Plant growth and development largely depend not only on the availability of mineral nutrients, but also on soil contamination with different pollutants. Each type of anthropopressure, including agriculture, causes many disturbances and contamination in the environment. Heavy metals are amongst the most frequently found and intensively studied inorganic chemical substances that contaminate the environment. This is due to their negative effects to the environment and human health. It is also worth to notice, that high metal concentration in soil is one of the main constraints for plant development. If heavy metal concentration is significant, it will become toxic for most plants. Metal toxicity is important for scientists from both theoretical and practical point of view, because it affects crop yields, soil biomass and fertility. Heavy metals act as stress factor to plants and affect the plant vitality, morphology and physiology. Plants growing on soils contaminated with heavy metals show a reduction in growth, performance, and yield, what is especially important when plants have an economical value, i.e. they are crop plants, including cereal plants. The objective of the present study is to examine the toxic effect selected of heavy metals (Pb, Zn, Ni, Cd and Cu) on the cereal plants, i.e. on four most important cultivable Central European grains – wheat, rye, oat and barley, and compare this influence with the impact on maize, which is characteristic for warmer climatic areas, such as Southern Europe, USA or China. Seeds were placed in soil with increasing concentration of investigated heavy metal ions. The incubation temperature was set at 23°C with a 12-hr photo period under 1000 lx. Plants were harvested after 14 days. After seedlings collection seed germination rates were calculated. Biometric parameters of underground and aerial organs were measured. The concentration of chlorophyll *a* and *b* were determined using DMSO extraction and spectrometry. Generally, all examined heavy metals had detrimental effect on germination and seedlings growth at early stages of development, although in different rates. This was proved by decreasing of length and mass of all organs as well as by chlorophyll content. Total chlorophyll (both investigated types of this photosynthetic pigment) content declined progressively with increasing concentrations of heavy metals. The obtained results showed that different species of investigated cereal plants exhibited diversified sensitivity for increasing concentration of heavy metal in soil.

Key words: heavy metals, cereal plants, soil, contamination.

***Corresponding author:** Wiłkomirski Bogusław, E-mail: bowi@biol.uw.edu.pl

Zinc nanoparticles help biofortification when subsiding salt stress in rice in saline soils

Zulfiqar Ahmad Saqib[1,*], Tabinda Athar[1], E.E. Hakki[2], Safdar Bashir[1], Javaid Akhtar[1], Zubair Aslam[3]

[1]Institute of Soil and Environmental Sciences, University of Agriculture, Faisalabad, Pakistan
[2]Department of Soil Science and Nutrition, Faculty of Agriculture, Selcuk University, Konya, Turkey
[3]Department of Agronomy, Faculty of Agriculture, University of Agriculture, Faisalabad, Pakistan

Salinity is one of the most common environmental factors which hinders germination and reduces growth of plants. Rice (*Oryza Sativa* L.) is most imperative cereal crop in world as well in Pakistan. Zinc nutrition plays an important role for the growth and development of rice plant. Improving Zn grain contents or biofortification is recently focus of research to deal with malnutrition and nutrient security. Nanotechnology has novel applications in agriculture industries due to their unique physicochemical characters. Zn nanoparticles have good role in agriculture systems to improve the growth and yield of most crop plants. A pot experiment was conducted to compare the biofortification potential and efficiency of bulk ($ZnSO_4$) and nano-zinc (ZnO) on growth, yield and grain zinc contents in rice. Treatments were applied in two different with irrigation water as well as root dipping method. Twenty days old rice seedlings (Basmati-385) were transplanted into pots having 12 kg saline soil with EC_e 7dS m^{-1}. The results exhibited that 200 ppm and 500 ppm application of nano zinc was more effective to increase growth and yield of rice. Zinc nanoparticles application also alleviated the salt stress. It was concluded that root dipping with less concentration of ZnO nanoparticles at transplanting can give much better results under salt stress and gives higher grain zinc contents thus improves the rice grain quality and quantity.

Key words: Rice, Zinc nutrition, Biofortification, Nanotechnology, Zn nanoparticles, Root dipping.

***Corresponding author:** Zulfiqar Ahmad Saqib, E-mail: Zulfiqar.dasti@uaf.edu.pk

Tillage systems and nitrogen timing effects on growth dynamics, chlorophyll contents and grain quality in maize (*Zea mays* L.)

Allah Wasaya*, T.A. Yasir

College of Agriculture, Bahauddin Zakariya University (BZU) Bahadur Sub Campus, Layyah, Pakistan

Nitrogen being a mobile element exposed to various losses due to injudicious use of nitrogen, conventional soil and crop management practices which can be minimized by temporal nitrogen application and different tillage practices. Therefore, this study was conducted to elucidate the effect of different tillage systems (tillage with cultivator, mouldboard plough (MBP) + 2-cultivations and chisel plough (CP) + 2-cultivations); and nitrogen timings (full at planting, ½ at planting + ½ at V_5 (5-leaf stage), ½ at planting + ½ at tasseling (VT), ½ at V_5+½ at VT, 1/3 at planting +1/3 at V_5+1/3 at VT) on growth dynamics, chlorophyll contents, and grain quality in maize. Tillage systems and nitrogen application had improved leaf area per plant (LAPP), specific leaf area (SLA) and leaf area ratio (LAR). Tillage systems had non-significant effect on chlorophyll contents and grain quality parameters except for oil contents which were found higher in MBP than other tillage systems. However, nitrogen application timings had significant effect on chlorophyll a, b and total contents as well as grain quality parameters. The higher a, b and total chlorophyll contents were noted with N5 compared with other treatments. Similarly, higher protein contents were noted with N5 compared with other treatments while, higher oil and starch contents were noted with N1 compared with other treatments. Results suggest to grow maize by applying N in three splits to improve its growth dynamics, chlorophyll contents as well as grain quality in terms of proteins contents which is major constituent of maize grain.

Key words: chlorophyll contents, leaf area ratio, specific leaf area, grain quality, Maize, nitrogen application timings, tillage systems.

***Corresponding author:** Allah Wasaya, E-mail: wasayauaf@gmail.com

Sustainable production of cellulase by soil bacterium *Sinorhizobium meliloti* using commercial and agroindustrial waste substrates

Aneta V. Buntić[1]*, Olivera S. Stajković-Srbinović[1], Marija D. Milić[2], Djordje Ž. Kuzmanovi [1], Nataša V. Rasulić[1], Suzana I. Dimitrijević-Branković[2], Dušica I. Delić[1]

[1] Institute of Soil Science, Department of Microbiology, Belgrade, Serbia
[2] Faculty of Technology and Metallurgy, University of Belgrade, Department of Biochemical Engineering and Biotechnology, Belgrade, Serbia

Cellulases are industrially important enzymes which can convert the most abundant natural polysaccharide - cellulose into glucose, making it as a renewable resource of carbohydrate for the obtaining of bio-based products and bioenergy. The latest trends in microbial cellulase production include the use of various waste products for the microorganism's growth, especially of agroindustrial origin, within the solid-state fermentation (SSF), as a promising technology that can potentially reduce the overall costs. Among soil bacteria, rhizobia are rarely investigated as a cellulase producer. The rhizobial soil bacterium *Sinorhizobium meliloti* strain 224 was able to grow and express the metabolic activity on the commercial substrate carboxymethyl cellulose (CMC), but also cellulose based waste materials, such as soybean stems and oat dust. The cellulase produced in a liquid medium with commercial substrates, containing 0.1% (w/v) of CMC in yeast mannitol broth and 10 % of the inoculum, after 48 h of incubation, at 28 °C, expressed maximum Avicelase activity of 0.077 U/ml. On the other side, the cellulase produced in a medium with waste substrates, containing 1 g of soybean waste with 10 % of the inoculum, after 48 h of incubation, at 28 °C, expressed maximum Avicelase activity of 1.295 U/g. The hydrolysis of Avicel indicate a pre-dominant activity of exoglucanases, those produce the glucose, with traces of other soluble sugars, showing that the crude enzyme, produced on waste material using the soil bacteria *Sinorhizobium meliloti* strain 224, could be used in eco-friendly processes of cellulose bioconversion and reduction of biological waste.

Key words: cellulose production; waste material utilization; Avicelase activity; soil bacterium *Sinorhizobium meliloti.*

***Corresponding author:** Aneta V. Buntić, E-mail: anetabuntic@gmail.com

Prokaryotic communities in soil Chronosequences of Kursk Magnetic Anomaly mining area

Ekaterina Ivanova[1, 2*], Dina Karpova[3], Elizaveta Pershina[2], Elena Mitireva[3], Evgeny Andronov[2]

[1] V.V. Dokuchaev Soil Science Institute, Department of Soil Biology and Biochemistry, Moscow, Russia
[2] All-Russia Research Institute for Agricultural Microbiology, Pushkin, Saint Petersburg, Russia
[3] Lomosonov Moscow State University, Faculty of Soil Science, Moscow, Russia

Soil chronosequences formed on the base of overburden soil dumps and characterized by the exact dating of the dumps, are promising model objects to investigate the concurrent evolution of the soil and its microbiome as well as the role of microbiome in the soil-forming process and vice versa. The objects of the study were embryonic soils (technozems) formed on the dumps of the Tertiary Callovian Clays (10, 35, and 50 years) and the Loess Loams (1, 25 and 50 years). Reference samples were picked up from Greyic Phaeozems (fallow grassland). The analysis of vegetation cover and the main physic-chemical properties of technozems were carried out. DNA extraction was performed using the PowerSoil® DNA Isolation Kit (MO BIO, USA), sequencing of the 16S rRNA amplicon libraries was carried out on Illumina MiSeq machine. Data were processed using the QIIME_1.9.0 software (www.qiime.org). The analysis of taxonomic structure and microbiological diversity of the samples revealed that even at the earliest stages of soil formation technogenic dumps are a favorable substrate for microbial colonization. However, the increase in biodiversity indicators and the transition to a stable type of community were observed only 50 years after the formation of the dumps. This stage was characterized by the replacement of *Proteobacteria* lineages with group of actinobacteria, indicationg the replacement of copiotrophic forms of microorganisms by oligotrophic ones.

Key words: Microbiome, embryonic soils, 16S rRNA, soil prokaryotes

***Corresponding author:** Ekaterina Ivanova, E-mail: ektrnivanova@gmail.com

Acknowledgements: This work was supported by the Russian Scientific Foundation (№ 17-16-01057 and №17-16-01030)

The effect of biochar on the intensity of soil respiration: model experiment

Elena Vasilyevna Smirnova *, Kamil Gashikovich Giniyatullin, Albina Albertovna Valeeva

Kazan Federal University, Department of Soil Science, Kazan, Russia

The aim of the work was to estimate the duration of pre-incubation of soil : biochar model mixtures (in a ratio of 20: 1) on the intensity of basal respiration (BR) and substrate-induced respiration (SIR) of soils. For the experiment we used 10 biochar samples prepared from various wood and herbaceous residues in different slow pyrolysis regimes at temperatures below 400°C and in the interval 490-590°C. At different stages of incubation there is a positive and negative effect of biochar on the SIR and BR in comparison with the control. In the early stages of the model experiment (3 days) the biochar effect on the soil respiration is multidirectional, during the incubation for 3 and 6 months the effect on the SIR and BR becomes positive. For all variants of the incubation experiment during 6 months there is the general tendency to reduce the intensity of BR compared to the control. At short-term incubation were obtained 3 statistically significant regression coefficients which show the effect of the biochar properties on the value of the SIR: the content of medium-oxidizable fraction of organic matter (b_1=0,317), the water pH (b_2=0,536) and sodium content in acetate extract (b_3=-0,15). When incubated for 3 months only the content of the medium-oxidizable fraction of organic matter (b_1=0.277) significantly affects the intensity of SIR, when incubated for 6 months - the ash content (b_1=0,062).

Key words: Biochar, soil respiration, model experiment, basal respiration, substrate-induced respiration.

***Corresponding author:** Elena Vasilyevna Smirnova,
E-mail: elenavsmirnova@mail.ru

The effects of hazelnut husk and biochar application on soil biological properties

Funda Irmak Yilmaz*, Damla Bender Özenç, Ceyhan Tarakçioğlu, Sezen Kulaç

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

The most effective way to protect soil quality and health is known to provide organic matter to the soil. While organic resources provide nutrients to soil organisms, these organisms also promote their contribution to soil quality. The harvest residue of crops grown to meet growing population and food needs is also creating problems for both producers and the environment in many ways. The experiment applied 3 different mixing ratios (0 ton / da, 3 ton / da, 6 ton / da) of sandy loamy soil, 2 different organic materials (hazelnut husk, biochar) and each application. As organic material, biochar produced from hazelnut shell was used for hazelnut harvest residues for 4 years. Organic materials, soil as a function of time in biological characteristics to reveal changes occurring in the 4. period (0, 30 days, 60 days, 90 days and 120 days) and established 3 replications chance in the greenhouse under natural conditions by the plot experimental design. Biochar and hazelnut husk applications increased CO_2 production and microbial biomass carbon and were statistically significant in soil ($p < 0.01$). The most effective dose of microbial biomass - C was determined as 2. period 6 ton / da biochar (62,72 mg biyomas-C 100 $g.k.t^{-1}$). Applications also affected total N and amounts of soil organic matter. The effective dose was found to be in the application of 3 ton / da hazelnut husk (total N 0.108 %, organic matter 1.38 %).

Key words: Biochar, hazelnut husk, CO_2 production, Microbiyal Biomass-C.

***Corresponding author:** Funda Irmak Yilmaz, E-mail: fundairmak@hotmail.com

Acknowledgements: This study has supported by Ordu University Scientific Research Projects AP-1711 fund.

Impact of the Crimean plateaus afforestation on mountain-meadow soils structure, organic carbon content, and acidity

Igor Kostenko*

FSFIS The Labour Red Banner Order Nikitsky Botanical Gardens – National Scientific Center", Yalta, the Crimea, Russia

The aim of the study is to assess the impact of the artificial forest plantations on some characteristics of the Crimean mountain-meadow soils. According to the results obtained the significant changes in the properties of mountain-meadow soils of the Crimean Plateaus have taken place under the impact of artificial plantations of pine, birch, and larch created in the Crimean highlands in the middle of the 20th century. The same processes were observed when the natural forest invasion on meadow soils occurred. In comparison with the soils under the meadow vegetation, the soils under forest vegetation are characterized by the increased content of large aggregates, the decrease in the humus content, and the increase in the soil acidity. The most dramatic changes in the structural state of the artificially afforested soils were observed under the plantations of pine where the content of soil aggregates >10 mm was 3.4-4.2 times higher as compared with the meadow soils. The changes in the acidity were the most pronounced under larch stands. These changes of acidity and soil structure were close to those of natural forest stand. The decrease in the humus content is observed under all tree species. Thus, in the soil layer of 0–10 cm under all artificial forest plantations, the content of C org was by 0.36-1.61% lower than that under the meadow, whereas under natural forest the difference in mean values of C org for the soil of forests and meadows was only 0.24%.

Key words: mountain plateaus, artificial forest plantations, soil properties.

***Corresponding author:** Igor Kostenko, E-mail: ik_64@bk.ru

Evaluation of soil stress related with erosion

Imanverdi Ekberli, Coşkun Gülser *, Nutullah Özdemir

Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

Evaluation of soil stress is one of the important parameters of soil management and conservation practices. The objective of this study was to determine stress and deformation in solid media theoretically with the functional relation between stress and strain. For this aim, an analytical expression was determined using time independent equations between stress and deformation to evaluate soil stress after erosion. Soil stress values were calculated for different soil depths using soil particle density values in this expression after erosion process. After erosion process, the vertical surface stress was directly proportional with particle density and soil depth. It was found that change in soil depth was more effective on soil stress than change in particle density. When soil particle density ranged from 2.50 to 2.80 g/cm^3, stress in sandy soil with an average Poisson number 0.25 varied from 0.0327 to 0.0366 kPa in 0.20 cm depth, and from 0.8175 to 0.9156 kPa in 0.50 cm depth. In this case, stress in clay soil with an average Poisson number 0.40 varied from 0.0163 to 0.0183 kPa in 0.20 cm depth, and from 0.4087 to 0.4578 kPa in 5.0 cm depth.

Key words: soil stress, erosion, rheology, Poisson number.

***Corresponding author:** Coşkun Gülser, E-mail : cgulser@omu.edu.tr

Biological soil quality as affected by reduced and strategic tillage practices in an alluvial field

İsmail Çelik[1], Hikmet Günal[2], Mert Acar[1,*], Nurullah Acir[3], Zeliha Bereket Barut[1], Mesut Budak[4]

[1] Çukurova University, Faculty of Agriculture, Adana, Turkey
[2] Gaziosmanpaşa University, Faculty of Agriculture, Tokat, Turkey
[3] Ahi Evran University, Faculty of Agriculture, Kırşehir, Turkey
[4] Siirt University, Faculty of Agriculture, Siirt, Turkey

Management induced soil quality can be reliably assessed by measuring indicators sensitive to changes in management practices. In this study, the effects of long term (2006-2016) tillage practices on biological soil quality (BSQ) indicators, representative of essential soil processes and functions were investigated. The tillage systems under crop rotation of winter wheat (Triticum aestivum L.), soybean (Glycine max. L.) and grain maize (Zea mays L.) were; moldboard plowing with stubbles (CT-1), CT with stubbles burned (CT-2), heavy disc harrow reduced tillage (RT-1), rototiller reduced tillage (RT-2), heavy disc harrow zero soil tillage (RT-3), no-till or zero tillage (NT) and strategic tillage (ST). Half of NT plots were plowed by a moldboard plow in November, 2015, and this practice was defined as strategic tillage (ST). Soil samplings were carried out in November 2016 following the harvest of soybean at 0-10 cm depth. The Soil Management Assessment Framework (SMAF) was used as a tool for assessing and quantifying changes in BSQ induced by tillage. The values of four biological indicators (microbial biomass carbon (MBC), beta glycosidase enzyme activity (GEA), potential mineralizable nitrogen (PMN) and organic carbon (OC)) were individually scored using SMAF and integrated into an overall BSQ index. The BSQ index values significantly ($P<0.01$) differed among tillage systems, and changed between 42.0% (CT-2) and 77.5% (NT). The BSQ index under ST was 5.9% lower compared to that in NT treatment. The results revealed that BSQ index of soils decreased with increased number and density of tillage operations.

Key words: Soil quality, Biological indicators, SMAF, Tillage.

[*]**Corresponding Author:** Mert Acar, E-mail: macar@cu.edu.tr

Acknowledgements: This study was supported by TUBITAK (TOVAG 115O353)

Microbiological properties in a soil with addition of *Philoscia muscorum* and wheat straw

İzzet Akça[1,*], Murat Durmuş [2], Rıdvan Kızılkaya[2]

[1] *Ondokuz Mayıs University, Faculty of Agriculture, Department of Plant Protection, Samsun, Turkey*
[2] *Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey*

Organic matter decomposition is one of the main processes in material cycling and energy transformation in terrestrial ecosystems. Decomposition of organic waste can be substantially affected by the interactions of soil microflora and fauna. Whereas the soil microflora play a primary role in the chemical transformation and mineralization of soil organic matter, soil fauna contribute to litter decomposition by digesting substrates, increasing substrate surface area through fragmentation, and enhancing microbial activity. The effects of earthworms on the distribution of organic matter in the soil profile and on decomposition and carbon sequestration have been well studied, but less is known about effects of other macrofauna including terrestrial isopods. Isopods mainly inhabit the litter layer; by fragmenting leaf litter, they facilitate litter decomposition and nutrient cycling. As a consequence, terrestrial isopods indirectly affect the activity and community composition of the soil microflora. The isopod *Philoscia muscorum* is a common and abundant member of the saprophagous soil macrofauna in Turkey. The objective of this study was to determine effect of *Philoscia muscorum* (Isopoda; Philosciidae) on microbial biomass in wheat straw added clay loam soil. The microbial biomasss due to addition of increasing number of *Philoscia muscorum* into the soil was measured over a short term (four-week) period under laboratory conditions. Incubated microcosms under standard conditions were inoculated with a natural assemblage of Philosciidae species. At the end of the experiment, the soil with a high number of *Philoscia muscorum* content showed higher microbial biomass than the soil with a low number of *Philoscia muscorum* content. *Philoscia muscorum* stimulated soil microbial biomass and altered the response of this biomass with addition of wheat straw into the soil microcosms.

Key words : soil, isopod, microbial biomass.

***Corresponding author:** İzzet Akça, Email: iakca@omu.edu.tr

Influence of forest stands on soil and ecosystem carbon stocks in the conditions of the European part of Russia

V. Kaganov*

Center for Forest Ecology and Productivity of the Russian Academy of Sciences, Profsoyuznaya street, Moscow, Russia

To perform the study we've selected 9 objects located in European part of Russia from southern taiga to semi-desert zones. To study the influence of forest vegetation on soil carbon the following scheme of experiment was organized: we've chosen two key sites on each object, so that they originally were in same soil conditions, but under distinguishing course of vegetation development - wood or grass. As comparison sites under grass vegetation we've used perennial hayfields, perennial abandoned agricultural landscapes and virgin steppe. All sites were carried out accounting the major carbon pools: phytomass, mortmass, debris, litter and soil. All the data was recalculated using the conversion factors in carbon stocks in t C ha^{-1}. Soil samples were taken by layers each 10 cm, than at 50-75 and 75-100 cm. The results show that there are no statistically significant differences between sites of forest and grass vegetation (T-test with significance criterion of 0.05) considering the totality of 9 objects in 100-cm layer of soil. However, we've found a statistically significant increase in total organic carbon in the upper 10 cm of all soils under forest vegetation. Considering total ecosystem carbon stock of all objects an increase in total carbon content in the ecosystem on sites with forest vegetation was marked.

Key words: carbon cycle, soil carbon, forest belts, forest soil.

***Corresponding author:** V. Kaganov, E-mail: kaganov.vl@gmail.com

Rheological properties of undisturbed samples of Typical Chernozem (Kursk region, Russia) and Vertic Solonetz (Voronezh region, Russia)

D. Khaidapova[1*], N. Khitrov[2], V. Klueva[1,2]

[1]M.V. Lomonosov Moscow State University, Faculty of Soil Science, Department of Soil Physics and reclamation, Moscow, Russia
[2]V.V. Dokuchaev Soil Science Institute, Moscow, Russia

Rheological properties of undisturbed monoliths of Typical Chernozem of Kursk region (Russia) and Vertic Solonetz of Voronezh region (Russia) have been investigated. The rheological properties were determined by the amplitude sweep test on the rheometer MCR-302 (Anton Paar, Austria). Measurements were carried out at a moisture content of 3-day capillary humidification. It has been shown the linear viscoelastic range of Vertic Solonetz significantly exceeds the value of LVE-range of Typical Chernozem. This fact is probably related to the more heavy texture of Vertic Solonetz. At the same time, the storage modulus in the linear viscoelastic range of Vertic Solonetz`s sample is much weaker than of Typical Chernozem`s sample. Perhaps, this fact is due to a higher content the silt fraction (>40-55%) and the predominance of smectite minerals in them, which leads to the formation of weak interparticle bonds due to the expanding crystal lattice, and the greater amount of absorbed moisture. The value of the intersection of storage modulus and loss modulus (crossover, yield point) of Vertic Solonetz`s sample is considerably smaller than of Typical Chernozem`s sample. This is evidence that Vertic Solonetz has faster transition to a viscous state with increasing of stress than Typical Chernozem. The structural properties of Vertic Solonetz, its stability to mechanical stresses is much less than that of Typical Chernozem. The combination heavy texture, smectite mineralogy, high alkalinity, exchangeable sodium percentage and low total salt concentration in soil solution leads to the degradation of the soil structure and reduces the resistance to mechanical loads.

Key words: soil physics, soil structure, rheology, amplitude sweep test, Chernozem, Vertic Solonetz.

***Corresponding author:** D. Khaidapova, E-mail: dkhaydapova@yandex.ru

Adaptation FAO approach and tools on scaling out of SLM to enhance improvement of soil fertility and agricultural productivity of the salt affected landscapes: learning from Decision-Support GEF/FAO SLM project in Uzbekistan

T. Khamzina[1]*, G. Khasankhanova[1], A. Ismonov[2], R. Ibragimov[1], U. Abdullaev[1]

[1]Design and Research Institute UZGIP, Uzbekistan
[2] Institute for Soil Science and Agricultural Chemistry, Uzbekistan

The article shows the results of activities towards mainstreaming and scaling out of best agricultural practices that contribute to conservation and improvement of soil fertility and increase of productivity of irrigated and rain-fed croplands, demonstrated in the framework of global GEF/FAO project "Decision Support for Mainstreaming and Scaling up of Sustainable Land Management" (DS-SLM). The overall goal of the project is to assist the Government in increasing the agricultural productivity of salt affected and drought-prone croplands through promoting SLM best practices. Project team has performed joint efforts to adapt and demonstrate the most acceptable SLM practices, enhance building capacity of target groups and identify the needs in SLM measures to sustain the productive capacity of fertility declined and salt-affected soils. Knowledge has been obtained through spatial and temporal assessment of DLDD and selection of reliable SLM options that combine the best practices, soil conservation and restoration measures. The environmental benefits of project demonstrations during 2016-2018 is an follows: (i) increase of vegetative cover by 10-20% through the introduction of secondary and green manure crops and reduction of secondary salinization in the root zone of saline soils; (ii) preventing erosion and sequestration of 4.5 t/ha of carbon in wood based biomass and soil (equivalent to 16.5 tons of CO_2) by planting perennial desert forage plants and creating an almond plantation. As a result of expert evaluations, 11 most appropriate SLM technologies were selected and documented for wider scaling out and has been integrated into the WOCAT global knowledge base.

Key words: land degradation, soil health, best practices, technologies and approaches, SLM capacity.

***Corresponding author:** Tatyana Khamzina, E-mail: uzgip@bk.ru

Microbiological activity of cryoarid soils of the South of the Vitim plateau

Ts. D-Ts. Korsunova, G. D. Chimitdorzhieva

Institute of General and experimental biology SB RAS, Ulan-Ude, Russia

Experimental site was located on the territory of Eravninskiy soil-agrochemical station in s. Sosnovoborsk. To determine the carbon content of microbial biomass in frost-shattered cracks we have laid the soil trench with a length of 12 m. and a depth of 1 m. the Selection of soil samples was conducted in June (when the soil departs from the permafrost), separately from the soil column and from the cryogenic cracks. There were selected about 160 samples. Microbial soil carbon is an important functional part of soil organic carbon, providing the main production of carbon dioxide by soils. The present work is aimed at determining the content of microbial carbon and cellulose-fermenting abilities characterizing active microbial biomass in the meadow-chernozem and soddy-podzolic soils. The objectives of our research include the determination of carbon content of microbial biomass in the frost cracks and the soil stratum, and also dynamic monitoring of the content of C-biomass and cellulose-fermenting. Physico-chemical properties of soils were determined by conventional methods. For investigation of C-microbial biomass a rehydration method was used. The method is based on the phenomenon of environmental release of intracellular components from the dehydrated cells during their rehydration. Dynamic monitoring of the content of C-biomass was accompanied by a simultaneous determination of soil moisture. Seasonal dynamics of soil moisture in different years had common features. The highest humidity in the topsoil was noted at the beginning and at the end of the growing season. The lack of rainfall in late June and July in combination with high temperature led, as a rule, to the moisture deficit in the soil. The carbon content of the microbial biomass varied during the growing season.

Key words: permafrost, carbon, microbial biomass, meadow-chernozem, soddy-taiga soils.

***Corresponding author:** Ts. D-Ts. Korsunova, E-mail: zinakor23@yandex.ru

Acknowledgements: Expeditionary research was carried out at the expense of the budget for the topic № АААА-А 17-117011810038-7; analytical work with financial support under the гранта РФФИ №16-04-01297.

Existing condition of the soil resources in the Republic of Khakasia

Kutkina N.V.*

Research Institute of Agricultural Problems of Khakasia, Russia

Soil resources of Khakasia form 6156,9 thousand ha. Most part of the territory is occupied with the land of the forest resources (59,4 %), agricultural land of organizations and of citizens is 30,6 %. Black soils (59,1%), chestnut soils (12,1 %) and immature soils (10,6 %) prevail in the structure of soil cover of the agricultural land. In arable land the part of black soils constitutes 7 9,6 %, chestnut soils – 13,6%, while other soil types occupy only 6,8 %. The perspective of using soil resources in some ways is associated with global warming. The average annual temperature of Khakasia has increased to 1,2^{o} C over the past 60 years (1941-2000). So the risks causing such negative effects as frequent thaws; temperature extremes; frequent soil droughts during the vegetation period increase to 42 % for the period from 2002 to 2012. Consequently the aims of managing the productivity of agrocenosis and the soil fertility are becoming essentially more complicated. Agricultural land in the Republic occupies 650,6 thousand ha, but cultivated area forms only 268 thousand ha. Under conditions of the country's economic downturn (1990-2002) not only degraded but also a few fertile lands were withdrawn from the rotation, a particular harm was done to previously reclaimed land. Currently, only 5 thousand ha of the irrigated soil is used, comparatively in the past it was 50 thousand ha. The value of soil resources in the Republic has considerably deteriorated as a result of wind and water erosion. For the period from 1970 to 2009 average annual loss of humus supplies on the agricultural land form 1,1 ton/ha in the whole Republic while for the period of 2005-2016 the humus content in the soil of agricultural land was stabilized. It is necessary to mark that the balance of nutritional elements stays in a long-lasting negative condition. Currently, widespread soil drifting is almost stopped after excluding most part of the arable land from rotation. The reduction of sheep population (5-6 times) also contributed to this situation. Only rare local cases of erosion process are observed on the used arable land in case land owners violate the techniques of soil conservation.

Key words: climate, soil, fertility, agricultural land, productivity, degradation.

***Corresponding author:** Kutkina N.V., E-mail: cutcina19@mail.ru

Impact of biochar application on soil microbiological attributes under corn plant culture subjected to water deficit stress

Nasser Aliasgharzad*, Masoud Javani, Shahin Oustan

University of Tabriz, Faculty of Agriculture, Department of Soil Science, Tabriz, Iran

Biochar as a stable carbon source can affect soil properties including microbiological attributes. The effects of biochar may also be influenced by plant growth and water deficit stress. In a greenhouse study, the biochar at three levels of 0, 1 and 2% w/w was thoroughly mixed with soil. Half of pots were planted with corn seeds (*Zea mays* L. Single Cross 704) and the rest were left un-cultured. Soil moisture levels of 80-90% FC (S0), 60-70% FC (S1) and 40-50% Fc (S2) were applied to the pots by daily weighing and watering. After two months, the soil basal and substrate induced respirations (BS and SIR), microbial biomass carbon, nitrogen and phophorus (MBC, MBN and MBP) were determined. Metabolic and microbial quotients (q_{CO2} and q_{mic}) were also calculated as eco-physiological indices. The BS in un-cultured pots was markedly enhanced by increasing biochar level but there was no alteration in cultured pot with increasing biochar level, although the BS was higher in cultured than un-cultured pot at comparable biochar levels. SIR was adversely affected by increasing water deficit stress in un-cultured pots, but it was not affected in cultured pots. At soil moisture levels of S0 and S1 the addition of biochar caused an increase in MBC. Biochar levels had no significant effects on MBN at S0 and S1 but a marked increase in MBN was recorded at S2 with 2% biochar amendment. MBP was not affected by water deficit stress or biochar addition. q_{CO2} tended to increase by increasing water deficit stress but biochar at 1% level alleviated this index at all moisture levels. Both biochar levels of 1 and 2% exhibited positive effects on q_{mic} at S0 and S1, but biochar levels had no pronounced impact on q_{mic} at S2.

Key words: biochar, microbial biomass carbon, soil respiration, metabolic quotient.

***Corresponding author:** Nasser Aliasgharzad, E-mail : n-aliasghar@tabrizu.ac.ir

Assessment of soil quality index for rice cultivated soils based on standard scoring functions and weight assignment approach

Orhan Dengiz *

Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

Rice is an important food crop across the world. However, rice ecosystems are currently faced with numerous issues, such as unsuitable soil and land conditions, water scarcity, biotic and environmental stresses, and inefficient agronomical practices, which result in low returns from rice production. In order to increase rice production by developing sustainable management practices, it is quite important to try understanding of soil quality for rice cultivation. The aim of this study was to determine soil quality by using Integrated Soil Quality Index (SQI_w) model based on standard scoring functions and weight assignment approach in agricultural lands used for rice cultivation in Çarşamba Deltaic Plain located on Black Sea Region of Turkey. A total of fourteen soil quality parameters based on the key predictor variables that determine rice yield mentioned in relevant literatures were included in SQI_w model by grouping in three classes which are; i-physical indicators (hydraulic conductivity, bulk density, available eater capacity and percentage of sand, silty and clay), ii-chemical indicators (soil reaction, electrical conductivity and lime content), iii- nutrient elements (nitrogen, phosphors, potassium, and zinc). Soil samples were collected from the study area divided into 300 × 300 m grid squares and a total of 159 grid points were obtained. According to obtained results, 36.1% of soils were classified as high quality level whereas, %23.2 of the total soils has low and very low soil quality property in terms of rice requirement soil quality in the study area. It was also not detected very high soil quality. In addition, it was determined that mostly low and very low quality soils were located on Typic Ustipsmment soils whereas, high quality soils were found on Typic Haplısert and Typic Calciustert.

Key words: Soil quality index, analytical hierarchy process, rice.

***Corresponding Author:** Orhan Dengiz, E-mail: odengiz@omu.edu.tr

Soil micronutrients, food systems and human health in Central Asia and South Caucasus

Pavel Krasilnikov[1,*], Anastasia Fabrichnova[1], Maria Konyushkova[1], Ivan Semenkov[2], Alexey Sorokin[1]

[1]Eurasian Center for Food Security, Lomonosov Moscow State University, Moscow, Russia
[2]Geographical Faculty, Lomonosov Moscow State University, Moscow, Russia

"Hidden hunger" is the deficit of micronutrient in human food. Since micronutrients mainly originate from soils, their supply in food systems strongly depends on their concentration and availability in soils. We revised the existing literature to reproduce the chain of 10 microelements (B, Co, Cr, Cu, Fe, I, Mo, Mn, Se and Zn) from parent rocks to soil, from soil to plants, from plants to animal meat, and finally from crops and meat to human body. We proposed an approach based on hypothetical concentration of microelements in food depending of dominant rocks and soils in particular areas, and tested it for two countries: Kyrgyzstan in Central Asia and Armenia in South Caucasus. The analysis was made basing on the existing data on the concentration of the elements under study in the most abundant rocks and soils in Kyrgyzstan and Armenia. The preliminary assessment of the doses of the microelements received with food (considering the typical diet in the countries under study) showed that all the elements except I should be sufficient for humans. However, geoavailability and bioavailability of the elements, which are not sufficiently studied until now, might strongly affect the results. Recalculation of the doses using the most pessimistic bioavailability model resulted in the possible deficit of all the elements in both countries. Additional experimental studies are needed to assess the real deficiency in microelements in Central Asia and South Caucasus.

Key words: food security, geoavailability, bioavailability, human health, hidden hunger.

***Corresponding author:** Pavel Krasilnikov, E-mail: krasilnikov@ecfs.msu.ru

Successive two years treated sewage sludge applications: Effect on corn and second crop wheat yield and some soil properties of sandy loam soil

Sezai Delibacak *, Ali Rıza Ongun

Ege University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Bornova, İzmir, Turkey

In this study, effect of successive two years treated sewage sludge (TSS) applications on corn and second crop wheat yield and some soil properties of sandy loam soil (Typic Xerofluvent) were investigated. The field study was conducted in 20 parcels in a randomized-block design with four repetitions and five different applications including control, mineral fertilizer, treated sewage sludge 12.5 $t.ha^{-1}$, 25.0 $t.ha^{-1}$, 37.5 $t.ha^{-1}$ as dry matter during 2011-2012 in Menemen-İzmir, Turkey. Corn (*Zea mays*) and wheat (*Triticum vulgare*) were sown as the first and second crop respectively. During the experiment, soil samples were taken five times in two years. Increasing TSS applications to this soil resulted in significantly increased total biomass and grain yield of corn. Also increasing TSS applications to this soil significantly increased grain yield of wheat. Increasing TSS aplications were significiantly increased total N, available P and K, total salt, cation exchange capacity (CEC) and organic matter (OM) content of sandy loam soil. However, pH values of soil did not change significantly when compared with the control. Due to TSS applications of second year again, all soil properties were affected positively in five different soil sampling periods in two years. Also TSS applications of second year to experimental soil again significantly increased total biomass and grain yield of corn according to control. It is recommended that 37.5 $t.ha^{-1}$ TSS as dry matter can be added to sandy loam soil in Mediterranean region every year for improving soil properties, plant nutrients and crop yields.

Key words: corn, sandy loam soil, sewage sludge, soil properties, wheat.

***Corresponding author:** Sezai Delibacak, E-mail : sezai.delibacak@ege.edu.tr

Soil quality from the point of view of nutrients transport

Stanislav Torma[1*], Štefan Koco[1,2], Jozef Vilček[1,2]

[1] National Agricultural and Food Centre, Soil Science and Conservation Research Institute, Slovak Republic
[2]Department of Geography and Regional Development, Faculty of Humanities and Natural Sciences, University of Prešov, Slovak Republic

The transport soil function plays a dominant role in terms of transport and accumulation of substances in a vertical and horizontal direction in the soil. The aim of this paper is to evaluate the soil transport function on the base of present knowledge of nutrients (nitrogen and phosphorus) transport in the soil. The evaluation of nutrient transport consists from the vertical transport in framework of the soil profile (especially the nitrates leaching) and horizontal transport caused by locality slope (water erosion). The amount of nitrified nitrogen in the soil is very important in this case. The soil transport functions were classified in five categories: (1) very weak, (2) weak, (3) moderate, (4) strong and (5) very strong. According to the soil transport function information, the areas of individual categories of soil transport function in agricultural soils in Slovakia were created. Very weak, weak and moderate transport of nitrogen was recorded in almost 90% of agricultural soils in Slovakia and in 73% of agricultural soils in case of phosphorus transport. To these categories belong the deep soils (more than 0.6 m depth) with low amounts of gravel located on plains. More than a quarter of the area belongs to the category with strong and very strong transport of phosphorus. Especially in these localities (hilly landscape with shallow soils and/or with high content of gravel) can come to increased content of phosphorus in the water bodies and thus also to a decrease in water quality.

Key words: soil transport function, nitrogen, phosphorus, water pollution.

***Corresponding author:** Stanislav Torma, E-mail: s.torma@vupop.sk

Heterogeneity of typical chernozem productivity in Ukraine

V.M. Starodubtsev*, R.M. Basarab, D.S. Komarchuk, I.S. Vlasenko

National University of Life and Environmental Sciences, Kiev, Ukraine

The article considers the spatial heterogeneity of the water regime and soil productivity of the flat areas of the Right-bank Forest-Steppe of Ukraine, where typical chernozems are widespread. The most important factor of this heterogeneity is the presence of micro- and mesodepressions of topography, in which spring meltwater is flooded with various depths and duration of flooding. . In the conditions of such a feature of the relief and the water regime of the territory, the formation of a complex soil cover with significant differences in soil properties was revealed, and especially with the manifestations of leaching and gleying of soils on the slopes and bottoms of depressions . The decrease in the yield of soils on the bottom and slopes of relief depressions and the total yield loss from the fields of about 22-23% have been experimentally revealed in the field experiment. The expediency and effectiveness of the use of UAVs (drones), the GPS receiver and space images Landsat-8 and Sentinel-2 for remote studies of the dynamics of the water regime of microdepressions and the state of vegetation was confirmed. It is recommended to use these tools and methods in compiling detailed soil maps of plains with microdepressions of the relief.

Key words: spatial heterogeneity, productivity, soil, water regime, microdepressions.

***Corresponding author:** Volodymyr Starodubtsev,
E-mail: vmstarodubtsev@ukr.net

Investigation of micromycete species distribution to assess the environmental risk of contaminated soils

Vera Terekhova[1,2], Elena Fedoseeva[3], Anna Ivanova[1], Petr Korolev[2], Tatiana Poputnikova[1], Maria Pukalchik[4]

[1]Moscow State University, Soil Science Faculty, Moscow, 119234, Russia
[2]Severtsov Institute of Ecology and Evolution RAS, Moscow 119071, Russia
[3]Pirogov Russian Medical University, Moscow, Russia
[4]Skolkovo Innovation Centre, Moscow, Russia

A methodology of substantiating the ecological risk of polluted soils has been described according to the results of bioindication using microfungal communities. Sustainable functioning of terrestrial ecosystems depends, to the greatest extent, on the balance of the organic matter biosynthesis and destruction on Earth. In terrestrial cenoses, fungi control a paramount natural phenomenon such as the environment-forming function *via* the transformation of the soil organic composition and changes in the structure, acidity and even temperature parameters of soils. Steadily enhancing industrial impact and diverse stress factors dramatically affect the structural and functional organization of fungal communities. Studying of the dynamics of adverse exposure-insensitive melanin-bearing fungi is viewed as an important pathway to a better understanding of regulatory mechanisms responsible for stable functioning and ecological quality of ecosystems. The involvement of structural and functional parameters of mycobiota as the most important destructors of organic matter is one of the urgent tasks for improving the system of assessing the ecological risk of soil contamination and rationing of impacts. Heavy metal contamination is a priority issue affecting millions of hectares of soil throughout the world and Russia. Experimental work devoted to the identification of regularities in the distribution of the occurrence of micromycete species in soils samples (from the European part of Russian Federation) contaminated with heavy metals (Zn, Pb, Cu), before and after remediation by modern agents – humic preparations and biochar. The peculiarity and novelty of the study is the experimental substantiation of the possibility of using mycological indices for the assessment of environmental risk in soils with different humus enrichment. We marked that the accumulation of melanized forms of fungi resistant to adverse effects in soils with humus up to 3.0% and above 8.0% supports the hypothesis of the contribution of melanin-containing fungi to the stability of different soils.

Key words: micromycetes, structure of communities, soils, heavy metals, remediation, humic substances, biochar, melanin, environmental risk assessment.

***Corresponding author:** Vera Terekhova, E-mail: vterekhova@gmail.com

Financial Support: by Russian Foundation of Basic Research, project № 18-04-01218-a

Structure of typical chernozem of different biosystems

Zemfira Tyugai*, Evgeny Milanovskiy, Galina Bykova

Lomosonov Moscow State University, Soil Science Faculty, Department of Soil Physics and Reclamation, Moscow, Russia

We have investigated the structure of the typical chernozem on the aggregate level of its organization. The differences in the aggregate composition and in the properties of the picked-out aggregates are closely connected with the content and transformation of the organic matter inside aggregates. The location of the chernozem under the forest has led to the accumulation of the organic carbon and, as the result, to the increasing of the content of agronomically valuable aggregates in the upper horizon from 74,5% to 95,6%. Profile under the forest in comparison with profile under the arable land is much more hydrophobic. The general trend of the metamorphism of the chernozem under the prolonged fallow is the reduction of the share of hydrophobic humic substances and the increasing of content of hydrophobic substances. The general trend of the metamorphism of the chernozem under the prolonged fallow is the reduction of the share of hydrophobic humic substances and the increasing of content of hydrophobic substances. The content of the organic carbon in the soil under the prolonged fallow for the last 60 years has decreased. It has reached the constant value (about 2,6%) in the last twenty years.

Key words: soil's structure, aggregate composition, soil organic matter, water stability, wettability.

***Corresponding author:** Zemfira Tyugai, E-mail: zemfira53@yandex.ru

Interpretation of soil urease activities along a topographic and textural gradient

Rıdvan Kızılkaya *, Coşkun Gülser, Orhan Dengiz

Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

The main objectives of this study were (i) to determine physico-chemical properties of six different soil profile (ii) to measure the range and degree of extracellular soil urease activities, (iii) to evaluate the influence of soil physico-chemical properties on soil urease activities in different slope gradient. Soil properties data of soils indicated significantly differences each other in terms of pedogenic processes which have been shaped by landscape position and parent material. According to soil taxonomy, 6 different soils were determined and classified as entisol, inceptisol and mollisol along transect. In addition, it was found that changes of landscape positions associated with erosion and organic matter content can alter the soil urease activity within the soil profile and along different slope.

Key words: Soil landscape, urease activity, soil genesis

***Corresponding author:** Rıdvan Kızılkaya, E-mail: ridvank@omu.edu.tr

Integrated nutrients management: symbiosis for sustainable soil resources and environment conservation

Dr. Amanullah*

The University of Agriculture, Peshawar, Pakistan

Soil resources and health is continuously declining due to removal of essential plant nutrients from the soils in the current changing climate scenario. Low and high water and temperature stresses results in the deficiencies of essential plant nutrients, organic soil carbon and beneficial soil microbes that had negative impact on soil health, crop productivity and grower's income globally. Integrated carbon and nutrients management increase soil fertility and health, increase crop productivity and grower's income. Integrated carbon and nutrients management refers to the maintenance of soil fertility and improvement in crop productivity with application of plant nutrients through combined application of organic carbons sources (animal manures and plant residues), chemical and bio-fertilizers. The 4‰-Initiative aims to improve the organic matter content and promote carbon sequestration in soils through the application of agricultural practices adapted to local situations both economically, environmentally and socially, such as agro-ecology, agroforestry, conservation agriculture and landscape management. Soil organic matter in soils plays a role in four important ecosystem services: resistance to soil erosion, soil water retention, soil fertility for plants and soil biodiversity. Stable and productive soils having sufficient amount of organic matter affect the resilience of farms to cope with the effects of climate change. Our long term field experiments on field crops e.g. cereals crops (rice, wheat & maize), oilseed crops (canola, sunflower & soybean) and grain legumes/pulses (chickpea, mungbean & mashbean) confirmed a significant increase in yield per unit area with integrated nutrients management under arid and semiarid climates. The combined application of plant nutrients especially major nutrients (nitrogen, phosphorus and potash) along with different organic carbon sources (farmyard manure; animal manures: poultry manure, cattle manure, sheep manure, goat manure etc.; plant residues: onion residues, garlic residues, wheat residues, rice residues, chickpea residues, fababean residues, canola residues etc.) into the soil had significantly improved crop growth and increased productivity and smallholder's income. Under arid and semiarid conditions, the application of beneficial microbes (Biofertilizers) was found beneficial in terms of higher nutrients use efficiencies, yield and profitability.

Key words: integrated nutrients management (INM), organic fertilizers, plant residues, animal manures, compost, biochar, chemical fertilizers, nitrogen, phosphorus, potassium, micro nutrients, biofertilizers, beneficial microbes, sustainable soil management, soil health, environment.

***Corresponding author:** Dr. Amanullah, E-mail: amanullah@aup.edu.pk

Kinetics and adsorption parameters related to ciprofloxacin adsorption on a volcanic ash derived soil: Effect of organic matter

Cristian Urdiales Flores[1,*], Mauricio Varas[1], Jonathan Suazo[2], Mónica Antilén[1], Carmen Pizarro[3], Mauricio Escudey[3]

[1]Pontificia Universidad Católica de Chile, Facultad de Química, Vicuña Mackenna 4860, Santiago, 7820436, Chile
[2]Universidad de la Frontera, UFRO, Centro de Interacción Suelo Planta y Biotecnología de Recursos Naturales, Temuco, 4780000, Chile
[3]Universidad de Santiago de Chile, Facultad de Química y Biología, Av. L.B. O'Higgins 3363, Santiago, 7254758, Chile

To fight diseases and improve animal growth, fluoroquinolones family antibiotics are prescribed for veterinary use and administered through the feed. Antibiotics are not fully metabolized in the gastrointestinal tract, being the soil one of their final destination through manure amendments. To establish the importance of (OM) the Ciprofloxacin (CIP) adsorption on Santa Barbara soil (SB, Andisol) with and without OM was studied. The OM was removed with hydrogen peroxide (30% v/v); the treatment efficiency was established by following the variation of the isoelectric point (IEP) of sample determined from electrophoretic mobility studies carried out in a Zeta Meter 4.0 equipment using 10-20 mg of sample suspended in 200 mL of 10-³M KNO□ solution. Adsorption kinetics study was performed by determining Ciprofloxacin concentration in KNO□ solutions, after suspending 500 mg of soil sample in 10 mL of a 5.0x10-¹ mmol L-¹ Ciprofloxacin solution, using batch assays, ranging from 5 to 120 min. The Ciprofloxacin equilibrium concentration (Ce) was determined by square wave voltammetry, through Potential (E) vs Current (I) measurements, using a Ce x Ip (current pick) calibration curve. Different kinetic models were applied to the experimental data, the pseudo-second-order model best fits the experimental results being the calculated Cm value close to that experimentally obtained.

Key words: ciprofloxacin, adsorption, isotherms.

***Corresponding author:** Cristian Urdiales Flores, E-mail: cgurdiales@uc.cl

Financial Support: Vicerrectoria de Investigación Pontificia Universidad Católica de Chile (VRI)

Utilization of biomass ash after combustion in an electric power plant: effect on soil and plant quality

Elmira Saljnikov[1], Branislav Repić[2], Nikola Koković[1], Dragan Čakmak [3], Aleksandar Saljnikov[4], Dragoljub Dakić [5],Veljko Perović[3]

[1]Soil Science Institute, Teodora Drajzera 7, Belgrade, Serbia
[2] Institute of Nuclear Sciences "Vinca", University of Belgrade, Belgrade, Serbia
[3]Institute for Biological Research Sinisa Stankovic," University of Belgrade, Belgrade, Serbia
[4]Faculty of Mechanical Engineering, University of Belgrade, Belgrade, Serbia
[5]Innovation center, Faculty of Mechanical Engineering, Belgrade, Serbia

The research studied possibilities of biomass ash utilization and its effect on soil and plant quality after combustion of soybean straw for energy purposes. Permanent collecting of crop residues from fields may deteriorate soil fertility. Considering the content of valuable nutrients, physical properties and alkaline nature of the ash obtained after combustion of most agricultural crops the ash utilization in agriculture may have a fertilizing effect thus contributing to the sustainable soil fertility management and at the same time solving the problem of ash deposits. A pot experiment was set up with low and high doses of ash alone and in combination with mineral fertilizer on growing barley in 2015. The ash, soil and plants samples were tested for: main soil agrochemical properties (N, C, S, $CaCO_3$, P_2O_5 and K_2O) and the content of potentially toxic and hazardous microelements (As, Cd, Co, Cr, Cu, Ni, Pb, Zn, Fe and Mn). Ash amendment significantly reduced soil acidity, increased content of available P for 83-91%, and K for 64 – 81%, increase yield of barley biomass for 46-54% compared to the control treatment. The higher dose of added ash (20 g/kg soil) didn't show better effects on soil and plant than the lower dose (10 g/kg soil). Content of potentially toxic microelements in soil and plant were below the maximum allowed concentrations. Application of biomass ash was effective in terms of soil nutritional and physical properties resulting in yield increase, suggesting that the analyzed ash can be used as a fertilizer on acid soils with low nutrients content.

Key words: biomass ash, soil, plant, nutrient, trace elements.

***Corresponding author:** Saljnikov Elmira, Email: soils.saljnikov@gmail.com

The effects of different growing media on the development of the (*Stevia Rebaudiana*) plant and its nutrient content

Ihsan Arslan, Füsun Gülser*

Van Yüzüncü Yıl University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Van, Turkey

In this study, it was aimed that effects of different growing media on plant growth criteria and nutrient content of the Stevia Rebaudiana.The experiment was conducted out in six different growing media as Soil, Peat, Soil: Peat: Manure, Soil: Sand: Manure in ratio of 1: 1: 1 and 2: 1: 1 for each combined growing media with and without basic fertilization according to randomized experimental design with three replication. As a basic fertilizer 100 mg kg^{-1} P_2O_5, 150 mg kg^{-1} K_2O and 250 mg kg^{-1} N were applied as triple super phosphate K_2SO_4 and $(NH_4)_2SO_4$, respectively. At the end of the experiment the highest means of plant growth criteria in the harvested plants were obtained in the peat growing media both in the basic fertilized and in the non basic fertilized applications. The highest means of macro and micro nutrient content of *Stevia Rebaudiana* were found in basic fertilizer applications. The highest phosphorus (0.71%), potassium (5.04%), magnesium (1.16%) and calcium (2.11%) contents were obtained in Peat, Soil: Peat: Manure (1: 1: 1), Soil: Sand: Manure (2:1:1) growing media, respectively. Similarly, the highest micronutrient contents were obtained in basic fertilized growing media expect zinc. The highest iron (1399 mg kg^{-1}), copper (15.60 mg kg^{-1}), manganese (350.92 mg kg^{-1}) were found in Soil and Soil: Sand: Manure (2: 1: 1) growing media, respectively.

Key words: *Stevia Rebaudiana*, soil, growing media, plant growth, nutrient.

***Corresponding author:** Füsun Gülser, E-mail: gulserf@yahoo.com

Acknowledgements: This study was financially supported by Van YYU Scientific Research Project Coordination Unit (Project no: FYL-2017-6291).

Testing the effectiveness of biologics - Ameliorants developed in Uzbekistan on saline soils in the middle reaches of the Syrdarya river

I. Khudoinazarov[1], Yu. Shirokova[2,*], Sadiev F.[2], G.K. Paluashova[2], N.Sh. Sharafutdinova[2]

[1]A.S.Sadykov Institute of Bioorganic Chemistry of the Academy of Sciences of Republic Uzbekistan
[2]Research Institute of Irrigation and Water Problems, (NIIIWP, former SANIIRI) Tashkent, Uzbekistan

Salinization of soils is widespread in the plains of the Republic of Uzbekistan. This is a serious obstacle to ensuring high productivity of irrigated lands. Frequently repeated water scarcity aggravates this problem. As a rule, in order to obtain the shoots of summer crops, such as cotton, leaching of land is carried out in early spring. However, the salinization of the soil is relatively quickly restored, since in the irrigated zone the ground waters close to the surface predominate, which evaporate intensely under arid conditions. Since leaching the soil is a time-consuming and costly exercise requiring large amounts of water, the search for measures to combat salinization of the soil, alternative for leaching, is very important. Biological preparations-ameliorants for saline soils have been developed in two institutes of the Academy of Sciences of Uzbekistan. These are biologics "RIZOKOM 1" and desolenizer "BIOSOLVENT". The testing of these preparations in laboratory and field conditions was carried out on medium and heavily saline soils of the Middle Syrdarya River. The application of the biological preparation "RIZOKOM 1" in saline soil, by the method of cotton seed stamping, promotes the development of microbiological processes in the root zone, improving soil properties. In relation to the control in the experiments it was noted:- better soil moisture retention - decrease in pH of saline soil - decrease in seasonal accumulation of salts in the root layer - Increase cotton yield by 30%. For the preparation-desolenizer "BIOSOLVENT" (the analogue of the Swiss "Spersal"), the best technology of application was found: treatment of the soil surface by spraying with 10% solution of the preparation. Spraying saline soil in field trials showed that the preparation "BIOSOLVENT": 1. In the winter-spring leaching of the soil from salts, it causes an increase in the leaching of harmful ions in comparison with the control: chlorine by 35 ... 42 %; sulfates by 13 ... 16 %, sodium by 21 ... 23 %. 2. In the treatment of furrows in front of the cotton irrigation, the decrease in soil salinity in the root zone is 25 % greater than without treatment, which allows obtaining an increase in yield up to 30 %. Both preparations are approved as effective for increasing the productivity of saline irrigated lands and recommended to farmers for use.

Key words: salinization of soils, biological preparations-ameliorants, cotton irrigation.

***Corresponding author:** Yuliya Shirokova, E-mail : yulia.i.shirokova@gmail.com

Agrochemical efficiency of the multifunctional fertilizers produced from Kara-Kalpak's Glauconites

L.E. Mamasalieva*, R.N. Kim, O.V. Myachina, A.T. Aliev, O.I. Popova, A.H. Rahmonov, O.S. Narzullaev

Institute of General and Inorganic Chemistry, Tashkent, Uzbekistan

At present modern agriculture, one of the way to produce highly effective and economically profitable mineral fertilizers is involved local agro-minerals. For our region, it can be such natural friable mineral-ionites as quartz-glauconite sands (Kara-Kalpak's glauconites) of Khodjakul deposit. Producing of multifunctional fertilizers from Kara-Kalpak's glauconites and assessment of their influence on the growth and development of agricultural crops is an actual and promising direction for modern efficient, environmentally friendly and resource-saving agriculture. The process flowsheet obtaining of mineral fertilizers based on nitrogen-containing salts and glauconites has developed. On the laboratory installation by the powdering and mixing (introduction to fusion) methods of ammonium nitrate and carbamide with glauconites had obtained new multifunctional fertilizers. The studies of physical and chemical properties of granules new glauconite-containing nitrogen fertilizers had made the possibility to select the optimal ratios. Thus were selected two optimal rations 100:20 – ammonium nitrate to glauconite, and 100:25 – carbamide to glauconite. To establish the agrochemical efficiency of these new glauconite-containing nitrate fertilizers were conducted vegetative experiments. Agrochemical researches of mineral fertilizers had shown that the most effective variant with applied of fertilizers in the ratio of 100:20. Availability nutrients and physical-chemical properties of mineral fertilizers pellets had increased the harvest of cotton plants compared to the control variant.

Key words: Glauconites, ammonium nitrate, mineral fertilizers, cotton plant, agrochemical properties, phenology indicators, harvest.

***Corresponding author:** L.E. Mamasalieva, E-mail: lazizochka@mail.ru

Climate smart agriculture: residual effects of biochar and summer legumes on succeeding maize crop with varying levels of nitrogen

Muhammad Arif [1*], Ishaq A. Mian[1], Fahd Rasul[1], Ikramullah[1], Amanullah[1], Zahir Shah[1], Shah Fahad[2]

[1] University of Agriculture, Peshawar, Pakistan
[2] Swabi University, Swabi, Pakistan

Soil carbon sequestration and fertility is one of the major agricultural strategies to mitigate greenhouse gas emissions, enhance food security, and improve agricultural sustainability. This experiment was conducted at the Agronomy Research of the University of Agriculture Peshawar during summer 2016. Wheat-maize-wheat cropping pattern was followed for the experiments. The summer legumes were adjusted in the summer gap (the period after wheat harvesting up to sowing of maize) for grain, fodder and green manure purposes. Mungbean, cowpea and sesbania were used for grain, fodder and green manure purposes, respectively. A fallow was included in the experiment as control. Biochar was also applied to legumes at the rate of 0, 5 and 10 t ha^{-1}. Each plot of the previous legumes' experiment was split into four sub plots to accommodate four levels of N to maize crop. Maize was sown with four levels of N fertilizer (0, 60, 120 and 180 kg ha^{-1}) in mid July. The results indicated that previously grown legumes significantly increased plant height, grains ear^{-1}, thousand grains weight, grain and biological yield of maize crop. Previously grown sesbania crop proved superior as compared to other legumes and fallow plots. Similarly, application of biochar at the rate of 10 tons ha^{-1} increased plant height, grains ear^{-1}, thousand grains weight, biological and grain yield of maize. Application of nitrogen significantly increased plant height, grains ear^{-1}, thousand grains weight, grain and biological yield. Application of 180 kg N ha^{-1} produced taller plants, more grains ear^{-1}, heavier grains, more biological and grain yield in maize as compared to other levels of N and control. Among different preceding crops, sesbania increased soil N, stover N and grain N content of maize. The effect of previously grown legumes was not significant on soil pH, soil EC, bulk density, and soil Ca, Mg, Na and soil C content. Similarly, application of 10 tons biochar ha^{-1} significantly increased stover N, grain N, soil C and soil N. Bulk density of the soil decreased with increasing biochar application. The soil pH, EC, soil Ca, Mg and Na content were not significantly affected by biochar application. Among different nitrogen levels nitrogen application at the rate of 180 kg ha^{-1} significantly increased stover N and soil N. Grain N content were higher with all N application as compared to no N application. Soil pH, EC, bulk density, soil carbon, soil Ca, Mg and Na were not significantly affected by nitrogen application.

Key words: biochar, legumes, nitrogen, maize, yield and soil fertility.

***Corresponding author:** Muhammad Arif, E-mail: marifkhan75@aup.edu.pk

Integration biochar with mineral fertilizer enhanced raddish (*Raphanus raphanistrum*) growth, biomass production and improved soil biochemical properties in nutrient poor alkaline soil

Muhammad Riaz[1,*], Muhammad Adnan[1], Muhammad Saleem Arif[1], Tahira Yasmeen[1], Sher Muhammad Shahzad[2], Qaiser Hussain[3], Muhammad Arif[4]

[1] Government College University Faisalabad, Pakistan
[2] University College of Agriculture, University of Sargodha, Pakistan
[3] PMAS-Arid Agricultural University Rawalpindi, Pakistan
[4] The University of Agriculture Peshawar, Pakistan

Biochar is carbon (C) material developed from pyrolysing the biomass waste under no or limited supply of oxygen. Biochar is recalcitrant to decomposition, generally has high surface area and porous structure, and these properties impart multiple benefits to soil-plant systems including increasing water holding capacity, cation exchange capacity, nutrient retention and reducing nutrient losses to environment. However, these benefits vary across soils and climatic conditions, and also depends on feedstock type and pyrolysis conditions. In addition to multifaced benefits of biochar, there is growing body of knowledge demonstrating enhanced nutrient use efficiencies after biochar incorporation. In the light of this discussion, a pot experiment was used to investigate the effects of corncob-derived biochar on raddish (*Raphanus raphanistrum*) biomass production and soil biochemical properties in the presence of chemical fertilizer in nutrient poor alkaline aridisol. Biochar was applied at 0, 1.5 and 3% w/w basis whereas recommended chemical fertilizer (RCF) was applied at 0, 50 and 100% RCF rates following completely randomized design (CRD) using three replicates per treatment. Experiment was conducted for 12 weeks and changes in plant parameters and soil biochemical properties were recorded. Biochar and mineral fertilizer enhanced raddish biomass and significantly improved soil biochemical and nutrient properties. Soil mineral N, phosphorus and potassium contents increased with increasing rate of biochar whereas mineralizable C was the lowest at higher biochar application rates. The results of the study suggested that biochar enhanced biomass production and exerted positive effects on soil quality attributes. The results also demonstrated that biochar increased nutrient use efficiency of chemical fertilizer. We concluded that biochar has the potential of increasing soil fertility, organic C contents and plant biomass in organic matter deficient alkaline soils of arid and semi-arid regions. These findings, however, needs to be reassessed under field conditions before large-scale adaptations of using biochar in the field.

Key words: biochar, raddish, mineral fertilizer, soil organic matter, arid agriculture.

***Corresponding author:** Muhammad Riaz, E-mail: mr548@ymail.com

Acknowledgements: The authors are thankful to the Higher Education Commission of Pakistan for financial support to conduct the research via grant no. 20-3485/NRPU/R&D/HEC/14/849.

Gasification of solid wastes originating from the broiler production and determination of the potential of the resulting biochar for agricultural use

Muhittin Onur Akca, Ayten Namli*

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

The aim of this study is to reveal the effects of the biochar obtained after the gasification of the broiler litter on the yield parameters tomato, pepper and lettuce and on some chemical and biochemical characteristics of the soil. For this purpose, tomato, lettuce and pepper were grown for a period of 9 weeks in a greenhouse by way of application of 8 different treatment items. 15.15.15 fertilizer was applied as the chemical fertilizer in a quantity that would be required by the pepper, tomato and lettuce plants. For the applications that involved the 15.15.15 in addition to the biochar, the chemical fertilizer was applied in reduced quantities depending on N, P and K contents of the biochar. According to the results; the alkaline phosphatase enzyme activities of the soils exhibited a significant increase at $P<0.05$ depending on application of biochar. The aryl sulfatase enzyme activities of the soils showed a statistically significant increase in cases of application of biochar. K, P and Mg contents of the soils were increased significantly at $P<0.05$ depending on the application of the increased dose of biochar and no difference was determined among the applications in terms of the lime, Ca and Na contents. In general, in case the quantity of chemical fertilizer was decreased and the quantity of biochar was increased, the growth for all the 3 plants was affected by the same extent as compared to the case of application of a high dose of chemical fertilizer.

Key words: gasification, biochar, soil, enzyme activity, organic fertilizer.

***Corresponding author:** Ayten Namli, E-mail: aytenkrc@gmail.com

Effect of N fertilization on changes of nutrient concentrations in soils

G. Mühlbachová*, P. Čermák, M. Káš, M. Marková, R. Vavera, M. Pechová

Crop Research Institute, Drnovská 507/73, CZ 161 06 Prague 6, Czech Republic

Nitrogen, phosphorus and potassium fertilization is decisive for correct plant nutrition and adequate crop yields. This research was aimed at evaluating the effect of different levels of nitrogen fertilization on the availability of nutrients in soils from a long-term field experiment established in 1984 at two experimental sites with different pedo-climatic conditions in the Czech Republic. The field experiment consists of mineral, farmyard manure (FYM) or straw, and four different applied doses of mineral nitrogen given to each of the basic fertilization systems (0 - 40 - 80 -120 -160 kg N ha^{-1}). Phosphorus and potassium is given to each treatment (with the exception of the unfertilized control) in annual doses of 35 kg P ha^{-1} and 83 kg K ha^{-1}. As might be expected, the level of nitrogen fertilization increased the average yields during the experiment; however, the mineralization processes induced by the nitrogen supply also led to a decrease of soil pH of about 0.3-0.45. Both factors affected the nutrient availability in the soils. Generally, the nutrient contents (mainly P, K, B) decreased with increasing N dose, however differences depending on the soil type at each experimental site were noted. The content of S increased proportionally with N dosage at both experimental sites. Considering all obtained results, the nitrogen showed to be the important factor affecting the nutrient contents in agricultural soils. Optimized soil fertilization should lead to the harmonised plant nutrition which is important and necessary for adequate crop yields and plant health.

Key words: long-term experiments, soil, nitrogen, nutrients, microelements.

***Corresponding author:** Gabriela Mühlbachová, E-mail: muhlbachova@vurv.cz

Effect of zinc application methods on yield and yield components of maize

Niamat Ullah, Muhammad Arif*, Tahseen Zeb

Department of Agronomy, KPK Agricultural University Peshawar, Pakistan

There are three main methods of adding micronutrients to crops: soil fertilization, foliar sprays and seed treatment. Each method has the potential to affect plant micronutrients nutrition. The objective of this research was to evaluate the effect of different Zinc (Zn) application methods for yield and yield components of maize. A field experiment was conducted at Agricultural Research Farm of Khyber Pukhtoonkhwa Agricultural University Peshawar during summer 2006. The experiment was laid out in Randomized Complete Block design with three replications. Seed of maize variety 'Azam' was sown with the help of a hand hoe on June 20, 2006 in a plot size of 5m length and 3m width at the rate of 40 kg ha^{-1}. Three methods of Zinc sulphate application (soil application, foliar spray and seed priming) were included in the experiment. Three levels of Zinc sulphate (5, 10 and 15 kg ha^{-1}) were supplied to the maize crop as soil application before sowing. Solutions of 0% (water), 1%, 2% and 3% Zinc sulphate were sprayed on the crop at mid-whorl stage. For seed priming, the maize seed was soaked in water, 0.1%, 0.5% and 1% Zinc sulphate solutions for 12 hours. The control treatment was dry seeds of maize. Zn application methods significantly affected grains ear^{-1}, thousand grain weight, biological yield and grain yield. Soil application of Zn at the rate of 15 kg ha^{-1} resulted in greater number of grains ear^{-1} (399), thousand grain weight (196 g), biological yield (12286 kg ha^{-1}) and grain yield (4095 kg ha^{-1}). It is concluded that soil application of Zn at the rate of 15 kg ha^{-1} resulted in greater yield and yield components of maize. Likewise, seed priming in 1% Zn solution also improved yield and yield components of maize.

Key words: zinc, application methods of zinc, zinc applications methods and yield, maize.

***Corresponding author:** Niamat Ullah, E-mail: marifkhan75@yahoo.com

Effect of water-saving irrigation on rice growth and micronutrients concentrations under different levels of organic and chemical fertilizers

Nosratollah Najafi*, Masumeh Abbasi, Shahin Oustan, Nasser Aliasgharzad

Faculty of Agriculture, University of Tabriz, Tabriz, Iran

In a greenhouse research, the integrated effects of poultry manure, sewage sludge and chemical fertilizers (CF) on rice plant (cv. Ali Kazemi) growth and concentrations of copper (Cu), iron (Fe), manganese (Mn), zinc (Zn), cadmium (Cd), and lead (Pb) in rice shoot and root were studied in a loamy sand soil under different irrigation regimes. The study was performed as a factorial experiment with three replications in a randomized complete blocks design including irrigation regime at three levels (continuous waterlogging, alternate waterlogging and alternate saturation) and source and amount of fertilizers at 10 levels of control, 100% CF, sewage sludge (20 g/kg), sewage sludge (20 g/kg) + 50% CF, sewage sludge (40 g/kg), sewage sludge (40 g/kg) + 50% CF, poultry manure (20 g/kg), poultry manure (20 g/kg) + 50% CF, poultry manure (40 g/kg), poultry manure (40 g/kg) + 50% CF. The results showed that the continuous waterlogging increased the rice shoot concentrations of Fe and Mn compared to alternate waterlogging and alternate saturation. The rice shoot and root dry matters in the continuous waterlogging and alternate waterlogging were greater than the alternate saturation. The rice shoot concentrations of Cu and Zn in the alternate saturation were significantly greater than the continuous waterlogging. Application of sewage sludge with and without CF increased concentrations of Cu, Fe, Mn and Zn and dry matter of rice shoot and root. In all treatments, Cd and Pb concentrations in rice shoot were not measurable by atomic absorption spectrophotometry. The Mn concentration in rice shoot was greater than that of root while the Cu, Fe, and Zn concentrations in rice shoot were less than those of root. The highest rice growth and concentrations of Cu, Fe, Mn and Zn were observed in treatments of sewage sludge (40 g/kg) + 50% CF under continuous waterlogging and alternate waterlogging conditions.

Key words: copper, heavy metals, iron, manganese, poultry manure, sewage sludge, zinc.

***Corresponding author:** Nosratollah Najafi, E-mail: n-najafi@tabrizu.ac.ir

Use an organic biostimulant (Vermicompost tea) for enhancement *in vitro* callus growth in sainfoin (*Onobrychis viciifolia* Scop.)

Ramazan Beyaz, Fevziye Şüheyda Hepşen Türkay*

Ahi Evran University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Kırşehir, Turkey

The health and vitality of callus growth is one of the prerequisites for the success of further *in vitro* studies. Vermicompost produced by the activity of earthworms is rich in macro and micronutrients, vitamins and growth hormones. This study investigated the efficiency of different percentage (0 %, 10 %, 20 %, 30 % and 40 %) of vermicompost tea as an organic substance on *in vitro* callus growth in sainfoin. Morpho-physiological responses (callus percentage, fresh and dry weight, relative water content, texture of callus, chlorophyll contents, maximum length and width, area, red, green and blue color channels (RGB)) of calli to vermicompost tea under *in vitro* conditions. As a result of this investigation, a combination of plant growth regulators (4 mg/l BAP and 0.5 mg/l NAA) with 20 % of vermicompost tea causing significant ($p<0.01$) callus initation and growth in sainfoin stem explants. Under the light of these scientific findings, vermicompost tea might be used as an organic biostimulant for efficient callus growth and complementary to commercial chemical hormones in sainfoin. This research is important due to it can contribute positively to the plant species that are difficult in terms of callus growth, development and plant regeneration in tissue culture.

Key words: sainfoin, vermicompost tea, callus growth, *image analysis,* NI vision asistant module.

***Corresponding author:** F. Şüheyda Hepşen Türkay,
E-mail: suheda.turkay@ahievran.edu.tr

Vermiremoval of zinc in various composition of feed mixtures by utilising *Eisenia foetida*

Rıdvan Kızılkaya *

Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey

Earthworms are a key indicator of ecosystem health and many studies have been performed on the response of earthworms to metals. Vermiremoval is an enhancement of the natural process that integrates earthworms' and microbes' role as an efficient tool in accumulating heavy metal in the earthworms' tissues. This study on the duration of zinc removal from the various composition of feed mixtures also investigates the change of zinc content in vermicompost after its removal period. Therefore, this work aimed to study the removal of zinc in anaerobically digested sewage sludge (SS) amended with hazelnut husk (HH) and cow manure (CM) in different proportions under laboratory condition (in darkness at 25°C ± 0,5 ^{0}C) for *Eisenia foetida* via vermicomposting and to investigate the effect of zinc content until 90 days of the vermicomposting process. Three approaches investigated in the study were: (i) to find the best medium for growth and reproduction of *E. foetida* in different feed mixtures, (ii) to analyze the zinc concentrations in different feed mixtures of SS-HH-CM before and after vermicomposting, and (iii) to explore Zn accumulation of earthworms in sewage sludge with different feed mixtures. Number and biomass of earthworms and Zn contents in feed mixtures and earthworms were periodically monitored. The results indicated that maximum earthworm biomass was attained in feed mixture of 20% SS + 40% CM + 40% HH while the earthworm number was highest in feed mixture of 30% SS + 35% CM + 35% HH during the vermicomposting period. Zinc concentration in all feed mixtures decreased associated with the increasing vermicomposting time. Zn content in the feed mixtures was lower than that of initial mixtures. Zn analysis of earthworms revealed considerable bioaccumulation of Zn in their bodies' tissue. Zinc analysis of earthworm body showed that increasing proportion of SS in the feed mixtures promoted the Zn content of earthworm body.

Key words: bioaccumulation, enrichment factor, zinc, sewage sludge, vermicompost *Eisenia foetida.*

***Corresponding author:** Rıdvan Kızılkaya, E-mail : ridvank@omu.edu.tr

Direct and residual effects of boron and zinc on growth and nutrient status of rice and wheat crop

Saleem M.*, Gandahi A.W., Bhatti S.M.

Department of Soil Science, Faculty of Crop Production, Sindh Agriculture University Tandojam, Pakistan

The micronutrients deficiencies are widespread in the areas of rice wheat cropping system. Since rice and wheat are major staple food of worlds' populace, the higher yields and nutrition status of these crops has direct effect on the health of human being. A field study was conducted to observe the direct and residual effect of two selected micronutrients (boron (B) and zinc (Zn)) on rice and wheat crop growth and its grain nutrient status. Each plot received either B or Zn at the rates of 0, 1, 2, 3 and 4 kg B ha^{-1}, and 5, 10, 15 and 20 kg Zn ha^{-1}, combined B and Zn application at 1 kg B and 5 kg Zn ha^{-1}, 2 kg B and 10 kg Zn ha^{-1}. Colemanite ore were used as source of B and zinc sulfate for Zn. Boron and Zn application significantly enhanced the growth and yield of rice crop at all defined levels as compared to control. The highest yield (10.00 tons/ha) was recorded at 2 Kg B, 10 Kg Zn ha^{-1} rates. Boron also improved the nutrition status of rice as B, protein and total carbohydrates content of grain augmented. The B and Zn content in post-harvest soil samples was high in colemanite and zinc sulfate applied plots. The residual B and Zn were also effectual for the second season wheat crop, as the yield components of the crop significantly improved. The highest wheat grain yield (4.23 tons/ha) was recorded at the residual rates of 2 kg B and 10 kg Zn ha^{-1} than the other treatments. This study showed that one application of B and Zn can increase crop yields for at least two consecutive seasons and the mineral colemanite can confidently be used as source of B for rice crop.

Key words: residual boron, zinc, rice, wheat.

***Corresponding author:** Muhammad Saleem, E-mail: sarkisaleem@yahoo.com

Effect of soil amended humic acid and phosphorus levels on wheat yield under irrigated calcareous soil of Peshawar Valley

Sulaiman Khan, Asim Muhammad*

Department of Agronomy, Faculty of Crop Production Sciences,
The University of Agriculture, Peshawar

To study the "effect of soil amended humic acid and phosphorus levels on wheat yield under irrigated calcareous soil of Peshawar Valley" was carried out at Agronomy Research Farm, The University of Agriculture Peshawar during 2015-16. The design of the experiment was randomized complete block design with three replications. Humic acid (HA) (4, 8 and 12 kg ha^{-1}), phosphorus (60, 90 and 120 kg ha^{-1}) and two wheat varieties (Pakhtunkhwa-2015 and Pirsabak-2013) were used for experimental units. The seed rate for varieties was 120 kg ha^{-1} and sown in six rows with 30cm row to row apart in each plots. The plot size was 1.8 m x 4 m. Results of the study revealed that 12 kg ha^{-1} HA enhance leaf area tiller (122 cm^2), leaf area index (3.6), grains $spike^{-1}$ (56.9), biological yield (9899.4 kg ha^{-1}), grain yield (3933 kg ha^{-1}) and harvest index (39.8 %) as compared with other levels of HA. Phosphorus at a rate of 120 kg ha^{-1} produce higher leaf area $tiller^{-1}$ (122 cm^2), leaf area index (3.6), grains $spike^{-1}$ (56), biological yield (9901.6 kg ha^{-1}), grain yield (3819.7 kg ha^{-1}), while harvest index (39 %) was maximum in 90 kg ha^{-1} P applied plots. Wheat variety Pakhtunkhwa-2015 performed better in leaf area tiller (126.2 cm^2), leaf area index (3.6), grains $spike^{-1}$ (56.1), biological yield (9938.1 kg ha^{-1}), grain yield (3766.4 kg ha^{-1}) as compared with Pirsabak-2013. Where maximum harvest index (39 %) was recorded in Pirsabak-2013. It is concluded that variety Pakhtunkhwa-2015 with HA and P at rate of 12 and 90 kg ha^{-1} best for yield and yield components of wheat.

Key words: humic acid, phosphorus, wheat, yield.

***Corresponding author:** Asim Muhammad, e-mail: asimmuh@aup.edu.pk

The influence of organic fertilizers on the properties of sward-podzolic soil

Tamara Persikova*, Mariia Tsareva

Eductation Establishment "Belarusian State Agricultural Academy"
Mogilev region, Gorki 213487, Belarus

The purpose of research is to study the influence of chicken manure and cattle manure on the physical, physical-chemical and microbiological properties of sward-podzolic soil, depending on its granulometric composition and biological characteristics of crops. The results of research: on sward-podzolic fixed-sandy loamy soil, with application of cattle manure for winter wheat, hydrolytic acidity increased by 0.08 in comparison with chicken manure per 0.12 meq / 100 g of soil, the degree of saturation with bases decreased by 5%, soil density decreased by 0.20, the density of solid phase decreased by 0.15 g / cm^3, porosity and the porosity of soil aeration was 31 and 33%. On fixed-sandy loamy soil, with application of cattle manure for corn, hydrolytic acidity decreased by 0.02 and increased with application of chicken manure by 0.03 meq / 100 g of soil. On average loamy soil it increased by 0.04 and 0.14 meq / 100 g respectively. On fixed-sandy loamy soil, with application of cattle manure, the degree of saturation with bases increased by 3%, with application of chicken litter – by 9%. The density of solid phase increased by 0.15 g / cm^3 and 0.17 g / cm^3; on average loamy soil – by 0.10 and 0.17 g / cm^3, respectively, the total porosity decreased from 51 to 32 (cattle manure) and 35% (chicken litter) on fixed-sandy loamy soils and from 46 to 30 and 31%, respectively, on medium loamy soil. The microbiological activity of the soil during the cultivation of winter wheat was medium on fixed-sandy loamy soil with application of chicken litter and cattle manure – 45 and 42%, and amounted to 38 and 34%, respectively, on medium loamy soil; it was strong in corn with application of chicken litter and cattle manure cattle on fixed-sandy loamy soil – 51 and 54%, and amounted to 42 and 50%, respectively, on medium loamy soil. Conclusion: the type of organic fertilizer, biological characteristics of the crop, and granulometric composition of sward-podzolic soil affect its physical, physical-chemical and microbiological properties.

Key words: soil, properties, organic fertilizers, winter wheat, corn

***Corresponding author:** Tamara Persikova, E-mail: persikova52@rambler.ru

Impact of organic amendments on the reduction of cadmium phytoavailability to wheat

Tauqeer Ahmad Yasir[1,*], Sobia Aslam[1], Allah Wasaya[1], Muhammad Shahid Rizwan[2], Sami-ul-Allah[1], Muhammad Ijaz[1], Muhammad Sarfraz[1]

[1]College of Agriculture, Bahauddin Zakariya University, Bahadur Sub-Campus Layyah, Pakistan

[2]Cholistan Institute of Desert Studies, The Islamia University Bahawalpur, Pakistan

Cadmium (Cd) is a well-known and widespread toxic heavy metal. The effects of organic amendments on Cd phytoavailability and toxicity in wheat, especially in alkaline sandy contaminated soils are largely unknown. A pot experiment was conducted in the green house of College of Agriculture BZU, Bahadur Campus Layyah, Pakistan to investigate the impact of organic amendments on the phytoavailability of Cd to wheat in contaminated soil. The soil was collected from cultivated areas and artificially contaminated with $CdNO_3.4H_2O$ salt (5 mg kg^{-1}). The Cd polluted soil was amended with different levels of organic additives such as poultry manure (PM), Farm yard manure (FYM) and sugar cane press mud (PS) were incorporated and incubated for three months at room temperature with 60% moisture level. The experiment was laid out in Completely Randomized Design with three replications. The treatments included, T1: Control, T2: PM 5 t ha^{-1}, T3: PM 10 t ha^{-1}, T4: FYM 5 t ha^{-1}, T5: FYM 10 t ha^{-1}, T6: PS 5 t ha^{-1} and T7: PS 10 t ha^{-1}. Afterward, wheat plants were grown in the amended soil until maturity. The results showed that the organic amendments with FYM, poultry manure and press mud at the rate of 10 t ha^{-1} increased the germination, number of tillers, chlorophyll content, plant height, spike length, biological and economic yield and reduced the Cd concentration when compared with control treatment. Overall, it is concluded that the application of FYM at the rate of 10 t ha^{-1} was more effective in immobilization of Cd metal in the soil and reducing its uptake and translocation from roots to shoots and then grains.

Key words: cadmium, organic amendments, chlorophyll content, growth, wheat.

***Corresponding author:** Tauqeer Ahmad Yasir, E-mail: tayasir@yahoo.com

Investments of the MERS micro-fertilizer in crop farming of the republics of Kazakhstan and Uzbekistan, and the state of Turkmenistan

S. Usmanov*, R.U. Makhmudov, K.U. Makhmudov, G.K. Zulpanova, Kh.S. Usmanov, A.S. Usmanov, A.K. Tashkeneva

"Ana Zher" Research and Production Association LLP, Almaty city, Kazakhstan

Aim of the project: The staged investment of the MERS innovative microbiological fertilizer to the crop farming of the Republic of Kazakhstan and Uzbekistan and the State of Turkmenistan, in order to participate in implementation of the roadmap priority areas within the "Action strategy for 2019-2023". Results. Based on performed complex of agrochemical and economic studies on crops of the Republic of Kazakhstan and Uzbekistan and the State of Turkmenistan, as well as taking into account the results of application of the MERS micro-fertilizer in the Republic of Kazakhstan in the area of over 3 million hectares (2003-2017), the State of Turkmenistan - 90 thousand hectares (2015-2017), the Republic of Uzbekistan in 9 oblasts (2013, 2014, 2017, 2018), in 4 regions of the Russian Federation (2013-2014), the main framework and source of financing have been identified for implementation of the "Action strategy for 2019-2023" by priority areas of development and liberalization of the economy and social sector improvement. The staged investment of the MERS fertilizer in the crop farming in 2019-2023, within the full-scale introduction of the development product, out of implementation of additional yields, will ensure the following domestic market income (USD million): -in the Republic of Kazakhstan - under irrigation conditions of 1.3 million hectares and dryland of 12 million hectares - 3,278.5; - in the Republic of Uzbekistan - under irrigation conditions of the area of 3,000 thousand hectares - 2,735.04; - in the State of Turkmenistan - under irrigation conditions of the area of 1,531 thousand hectares - 524,504. In case the sale of products on a domestic market would provide the income of 15-40 USD per 1 USD expenses, then in a foreign market the value-added additional harvest processing would provide the income raise up to 100-1,000 USD per 1 USD expenses. Conclusion. The MERS microfertilizer at the background of mineral nutrition by increasing the yield of agricultural crops on dryland soil by 20-40% and under irrigation conditions up to 40-100% ensures the income of 15-40 USD per 1 USD expenses. Moreover, an advanced processing of additional crops contributes to receipt of the profit of 100-1000 USD. Hence, it is the basis for rapid development of the economic power of the Republics of Kazakhstan and Uzbekistan, and the State of Turkmenistan. The economic analysis results serve as the basis for rapid development of the economic power of the Republics of Kazakhstan and Uzbekistan, and the State of Turkmenistan.

Key words: MERS micro-fertilizer, yield gain, investment, action strategy.

***Corresponding author:** S. Usmanov, E-mail: anazher@yandex.kz

Synthesis, physicochemical and toxicological characteristics, agrochemical and economic efficiency of new complex active substances for cotton seeds dressing on the methylol urea and zinc phyto-compound basis

S.Usmanov[1*], G.T.Omarova[2], R.U.Makhmudov[1], Kh.S.Usmanov[1], A.S.Usmanov[1] , A.K. Tashkeneva[1]

[1] "Ana Zher" Research and Production Association LLP, Almaty, Kazakhstan
[2] "Institute of Chemical Sciences named after A.B.Bekturov» JSC, Almaty, Kazakhstan

Aim of the study: Synthesis, study of physicochemical and toxicological characteristics, determination of agrochemical and economic efficiency of new complex active substances for cotton seeds dressing on the methylol urea and zinc phytocompound basis. The preparative form of the composition, with its high biological efficiency against root rot and gummosis of the cotton plants, provides, in comparison with the standard, the yield gain of 4-5.5 c/ha, increase in fiber yield by 1.5-2% and its length up to 0.5-0.7 mm, and decrease of micronaire by 0.7-0.9 units, as well as accumulation in the soil of organic substances of 6.8-7.6 t/ha, 4,5-14,5% NPK nutrients. Conclusion: Double connections of MMU•ZPC, 4DMU•ZPC and complex double connection [MMU•ZPC + 4DMU•ZPC] – are an active substances of dressing composition of multifunctional action in comparison with the standard due to the yield gain provide the economic benefit of 69 700-95 950 tenge/ha, accumulation in the soil of additional 10-15% of nutrients and 3.6-7.6 t/ha of organic substances.

Key words: double compounds, active substances, crop, root rot, gummosis.

***Corresponding author:** Sultan Usmanov, E-mail: anazher@yandex.kz

Performance of Polylatice nanopolymer on controlling of dust storms in Uremia Lake region

Abbas Ahmadi *, Mojtaba Nouri, Ali Asgar Jafarzadeh, Nosratollah Najafi

University of Tabriz, Faculty of Agriculture, Department of Soil Science, Tabriz, Iran

Polylatice nanopolymer is produced by nanotechnology technology based on natural hydrophilic materials, which in addition to soil stabilization reduces the evaporation rate of water. In this study performance of this mulch in dust stabilization of Uremia Lake dried bed was investigated in factorial experiment on the basis of completely randomized design. Treatments were 240 mL of nanopolymer solution with concentrations of 0, 0.5 and 1 percent, which sprayed on soil samples surfaces. Soil samples were collected from three parts of dried bed of Uremia Lake (the current coast, previous bed and the affected area of lake), then passed from 8 mm sieve and were poured in trays. Then nanopolymer solution was sprayed on sample surface of each tray. Laboratory and environmental treatments were kept at in vitro and in field (outside of the laboratory and in a free space) conditions respectively, for three months. Finally Polylatice effect on soil stability was measured in wind tunnel at 16 m/s wind speed. Results showed that at in vitro condition Polylatice treatments caused significance decreases of the eroded materials amount compared to control treatment (%86 and % 99.81 decreases in the 0.5 and 1 percent treatments, respectively). In field condition at the 1 percent of mulch treatments samples erosion were reduced, but at the 0.5 percent mulch treatments only at the current coast soil samples erosion were reduced.

Key words: dust production center, penetration resistance, polylatice nanopolymer, wind erosion, wind tunnel.

***Corresponding author:** Abbas Ahmadi, E-mail : a_ahmadi@tabrizu.ac.ir

Investigation of morphogenetic properties and reclamation methods of oil polluted soils of Absheron peninsula

Ali Ibrahimov[1,*] Konul Gurbanova[2]

[1]*Azerbaijan Republic Ministry of Agriculture Research Institute of Crop Husbandry, Plant and Soil Analysis laboratory, AZ 1098, Azerbaijan*
[2]*Baku State University Faculty of Ecology and Soil Science, AZ1148, Azerbaijan*

The Absheron peninsula, one of the largest carbohydrogen centre, is the geographical, biological and ecological system. From this point of view, preventing deterioration in the ecological balance of the region has a significant importance for public and the state. The rapid population growth and the building of new residential areas increase the demand for useful soil. For meet the demand, protection of the environment and establishment of new gardening and green areas, each activity towards recultivation and recovery of oil polluted soil is one of the most topical issues of the modern period. The crude oil and oil products falling into on the soil surface in the oil-field areas indicate the morphological marks, strong change of the physico-chemical characters, completely disorder of the genetic layers on the soil profile. The soils were grouped for oil-polluting: as the followings weak polluted, mean polluted, strong polluted. The soil quantity on the soil surface is 208-132 g/kg in the study soils. The zones polluted with much oil are heavy loamy, sandy soils for their mechanical structure, in these soils the environment reaction (pH) is7,5-8,8, humus 1,14 -0,9%, total nitrogen is 0,8-0,06%, phosphorus is 0,13-0,11%, the absorbed bases sum is 14,5-16 mg/ekv/100grams. A negative correlative relation between the oil quantity and humus was defined in the oil-polluted soils from the Absheron peninsula. Some indices of the biological activities in the oil-polluted grey-brow soil were investigated in the Absheron peninsula.

***Corresponding author:** Ali Ibrahimov, E-mail: aze.ecosoil@gmail.com

Results of the research of reclamation of salt-affected soils in the green zone of Astana

Bolat M. Mukanov*

Kazakh Research Institute of Forestry and Agroforestry, Shchuchinsk, Kazakhstan

The aim of the research was to determine the optimal application rate of phosphogypsum for soil reclamation of different forest suitability in the green zone of Astana. The influence of the minimum amount of introduced phosphogypsum (15 t/ha), average (20 t/ha) and maximum (30 t/ha) on the content of toxic salts in the soil was studied. Five-year observations showed that in the first year after application of phosphogypsum content of all salts sharply increased in comparison with control sites without application of meliorant, especially sulfates. But after a few years, the number of them is still decreasing. Thus, on conditionally forest suitable soils the amount of salts varied from 0.496% (2014) to 0.182% (2017), on limited forest soils-respectively 0.294-0.189%, on non-forest suitable soils - 0.1–0.08% at minimum dose of application of phosphogypsum. The rank analysis showed the advantage of the minimum amount of phosphogypsum application in the soil. In addition, the conclusion is confirmed by the study of survival and growth of two species of plants that had the best performance in these areas. On conditionally- and limited-forest suitable soils the greatest survival rate of *Ulmus parvifolia* was observed at the minimum dose of phosphogypsum application - respectively 73.8 and 39.1%, at the maximum dose survival rate of plants was 58.9 and 20.3%. At the control and at the average dose of application the survival rate was the lowest – respectively 38.9 and 48.0%; 20.3 and 21.0%.On non-forest suitable soils, the survival rate of *Acer platanoides* was very weak – from 13.3% in the experiment with minimal introduction of meliorant to 28.3% in the experiment with application of the average dose. At the average dose of phosphogypsum application, plant growth exceeded the similar indicator of control plants on 7.6 cm (25.2%). At entering of the maximum and minimum dose growth of plants was approximately 25 cm. The conducted researches allow to recommend application of 15 t/ha of phosphogypsum without soil washing on saline soils.

Key words: phosphogypsum, forest cultures, dose of application, reclamation.

***Corresponding author:** Bolat M. Mukanov, E-mail: kafri50@mail.ru

The change of agricultural areas in Turkey

Hüseyin Sarı *

Namık Kemal University, Faculty of Agriculture, Department of Soil Sciences and Plant Nutrition Tekirdag, Turkey

Agriculture, which started with the emergence of settled social order, took shape as the primary means of living of human being from time immemorial. However, agricultural activities, which are carried out in agricultural areas serving to supply food and functioning as the living space of living beings, have been seriously damaged by some wrong practices recently. According to the official data, Turkey loses 1.8 million decares of agricultural area on average every year. Increasing every passing day, such loss may lead to important food problems in the near future. The purpose of this study is to examine the changes in agricultural areas in Turkey in recent years. In this way, it is aimed to create a database for an information-based management, considered as the basic rule of agricultural soils policy. Employing the comparative cartographic methods and GIS techniques, the study used the statistical data published by Turkish Statistical Institute and the agricultural areas data extracted from Copernicus Land Monitoring Services. The study found out that agricultural areas in Turkey decreased 2,975 thousand hectares in the last 17 years (2001-2017). Spatially, such decrease especially occurred in the agricultural areas around large urban areas. Accordingly, we may look to the future with more confidence if the Law on Soil Conservation and Land Use numbered 5403 is taken as basis in all the practices concerning agricultural areas.

Key words: soil, Turkey, land use, agricultural areas.

***Corresponding author:** Hüseyin Sarı, E-mail : hsari@nku.edu.tr

The effect of lead pollution on soil physicochemical properties

I. V. Zamulina*, S. S. Mandzhieva, T. M. Minkina, S. N. Sushkova

Southern Federal University, Academy of Biology and Biotechnology named after D.I. Ivanovsky, Rostov-on-Don, Russia

The effect of heavy metals high rate on the physical and chemical properties of soils can be significant and vary among soil types. Changes of physicochemical properties of polluted soil are usually not considered in relation to the sorption of metals by soils. The effect of Pb high rates on the physical properties of Haplic Chernozem under model experimental conditions was studied. In a model experiment, soil samples of Haplic Chernozem (Clayic) were artificially contaminated with 2000 mg/kg of Pb acetates. The particle-size fraction, the microaggregates distribution, the structural status, physico-mechanical properties were determined in soil without metals and soil contaminated with metal. Physical and chemical properties of the studied soil were analyzed by the commonly used Standard method for the Russia. At the soil contamination with Pb, the content of organo-mineral colloids increased, which results to the increasing of the clay fraction content by 4.5% compared to the control. The analysis of the microaggregate size composition of the studied soil shows that the content of coarser aggregates (1–0.25 mm) increases and the content of finer (0.05–0.001 mm) aggregates decreases after the addition of HMs. A significant decrease in the coefficient of water stability in the control from 3.0 to 1.4–1.5 in the contaminated treatments. The structural status (estimated from total agronomically valuable aggregates) changes from excellent to good. Under conditions of model experiment, the contamination of Haplic Chernozem (Clayic) with high rates of Pb leads to changes of the microaggregates distribution, the structural status.

Key words: aggregate content, heavy metals, particle size distribution, plasticity, soil, solid phase density, structural status.

***Corresponding author:** Inna V. Zamulina, E-mail: ivzamulina@sfedu.ru

Acknowledgement: This study was funded by the Ministry of Education and Science of Russia, no. 5.948.2017/PP.

Assessment of the salinification of arid territory degraded soils by electrical resistance methods

Lyudmila Yakovleva, A.V. Fedotova

Astrakhan State University, Astrakhan, 20a, Tatishcheva St. Russia

Water-soluble salts contained in arid regions covering about a third of the earth square to a rather significant extent determine soil quality and their availability for agriculture. In context of global soil degradation express methods of soil evaluation and ecological monitoring are becoming peculiarly important, especially for arid regions with very low level of soil humidity (1-2%). Changing climatic conditions and Caspian Sea regime and intensive farm production held on meliogenic soils of the Astrakhan Region caused increasing degradation of soils of the Volga Delta Region associated with increasing salt content in them. The current work considers the issues of electrical resistance employment for assessment of degraded soil salinification in arid regions characterized by low level of soil humidity. As the objects of the research soils of the eastern Volga Delta suffering humidity shortage due to bunding of the territories and existing under influence of salt accumulation have been chosen. The assessment of soil salinification has been performed under hardware control by the value of electrical resistance of pastes. It has been found out that electrical resistance values vary depending on extent of soil salinification in wide range: from 908 O*m to 0.8 O*m. Salt accumulation and formation of sodium ions in soil adsorption complex determines decreasing electrical current. The use of electrical resistance values makes it possible to simplify the procedure of ecological monitoring and soil regulation in terms of its applicability for agriculture without any laboratory researches. Assessment of soil salinification within the conditions of low soil humidity is also possible.

Key words: Soil cover, salinification, electrophysical methods, arid soils.

***Corresponding author:** Lyudmila Yakovleva, E-mail: yakovleva_lyudmi@mail.ru

Pollution indices of heavy metal of soils of Mačkatica, Pčinja district

Sonja Tosic[1]*, Elmira Saljnikov[1], Vesna Mrvić[1], Snežana Belanović-Simić[2], Milan Pesic[1], Darko Jaramaz[1]

[1]Institute of Soil Science, Belgrade, Serbia
[2] University of Belgrade, Belgrade, Serbia

Mačkatica is a mountainous area belonging to the southern part of Serbia in the district of Pčinj, where the altitude ranges from 860m to 1200m. The whole surface is very separated, they noticed numerous locations for water erosion, mainly linear erosion. Some landslides were discovered, but because the area is well covered with vegetation, the signs of recent landslides have not been much presented. The dominant type of ground for exploration and observation on the ground is Ranker, then Cambisol, followed by Regosol, Colluvium, Luvisol and Deposol. Alluvium, Pseudoglei and Lithosol represent 1 profile. The total number of samples from the full profile is about 181, where the analyzed samples were taken at a depth of 0-30 cm. The aim of the study was to determine the state of contamination of soil from the most important inorganic pollutants by calculating different pollution indexes and identifying sources of pollutants by analyzing PCA and loading each factor for an individual element. The unique pollution index showed a moderate level of pollution Cd. The integrated Nemerov pollution indicator showed a low level of pollution, which indicates a slight ecological risk. There were no restrictions on agricultural production in the investigated area.

Key words: heavy metals, pollution indices, Pčinja District, ecological risk, PCA

***Corresponding author:** Sonja Tosic, E-mail: soils.tosic@gmail.com

Urease enzyme activity in a sandy clay loam soil outflow solution influenced by organic waste addition

Coşkun Gülser [1,*], Rıdvan Kızılkaya[1], Füsun Gülser [2]

[1]*Ondokuz Mayıs University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Samsun, Turkey*
[2] *Yüzüncü Yıl University, Faculty of Agriculture, Department of Soil Science and Plant Nutrition, Van, Turkey*

The effect of hazelnut husk (HH) application on urease enzyme activities in outflow solution of sandy clay loam soil column was investigated. Hazelnut husk was incorporated with four different rates (0, 2, 4 and 6%) into the soil. Changes in soil properties were determined at the end of 1, 2, 4 and 8 weeks. Addition of HH into the soil increased organic carbon content, basal soil respiration, aggregate stability, total porosity, and decreased soil bulk density. Urease enzyme activities in a pore volume (PV) of outflow solution increased from 0.93 µg N/PV in control treatment to 11.37 µg N/PV in 6% HH application doses at the end of 8th week. Urease enzyme activities in outflow solution had significant positive correlations with aggregate stability (0.947**), saturated hydraulic conductivity (0.654**) and a significant negative correlation with outflow EC (-0.586*). Urease enzyme activity in outflow solution had a positive relationship with basal soil respiration.

Key words: Urease, enzyme, hazelnut husk, outflow solution.

***Corresponding author:** Coşkun Gülser, E-mail: cgulser@omu.edu.tr

Accuracy analysis of 1/5000 scaled maps produced in Turkey

Ferruh Yildiz *

Konya Technical University, Department of Geomatic Engineering, Konya, Turkey

1/5000 scaled standard topographical maps are produced as the meaning of photogrammetric methods in Turkey. All production processes, equipment that used and techniques that applied affect the accuracy of these kind of maps those will be produced. These kind of accuracy are established either separately by using each country standards or they are all accepted as International Standards. In this study, production processes, equipment that used and techniques that applied of the 1/5000 scaled maps those produced in Turkey are determined in some detail and all the maps produced as means of these techniques are compared with the criteria as dictated by both National and International Standards.

Key words: Accuracy, topographic map, photogrammetry .

***Corresponding author:** Ferruh Yildiz, E-mail: ferruhyildiz@gmail.com

The Proceedings of the 10th International Soil Science Congress on “Environment and Soil Resources Conservation”, Almaty: 2018. - 186 p.

Electronic layout of the book: Abugaliyeva S., Ekeibaiyeva D.

Printed in the printing-office JSC «Poligrafservis i K», Almaty, 050000, Yassaui 66 «a»,
tel: +77272549864, e-mail: polygraph_servis@mail.ru
Pressrun: 300