Moldova-China Forum on Black Soil Farming

Organized by

The Academy of Sciences of Moldova (ASM)

ANSO-World Mollisols Association

National Center for Research and Seed Production

Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences (CAS)

September 1-5, 2026

Chișinău and Bălți, Moldova

Chișinău–Bălți, 2026

Theme
Sustainability of Black Soil Farming

Organized by
The Academy of Sciences of Moldova
ANSO-World Mollisols Association
National Center for Research and Seed Production
Northeast Institute of Geography and Agroecology, CAS

Co-organized by
Society of Mollisols Resources Conservation and Utilization, Heilongjiang Province, China
Key Laboratory of Water & Soil Conservation, Heilongjiang Province, China
Alecu Russo Balti State University, Balti, Republic of Moldova

Supporting projects
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European project: "Transformative Living Labs for Soil Health: Advancing Regenerative and Conservation Agriculture Across Europe" (TRAILS4SOIL). Project number101218949.
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Pro-Co-Re, Balti, Republic of Moldova

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Academician Prof. Boris Boincean (Co-chairman, Republic of Moldova)
Prof. Xiaobing Liu (Co-chairman, China)
Academician Boris Gaina (Member, Republic of Moldova)
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Prozorovschi Maxim (Member, Republic of Moldova)
Zaharco Dionisie (Member, Republic of Moldova)
Rotari Alexandra (Member, Republic of Moldova)

Forum Language

English

Forum Important Dates

September 1, 2026, Forum
September 2, 2026, Field Experiments
September 3, 2026, Conservation farm
September 4, 2026, Academic exchanges

Forum Program

September 1st (Venue: Small Hall, Academy of Sciences of Moldova, Chișinău)			
08:00 - 09:00		Registration & Welcome Coffee	
Opening Ceremony			
Time	Greetings and welcome remarks		Moderator
09:00	**Academician Ion TIGINYANU**, President of the Academy of Sciences of Moldova **H.E. Zhihua DONG**, Ambassador Extraordinary and Plenipotentiary of the People's Republic of China to the Republic of Moldova **Prof. Xiaobing LIU**, President ANSO-World Mollisols Association **Minister,** The Ministry of Agriculture and Food Industry **Dr. Anatol SPIVACENCO,** Director of the National Center for Research and Seed Production, Moldova **Prof. Rattan LAL,** World Food Prize Laureate**,** The Ohio State University, USA		Academician Ion TIGINYANU
09:25	Group Photo		
Session I Soil Formation and Fertility			
09:30-09:45	Bacean Ion (Moldova)	Pedogenetic Factors of Chernozems in the Republic of Moldova in the Conceptions of Vasily V. Dokuchaev and Nikolai A. Dimo	Arcadie CAPCELEA
09:45-10:00	Guanghua Wang (China)	Does soil microbial community reflect the Black Soil formation?	
10:00-10:15	Andriucă Valentina (Moldova)	Fertility of Chernozems in the Republic of Moldova and the need for Agroecological surveillance in current conditions of agricultural use	
10:15-10:30	Yueyu Sui (China)	Genesis and Classification of Chinese Black Soil	
10:30-10:45	Aimin Zhang (China)	The Age of Chinese Black Soils	
Coffee break（10:45-11:15）			

Session II Soil Degradation and Health			
11:15-11:30	Boris Boincean (Moldova)	Agriculture in front of transformations	Xingyi ZHANG
11:30-11:45	Xiaojing Hu (China)	Biodegradable Microplastic-Derived Carbon and Its Impacts on Soil Carbon Cycling	
11:45-12:00	Viorel Gherciu (Moldova)	eAgronom supports regenerative farming practices through the Carbon Sequestration Program	
12:00-12:15	Xiaofang Du (China)	Ecological Impacts of Black Soil Degradation on Biota and Soil Quality	
12:15-12:30	Dumitru Galupa (Moldova)	Ecological rehabilitation of degraded lands through agro-forestry and silvo-pastoral practices	
12:30-12:45	Yimin Chen (China)	Soil Enzymatic Stoichiometry as a Diagnostic Tool for Black Soil Degradation: Implications for C and P Co-Management	
12:45-14:00	Lunch break		
Session III Conservation Agriculture and Sustainability			
14:00-14:15	Rattan Lal (USA)	Live video connection	Viorel GHERCIU Boris BOINCEAN
14:15-14:30	Arcadie Capcelea (Moldova)	Soil Conservation in the Republic of Moldova: Evolution, Problems, Perspectives	
14:30-14:45	Xingyi Zhang (China)	Conservation soil tillage in the cool area of Northeast China	
14:45-15:00	Ilya Trombitsky (Moldova)	Water Erosion of Chernozems in Moldova and the Challenge of Non-Point Water Pollution: Innovative Assessment and Modeling in a Small River Basin in Moldova	
15:00-15:15	Yansheng Li (China)	Mollisols Fertility response to field management practices in Northeast China	
15:15-15:30	Nina Frunze (Moldova)	Considerations on the relationship between the soil microbiome and the development of sustainable agriculture	
15:30-15:45	Siyu Gu (China)	Unraveling Long-Term Stubble-Retained No-Tillage Driven Soil Quality Improvement and Yield Sustainability in Mollisols of Northeast China	
Coffee break (15:45-16:00)			

Session IV Crop Breeding and Productivity			
16:00-16:15	Volosciuc Leonid (Moldova)	Ecological Agriculture: Achievements and problems	Guanghua WANG
16:15-16:30	Changkai Liu (China)	Soybean Breeding and Physiological Research in the Black Soil Region of China	
16:30-16:45	Costel Gutu (Moldova)	Evolution of Soybean Breeding Research in Moldova	
16:45-17:00	Qingsong Shen (China)	Soil Organic Matter and Crop Productivity	
17:00-17:15	Ela Malai (Moldova)	Donau Soja Association: Promoting sustainable, traceable and non-GM Soya in Europe and the Republic of Moldova	
17:15-17:30	Declaration Ceremony		Boris BOINCEAN/ Xiaobing LIU
18:00	Dinner		
September 2nd – Bălți			
08:00 Departure from Chișinău 10:00 Arrival at National Center for Research and Seed Production 10:00 Visiting long-term field experiments on crop rotations, permanent cropping, and conservation agriculture 12:00 Lunch 13:00 Visiting field trials with soybeans, common beans, corn and others Examination of the Chernozem soil profile 15:00 Cultural program at the Alecu Russo Bălți State University 18:00 Dinner Stay in Bălți			Boris BOINCEAN Natalia GASITOI
September 3rd – Bălți			
08:30 Departure to Conservation Farm 09:30 Traveling in the North part of Moldova in order to visit two farms practicing Conservation Agricultural System (Cupcini, Edineț district) for different periods of time 12:00 Lunch 13:30 Farm visit 16:30 Transfer to Bălți 18:30 Dinner Stay in Bălți			Boris BOINCEAN Veaceslav CERNII

September 4th	Visit to Porumbeni sector of the National Center for Research and Seed Production Lunch 13:00-14:00 Free discussion and visits of Chișinău city Stay in Chișinău	Boris BOINCEAN Pantelimon BOROZAN
September 5th	Participants Departure	Boris BOINCEAN

Registration

Registration is free to all attendees while post meeting excursion is optional.

Accommodation

Villa Nataly Hotel, Chișinău; Elit Hotel, Bălți.

Secretariat

If you need any information or assistance, please feel free to contact the Secretariat at any time.

The Secretariat staff will be happy to provide a response as soon as possible.

For more information, you can also contact the Secretariat through the following methods:

Tatiana LUPOLOV Tel: (+373) 69382887; E-mail: talupolova@gmail.com

Speakers and Moderators

Ion Tiginyanu (Tighineanu) graduated from the Moscow Institute of Physics and Engineering in 1978. He received his Ph.D. degree in Semiconductor Physics from the Lebedev Institute of Physics in Moscow in 1982. He carried out research projects at the Technical University of Darmstadt, Germany, as an Alexander von Humboldt Research Fellow in 1995/96 and 1998/99, and at the University of Michigan, Ann Arbor, USA, in 2000/2001. He became a full professor at the Technical University of Moldova in 1993 and served as vice-rector from 1998 to 2004. In 2004, he was elected vice-president of the Academy of Sciences of Moldova, and in 2019, its president. In this capacity, he initiated communication platforms aimed at fostering efficient scientific dialogue within the academic community, as well as between researchers and society. Since 2001, he has served as founding director of the National Center for Materials Study and Testing, affiliated with the Technical University of Moldova. Professor Tiginyanu's research interests focus on nanotechnologies, smart nanomaterials, and the development of novel photonic and electronic device structures. He has authored more than 450 journal publications and holds 54 technological patents. He developed new technologies, including surface charge lithography and hopping electrodeposition, and invented the first artificial material with dual hydrophobic/hydrophilic properties, known as Aerogalnite.

Professor Tiginyanu received the Outstanding Inventor Award from the World Intellectual Property Organization. He is a member of Academia Europaea, the CORE Academy, and the European Academy of Sciences and Arts; an honorary member of the Romanian Academy; and a Fellow of the International Science Council and of the International Society for Optics and Photonics (SPIE).

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Boris Boincean is a research professor, doctor habilitate of agricultural sciences, academician of the Academy of Sciences of Moldova. He graduated from Moscow Agricultural Academy by name of K.A. Timiriazev and defended both his thesis in the same academy. Now, he is the Head of the Laboratory of Sustainable Farming Systems at the National Center for Research and Seed Production, Selecția sector (mun. Bălți). Before the fusion of two research institutions (in 2023), he servied at Selectia Research Institute of Field Crops (mun. Bălți) as the scientific secretary of the institute (1985-1990); research director (1990-1999); director of the institute and general director of the Scientific Production Association, Selectia" (1999-2009).

His research is directed towards achieving sustainable and resilient agriculture on Chernozem soils of Moldova through promoting alternative farming systems, including ecological (organic, biologic) agriculture, regenerative (conservation) agriculture systems etc. He was elected in 2026 as the member of the Academy of Sciences of Moldova, profile – agronomy. He has published more than 350 scientific publications, including 12 books in prestigious publishing houses. He was mentioned by the highest national distinction – The Order of Republic".

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Anatolie SPIVACENCO is the director of the National Center for Research and Seeds Production (PI NCRSP), a pillar of national agricultural research, since June 2020. He earned a Ph.D. in Economics from the State Agrarian University of Moldova in 2009. He is a manager with over 25 years of experience in the administration of agricultural and government structures.

His professional career includes major leadership positions, among which: Deputy Minister of Agriculture and Food Industry (2003–2009), Prefect of Orhei County (1999–2001), and Deputy General Director at the "Cricova" Winery SA (2018–2020).

Currently, he is guiding PI NCRSP toward the adoption of modern technologies and alignment with international quality standards. His areas of interest and expertise include strategic management in agriculture, the optimization of cultivation processes, and the development of native genotypes of hybrids and varieties adapted to climate change, with an emphasis on drought resistance.

For his work, he was awarded the state decorations "Civic Merit" (1995) and "Glory of Labor" (2009).

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Xiaobing Liu is a professor of plant and soil science at the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. He obtained his first Ph.D. in Agronomy from Northeast Agricultural University, China and his second Ph.D. in Plant and Soil Science from the University of Massachusetts, Amherst, USA. Currently, he serves as the President of the ANSO-World Mollisols Association and a member of the World Soybean Research Conference Continuing Committee. He also holds the position of President of the Heilongjiang Society of Mollisols Resources Conservation and Utilization. He was a member of the Editorial Board of the Journal of Agronomy and Crop Science (Germany) and is currently an Associate Editor of The Crop Journal (China), Agronomy (Switzerland), and the Executive Editor-in-Chief of Soils and Crops. He has authored over 290 publications, 5 patents and 5 monographs, and was awarded 14 Natural Science or Science and Technology Progress prizes. He is the world's top 2% scientist by Stanford and Elsevier, author of ESI highly cited papers, the top 0.05% of all scholars worldwide according to the most recent 2025 Scholar GPS based on his accomplishments over the totality of his career (lifetime), and one of the best ten soybean yield physiologists in the world.

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Xingyi Zhang is a senior researcher and professor at the Northeast Institute of Geography and Agroecology (IGA), Chinese Academy of Sciences (CAS). He serves as the director of the Hailun Station for Monitoring and Research on Mollisols Erosion. Additionally, he holds positions of vice president of the ANSO-World Mollisols Association as well as the Heilongjiang Society of Mollisols Resources Conservation and Utilization. He is an executive member of the China Society of Soil and Water Conservation, specializing in the study of soil erosion and its management.

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Guanghua Wang Professor and PhD Supervisor at the Agricultural Technology Center of the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. His research primarily focuses on black soil microbial ecology, environmental viral ecology and microbial resource exploration. He has published more than 170 SCI-indexed papers, and his research outcomes have been

awarded 3 Second Prizes for Natural Science of Heilongjiang Province and 1 First Prize for Science and Technology Progress of the Chinese Society of Soil Science.
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Shouyi Ma is a senior researcher of Heilongjiang Academy of Land Reclamation (HALR) and a professor with Northeast Agricultural University. He has long been engaged in research on agricultural machinery and the protective use of Black Soil. He serves as the chief expert on conservation tillage in the State Farm of Heilongjiang province; the chief expert of the Second National Black Soil Conservation Project in Heilongjiang Province; and the head of the expert group for the Soil Fertility Improvement Project in the ecologically fragile areas of the Songnen Plain in Heilongjiang Province. He was the former president of HALR.
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Arcadie Capcelea holds a doctor Habilitatus degree in Biology and a PhD in Geography. He currently works as an International Freelance Expert in Environmental Management and Environmental Assessment. He began his professional career in 1978 as a geographer-engineer at the Geography Sector of the Academy of Sciences of the Republic of Moldova, subsequently serving as junior researcher, researcher, and senior researcher. Between 1990 and 1998, he served as First Deputy Director General of the Department for Environmental Protection and Natural Resources. From May 1998 to September 2000, Dr. Capcelea held the position of Minister of the Environment. During 2000–2023, he worked at the World Bank, at its headquarters in Washington, D.C., as a Senior Environmental Specialist. In 2023–2026, he served as a university lecturer at the Faculty of Biology and Earth Sciences of the Moldova State University.

He is the author of more than 180 scientific publications, including 15 monographs and 6 university textbooks in the fields of geomorphology, geoecology, physical geography, ecological management, environmental assessment, and sustainable development.
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Dr. Siyu Gu is a professor of Northeast Agricultural University, former head of the Department of Soil Science, College of Natural Resources and Environment. Research interests: soil fertility regulation and soil health. Now, she is the executive director of the World Society for the Study of Black Earth China Chapter, the executive director of the Heilongjiang Province Black Soil Resources Conservation and Utilization Society.
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Ela Malai holds a PhD in in Biological Sciences. She serves as Director of the Donau Soja Association – Moldova Office. She leads the implementation of the ADA Strategic Partnership program and coordinates activities to strengthen the Moldovan agri-food sector through sustainable, traceable, and non-GM crop systems.
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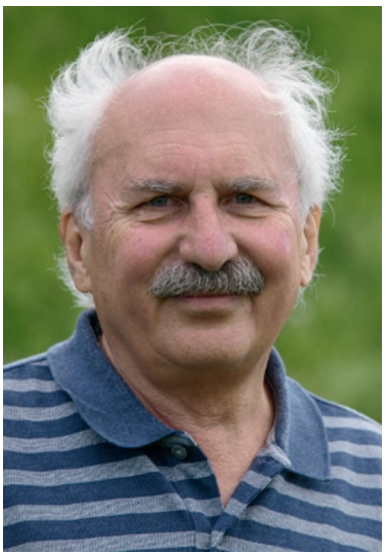

Dr. Ilya Trombitsky is an environmental scientist, researcher, and the Executive Director of the *Eco-TIRAS International Association of River Keepers* based in Chisinau, Moldova. It is the umbrella of environmental NGOs of the transboundary Dniester River basin (Moldova and Ukraine. He has dedicated over three decades to transboundary river basin management, environmental monitoring, and the protection of water ecosystems across Eastern Europe, including biodiversity. His primary research focus lies in eco-hydrology, the integration of remote sensing and modeling to combat non-point source water pollution, and the advancement of public policy in alignment with the European Water Framework Directive. He has spearheaded numerous international transboundary projects funded by the European Union and international donors.
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Viorel Gherciu has a bachelor degree in Agronomy followed by a postgraduate degree in agrobusiness and a master degree in International Relation. He is a senior expert in agriculture and agricultural value chains, successfully worked with farmers in different international projects improving the effectiveness and efficiency of agri-food value chains in Moldova during more than 30 years, plus two years in international agricultural development working for EIB in different EU and non-EU countries as well the last half of the year in Ukraine.

On different assignments the transfer of know-how and best practice to agricultural producers through promotion of the regenerative agriculture, soil health principals organizing of practical trainings and demonstration fields was one of key element in the promotion of sustainable climate change adaptation agricultural technologies. He was involved in the design and implementation of short- and long-term development projects and strategies mainly in agricultural and rural development sectors, innovative environment friendly & climate change mitigation and adaptation interventions; best practices transfer, carbon sequestration and certification practices, organic agriculture certification activities in Moldova, as well as Donau Soya from Austria aimed for supporting Non-GMO soy value chain development including the implementation of the DS non-GMO standard and transfer of know-how/best practice to agricultural producers and related value chain actors.

Viorel Gherciu has extensive experience and skills in working successfully with all stakeholders in the value chains, encouraging them to cooperate sharing the best practice and to treat each other with dignity and respect.
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Ion Bacean is a specialist in Soil Science, PhD in Agricultural Sciences, Associate Professor, Research Scientist at the Department of Agronomy and Environment, Faculty of Agricultural, Forestry and Environmental Sciences, Technical University of Moldova. His professional and academic activity has been carried out for more than two decades within the country's leading agricultural and technical higher education institutions.

In addition to his teaching and research activities, Dr. Ion Bacean has held several important academic management positions. He served two separate terms as Vice-Dean of the Faculty of Agronomy and was Dean of the Faculty of Agronomy from 2015 to 2022, contributing to the development of educational programs, scientific research, and institutional cooperation. As author and co-author of more than 90 scientific and methodological publications, Dr. Ion Bacean has participated in 12 national and international research and development projects. Through his professional, scientific, and managerial activities, he has made a significant contribution to the advancement of agricultural education and research in agricultural sciences in the Republic of Moldova.
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Dr. Yueyu Sui is a Research Professor, Ph.D Supervisor, and Head of Research Group at Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. He serves as Executive Deputy Director of the Hailun National Field Scientific Observation and Research Station of Agroecosystems, Deputy Director of the Soil Genesis, Classification and Geography Professional Committee of the Soil Science Society of China, Vice President of the Heilongjiang Soil and Fertilizer Society, Secretary-General of the Heilongjiang Society for Black Soil Resource Conservation and Utilization, as well as the ANSO-World Mollisols Association, member of the Expert Advisory Group of the Office of the Leading Group for the Third National Soil Survey under the State Council, and a recipient of the Heilongjiang Provincial Outstanding Youth Science Foundation.

His research focuses on regional soil geography and soil ecology. He has led more than 50 national-level research projects, and published over 150 papers in domestic and international journals, including 90 papers indexed by SCI or EI. He holds 6 national invention patents, and received 5 awards, including the Heilongjiang Provincial Science and Technology Progress Award and Natural Science Award. He authored or co-authored 5 monographs, including Chinese Soil Series: Jilin Volume, and has participated in the formulation of 4 local standards.

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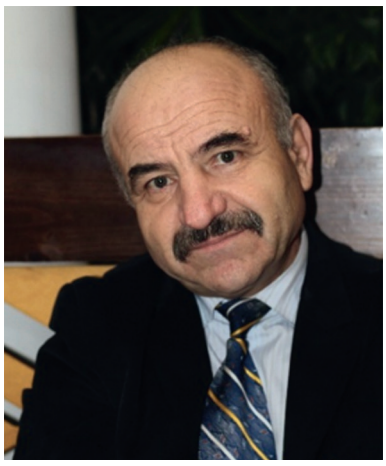

VOLOSCIUC Leonid is a professor at the State University of Moldova, Scientific Consultant in the Laboratory of Phytopathology and Biotechnology of the Institute of Genetics, Physiology and Plant Protection, corresponding member of the Academy of Sciences of Moldova.

Research direction: "Development of scientific and practical bases of the functioning of organic agriculture, development of methods, means, ecologically harmless systems of plant protection and technologies for their application in conventional and organic agriculture".

Implementations: developed production technologies and homologation of 6 baculoviral insecticides for combating harmful noctuid species and 14 bacterial and mycotic preparations for combating harmful insects and phytopathogenic agents of bacterioses and mycoses.

Scientific publications: 535, scientific articles in peer-reviewed journals and collections-120, monographs-7, books-5, textbooks-3, course materials-2.

International recognition: Organization as president of the Organizing Committee of 6 international scientific forums (2009, 2012, 2015, 2018, 2020, 2023). The results recorded are highly appreciated by the scientific community. This is manifested by: Invitations to various international forums (Montpellier, Irvine, Warsaw, Poznan, Moscow, Saint Petersburg, Novosibirsk, Tehran, Prague, Kiev, Bucharest, Cluj-Napoca, Iași, Krasnodar, Odessa, Minsk); Frequent citation in various scientif-

ic works; Awarding international grants and participating in the implementation of various bilateral projects; Participation as a moderator in many international (Romania, Belarus, Ukraine, Russian Federation) and local scientific forums; Development as a member of specialized scientific councils and referee of doctoral and habilitated theses in the Republic of Moldova and Romania.

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Yansheng Li, Ph.D. is a professor of agronomy at the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. His research focuses on crop cultivation and tillage systems, agroecology, Mollisol fertility evolution, and nutrient cycling in agricultural ecosystems. In recent years, he has conducted systematic studies on long-term fertilization, organic amendments, soil acidification regulation, microbial mechanisms of nitrogen and phosphorus cycling, and the effects of field management practices on crop yield and soil fertility in the Black Soil region of Northeast China. He currently serves as Vice President of the Heilongjiang Society of Crop Science, Council Member of the Heilongjiang Society of Black Soil Resources and Utilization, and Editorial Board Member of Crop Science in the USA.

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Dr. Valentina Andriucă is an associate professor with the Department of Agronomy and Environment, Faculty of Agricultural, Forestry and Environmental Sciences, Technical University of Moldova (TUM).

She teaches courses on Ecopedology, Qualitative Soil Analysis, Soil Improvement Pedology, Environmental Protection, Ecological Monitoring, Agroecology, as well as Agroecological Monitoring.

Project Leader: Correlation of some elements of potential soil fertility with crop productivity indicators to ensure food security in the Republic of Moldova under climate change conditions.

Coordinating Research Scientist of the Project: Development and Implementation of Good Practices for Sustainable Agriculture and Climate Resilience (GREEN).

Research group theme: Agroecological Elements for the Establishment of Sustainable Agroecosystems (Orchards and Field Crops) and Climate Resilience.

She holds the habilitation to supervise PhD students in the specialties of Agropedology and Agroecology. Under her supervision, 2 doctoral (PhD) dissertations have been successfully defended. She has published over 230 scientific articles, including 100 international publications.

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Dr. Dumitru Galupa got his Ph.D in Economy from the Technical State University, Chisinau, Moldova in 2006.

He was selected as Honorary Memeber by Academy of Forestry Sciences of Ukraine in 2013, and Honorary Memeber by "Gheorghe Ionescu-Șișești" Academy of Agricultural and Forestry Sciences (A.S.A.S.) in 2025, and rewarded as Honorary Professor by Brasov Transilvania University, Romania, in 2018.

From 1998-2024, he was the Director of Forestry Research and Management Institute (FRMI).

He has the work experiences in Moldova, Romania, Albania, Russia, Ukraine, and USA.

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Nina Frunze – doctor of science, is a chief researcher at the Institute of Microbiology and Biotechnology of the Technical University of the Republic of Moldova. Received the degree of Doctor of Science the National University of Life and Environmental Sciences of Ukraine. Her research interests focus on soil microbial ecology, microbial resources, and the health of chernozems. She currently leads a research group studying the soil microbiome. She studies edaphic prokaryotes using high-throughput sequencing and other non-cultivation-based methods. She is the author of over 300 scientific papers, including a monograph, co-author of two national and two international monographs, 13 articles with an impact factor in the Scopus database, two inventions, 22 innovations, three practical recommendations, supervisor of five bachelor's theses, and supervisor of four national research projects and one international project. The scientific results were recognized at the International Invention Salons with a diploma and a bronze medal (2024), a diploma and a silver medal (2025), and a diploma for outstanding achievements and a gold medal (2023, 2026).

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Xiaojing Hu, Ph.D. Associate Professor at the Agricultural Technology Center of the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, and experienced Humboldt Fellow in Germany.

Her research bridges soil microbial ecology and agricultural sustainability, investigating community dynamics, genome reconstruction, and viral–host interactions under varying management regimes.

She has published over 70 papers (h-index: 23), including more than 30 as first/corresponding author in leading journals such as Environment International *and* Geoderma, with 3 ESI Highly Cited Papers.

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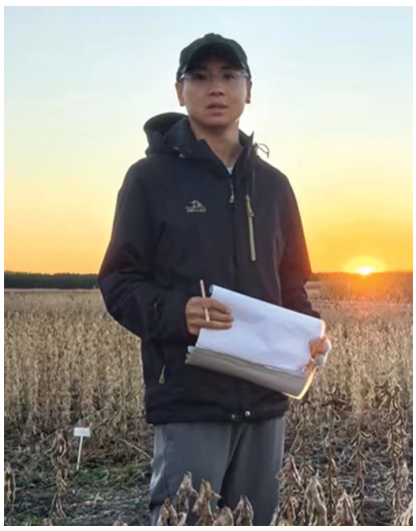

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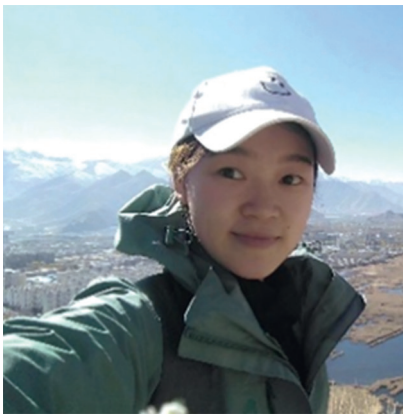

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CZU 631.41/.42

PEDOGENETIC FACTORS OF CHERNOZEMS IN THE REPUBLIC OF MOLDOVA IN THE CONCEPTIONS OF VASILY V. DOKUCHAEV AND NIKOLAI A. DIMO

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Summary Chernozems represent the dominant genetic soil type in the Republic of Moldova and constitute one of the country's most important natural resources, supporting agroecosystem productivity and food security. Their genesis and evolution are determined by the complex interaction of pedogenetic factors defined within the genetic theory of soils developed by Vasily V. Dokuchaev, who is widely recognized as the founder of modern pedology. According to this concept, soil is a distinct natural body formed under the combined influence of climate, living organisms, parent material, relief, and time. These factors act simultaneously and determine the direction and intensity of pedogenetic processes.

This paper examines the role of the principal pedogenetic factors in the formation and evolution of Chernozems in the Republic of Moldova through the perspective of the genetic concept formulated by Dokuchaev and subsequently developed by Nikolai A. Dimo. The study is based on a critical analysis of classical and contemporary soil science literature, with particular emphasis on the interpretation of Chernozem-forming processes under the specific environmental conditions of Moldova.

The results demonstrate that the genesis of Chernozems is closely associated with the climatic conditions of the steppe and forest-steppe zones, characterized by a favorable thermal regime and a moderate water balance that promote the accumulation and preservation of organic matter within the soil profile. Natural grassland vegetation served as the primary source of organic residues, contributing to the development of a deep, humus-rich surface horizon. An essential role is played by the parent material, predominantly represented by carbonate loess-like deposits, which provide physical and chemical properties favorable for the development of the Chernozem profile. Relief influences the spatial distribution of soils and the intensity of erosion processes, while the factor of time enables the long-term operation of pedogenetic processes and the maturation of the soil profile. The contributions of Dimo complement the Dokuchaevian concept by highlighting the importance of biological processes and the activity of soil organisms in the development of soil fertility, as well as by providing a scientific basis for soil conservation and erosion-control measures.

The study confirms the continuing relevance of the concepts proposed by Dokuchaev and Dimo and highlights their importance for understanding the formation processes, properties, qualitative characteristics, fertility, systemic functioning, evolution, and anthropogenic transformations of Chernozems under agricultural use. Furthermore, these concepts remain highly relevant for the conservation and sustainable management of Chernozem soils under current land-use conditions in the Republic of Moldova.

CZU 631.46

DOES SOIL MICROBIAL COMMUNITY REFLECT THE BLACK SOIL FORMATION?

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Summary Soil formation is a very slow and complex process involving the interaction of abiotic factors (e.g., climate, parent materials, topography, and time) and biotic factors (e.g., plants, microbes, and animals). Among them, biotic factors are regarded as the most active agents in soil formation. Microorganisms are the main biotic components driving the incipient soil formation without vegetation. Pioneering microorganisms contribute a biological component for weathering, affecting the early accumulation of labile nutrients that help the growth of higher-order plants. Therefore, the research on the distribution patterns of soil microbial communities in the soil profile and their relationships with soil physical and chemical properties are crucial to understanding the formation and development of soils.

Although microbes are inhabited in the whole soil profile, our knowledge on the structure and diversity of soil microbial communities is mainly limited in the topsoil. Isohumosols is a soil order that is nominated based on Chinese Soils Taxonomic Classification (CST), which roughly equal to Black Soils. Isohumosols is divided into two suborders of Ustic and Udic Isohumosols. We collected soil samples based on the diagnostic horizons from eight Isohumosols (four from each Ustic and Udic Isohumosols individually) in agricultural soils. The soil physical and chemical properties and bacterial, archaeal, and fungal community structures were investigated using High throughput sequencing method. We found that all soil microbial community structures were obviously separated into Ustic and Udic groups, and a distinct succession of microbial communities was detected from Ah horizons to C horizons at individual sites. Using machine-learning methods, we also found that soil microbial communities can be used to accurately predict two suborders of Isohumosols and diagnostic horizons. Overall, this study provides a good link between soil properties, formation processes, and microbial communities in Ustic and Udic Isohumosols based on diagnostic horizon sampling.

CZU 631.452

FERTILITY OF CHERNOZEMS IN THE REPUBLIC OF MOLDOVA AND THE NEED FOR AGROECOLOGICAL SURVEILLANCE IN CURRENT CONDITIONS OF AGRICULTURAL USE

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Summary The current promotion of the development of agroecosystems, the competitiveness of agriculture as a priority economic branch, the maintenance of the specific quality of agricultural

products from chernozems type of soil, offered by agricultural producers to the markets, requires a more complex approach to research of agroecosystem components, currently involved in the agricultural sector. Currently, it is not possible to separately research only the soil, but the problem of agroecological research and evaluation arises, given that the current agricultural system includes not only the soil, but also biotic and abiotic factors, their changes under climatic conditions, droughts, lack of nutrients in the soil, lack of water, these being always the determining factors of production, and not just the natural fertility of the soil.

Currently, some modern agroecosystems of field crops, fruit and viticulture have been founded in Criuleni Agricultural Research and Extension Station of the Technical University of Moldova (ARES, Criuleni, TUM). The representative soils are Chernozems – typical and carbonate, loamy-clayey. Some elements of potential and effective natural fertility for the Chernozems in Criuleni Agricultural Research and Extension Station of the Technical University of Moldova are presented and discussed. The abiotic and climatic factors of the research area are highlighted, by applying current methods for characterizing the climatic situation, some conditions for the development of winter wheat, the limits of some potential fertility parameters of the soils of the research polygons, the content of nutritional elements - N, P, K, pH reaction and others, by various methods. The production of winter wheat, the quality of the grains (year 2025) was quantitatively and qualitatively analyzed for protein content, gluten, Zeleny index. The soil from 3 agroecosystems was examined for the content of heavy metals - Zn, Cu, Ni, Co, Cr, which fall within the allowed limits, values without ecological risks for agricultural production.

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CZU 631.44

GENESIS AND CLASSIFICATION OF CHINESE BLACK SOIL

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Summary Black Soils in Northeast China represent one of the most important soil resources in the world, supporting intensive grain production and regional ecological security. Based on the distribution, pedogenic environment, profile morphology, and classification of major soil types in this region, this presentation summarizes the genesis and taxonomic position of Chinese Black Soils. The Northeast China Black Soil region covers approximately 1.09 million km², accounting for about 12% of the global Black Soil area, and extends across the Hulunbuir grassland, the Greater and Lesser Khingan Mountains, the Sanjiang and Songnen plains, and the Changbai Mountain region. In the narrow genetic sense, Black Soils mainly occur in the Songnen and Sanjiang plains under meadow steppe or steppe meadow vegetation, with a total area of about 70,000 km².

The formation of these soils is controlled by Quaternary sedimentary parent materials, temperate humid to semi-humid monsoon climate, herbaceous vegetation, gently undulating plains, and regional hydrological conditions. Typical Black Soils develop thick, dark humus-rich surface horizons over loamy or clayey parent materials, reflecting strong organic matter accumulation and moderate leaching. Related soil types, including Chernozems, dark brown

forest soils, meadow soils, albic soils, and brown soils, differ markedly in climate, vegetation, drainage, carbonate accumulation, gleyic features, argilluviation, and profile differentiation. Representative soil profiles show systematic variation in horizon sequence, color, structure, bulk density, root distribution, pH, carbonate reaction, redox mottling, and clay or iron-manganese coatings, indicating diverse pedogenic pathways across Northeast China.

The classification of these soils is discussed within both genetic and diagnostic frameworks. The Chinese genetic soil classification system emphasizes soil-forming factors, processes, and profile characteristics, while Chinese Soil Taxonomy and American Soil Taxonomy rely on diagnostic horizons, diagnostic properties, and quantitative criteria. Comparison with the former Soviet genetic classification further demonstrates the historical influence of Dokuchaev's soil-forming theory on the interpretation of Black Soils. Overall, Northeast China Black Soils should be understood not as a single homogeneous soil unit, but as a soil assemblage formed under distinct combinations of climate, vegetation, parent material, relief, and hydrology. Clarifying their genesis and classification provides a scientific basis for soil survey, land evaluation, Black Soil conservation, and sustainable agricultural management in this globally significant region.

CZU 631.4

THE AGE OF CHINESE BLACK SOILS

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Summary Accurately determining the age of Black Soils (Mollisols) is fundamental to understanding their formation and assessing the sustainability of this critical resource. While radiocarbon (^{14}C) dating of soil organic matter and luminescence dating of parent material are widely used, their conventional application often fails to reveal the true formation age due to signal averaging caused by processes like pedoturbation.

To overcome these limitations, this research highlights two promising pathways: ^{14}C dating of closed-system materials (e.g., charcoal, buried paleosols) and single-grain luminescence dating to quantify pedoturbation. Evidence from these complementary approaches indicates that the Black Soils of Northeast China initiated formation during the Last Deglaciation—significantly earlier than the previously held Holocene-centric view. Moving forward, the broader application of this integrated methodological framework is essential to refine pedogenetic models and to scientifically guide the long-term conservation and sustainable use of these vital soils.

CZU 631.147/.15

AGRICULTURE IN FRONT OF TRANSFORMATIONS

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Summary The industrial approach to agriculture intensification based on using of nonrenewable sources of energy and their derivates known under the name of green revolution" didn't provide a sustainable development of agriculture from economic, ecologic and social points of view. Agriculture is at the crossroad. Farmers in all over the world are looking for innovative, alternative farming systems such as: conservation/regenerative systems of agriculture, organic agriculture etc.

A new model of agricultural development should replace the dominating reductionistic (simplistic) approach by systemic one as well as to prevent causes but not to control the created consequences. For example, the lack of crop rotation is compensated by an extra amount of mineral fertilizers for crop nutrition and pesticides for weed, pest and disease control; by an increased numbers of mechanical soil disturbances etc. One of the most acute problems in modern agriculture is the discrepancy between the amount of carbon taken up during the mineralization of soil organic matter for yield formation and the amount of carbon returned to the soil with crop residues, organic fertilizers and other organic amendments. So, sustainable and resilient management of Chernozem soils is determined by sustainable management of soil organic matter. Data from the long-term field experiments conducted at the National Center for Research and Seed Production, Selectia sector are proving this statement.

CZU 504.5:631.4

BIODEGRADABLE MICROPLASTIC-DERIVED CARBON AND ITS IMPACTS ON SOIL CARBON CYCLING

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Summary Biodegradable microplastics influence soil carbon (C) cycling not only by supplying degradable polymer-derived C but also by reshaping the microbial communities that process it. Their surfaces function as dynamic plastic-C release interfaces, supporting microbial succession from primary degraders to secondary consumers and necromass utilizers. Bacteriophages further regulate this process by controlling microbial mortality, metabolism and community composition through lysis, lysogeny and auxiliary metabolic genes. These virus–host interactions redistribute plastic-derived C among microbial biomass, dissolved organic carbon, necromass and CO_2, thereby affecting both C sequestration and C loss. Understanding this plastic–microbe–phage network is essential for predicting the long-term effects of biodegradable microplastics on soil carbon cycling and ecosystem functioning.

CZU 631.58:631.41

eAGRONOM SUPPORTS REGENERATIVE FARMING PRACTICES THROUGH THE CARBON SEQUESTRATION PROGRAM

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Summary eAgronom is a Baltic-founded agri-climate technology company with a mission to accelerate the adoption of regenerative farming practices across Europe and beyond. While agriculture is one of the major sources of global emissions today, it also represents an opportunity for removing CO_2 from the atmosphere - soils constitute the largest carbon sink outside the oceans, with scientists estimating they can sequester over a billion additional tonnes of carbon per year. eAgronom's carbon program guides farmers in transitioning to regenerative farming practices that simultaneously restore soil health and generate additional farm income through carbon credits.

The agronomic principles of the program rest on two main principles: keeping the soil covered and reducing tillage. Cover cropping - growing plants between main crop cycles - protects bare soil from erosion, suppresses weeds and feeds soil biology by continuously supplying fresh organic input. Over time, this builds a stable humus layer that holds more water and nutrients, directly improving yield resilience, particularly valuable in Moldova's increasingly drought-prone continental climate. Reducing or eliminating tillage preserves the soil's physical structure, protecting the networks of fungi, bacteria and earthworms that drive nutrient cycling. Undisturbed soils retain moisture deeper in the profile and develop better aggregate stability, making them more resistant to both erosion and compaction.

Complementing these practices with precision nutrient management and thoughtful crop rotation further reduce input costs while diversifying the organic matter returned to the soil each season - creating an improvement in soil fertility year after year. The result is a farm that becomes progressively more productive, more resilient to weather extremes and less dependent on external inputs, while the carbon sequestered in its soil generates verified credits that provide farmers with an entirely new revenue stream.

CZU 631.459

ECOLOGICAL IMPACTS OF BLACK SOIL DEGRADATION ON BIOTA AND SOIL QUALITY

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Summary Black Soil degradation results in the loss of biodiversity and leads to the deterioration of ecosystem functions. Assessing the intensity of degradation and developing appropriate

restoration approach are two key ecological issues in Black Soil relevant research. In order to accurately assess the influence of degradation, we investigated the influences of degraded grassland with different levels of degradation on soil quality and soil biotic communities.

Soil quality declines significantly along the degradation gradient, with the lowest index recorded in heavily degraded grasslands, followed by moderately degraded (MD) and non-degraded (ND) sites. Soil quality index calculated based on the minimum data sets could effectively assess the effect of degradation on soil biodiversity and ecosystem function. In order to effectively restore degraded grasslands, soil carbon, the key contributor to the soil quality, should be taken on priority basis for revitalizing the soil biodiversity and ecosystem function. We further conducted a three-year soil inoculation experiment at a degraded grassland using two different soil inocula from MD and ND grasslands. We found that soil inoculation steers the soil bacteria, fungal and plant communities at the inoculated site into different directions. Soil quality index increases with inoculation years and higher soil quality index is found in ND soil inoculation plots. Our findings emphasize the specific effects of donor soil on soil bacterial, fungal as well as plant communities and that the direction of development depends on the origin of soil.

CZU 630:631.61

ECOLOGICAL REHABILITATION OF DEGRADED LANDS THROUGH AGRO-FORESTRY AND SILVO-PASTORAL PRACTICES

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Summary In order to improve the ecological and microclimatic situation on the agricultural fields of Moldova, various forest curtains have been created, which are distinguished:

(1) According to the purpose for which they were created: anti-erosion protection; protection against winds; protection of valley banks; protection of ravine banks; with sanitary and hygienic functions; protection of various balneological objects; protection of waters; protection of meadows.
(2) According to the place of creation, protective forest curtains are distinguished located: on agricultural arable fields; in orchards and fruit plantations; in vineyards; along roads and railways; around objects of particular importance (sanatoriums, hospitals, resorts, military units, etc.); around and inside localities; on meadows (pastures and hayfields); on water bodies; on other lands.
(3) By consistency or density: compact or impenetrable curtains (they do not let the wind pass through them, creating an area of absolute calm behind them); semi-penetrable curtains (the wind passes through them, progressively decreasing its intensity, the most recommended type of curtains for field protection); penetrable curtains (the wind penetrates easily, especially below the level of the tree crowns).
(4) According to their structure as a stand: pure curtains, when they are formed from a single species; mixed curtains, when they are formed from several species of trees and shrubs;
(5) According to the nature of the species that compose them: forest curtains, only forest tree and shrub species are used; forest-horticultural curtains, the basic species being forest ones, ornamental species, fruit trees, etc. can also participate in the composition of the afforestation formula; horticultural protective curtains.

(6) Field protection curtains; main curtains, placed perpendicular to the direction of the prevailing wind; secondary curtains placed perpendicular to the direction of the main curtains and thus completing the curtain network in a given perimeter.

The main effects of installing protective forest curtains are to increase the stability and heterogeneity of the agro-landscape, to preserve the relief forms characteristic of the Republic of Moldova and to improve microclimatic conditions by reducing the diurnal amplitude of air temperature. The diversity of the landscape, the presence of trees and shrubs, water sources are of colossal importance as areas of sanitation, aesthetics and recreation. By reducing the speed of the prevailing winds, reducing evaporation and transpiration of plants, increasing the relative humidity of the air, increasing the humidity in the soil, forest curtains protecting the field create an environment conducive to good development of agricultural crops in protected areas and implicitly obtaining a harvest increase compared to agricultural crops in the open field. Forest curtains for field protection have a beneficial influence on agricultural crops in the protected area both by registering an increase in production and by increasing its quality. According to scientific norms, the share of areas occupied by protective forest curtains in the total area of the field is 4-6%. For the Republic of Moldova, it would be necessary to plant protective forest curtains on an area of 40-60 thousand ha.

CZU 631.423

SOIL ENZYMATIC STOICHIOMETRY AS A DIAGNOSTIC TOOL FOR BLACK SOIL DEGRADATION: IMPLICATIONS FOR C AND P CO-MANAGEMENT

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Summary Black Soils are among the most fertile agricultural soils globally, yet they are increasingly threatened by erosion, intensive cultivation, organic carbon depletion and nutrient imbalance. Soil extracellular enzymes mediate the acquisition of carbon, nitrogen and phosphorus by microorganisms, and their stoichiometric relationships may provide an integrated indicator of soil functional degradation and recovery. However, evidence for the response of soil enzyme stoichiometry to Black Soil degradation and restoration remains fragmented across soil types, regions and management practices.

Here, we propose a meta-analysis to synthesize published studies on soil enzyme activities in Black Soils, including Mollisols, Chernozems, Phaeozems and related dark soils. We classify reported enzymes into C-, N- and P-acquiring groups and calculate enzymatic C:N:P ratios, vector length and vector angle to infer microbial nutrient limitation. The analysis compares degraded and restored soils with appropriate controls and evaluates how responses vary with degradation type, restoration practice, soil depth, experimental duration and soil type.

We expect that degradation will disrupt enzyme allocation patterns by reducing carbon availability and altering microbial nutrient demand, whereas restoration practices such as organic amendment, straw return, conservation tillage and vegetation recovery may partially rebalance enzymatic stoichiometry. By integrating enzyme activity data across black soil systems, this study aims to test whether soil enzyme stoichiometry can serve as a sensitive biochemical indicator of black soil degradation and restoration. The synthesis could provide a functional framework

for assessing Black Soil health and may help identify management practices that most effectively restore microbial nutrient cycling and soil ecological function.

CZU 631.459.2

SOIL CONSERVATION IN THE REPUBLIC OF MOLDOVA: EVOLUTION, PROBLEMS, PERSPECTIVES

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Summary Although the Republic of Moldova is predominantly endowed with highly productive chernozem soils, they are affected by a series of destructive natural processes (erosion, landslides, climate change, etc.) as well as human-induced pressures (deforestation and destruction of natural vegetation cover, soil compaction, slope leveling, irrational irrigation, and others). Large-scale soil degradation has been occurring since the beginning of the 19th century, when extensive agricultural land conversion took place and nearly half of the country's forests (initially about 550 thousand ha, or 15–17%) and around 70% of steppe ecosystems were cleared. By the end of the 19th century, natural habitats covered less than 12–13% of the territory. Under these conditions, various soil degradation processes began to manifest and intensify.

A new stage of intensive soil degradation occurred during the socialist period of the Republic's development, which led to an even more advanced conversion of natural habitats. Approximately 300 thousand hectares of steep slopes, river valley lands, and low-productivity areas were transformed into vineyards, orchards, or irrigated zones, many of which later degraded. Against this background, agriculture became increasingly specialized and concentrated; large-scale irrigation systems were constructed, including canal excavation and the irrigation of sloped terrains; heavy machinery was widely used; and natural fertilizers and pesticides were applied irrationally and excessively. All these factors contributed to continuous soil pollution and degradation.

The issues described above, together with the growing awareness of soil degradation in the country, make soil protection and restoration a priority task for society. In this context, it becomes important to assess the historical development of soil conservation activities—not only the technical measures, but primarily the management system behind them. By analyzing the emergence and evolution of soil conservation organization and administration from their beginnings to the present stage, as well as the successes, failures, and impacts of the measures undertaken, a solid factual basis can be established for identifying the most effective ways to improve the soil conservation system and to apply the most efficient approaches and interventions.

This presentation is based on data from the historical archives of Bessarabia, the archives of state institutions in the field (Ministry of Environment, Ministry of Agriculture), scientific organizations (Academy of Sciences), political archives (Communist Party of the MSSR), and, of course, published materials not only from scientific works but also from the mass media.

CZU 631.51:631.4

CONSERVATION SOIL TILLAGE IN THE COOL AREA OF NORTHEAST CHINA

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Summary The cultivated area of Black earth and its annual grain production respectively account for 1/4 of the national total, while commodity grain accounts for 1/3 of the national total, which is of paramount importance to the national food security. Though this area has been relatively recently developed over a 100-year period since the large-scale agricultural reclamation, it went through highly intensive cultivation and rapid succession processes. The cropping changes and poor management choices, the regional sloping topography coupled with a continental climate have led to soil degradation and water runoff. These processes have caused excessive hillslope and soil erosion, which seriously threatens agricultural production and environmental quality in the region. To effectively conserve and utilize the Black earth soils, the national government decreed the First National Black Earth Protection Legislation, and has implemented a series of soil and water conserving projects, especially the conservation soil tillage. However, from the scientific point of view, the key points and critical issues that urgently need to be resolved are not clear. Based on our research group's long-term research and monitoring of Black earth erosion and its impacts on soil quality and grain production, we propose the conservation soil tillage is the priority practice to control of soil and water losses, and identify several urgent problems.

A long-term field experiment initiated in 2004 at the Hailun Agro-ecological Experimental Station, China, with annual air temperature of 1.5°C, and precipitation of 530 mm. Soil quality, carbon dynamics, and agro-ecosystem functions under no-till (NT) and conventional tillage (CT) with corn-soybean rotation were compared. Results demonstrate that long-term NT fundamentally reshapes the soil ecosystem. It significantly enhances surface soil (0-5 cm) aggregate stability (20% increase in MWD) and creates a more connected, less tortuous macro-pore network, and thus improving water infiltration. Nutrient stratification distinctly occurs under NT, with SOC and available nutrients (e.g., NO_3-N, available phosphorus) significantly concentrated in the top 0-5 cm. NT significantly increases the content and alters the size distribution of colloidal phosphorus (Pcoll) throughout the profile, and enhances P mobility. The overall Soil Quality Index for NT is 34% higher than for CT. NT acts as a significant carbon sink, with increased SOC stocks around 37.6-45.2% in the 0-10 cm layer and a sequestration rate of 0.054 t C ha^{-1} yr^{-1} in the 0-20 cm layer compared to a loss under CT. These findings offer a robust scientific support for promoting NT as a cornerstone strategy for the sustainable management and restoration of Northeast China's Black Soils. But soybean yield consistently increases (~7%) ever since the implementation of NT, while corn yield is reduced >15% in the initial 6-7 years and then increases (5%). Famers couldn't accept the corn yield decrease. We found the increased soil moisture of 3 to 5 percentage points and lower soil temperature of 2.1°C in the plowed layer are the dominate reasons of yield decrease under NT in the cool area. A new reduced soil tillage practice (ST) stripping the top ridge to form a loose and warm seed bed was developed. Based on more than 15-yr field trial, similar corn yield was obtained initially compared to CT, and soil quality and crop yield increased slowly with time. Overall, strip tillage is a practice of conservation soil tillage system to synergistically control erosion with improved soil fertility in the cool area of Northeast China.

CZU 631.459.2:504

WATER EROSION OF CHERNOZEMS IN MOLDOVA AND THE CHALLENGE OF NON-POINT WATER POLLUTION: INNOVATIVE ASSESSMENT AND MODELING IN A SMALL RIVER BASIN IN MOLDOVA

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Summary This study addresses the critical environmental issue of water-induced soil erosion of highly fertile Chernozems in the Republic of Moldova and its direct cascading impact on non-point source pollution of surface water systems draining into the Black Sea basin. Focusing on the Baltata River basin - a representative small agricultural watershed of 153.sq.km characterized by intensive land use, low agricultural culture, and a degradation rate exceeding 29%—the research deploys an innovative, multi-scale methodological framework. By integrating traditional monitoring with state-of-the-art technologies, including the SWAT (Soil and Water Assessment Tool), GeoWEPP (Geo-spatial Water Erosion Prediction Project) modeling, satellite remote sensing (Landsat-5 and Sentinel-2 utilizing NDVI [Normalized Difference Vegetation Index] and NDWI [Normalized Difference Water Index] vegetation indexes), UAVs (Unmanned Aerial Vehicles) / drones and sediment fingerprinting methods, the study quantifies sediment budgets and identifies primary pollutant pathways.

The WEPP offsite simulations reveal an alarming average annual sediment delivery to the basin outlet of 5,432 tons per year (0.4 t/ha/yr), with approximately 90% of the generated sediments entering the Dniester River and subsequently driving severe downstream marine eutrophication and hypoxia in the Black Sea. Furthermore, remote sensing and drone mapping highlight that stream bank erosion, catalyzed by riparian zone deforestation and intensive crop production up to the water margins, remains a massive, undocumented contributor to total sediment load. SWAT predictive modeling under varying regional climate change projections (EURO-CORDEX [European Coordinated Regional Climate Downscaling Experiment] scenarios RCP2.6 [Representative Concentration Pathway 2.6], RCP4.5 [Representative Concentration Pathway 4.5], and RCP8.5 [Representative Concentration Pathway 8.5]) foresees highly volatile hydrological responses, indicating that surface runoffs will initially increase by roughly 2% by mid-century but decline by up to 17% by 2071–2100, severely impairing the river's self-purification capacity. To mitigate these pressures, a MCDA (Multi-Criteria Decision Analysis) and an online DSS (Decision Support System) are developed to establish targeted nature-based solutions and best management practices, alongside localized field installations like innovative litter traps.

Acknowledgments: The research is realized in frames of BSB963 project with support of the EU Regional Operational Black Sea Program.

CZU 631.8:631.452

MOLLISOLS FERTILITY RESPONSE TO FIELD MANAGEMENT PRACTICES IN NORTHEAST CHINA

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Summary Mollisols in Northeast China are highly productive but increasingly threatened by intensive cultivation, soil acidification, nutrient imbalance, and declined soil biological function. This presentation summarizes our recent studies on how long-term field management practices in regulating Mollisol fertility, with particular emphasis on integrated mineral fertilization and cattle manure amendment. Our results show that manure combined with mineral fertilizers improves soil organic matter, pH, nutrient availability, maize yield, and nitrogen use efficiency compared with mineral fertilization alone. Metagenomic analyses further indicate that these fertility improvements are closely associated with shifts in microbial functional genes involved in nitrogen transformation, phosphorus solubilization, organic phosphorus mineralization, and nutrient transport. Manure addition enhances both labile and stable phosphorus pools while reducing microbial phosphorus-starvation responses, suggesting an improved nutrient supply capacity and microbial nutrient cycling potential. Overall, sustainable Mollisol management should move beyond single fertility indicators and shopuld focus on coordinated regulation of soil acidity, organic matter, N-P cycling, microbial functions, and crop productivity.

CZU 631.147

ECOLOGICAL AGRICULTURE: ACHIEVEMENTS AND PROBLEMS

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Summary Transformations in the global economy, against the background of the worsening phytosanitary condition of agricultural crops and climate change, in the last decade there has been an increase in the role of organic agriculture and plant health. The achievements recorded in the foundation and implementation of organic agriculture have strengthened the value of organic products through the integrated use of resources and increased interest in ecological indicators. Obtaining and marketing organic products strengthens the ability of collectives and farmers to obtain ecological benefits, which determines the need to transform the value of organic products and the advantages of ecological resources into economic advantages. Systems for obtaining organic products have been established for the main agricultural crops, which has allowed the involvement of a large number of organic companies and operators, the achievement of substantial volumes of products obtained and exported. In the conditions of fierce competition with pesticide producing companies, organic agriculture is faced with various technological and trade organization problems.

To solve problems and avoid frequent risks, researchers in the field of organic agriculture develop and implement effective procedures and means aimed at ensuring the functionality of the field of obtaining organic products, intelligent management of agricultural processes and reducing the gaps between the results of agricultural research and market requirements. In addition to the results of technological research, an important role is played by activities aimed at promoting ideas regarding agricultural culture and organic lifestyle, which are important for maintaining a vigorous rural community and require the conceptualization of a way of life with the predominance of organic agriculture and ensuring rural sustainability.

CZU 631.46:631.147

CONSIDERATIONS ON THE RELATIONSHIP BETWEEN THE SOIL MICROBIOME AND THE DEVELOPMENT OF SUSTAINABLE AGRICULTURE

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Summary Soil biodiversity is increasingly recognized as useful for soil health, but often land use methods and environmental changes affect underground communities worldwide, and the reduction in soil biodiversity caused by this reduces and worsens its benefits. In this regard, one of the ways to increase the positive effect of organic farming can be the synergistic effect of the combination of agricultural technology with the ability of microorganisms to both stimulate plant growth and bioremediation of polluted soils formed as a result of intensive farming.

Using high-throughput sequencing, we studied the taxonomic structure and diversity of prokaryotic communities in long-term fertilized calcareous chernozem. The microbiome was found to consist of 16 bacterial and one archaeal phylum. Ecological assessment using Shannon indices revealed low diversity in the studied treatments: the highest diversity was observed in the natural soil, higher in the NPK treatment compared to the control treatment (CON), higher in the ORG treatment compared to CON, and higher in the ORG treatment compared to NPK. Thus, long-term fertilization of calcareous chernozem resulted in a decrease in prokaryotic diversity, albeit in varying proportions. Global research has revealed a complex relationship between soil microorganisms and the human microbiome, confirming that biodiversity in general, and soil microbial biodiversity in particular, are essential not only for soil health but also for human health. Given this latter concern, it is important to note that preserving and/or enhancing soil microbial diversity is becoming a critical task for humanity in sustaining life on Earth. In this sense, along with improved soil management practices, microbial biodiversity represents an underutilized resource for the development of sustainable agriculture.

Acknowledgments: This study was supported by the research institutional project № 020101 «Innovative biotechnological solutions for agriculture, medicine and environmental protection», financed by the National Research and Development Agency of the Ministry of Education and Science of the Republic of Moldova.

CZU 631.51/.55

UNRAVELING LONG-TERM STUBBLE-RETAINED NO-TILLAGE DRIVEN SOIL QUALITY IMPROVEMENT AND YIELD SUSTAINABILITY IN MOLLISOLS OF NORTHEAST CHINA

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Summary Conventional intensive tillage triggers severe soil organic carbon depletion, structural degradation, and microbial diversity loss in the fertile Mollisols of Northeast China, posing a mounting threat to the long-term sustainability of the soybean-maize rotation system. Conservation tillage has emerged as a promising solution, while the biological mechanisms underlying its yield-enhancing effects-particularly in cold temperate regions constrained by slow spring soil warming-remain largely unresolved.

Based on fixed-site field trial, we evaluated four tillage regimes: deep tillage (DT), shallow rotary tillage (RT), no-tillage without straw retention (NT), and stubble-retained no-tillage (KSNT). By integrating soil physicochemical properties, extracellular enzyme stoichiometry, bacterial/fungal community assembly, co-occurrence network analysis, and a minimum dataset-derived soil quality index (SQI), we disentangled the causal pathways linking tillage practices to crop productivity.

Our results demonstrate that long-term KSNT significantly increased soybean and maize yields by 6.3–8.1% relative to conventional tillage, alongside pronounced improvements in nutrient availability, microbial biomass, and hydrolase activities. KSNT markedly reshaped soil microbial community structure, enhanced α-diversity, and selectively recruited functional beneficial taxa including Sphingomonas, Nocardioides and Trichoderma, which assembled into more complex, stable, and synergistic microbial networks. The SQI was substantially elevated under conservation tillage and exhibited a robust linear correlation with crop yield, serving as a reliable integrative indicator of soil productive capacity.

This study reveals that stubble-retained no-tillage drives yield gains primarily by optimizing soil microhabitats, enriching degrader and growth-promoting microbial consortia, and enhancing holistic soil quality. Our findings provide mechanistic insights and a field-validated tillage paradigm for sustainable Black Soil management in cold temperate agroecosystems, supporting the transition toward eco-friendly and high-yielding agriculture.

CZU 633.34:631.52

SOYBEAN BREEDING AND PHYSIOLOGICAL RESEARCH IN THE BLACK SOIL REGION OF CHINA

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Summary Soybean is a strategic crop for food security and agricultural sustainability in China, with the Northeast Black Soil Region serving as the nation's most critical production base. As the

world's leading area for non-GMO soybean cultivation, this region prioritizes breeding objectives that synchronize high yield with superior seed quality to ensure both market competitiveness and sustainable land use. Our research integrates physiological and molecular approaches to support the development of high-quality and resource-efficient soybean cultivars.

By leveraging advanced breeding techniques, we have successfully developed and registered 10 new soybean cultivars. These include a diverse range of specialized varieties such as high-protein, high-oil, high-isoflavone, and high-sugar (vegetable) soybeans, as well as salt-tolerant types. Notably, the "Zhongke" vegetable soybean series has been extensively adopted by farmers, demonstrating significant practical impact in improving yield stability and nutritional value within the Black Soil region. This work provides a robust foundation for enhancing soybean productivity and fostering international collaboration in sustainable Black Soil farming.

CZU 633.34:631.52

EVOLUTION OF SOYBEAN BREEDING RESEARCH IN MOLDOVA

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Summary Scientific research on soybean began immediately after the establishment of the Breeding Station in Bălți during the post-war period. The initial research activities focused on the establishment of a primary soybean germplasm collection, which served as the foundation for subsequent breeding programs. To this end, expeditions were organized to collect local soybean populations as well as seed material inherited from the Romanian-German Soybean Association ("Soia"). Following the evaluation of the collected genetic resources, the cultivars Dobrujanca, Unguroaica, and Rainer were identified and selected as the primary sources of breeding material.

At the initial stage, the principal objective of the breeding program was the development of indigenous soybean cultivars and their introduction into agricultural production. Breeding activities were primarily focused on achieving the following objectives:

- increasing grain yield potential and improving seed quality;
- enhancing resistance to biotic and abiotic stress factors;
- improving resistance to diseases and pests;
- optimizing morphological and biological traits to ensure suitability for mechanical harvesting;
- adapting to the pedoclimatic conditions in different cultivation zones.

During the first phase of the breeding program, research was directed toward developing multipurpose soybean cultivars suitable for both grain production and forage biomass utilization. The principal breeding method utilized was controlled hybridization. As a result, the first cultivars combining these valuable agronomic characteristics were developed, including Belițcaia 636, Biruința 12, and Belițcaia 25, which were subsequently cultivated on extensive areas throughout the Republic of Moldova.

Beginning in the 1980s, breeding programs were reoriented toward the development of semi-early soybean cultivars characterized by high productivity and superior grain quality. Representative cultivars from this group include Bucuria, Aurica, Scânteia, and Dorința, which demonstrated excellent agronomic and technological performance.

Following the recognition of the global shortage of plant protein by the Food and Agriculture Organization of the United Nations (FAO), soybean breeding research expanded to the development of food-grade cultivars. Within this research direction, particular emphasis was placed on improving the nutritional quality of soybean seeds, especially by increasing protein content and other valuable biochemical constituents. The first cultivars meeting the quality standards required by the food industry were Aura, Horboveanca, and Veronia.

In recent decades, climate change and the increasing frequency of drought conditions have led to a redefinition of soybean breeding objectives. Priority has been given to the development of genotypes with enhanced adaptability to water deficit and heat stress. Simultaneously, these environmental changes have necessitated the optimization of several agrotechnical practices. To develop cultivars with enhanced adaptation to adverse environmental conditions, breeding research has focused on establishing criteria for designing plant architecture capable of maximizing the efficient use of water, solar radiation, and soil nutrients. These cultivars are distinguished by high yield potential, stable performance across diverse growing environments, and superior adaptation to the pedoclimatic conditions of the Republic of Moldova. A major competitive advantage of the soybean cultivars developed at the Institute of Field Crops "Selecția" is that they have been obtained exclusively through conventional breeding methods and therefore belong to the category of non-genetically modified (non-GMO) cultivars.

At present, one of the major priorities of the breeding program is the development of ultra-early soybean cultivars with a vegetation period of 80–90 days, corresponding to maturity group 000. These genotypes are currently being evaluated within breeding nurseries and experimental collections with the objective of identifying highly productive, ecologically stable, and climate-resilient cultivars suitable for both current and future environmental conditions.

CZU 631.417:631.559

SOIL ORGANIC MATTER AND CROP PRODUCTIVITY

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Summary Soil organic matter (SOM) plays a fundamental role in regulating soil fertility and crop productivity. This presentation synthesizes current understanding of the interactions between SOM and crop productivity in arable Mollisols under long-term cultivation.

By integrating evidence from long-term field experiments, regional soil surveys, and process-based modeling, the study reveals how SOM quantity and quality influence soil physical structure, nutrient availability, and biological activity, thereby affecting crop yield and stability. Furthermore, the study quantitatively establishes the threshold relationships between SOM and crop productivity, and evaluates their responses to climate variability.

CZU 633.34:631.15/.16

DONAU SOJA ASSOCIATION: PROMOTING SUSTAINABLE, TRACEABLE AND NON-GM SOYA IN EUROPE AND THE REPUBLIC OF MOLDOVA

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Summary Soybean (*Glycine max* L.) is one of the most important protein crops worldwide, playing a strategic role in ensuring the supply of plant-based proteins. In the Republic of Moldova, the importance of this crop is increasing, although the cultivated areas remain relatively limited. Currently, soybean is grown on approximately 20,000–25,000 hectares, representing about 1.5–2% of the total agricultural land, with production predominantly concentrated in the northern region of the country.

The total annual production ranges between 30,000 and 50,000 tons, this value reflects specific agroecological constraints, particularly the crop's sensitivity to thermal and water stress, especially during critical phenological stages such as flowering and seed filling. In this context, climate change can no longer be considered a potential risk, but rather a limiting factor already affecting production stability.

The plant protein sector in the Republic of Moldova faces a major structural challenge, driven by a high dependence on imports of soybean grain and soybean meal, primarily required for the livestock sector. This dependence creates economic, environmental, and food security vulnerabilities.

At the same time, the domestic production deficit can be viewed as a development opportunity. The steadily increasing demand for plant-based proteins across Europe, for both animal feed and human consumption, as well as for industrial applications, creates favorable conditions for expanding soybean cultivation in the Republic of Moldova. Capitalizing on this potential depends on the implementation of adapted agricultural technologies, access to high-performing and resilient genotypes suited to local pedoclimatic conditions, and effective integration into European value chains and markets.

This is precisely where Donau Soja plays a key role. Founded in 2012 and headquartered in Vienna, Austria, Donau Soja is a European, not-for-profit membership association bringing together farmers, processors, traders, retailers, non-governmental organizations, and policymakers from more than 27 countries across the Danube Region and Europe. Our vision is a sustainable, safe, and European protein supply. Our mission is to support our partners and members in addressing the social, environmental, and economic challenges of soya production and consumption – increasing efficiency, fairness, and sustainability across European food and feed protein value chains.

Moldova is an integral part of our network. Through the ADA (Austrian Development Agency), Strategic Partnership, Donau Soja works directly in the country to strengthen the national agri-food sector through sustainable and traceable non-GM crop systems. We support farmers and agri-businesses, build institutional capacity for non-GMO agriculture at national level, and connect Moldovan producers to European markets. Our work in Moldova is long-term and community-driven: we invest in people, knowledge, and systems that deliver real, lasting change – turning Moldova's soybean potential into a concrete contribution to Europe's protein transition.

CZU 631.445.4:502.1

CHIȘINĂU DECLARATION:

SECURING AND CONSERVING CHERNOZEMS (MOLLISOLS) IN CHINA AND THE REPUBLIC OF MOLDOVA

Participants of the Moldova-China Forum on Black Soil Farming held in Chișinău and Bălți, Republic of Moldova (1-5 September, 2026) are aware about the state of Chernozem soils and agreed on the following:

- Chernozems are an irreplaceable natural resource to both China and the Republic of Moldova. Their conservation is essential not only for maintaining ecosystem integrity, but also for securing long-term food and water resilience.
- Services provided by Chernozems are indispensable to human life and to the ecosystems, particularly agro-ecosystems, on which we all depend.
- Chernozems have largely lost their capacity to deliver ecosystem and social services. Yet they are still the major buffer against climate change – and the only one that we can manage effectively.
- Chernozems are being degraded with their natural productivity declining as soil health deterioration and erosion intensify. However, the many parts played by the soil in assuring public health and well-being are not well appreciated by society at large – and insufficiently studied by the research community.
- Maintenance of soil fertility by preventing soil erosion and ensuring the full return of nutrients and organic matter to the soil (compensating for the loss of soil organic matter through biological mineralization) is much more effective than controlling the consequences of bad agricultural practices.
- Promoting conservation farming systems is crucial for the transition to a more sustainable and resilient agriculture. Long-term field experiments that represent a national treasure house of the skills, experience and fundamental data are essential to develop and support sustainable farming systems.
- The deepening knowledge and exchanging scientific and practical information between both countries is needed to develop sustainable practices of Chernozem management, recovery of its fertility, and carbon fixation.
- Future acts and norms in the fields of agriculture, rural development and the rational use of Chernozems resources in both countries should avoid conflict between the fundamental ecological principles of managing the soil as a living body and the economic interests of the people.

This declaration is endorsed by all participants in Chișinău, Moldova.

CZU 061.12(478):5/6

BRIEF INTRODUCTION TO THE ACADEMY OF SCIENCES OF MOLDOVA

The Academy of Sciences of Moldova (ASM) is a public institution of national importance, autonomous and independent of the state authorities.

The Academy of Sciences of Moldova brings together personalities with outstanding achievements in the fields of research, innovation and culture: titular members (academicians),

corresponding members, honorary members as well as researchers, elected as members of the Scientific Sections of the Academy.

The titular members and corresponding members of the Academy of Sciences are scientists and people of high civic standing, well-known specialists in the field, citizens of the Republic of Moldova, who have distinguished themselves by works of great theoretical or practical value and have contributed considerably to the development of national science and culture. Honorary members of the Academy of Sciences are prestigious personalities from the country and abroad, who have achieved remarkable results in science and culture, support the Academy of Sciences, actively participate in technical and scientific cooperation with organizations in the fields of research and innovation in Moldova.

The activities of the Academy of Sciences of Moldova are organized in three Scientific Sections: **Life Sciences Section, Exact and Engineering Sciences Section** and the **Social, Economics, Humanities and Arts Section**. The Scientific Sections bring together titular and corresponding members, as well as 45 members (researchers) from the specific fields of research, chosen by competition, for a period of 4 years.

The Academy of Sciences is the strategic counsellor of the Government in the fields of science and innovation, publishing the yearly report on the state of science in the country. At ASM, there are seven communication platforms actively promoting scientific dialogue within the academic community and between researchers and society:

"Ecological security in the context of accelerated environmental changes" (coordinator: Acad. Elena Zubcov)

"Food Security and Food Safety" (coordinator: Dr. hab., Prof. Rodica Sturza)

"Economic security, migration and demographic transformations" (coordinators: Acad. Grigore Belostecinic and Acad. Alexandru Stratan)

"Strokes" (coordinator: Acad. Stanislav Groppa)

"New type of coronavirus SARS-CoV-2 and interference with other diseases" (coordinator: Acad. Eva Gudumac)

"Basic sciences for sustainable development of the society" (coordinator: Prof. Vladimir Fomin)

"Education in society" (coordinator: c. m., Prof. Ion GAGIM).

The supreme representative body of the institution is the General Assembly of the Academy of Sciences. The executive body of the Academy of Sciences of Moldova is the Presidium, which organizes and coordinates the activity of the Academy of Sciences according to the Code on Science and Innovation of the Republic of Moldova.

The Academy of Sciences of Moldova collaborates with many partners at national and international levels promoting science-related activities beneficial for the society and integration in the European Research Area.

CZU 631.521.1/.5:061.6(478)

BRIEF INTRODUCTION TO THE NATIONAL CENTER FOR RESEARCH AND SEED PRODUCTION (NCRSP)

NCRSP is a public institution created by merging of two institutions: Institute of Crop Science "Porumbeni" and Research Institute of Field Crops "Selectia", according to the Government Decision nr.791 from 18.10.2023.

The main objectives of the NCRSP are:

Creation and valorification of genotypes with ecological adaptation based on the requirements for different regions taking in consideration climate changes and higher diversity of varieties and hybrids from different groups of maturity and directions for extending them in production.

The development and improvement of technologies for seed production according to the European standards OECD and ISTA.

Production of seeds for hybrids and varieties of high quality and parental forms in order to provide seed producers and agricultural producers.

Studying and elaboration of sustainable farming systems, technologies and technological elements of growing field crops in order to reduce the hydrological and thermic risks for a more efficient valorification of water resources from atmospheric precipitation and from the soil.

Each sector is specialized in breeding, seed production and working out technologies for:

corn and sorghum – Porumbeni sector

winter wheat, winter barley, spring barley, peas, soybean and common bean, sunflower, sugar beet etc. – Selectia sector

Former Selectia Research Institute of Field Crops is conducting more than 60 years long-term field experiments on crop rotations and permanent cropping; polyfactorial experiment on action and interaction between different crop rotations, systems of soil tillage and fertilization without using chemical means for crop protection against weeds, pests and diseases control almost 40 years; long-term field experiment on conservation/regenerative agriculture over 7 years on Chernozem soils of the Balti steppe.

CZU 061.2:631.445.4

BRIEF INTRODUCTION TO ANSO-WORLD MOLLISOLS ASSOCIATION

The World Mollisols Association (WMA), established in January, 2011, was initiated by Xiaobing Liu, Xingyi Zhang, the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences, China; Richard M. Cruse, C. Lee Burras, Iowa State University, USA; Yuriy S. Kravchenko, University of Life and Environmental Sciences of Ukraine, Ukraine; Ted Huffman, Agriculture and Agri-Food Canada, Ottawa, Canada; Bingcheng Si, University of Saskatchewan, Saskatoon, Canada; Artigas Duran, Faculty of Agronomy, Universidad De LaRepublica, Uruguay; Guillermo A. Studdert, Faculty of Agricultural Sciences, UNMdP, Argentina. In December 2019, WMA was officially selected as the member of Alliance of International Science Organizations (hereinafter as ANSO).

The current president of ANSO-WMA is Prof. Xiaobing Liu. The vice presidents are Prof. Richard M. Cruse from Iowa State University, Prof. Yury S. Kravchenko from the National University of Life and Environmental Sciences of Ukraine, Prof. Miguel Angel Taboada from the Institute of Soil Science, the Argentine Academy of Agriculture and Animal Husbandry Technology, and Prof. Xingyi Zhang from the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. The secretary general is Prof. Yueyu Sui from the Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences. In December 2022, the WMA Chinese Research Council was established, and Prof. Ganlin Zhang from Institute of Soil Science, Chinese Academy of Sciences was elected as the president.

The Host institution is Northeast Institute of Geography and Agroecology, Chinese Academy of Sciences.

Currently, ANSO-WMA has 29 member institutions from Argentina, Austria, Australia, Canada, China, Czech, Kazakhstan, Moldova, Russia, Ukraine, Uruguay, and USA. Since the

foundation of the ANSO–WMA many activities have been realized including international workshops; field scientific investigations on Mollisols; scientific publications; building resource database information etc.

The project granted to ANSO–WMA, international cooperation partnership program of Chinese Academy of Sciences, titled: "Mechanism and Control of World Mollisols Degradation" (No. 131323KYSB20210004) with involvement of scientists from Argentina, Australia, China, Russia, Ukraine and USA is developing a quantitative diagnostic criterion for world Mollisols degradation. It is supposed to propose new technologies for preventing and controlling erosion and degradation for sloping farmland.

CZU 061.6:911.2+631.95(510)

BRIEF INTRODUCTION TO THE NORTHEAST INSTITUTE OF GEOGRAPHY AND AGROECOLOGY, CAS

The Northeast Institute of Geography and Agroecology (IGA), Chinese Academy of Sciences (CAS) was formed by merging the former Changchun Institute of Geography and the Heilongjiang Institute of Agricultural Modernization in March 2002. It is a comprehensive research and training base specialized in geography, agriculture, ecology, environmental science and technology.

The institute provides solid scientific foundations for national strategies on food security, ecological security and the implementation of the Revitalization of Old Northeast Industrial Base. IGA has made great achievements in many fields. It established the theory of China's wetland discipline, discovered the processes of wetland formation and evolution, developed key technologies for restoration of degraded salt marshes and the compound ecological paradigm of the Reed-Crab/fish-Rice, elucidated the degradation mechanism of Black Soil, cloned gene E1 which controls the flowering of soybean and gene J which regulates soybean yield and established the theoretical scheme of soybean molecular design breeding and the soybean gene bank with huge capacity.

IGA developed and demonstrated key technologies of low yield farmland management, fast restoration of climax vegetation on sodic lands and large-scale rice planting and soil improvement in saline-sodic lands and crop planting mode with high light efficiency. IGA joined a massive research campaign to evaluate and tackle Black Soil degradation in 2021, creating new crop varieties and farming equipment that can ensure the sustainability and productivity of this fertile land. Its efforts have led to discoveries and breakthroughs in Black Soil conservation and use, cementing China's position as the leader in global Black Soil research since 2021. IGA houses the Key Laboratory of Wetland Ecology and Environment, CAS, the Key Laboratory of Black Soil Agroecology, CAS, the Key Laboratory of Soybean Molecular Design Breeding, CAS, the Center of Remote Sensing and Geographic Information and the Regional Development Research Center of Northeast China.