ADOP 2023

Third International Conference on
**Agriculture Digitalization
and Organic Production**
ADOP 2023

Conference Programme and Abstracts

June 5–7, 2023
St. Petersburg
Russia

СПб ФИЦ РАН

Springer

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Conference at a glance

Monday, June 5, 2023		
09:00-10:00	**On-line Registration**	
10:00-10:15	**Opening Ceremony (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Andrey Ronzhin**	
10:15-12:15	**Plenary Session 1 (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Andrey Ronzhin**	
	Keynote lecture 1: *Alexander Kostyaev.* Socio-Economic Problems of Digital Transformation of Rural Areas	
	Keynote lecture 2: *Andrey Ivanov and Igor Savin.* Digital Technologies for Optimizing the use of the Resource Potential of Russian Lands in Agriculture	
	Keynote lecture 3: *Sergey Pulnikov.* From Consumer to Investors – Digital Cooperation for the Mobilizational Economy of Russia	
	Keynote lecture 4: *Elena Semenova.* Problems of Marketing of Organic Agricultural Products	
12:15-12:30	**On-line Joint Photography of Conference Participants** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09	
12:30-14:00	**Lunch break**	
14:00-16:00	**Oral Session 1: Strategic and Regional Factors of Organic Production (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Galina Nikonova**	**Oral Session 2: Interdisciplinary Aspects of Organic Agriculture (room 406)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Evgenia Rakhimova**
16:00-16:30	**Coffee break**	
16:30-18:00	**Oral Session 3: Approaches to the Production of Organic Agricultural Products (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Vladimir Surovtsev**	**Oral Session 4: Opportunities, Limitations and Digital Aspects of Organic Production (room 406)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Abusupyan Dibirov**
18:00-20:00	**Social event**	
Tuesday, June 6, 2023		
10:00-12:30	**Plenary Session 2 (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Alexander Kostyaev**	
	Keynote lecture 5: *Gantulga Gombo.* Topical Issues and Problems of the Development of the Agricultural Sector of Mongolia, the Need for the Introduction of Smart Farming Technologies	
	Keynote lecture 6: *Viktor Yakushev.* Theoretical Foundations and Tools for Detecting Intra-Field Heterogeneity for Precision Farming	
	Keynote lecture 7: *Alexey Dorokhov and Alexey Sibirev.* Robotic Systems in Vegetable and Potato Breeding and Seed Production	
	Keynote lecture 8: *Roman Nekrasov.* Role of Feed Adaptogens in Forming the Concept of Organic Pig Production	
	Keynote lecture 9: *Elena Chertina and Irina Kvyatkovskaya.* Digital Technologies for Environmental Management Question and Protection of Aquatic Biological Resources: Scientific Aspect	

12:30-14:00	Lunch break	
14:00-16:30	**Oral Session 5: Robotics and Digital Technologies in Agriculture (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNIp4UT09 **Chair: Anton Saveliev**	**Oral Session 6: Robotics and Digital Technologies in Aquaculture and Environmental Management (room 406)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNIp4UT09 **Chair: Roman Meshcheryakov**
16:30-17:00	**Closing Ceremony (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNIp4UT09 **Chair: Andrey Ronzhin**	
Wednesday, June 7, 2023		
10:00-18:00	**Technology demonstration of SPC RAS**	

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	Valentina Kundius and Noov Bayarsukh. Organic Agriculture as a Strategic Factor of a New Quality of Economic Growth
	Natalya Nikonova. Global Trends in the Production and Consumption of Organic Products
	Natalya Zaruk, Yuliya Romantseva, Maria Kagirova, Muzaffar Aramov, and Shukhrat Zhumaev. Analysis of the State and Location of Organic Crop Production in Australia
	Aleksey Nikonov. Improving the Competitive Strategies of Organic Agricultural Producers
	Galina Nikonova, Svetlana Timoshenko, and Habas Bekulov. About Staffing the Production of Organic Products in Russia
	Aleksandr Nesmyslenov. Methodological Approach to the Assessment of the Development Opportunities of Organic Plant Production – Regional Aspect
14:00-16:00	**Oral Session 2: Interdisciplinary Aspects of Organic Agriculture (room 406)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Evgenia Rakhimova**
	Magomed Chabaev, Zhenis Ramazanov, Roman Nekrasov, and Evgenia Tuaeva. Improving the Quality of Haylage as Part of the Strategy of Organic Production of Livestock Products
	Yan Li and Viktar Lemiasheuski. Review of Publications on the Study of Poultry Manure Problems in Environmental Pollution and Its Reuse
	Astghik Pepoyan, Vardan Tsaturyan, Vardges Manukyan, Ivan Egorov, and Larisa Ilina. Novel Probiotic Lactiplantibacillus Plantarum Str. ZPZ as a Possible Candidate for "One Health" Probiotic
	Georgiy Laptev, Valentina Filippova, Larisa Ilina, Elena Yildirim, Darya Turina, Elena Gorfunkel, Andrey Dubrovin, Veronika Melikidi, Kseniya Kalitkina, Irina Kluchnikova, Ekaterina Ponomareva, Dmitriy Gromov, and Jie Zhu. Influence of Glyphosate Herbicide on the Functional State of the Poultry Intestine Microbiome
	Jan Puhalsky, Svyatoslav Loskutov, Anton Savelyev, Jacob Shiffon, Gleb Postnikov, Polina Kaushan, and Mikhail Vinogradov. Prospects for the Use of

	Additives in the Form of Fly Ash and Coke Breeze in the Creation of Soil Mixtures for Growing Plants
	Ludmila Bakina, Marina Chugunova, Alexander Gerasimov, and Yulia Polyak. Efficiency Evaluation of the Rehabilitation of Oil-contaminated Agricultural Soddy-podzolic Soils
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	Konstantin Ostrenko, Natalia Nevkrytaya, Anastasia Ovcharova, Ivan Kutyin, and Kirill Koltsov. Effect of Essential Oils of Coriander and Fennel on the Nonspecific Resistance of Dairy Calves
	Nadezhda Bogolyubova, Roman Nekrasov, Aloyna Zelenchenkova, Roman Rykov, Nikita Kolesnik, Natalia Volkova, Anastasia Vetokh, and Julia Bogolyubova. Metabolic Processes Indicators in Chickens of Different Productivity Directions and Their Relationship with the Composition of Muscle Tissue
	Ivan Perov, Kiro Petrovski, and Esmaeil Ebrahimie. Differences in Milk Production Curves on Ten Dairy Farms with Automated and Conventional Milking System in South-East Australia
	Mehak Rai Sethi, Vandana Singh. Sowing the Seeds of Change: a Study of Technology and Plant Breeding in Indian Agriculture from Stakeholder Perspectives
16:30-18:00	**Oral Session 4: Opportunities, Limitations and Digital Aspects of Organic Production (room 406)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Abusupyan Dibirov**
	Khapsat Dibirova. Opportunities and Constraints for the Development of Organic Production in Small-scale Farms in the North-West of Russia
	Petr Akmarov, Olga Abramova, Olga Knyazeva and Ekaterina Alypova. Development of the Labor Potential of Agricultural Production on the Basis of Improving the Digital Competencies of the Rural Population
	Lyubov Vinnichek and Nadezhda Smelik. Research of Regional Shifts in the Provision of Information Technologies
	Georgiy Laptev, Elena Yildirim, Larisa Ilina, Ekaterina Ponomareva, Kseniya Kalitkina, Darya Turina, Valentina Filippova, Andrey Dubrovin, Khairullamin Bashir, Tatyana Smetannikova, Ivan Malakhov, Natalya Novikova, and Michael Romanov. Effect of a Probiotic Strain Administration in Different Feeding Phases on α- and β-diversity and Gene Expression of the Rumen Microbiome in Lactating Cows
	Sophya Popletaeva, Denis Erokhin, and Vitaly Dzhavakhiya. Comparison of the Protective Activity of Elicitor Proteins MF2 and MF3 Applied Individually or in Combination Against Tobacco Mosaic Virus on Tobacco Leaves
18:00-20:00	**Social event**

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14:00-16:30	*Viktor Smelik, Alexandr Perekopskiy and Anton Zakharov.* Prerequisites and Effectiveness of the Introduction of Precision Farming Elements in the Sowing of Grain Crops
	Marina Astapova and Mikhail Uzdiaev. Classification and Segmentation of Agricultural Land Using Linear Discriminant Analysis for Soil Sensors Installation
	Vera Riksen and Vladimir Shpak. Deep Convolutional Neural Network Model for Weed Identification in Oil Flax Crops
	Lyubov Illarionova, Konstantin Dubrovin, Alexey Stepanov, and Tatiana Aseeva. Using NDVI Time Series for Interannual Cropland Classification in the Khabarovsk District
	Alena Zakharova and Aleksandr Podvesovskii. Model for Optimization of Heterogeneous Cargo Transportation Using UAVs, Taking into Account the Priority of Delivery Tasks
	Kantemir Bzhikhatlov and Inna Pshenokova. Intelligent Spraying System of Autonomous Mobile Agricultural Robot
	Peter Kazakievich, Dmitry Komlach, Anton Yuryn, and Alexander Verabei. Optical-Electronic System for Apple Sorting Line: Development and Implementation
	Svetlana Ulbasheva, Dmitry Vorobyev, Natalia Statsyuk, and Maria Kuznetsova. Pre-Planting and Post-Harvest Treatment of Potato with Low-Frequency Pulse Electric Field Suppresses the Development of the Leaf and Tuber Blight
	Aslan Leshkenov and Vladislav Shuganov. Resource-Saving Spraying Method Using the "Agroprotector-Robot"
	Maad Al-Rukabi, Vladimir Leunov, Ivan Tarakanov, Tatiana Tereshonkova, Alexander Khovrin, and Alexander Selyansky. Reaction of Tomato Hybrids to Different Ripeness in Conditions of a Multi-tube Hydroponic, Soil and Lighting Options

14:00-16:30	**Oral Session 6: Robotics and Digital Technologies in Aquaculture and Environmental Management (room 406)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Roman Meshcheryakov**
	Alexander Bekarev, Evgeny Ivashko, and Valentina Ivashko. Aquaculture Digitalization: Polling Karelian Fish Farmers
	Evgeny Savinov and Evgeny Ivashko. Modern Systems for Non-Contact Fish Weighing. A Review
	Roman Meshcheryakov, Konstantin Rusakov, Gleb Tevyashov, and Aleksej Myshkin. Detection and Characterization of Caviar Using a Neural Network Algorithm
	Andrey Lazukin, Anton Saveliev, Konstantin Krestovnikov, Nikita Volchenko, and Sergey Maslennikov. Automated Coastal Monitoring of Aquaculture Areas Using Microbial Fuel Cell Technology
	Andrey Ronzhin, Elchin Khalilov, Andrey Lazukin, Anton Saveliev, Zhenlin Ma, and Min Wang. Theoretical and Technological Foundations for Water Blooming Prevention Using Laser Radiation
	Elchin Khalilov, Yubao Li, Farid Khalilov, Elmar Allahverdiyev, Javanshir Talai, and Anar Khalilov. Experience in Using Magmatrix Technology to Increase Productivity of Plants
	Natalya Sevostyanova, Elena Shkodina, Olga Trezorova, and Maria Zhukova. Effect of Laser Radiation on the Growth and Yield of Forage Grasses
	Victor Gornyy, Olga Balun, Andrei Kiselev, Sergei Kritsuk, Iscander Latypov, and Andrei Tronin. Signs of a Significant Endogenous Component in the Thermal Regime of Soils on Agricultural Lands of the Novgorod Region
	Rashid Kurbanov, Natalia Zakharova, Maxim Litvinov и Alexander Fokin. Identification of Sosnovsky's Hogweed Plants According to Aerial Photography
16:30-17:00	**Closing Ceremony (room 401)** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair: Andrey Ronzhin**
Wednesday, June 7, 2023	
10:00-18:00	**Technology demonstration of SPC RAS**

Abstracts

Plenary Session 1
Keynote lecture 1

Alexander Kostyaev, Chief Researcher of the SPC RAS, Doctor of Economics, Professor, Academician of the Russian Academy of Sciences, St. Petersburg, Russia.

Lecture Title: Socio-Economic Problems of Digital Transformation of Rural Areas.

Abstract: Digital transformation is considered as a restructuring based on digital tech-nologies and large databases of the entire management system of rural devel-opment, including goals, strategies, models, operations, marketing approaches, etc. Socio-economic problems of digital transformation of rural areas are consid-ered in connection with the scale of the Russian Federation and interregional features of the demographic structure of its population. Long distances be-tween small rural settlements hinder the solution of the problem of their access to the Internet and mobile communications. The increased costs for rural areas make them unattractive for commercial structures. According to Western re-searchers, the digital divide between villages and cities is insurmountable and even intensifies, and socio-economic factors become decisive in the digital transformation of rural areas. Social, socio-demographic, economic and normative-institutional factors, due to their multidimensional nature, act as both drivers and barriers to the digital transformation of rural areas, which, in turn, has both a positive and negative impact on rural areas in socio-economic terms.

Keynote lecture 2

Andrey Ivanov, Director of the V.V. Dokuchaev Soil Science Institute, Doctor of Biological Sciences, Professor, Academician of the Russian Academy of Sciences, Moscow, Russia.

Igor Savin, Chief Researcher of the V.V. Dokuchaev Soil Science Institute, Doctor of Agricultural Sciences, Professor, Academician of the Russian Academy of Sciences, Moscow, Russia.

Lecture Title: Digital Technologies for Optimizing the use of the Resource Potential of Russian Lands in Agriculture.

Abstract: In order to prevent a decrease in the economic efficiency and competitiveness of Russian agricultural production, as well as to optimize the use of the resource potential of land, accurate, operational, and low-cost technologies for inventory and monitoring of land, as well as assessing their quality and planning rational agricultural land use are needed. Their creation and improvement at the present stage of the development of science is impossible without the use of digital and remote technologies, as well as computer spatial modeling. Development of digital mapping methods and monitoring of soils and lands based on satellite data and data obtained from UAVs, assessing the resource potential and potential crop yields, development of scenarios for rational use of land in agriculture and modeling of possible changes in land quality as a result of trends in technological development of agriculture and observed and forecast climate and soil changes they can be considered as the basis for a new scientific direction – digital land use. The introduction of modern digital technologies will increase the efficiency of agricultural production and the full exploitation of the resource potential of the lands of Russia.

Keynote lecture 3	
	Sergey Pulnikov, Chairman of the Board of ACC "Smartorg.Tyumen", The head of LLC AC "Rusich", Candidate of Technical Sciences, Tyumen, Russia. **Lecture Title:** From Consumer to Investors – Digital Cooperation for the Mobilizational Economy of Russia. **Abstract:** The report presents the results of the analysis and assessment of the current state of the cooperative system, reveals the existing acute problems of resource management. It is shown that the digital transformation of cooperation will make the process of managing collective forms open, operational and will allow flexible management of the economy and distributed resources of the state. Two developing trends in the digital transformation of rural areas, promising and for future periods, are considered. This is the use of information and communication technologies to find a place of residence and a place of work and to ensure the direct participation of geographically dispersed citizens in making important collective decisions by using online voting.
Keynote lecture 4	
	Elena Semenova, Head of the All-Russian Research Institute for the Organization of Production, Labor and Management in Agriculture – Branch of the Federal State Budgetary Research Center for Agrarian Economics and Social Development of Rural Territories of VNIIESH, Doctor of Economics, Moscow, Russia. **Lecture Title:** Problems of Marketing of Organic Agricultural Products. **Abstract:** Domestic and foreign experience in the use of marketing tools for organic agricultural products is summarized. The main directions and errors in the use of marketing tools in the introduction of organic agricultural products to the market were considered: determining the type of demand for organic products, choosing criteria for allocating a consumer segment and determining its size; life cycle phase planning for organic products; interrelated combination of elements of the 4R marketing complex; evaluation of the effectiveness of marketing programs. The use of matrix methods in forecasting the development of the organic products market is proposed.

Plenary Session 2
Keynote lecture 5

Gantulga Gombo, Chief Scientific Secretary of the Mongolian Academy of Agrarian Sciences, Professor of the Faculty of Engineering and Technology of the Mongolian University of Natural Sciences, Doctor of Technical Sciences, Ulaanbaatar, Mongolia.

Lecture Title: Topical Issues and Problems of the Development of the Agricultural Sector of Mongolia, the Need for the Introduction of Smart Farming Technologies.

Abstract: In recent years, the Government of Mongolia has been paying great attention to the development of agriculture by increasing its productivity and economic efficiency using environmentally friendly working methods and adaptation to climate change. Attention is also paid to the development of organic farming in order to produce environmentally friendly, healthy food in sufficient quantities for Mongolia to become an exporting country of organic food. Due to global warming, there are obvious negative consequences for the development of this sector, such as ecological imbalance, degradation of pasture resources and vegetation cover, and a decrease in soil fertility. For the rational solution of these problems, it is necessary to develop and implement modern technologies of smart farming in the practice of agriculture. Currently, researchers at the Mongolian University of Natural Sciences are successfully implementing several research projects on the development and implementation of technologies for digitalization of agriculture in Mongolia. There is a good prospect of developing and expanding export-oriented healthy and regulatory-compliant organic products, as well as expanding the practice of organic farming through the use or disclosure of Mongolia's unique biological and natural resources and diversity, as well as developing and expanding export-oriented organic products that support health and regulate.

Keynote lecture 6

Viktor Yakushev, Head of the Adaptive Agrotechnology Modeling Department of the Agrophysical Research Institute, Doctor of Agricultural Sciences, Professor, Academician of the Russian Academy of Sciences, St. Petersburg, Russia.

Lecture Title: Theoretical Foundations and Tools for Detecting Intra-Field Heterogeneity for Precision Farming.

Abstract: Precision agriculture (PA) is generally recognized as a global trend in the adaptation of crop production technologies to the intra-field variability of controlled productivity factors. The justified application of agricultural methods of PA is impossible without a quantitative assessment of the intra-field variability of indicators affecting the quantity and quality of the crop. The degree of variation (range) of intra-field heterogeneity determines the expediency and effectiveness of a differentiated approach to the cultivation of agricultural crops in a particular territory. The report presents the theoretical, methodological, and algorithmic foundations for identifying intra-field variability for the purposes of PA based on remote Earth remote sensing (ERS) data. A functional has been created for the implementation of two new methods for detecting and isolating the boundaries of intra-field heterogeneity according to remote sensing data. One of them uses geostatistical tools, and the other is based on a comprehensive assessment of the dynamics of changes in the optical characteristics of sowing. The prospects of scaling the results obtained in modern agriculture are assessed.

Keynote lecture 7	
	Alexey Dorokhov, Deputy Director for Scientific and Organizational Work, Chief Researcher of the Federal Scientific Agroengineering Center VIM, Doctor of Technical Sciences, Professor, Academician of the Russian Academy of Sciences, Moscow, Russia. **Alexey Sibirev,** Head of the Laboratory "Machine Technologies for Cultivation and harvesting of open-ground vegetable crops", Senior Researcher at the Federal Scientific Agroengineering Center VIM, Candidate of Technical Sciences, Moscow, Russia. **Lecture Title:** Robotic Systems in Vegetable and Potato Breeding and Seed Production. **Abstract:** As part of the implementation of the Strategy for the Development of the Information Society in the Russian Federation for 2017-2030, the FGBNU FNAC VIM is improving technologies and equipment with digital control systems for the production of virus-free seed material of vegetable crops and potatoes, high reproductions, resistant to mechanical damage, accelerated transfer of breeding work, original, elite and reproduction seed production of potatoes and vegetable crops to a modern organizational and technological level with the introduction of energy-efficient machines with digital control and management systems: module on accelerated propagation of potato minitubers and vegetable crops; control system for irrigation of a technological module with a control spectrum of irradiation in the production of potato minitubers and vegetable crops; robotic platform for removing infected potato and vegetable plants; automatic planting machine for selection and seed production of potatoes; a device for evaluating the suitability of potato tubers for mechanized harvesting; a line for post-harvest processing of onions, carrots, red beets and potatoes with an automatic control system; robotic platform for storage of potatoes and vegetable crops.
Keynote lecture 8	
	Roman Nekrasov, Head of the Department of feeding farm animals of the L.K. Ernst Federal Research Center for Animal Husbandry, Doctor of Agricultural Sciences, Podolsk, Russia. **Lecture Title:** Role of Feed Adaptogens in Forming the Concept of Organic Pig Production. **Abstract:** One of the priorities of the Strategy for Scientific and Technological Development of the Russian Federation (approved by Presidential Decree No. 642 of December 1, 2016) is the transition to a highly productive and environmentally friendly agriculture. An important aspect of organic livestock production is to reduce the impact of stress factors on the animals. Therefore, there is an urgent need to develop effective and sustainable management approaches to mitigate the negative effects of stress and increase feed conversion efficiency while producing higher quality pork. A promising solution could be the use of natural biologically active substances with pronounced antioxidant properties, which can through stabilization of free-radical oxidation increase the adaptation properties of the body to the effects of environmental stressors. The action of natural bioflavonoids (dihydroquercetin) as well as in complex with vitamins on the organism of fattening pigs during the periods of stress of various etiology (climatic, fodder, transport, social, etc.) was studied. A complex including vitamin C, vitamin E and dihydroquercetin has been developed. The provisions of the method of feeding pigs as a way to reduce the negative impact of stress factors on meat quality by studying nutritional factors have been experimentally studied.

Keynote lecture 9	
	Elena Chertina, Director of the Scientific and Educational Center of Professional Competencies of the Astrakhan State Technical University, Candidate of Technical Sciences, Associate Professor, Astrakhan, Russia. **Irina Kvyatkovskaya,** Vice-Rector for Academic Affairs of the Astrakhan State Technical University, Doctor of Technical Sciences, Professor, Astrakhan, Russia. **Lecture Title:** Digital Technologies for Environmental Management Question and Protection of Aquatic Biological Resources: Scientific Aspect. **Abstract:** The current stage of the fisheries industry development is characterized by the widespread introduction of digital solutions. Digital transformation has touched upon environmental management and protection of aquatic biological resources. For the Lower Volga, for the Astrakhan region, the tasks of environmental monitoring, conservation of natural features and biodiversity under the conditions of anthropogenic load have recently become especially relevant. The legislation strictly regulates the rules and restrictions in fisheries, recreational fishing, and environmental monitoring. However, compliance controls and enforcement mechanisms are not sufficiently supported by digital technologies, especially when integrating structured and unstructured information from various disparate and loosely connected data sources is required. To effectively respond to these questions, new approaches are required using up-to-date information and telecommunication technologies. This report recapitulates scientific research and development activities Astrakhan State Technical University has been carrying out in this direction.

Oral Session 1: Strategic and Regional Factors of Organic Production

Valentina Kundius, Altai State Agrarian University, Barnaul, Russia.
Noov Bayarsukh, Scientific Research Institute of Agriculture and Crop Production, Mongolian State Agricultural University, Ulaanbaatar, Mongolia.
Lecture Title: Organic Agriculture as a Strategic Factor of a New Quality of Economic Growth.
Abstract: Against the background of a slowdown in the economic growth of the branches of the national economy of Russia, agriculture shows an acceleration of growth rates achieved mainly on the basis of intensification of production. However, it is known that the global intensification of agriculture in the countries of the world in connection with the problems of food supply has caused an increase in diseases of the population, global environmental problems that have led to the development of theories of economic growth are inseparable from the concepts of "responsible consumption". The article presents the scientific discussion of modern authors about the factors of economic growth in modern conditions, substantiates the dominant factors of the new quality of economic growth, first of all, the development of organic agriculture. The results of scientific research of organic agriculture, the use of biotechnologies, market research of organic products, and the effectiveness of organic agriculture from the standpoint of socio-ecological and economic effects are presented. The mechanisms of strategic development and achievement of a new quality of sustainable growth of agricultural production on the basis of bioinnovations, biointensive technologies developed by scientists of Russia and Mongolia are proposed.

Natalya Nikonova, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Lecture Title: Global Trends in the Production and Consumption of Organic Products.
Abstract: In modern conditions of complex technological and economic challenges, the impulses for the sustainable development of the world market of organic products remain. In Russia, there are sufficient prerequisites for increasing the scale of organic agriculture. The purpose of the study is to analyze global trends in the production and consumption of organic food from the point of view of the acceptability of the experience of leading countries for Russia. Data from FiBL, IFOAM, the Ministry of Agriculture and the Union of Organic Agriculture of Russia were used. The trends in the world market of organic products for the period from 2010 to 2020 are estimated. This allowed us to conclude about stable trends in the production and consumption of organic products in the leading countries, including the strengthening of China's rating positions. Based on the analysis of the dynamics of the development of organic agriculture in Russia, it should be noted that the share of this type of product in export volumes and in the domestic food market is still small. However, the processes of formation of various mechanisms of state regulation and market nature strengthen the prospects for ensuring sustainable development of the organic market of the country.

Natalya Zaruk, Yuliya Romantseva, Maria Kagirova, Muzaffar Aramov, Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Moscow, Russia.
Shukhrat Zhumaev, Termez State University, Termez, Uzbekistan.
Lecture Title: Analysis of the State and Location of Organic Crop Production in Australia.
Abstract: The article is devoted to the features of organic production in Australia, which is characterized by the largest areas of certified agricultural land all over the world. The purpose of the study is to analyze the successful foreign experience in the production of organic crop products and the features of its location, taking into account the economic and soil-climatic conditions of various territories for the rational use of natural resources and sustainable development of rural areas. The study analyzes the current state and trends in organic production on the continent, changes in its exports and imports, the actual distribution of organic areas across the territory, as well as the location of organic crop production in Australia, taking into account soil-climatic and economic factors. The study of the experience of the development of organic crop production in Australia, which makes a significant contribution to the formation of gross agricultural output and exports, can expand the understanding of the features of the functioning of organic agricultural producers in different natural and climatic conditions and the formation of a sustainable structure of organic production as an information basis for adjusting state support measures.

Aleksey Nikonov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Lecture Title: Improving the Competitive Strategies of Organic Agricultural Producers.
Abstract: The purpose of the study was to analyze effective competitive strategies to ensure the sustainability of Russian producers in the organic market. The analysis showed a wide variety of approaches for the successful implementation of strategic positions of commodity producers. However, all of them are based on knowledge of the features of the external environment and qualitative forecasting of expected changes. The considered characteristics of the structure and size of production of agricultural producers of the Russian Federation indicate the potential for the development of the agricultural sector and the prospects of organic agriculture in the country. Moreover, it is important to create conditions for intensifying the efforts of small businesses, taking into account the prevailing trends, prerequisites and foreign experience. At the same time, an urgent task is a timely assessment of the degree of effectiveness of the set goals and criteria for their achievement, the ability to promptly make adjustments to production activities. Consequently, the implemented strategic and tactical decisions of the economic entities of the organic market must be combined with their personnel and scientific support, as well as state support measures.

Galina Nikonova, Svetlana Timoshenko, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Habas Bekulov, Kabardino-Balkarian State Agrarian University named after V.M. Kokov, Nalchik, Russia.

Lecture Title: About Staffing the Production of Organic Products in Russia.

Abstract: The growth of organic production in Russia actualizes the problem of its competitiveness in the food market, which is largely determined by the state of the labor force in the agricultural sector. Therefore, the purpose of the study was to analyze the current situation and priorities for solving the personnel problem of organic agriculture. The study is based on a generalization of scientific results, as well as official data from Rosstat and the Ministry of Agriculture of Russia. Modern personnel problems are considered, an analysis of trends in changes in the characteristics of labor potential in the agricultural sector is carried out, an assessment is made of the current structure of those employed at their main place of work, including in the informal sector, which made it possible to determine promising employment opportunities for organic production. It is concluded that it is necessary to increase the level of staff retention in the industry, especially young people, which will have an impact on the efficiency of organic production. The features of entering the agricultural labor market of university graduates and the tasks of integrating them into the system of staffing organic agriculture are shown.

Aleksandr Nesmyslenov, Povolzhskiy Scientific Research Institute of Economic and Organization of Agroindustrial Complex – Subdivision of the Federal State Budgetary Research Institution Saratov Federal Scientific Centre of the Russian Academy of Sciences (PSRIEOAIC), Saratov, Russia.

Lecture Title: Methodological Approach to the Assessment of the Development Opportunities of Organic Plant Production – Regional Aspect.

Abstract: The article studies methodological approaches to evaluation of competitiveness of directions of development of organic crop production on the basis of actual ideas of agricultural scientific thought about sustainable development, influence and relationship of factors of production - capital and labor, on economic stability of objects functioning in the agricultural system, in production of agricultural crop production. A systematic approach has been developed to quantify the competitiveness of the operation of various facilities at the level of farms using the organic production system and of the industrial type in the internal Russian organic market. The results show the possibilities of regulating the production of crop organic products in the region, using the possibilities of state support. With regard to the development of organic crop products, tradeoffs are characteristic of the relationship between the material and environmental interests of the enterprises producing these products. Based on the methodology of a systematic approach, when solving the problem of developing the production of organic crop products, it is possible to consider such production as a system of processes that ensure its sustainable development, balance of economic, environmental and social interests.

Oral Session 2: Interdisciplinary Aspects of Organic Agriculture

Magomed Chabaev, Roman Nekrasov, Evgenia Tuaeva, L.K. Ernst Federal Research Center for Animal Husbandry, Podolsk, Moscow region, Russia.
Zhenis Ramazanov, Kazakh Scientific Research Institute of Animal Husbandry and Feed Production LLP, Almaty, Kazakhstan.
Lecture Title: Improving the Quality of Haylage as Part of the Strategy of Organic Production of Livestock Products.
Abstract: When preparing haylage, the efficiency and quality of the fermentation process are of paramount importance, and here organic preservative starter cultures, in particular, the starter culture "Kazbiosil" made in Industrial Microbiology LLP, Republic of Kazakhstan, Almaty, can provide invaluable benefits. In the scientific and economic experience, the effect of feeding a haylage of alfalfa grass with the addition of 3 g / t of bacterial starter culture "Kazbiosil" in comparison with haylage harvested using traditional technology without preservative on milk productivity and the biochemical composition of the blood of lactating cows was studied. The experimental animals from the control group were fed a haylage of alfalfa grass as part of the diet, while the animals of the experimental group were fed a haylage with the introduction of a biological starter. At the end of the scientific and economic experiment, the animals of the experimental group outperformed the lactating cows of the control variant by the average daily milk yield of natural and 4% milk, respectively, by 20.7; 20.9 kg or 1.4; 1.8 kg (P<0.05). The results of biochemical studies of the blood serum of lactating cows that received various haylage options from alfalfa grass were within the physiological norm.

Yan Li, International Sakharov Environmental Institute of Belarusian State University, Minsk, Belarus.
Viktar Lemiasheuski, International Sakharov Environmental Institute of Belarusian State University, Minsk, Belarus; All-Russian Research Institute of Physiology, Biochemistry and Nutrition of Animals – Branch of the Federal Research Center for Animal Husbandry named after Academy Member L.K. Ernst, Borovsk, Russia.
Lecture Title: Review of Publications on the Study of Poultry Manure Problems in Environmental Pollution and Its Reuse.
Abstract: The environmental pollution caused by poultry manure has become a hot issue that needs to be solved urgently in the world. In order to solve the environmental problems caused by poultry manure, it needs to be treated and utilized. This report analyzes the impact of different harmful substances in poultry manure on the environment from the perspective of ecology and organic agriculture, as well as the potential environmental and economic benefits of the secondary use of poultry manure. Through literature analysis, the author compares and summarizes the advantages and restrictive factors of anaerobic digestion, anaerobic co-digestion, gasification, pyrolysis (thermochemical technology) and cobalt 60 radiation technology in sustainable development. The advantages and disadvantages of cobalt 60 irradiation technology were screened out to treat poultry manure, the advantages, and disadvantages of cobalt 60 irradiation technology were explained, its new advanced technology was proved sideways, and the sustainable and stable development of poultry manure was put forward. The corresponding proposals have made a significant contribution to reducing the pollution of poultry manure to the environment, so as to promote the harmonious development of the environment and economy.

Astghik Pepoyan, Armenian National Agrarian University, Yerevan, Armenia.
Vardan Tsaturyan, Armenian National Agrarian University; Yerevan State Medical University, Yerevan, Armenia.
Vardges Manukyan, Ivan Egorov, Federal State Budget Scientific Institution Federal Scientific Center "All-Russian Research and Technological Poultry Institute" of Russian Academy of Sciences, Sergiev Posad, Moscow Region, Russia.
Larisa Ilina, BIOTROF LLC, Federal State Budgetary Educational Institution of Higher Education St. Petersburg State Agrarian University, Pushkin, St. Petersburg, Russia.
Lecture Title: Novel Probiotic Lactiplantibacillus Plantarum Str. ZPZ as a Possible Candidate for "One Health" Probiotic.

Abstract: One Health is a "collaborative, multisectoral, and transdisciplinary approach – working at the local, regional, national, and global levels to achieve optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment". Unlike "regular" probiotics (live microorganisms that, when administered in adequate amounts, confer a health benefit to the host), the "One Health" probiotics have to be valuable for the unity of people, animals, and the environment. Given that Klebsiella spp. can be found in various environmental media: soil, water, plant/animal/human microflora, we aimed to evaluate the effects of Lactiplantibacillus plantarum str. ZPZ on the growth of K. pneumoniae spp. isolated from different sources: hospital's departments, cow with mastitis and intestinal microbiota of fish. For this the probiotic's cell-free cultures were used. Current investigations show the effect of cell-free supernatants of Lpb. plantarum ZPZ on the growth of K. pneumoniae spp., isolated from both infected fish and sick with mastitis cow. This study supports our previous suggestion that Lpb. plantarum strains can be applied as One Health probiotics for use in the fields of agriculture and healthcare. According to this study, more specifically, Lpb. plantarum str. ZPZ is a prime example of a One Health probiotic.

Georgiy Laptev, Valentina Filippova, Larisa Ilina, Elena Yildirim, Ekaterina Ponomareva, BIOTROF+ LLC, St. Petersburg State Agrarian University, St. Petersburg, Russia.
Darya Turina, Elena Gorfunkel, Andrey Dubrovin, Veronika Melikidi, BIOTROF LLC, St Petersburg, Russia.
Kseniya Kalitkina, Irina Kluchnikova, Dmitriy Gromov, St. Petersburg State Agrarian University, St. Petersburg, Russia.
Jie Zhu, Zhejiang A&F University, Hangzhou, Zhejiang, China.
Lecture Title: Influence of Glyphosate Herbicide on the Functional State of the Poultry Intestine Microbiome.

Abstract: Glyphosate is the most common and widely used broad spectrum herbicide. Although glyphosates are generally considered harmless to animals, they can affect macroorganisms through changes in microbial communities: glyphosate sensitive. In the present study, the toxic effect of glyphosate on the composition and functional state of the caecum microbiome of broiler chickens was assessed using the whole genome sequencing method. Functional differences in the microbiome that occur in the microbial community under the influence of glyphosate were identified at the level of glycolytic enzymes of the pathways responsible for the metabolism of simple carbohydrates. Elimination of a number of enzyme genes involved in the Embden-Meyerhof pathway was revealed. When glyphosate was added to the poultry diet at a concentration above the MPC, phosphodiesterases were eliminated in the microbial community, so glyphosate can lead to an increase in the concentration of second messengers (for example, cAMP) and disruption of signaling between

cells. In the microbiome of the experimental birds, the decrease in diversity occurred inversely with the concentration of glyphosate. Such changes can indirectly lead to a decrease in the efficiency of the digestive processes of digestion of feed by birds and a decrease in the level of energy metabolism.

Jan Puhalsky, Anton Savelyev, Mikhail Vinogradov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Svyatoslav Loskutov, VNIIIPD – a branch of Gorbatov Research Center for Food Systems, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Jacob Shiffon, Gleb Postnikov, Polina Kaushan, Novosibirsk State University, Novosibirsk, Russia.
Lecture Title: Prospects for the Use of Additives in the Form of Fly Ash and Coke Breeze in the Creation of Soil Mixtures for Growing Plants.
Abstract: A study was made of the possibility of using non-traditional materials from industrial production (fly ash and coke breeze) in order to involve them in the technological cycle of creating soils for growing cultivated plants in greenhouse conditions. Poor soddy-podzolic soil was used as the basis for creating the soil mixture. The objects for the study were the plants of common pea and white lupine. The experiment was carried out at full light culture in a closed grow tent. The total duration of the experiment was 35 days. The impact of additives was assessed by the dynamics of changes in the biometric characteristics of the resulting biomass (length and weight of shoots and roots). The addition of fly ash and coke breeze in small percentages did not lead to a significant stimulation of the biomass of cultivated plants. Therefore, it is too early to draw an unambiguous conclusion. However, the introduction of additives in small doses, up to 10-20%, may in the future affect the savings of mineral fertilizers and the amount of other components modifying the substrate.

Ludmila Bakina, Marina Chugunova, Alexander Gerasimov, Yulia Polyak, St Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Lecture Title: Efficiency Evaluation of the Rehabilitation of Oil-contaminated Agricultural Soddy-podzolic Soils.
Abstract: Remediation of agricultural soils subjected to accidental pollution by oil and oil products is an important economic and environmental problem. Bioaugmentation and biostimulation are the main strategies widely used in world practice for purification of oil-contaminated soils. The effectiveness of bioremediation methods depends on their environmental safety. We studied the effectiveness of bioremediation of oil-contaminated agricultural soddy-podzolic soils in long-term field experiment. The initial content of oil products in soil was over 50.000 mg kg-1. Different methods of bioremediation were applied: introduction of mineral fertilizers, lime, sowing of grasses, various biopreparations. The effectiveness of the methods of remediation was evaluated using chemical, microbiological, biological and other indicators. Diagnostic parameters were the aboveground plant biomass, the biological activity of soils, determined by the production of CO_2, and the rate of mineralization of oil products in the soil. These indicators made it possible to compare the effectiveness of remediation and to reveal the fundamentally different effects of used biopreparations. It is established that the joint use of agrochemical and biological methods is most effective if the biopreparation is selected correctly. The greater efficiency of single application of biopreparations in comparison with self-purification processes can be noticeable for three years.

Oral Session 3: Approaches to the Production of Organic Agricultural Products

Georgiy Laptev, Darya Turina, Elena Yildirim, Larisa Ilina, Kseniya Kalitkina, BIOTROF+ LLC., Pushkin, St Petersburg, Russia.
Elena Gorfunkel, Valentina Filippova, Andrey Dubrovin, Veronika Melikidi, Natalya Novikova, Vitaliy Molotkov, Ekaterina Ponomareva, BIOTROF LLC, Pushkin, St Petersburg, Russia.
Dmitriy Gromov, St. Petersburg State Agrarian University, Pushkin, St. Petersburg, Russia.
Michael Romanov, School of Biosciences, University of Kent, Canterbury, UK.
Lecture Title: Analysis of Changes in Broiler Microbiome Biodiversity Parameters Due to Intake of Glyphosate and Probiotic Bacillus Sp. Gl-8 Using Next Generation Sequencing.

Abstract: In recent years, there have been more data that the nonselective herbicide glyphosate (GLY) can negatively impact gut bacterial communities. The aim of our study was to investigate the composition of broiler caecal microbiome under chronic exposure to GLY and the introduction of a probiotic microorganism strain into the diet. 120 broilers were divided into three groups: Group 1 of control birds fed the basic diet (BD); Group 2 of experimental birds fed BD supplemented with GLY; and Group 3 of experimental birds fed BD supplemented with GLY and a probiotic strain of the microorganism Bacillus sp. GL-8. For analysis we used the next generation sequencing (NGS) technique. Under Due to GLY administration, there was a trend of lowering the biodiversity of normal microflora representatives, along with the intestinal colonization by undesirable forms of microorganisms. In particular, when adding GLY (Group 2), we observed a decreased number of Tepidimicrobium representatives ($0.001 \pm 0.00006\%$) that ferment indigestible polysaccharides, while in Group 1 their content was greater ($0.3 \pm 0.02\%$; $P \leq 0.05$). In Group 3 with probitic there was a lower number of Firmicutes (by 16.7%) and a rise in the number of Bacteroidetes (by 19.1%) as compared to Group 2 ($P \leq 0.05$).

Konstantin Ostrenko, Anastasia Ovcharova, Ivan Kutyin, Kirill Koltsov, All-Russian Research Institute of Physiology, Biochemistry and Nutrition of Animals – Branch of the L.K. Ernst Federal Research Center for Animal Husbandry, VNIIFBiP, Borovsk, Russia.
Natalia Nevkrytaya, FSBSI "Research Institute of Agriculture of Crimea", Simferopol, Republic of Crimea, Russia.
Lecture Title: Effect of Essential Oils of Coriander and Fennel on the Nonspecific Resistance of Dairy Calves.

Abstract: A wide range of essential oils contains biologically active compounds that can potentially act as multifunctional feed additives for animals. The aim of the study was to establish the effect of coriander and fennel essential oils on the non-specific resistance of calves and growth rates. The study was conducted on 3 groups of 21-day-old calves with 10 heads each. The animals of the control group received the basic diet (BD), the first experimental group BD + fennel essential oil (1 ml), the second experimental group BD + coriander essential oil (1 ml). The indicators of nonspecific resistance were studied: phagocytic number (PN) and phagocytic index (PI). PI in fennel is 95.6% higher (25.63:13.1) compared to the control, and in coriander – by 90.3% (24.93:13.1). PN in fennel is 114.4% higher (4.63:2.16), in coriander – by 205% (6.59:2.16). Under equal conditions of maintenance, we see that the immune response in calves of the experimental groups treated with coriander and fennel is significantly higher than in calves of the control group. Additives in the form of essential oils help to strengthen the nonspecific protection of the body.

Nadezhda Bogolyubova, Roman Nekrasov, Aloyna Zelenchenkova, Roman Rykov, Nikita Kolesnik, Natalia Volkova, Anastasia Vetokh, Julia Bogolyubova, L.K. Ernst Federal Research Center for Animal Husbandry, Podolsk Municipal District, Moscow region, Russia.

Lecture Title: Metabolic Processes Indicators in Chickens of Different Productivity Directions and Their Relationship with the Composition of Muscle Tissue.

Abstract: The object of our research was blood and muscle tissue samples of the breast and thigh, taken from birds at the age of 63 days of the following groups: group 1 – egg productivity (cockerels, Russian White breed, n=28), group 2 – meat and egg productivity (cockerels of a cross between Russian white and Cornish breeds, n=148 – blood, hens n=81 and cockerels n=148 – muscle tissue), group 3 – broilers (cockerels, cross Ross-308, n=9). As a result of the studies, we have established differences in the content of metabolites of carbohydrate-lipid and mineral metabolism in chickens of egg, meat-and-egg directions of productivity and broilers. The results obtained will serve to collect the database of biochemical parameters of poultry blood and further develop reference intervals for birds of various genotypes, which will be useful in terms of monitoring the health status of poultry and obtaining high-quality poultry products. Correlation relationships between biochemical blood parameters and indicators of metabolic processes were determined, and differences in the obtained values between poultry groups in terms of productivity were established. The data obtained open up prospects for expanding the range of biochemical parameters and their use in order to obtain high-quality livestock products.

Ivan Perov, Kiro Petrovski, Esmaeil Ebrahimie, School of Animal and Veterinary Sciences, Australia.

Lecture Title: Differences in Milk Production Curves on Ten Dairy Farms with Automated and Conventional Milking System in South-East Australia.

Abstract: The study, conducted in 2020-2021 aimed to provide a better understanding of the effect of automated milking system (AMS) on lactation curves by comparing them to these of the conventional milking system (CMS), from mainly pasture-based farms in South-East Australia. Ten farms in Tasmania, Western Victoria and New South Wales were enrolled (five of each AMS and CMS). The objectives of this study were to create lactation curves for 1) pasture-based AMS and CMS in South-East Australia; 2) 3 age categories: primiparae (parity 1); mid age category (2nd, 3rd and 4th parity) and old age category (>4th parity). At overall, this study demonstrated that lactation curves did vary with the type of milking system. The variability of cow average yield was observed among age categories and farms. In the AMS, the descending stage of lactation curve was slightly more persistent from approximately 150 days-in-milk (DIM) onwards. Variability in average cow milk yield observed between age categories were higher between mid-age and old-age cows in AMS. Herd structure, when grouped by age category, consisted of more old age cows on AMS (25.6%) compared to CMS (16.3%). Feeding system had a great impact on the milk yield in South-East Australia, being 21.1L and 38.9L for pasture-based and total mixed ration (TMR)-based AMS.

Mehak Rai Sethi, Vandana Singh, University School of Law & Legal Studies, Guru Gobind Singh Indraprastha University, Dwarka, Delhi, India.
Lecture Title: Sowing the Seeds of Change: a Study of Technology and Plant Breeding in Indian Agriculture from Stakeholder Perspectives.

Abstract: Agriculture contributes greatly to the Indian Gross Domestic Product (GDP) and employs over half of the country's total population. It is also a significant source of food, raw materials for industries, and foreign exchange through exports. However, this sector has witnessed several changes in the years of its gradual evolution. This transformation has been a gradual one. Rural transformation takes under its wings the idea of rural diversification as well. Various aspects, in addition to employment, like income, investment, access to resources, also form part of the phenomenon of rural diversification. Over the years, several efforts have been made by the Indian government to improve the conditions of agricultural laborers and other menial workers in the agricultural sector. But, how far have these policies and schemes reached the thresholds of the stakeholders is an issue that needs attention. Agriculture is the activity that is most dominantly carried out in the country, and it not only caters to the internal demands of the people in India, but also to the external demands, thereby contributing to the economy greatly in terms of exports. Additionally, since agricultural activities involve a constant interaction with the environment as well, the innovations in the methods of crop production have also had significant impacts over the environment. These impacts are further buoyed up when coupled with the realization that the world has now ushered into the digital age with several new technologies paving their way into the agricultural sector as well. This report is thus, an attempt: (i) to provide an account of the prevailing conditions of the stakeholders of the various agricultural schemes adopted by the government in the agricultural sector; (ii) to familiarize the readers with the impact of new developments in the methods of production upon the environment; (iii) to provide an empirical account of the prevailing conditions from the perspective of the stakeholders themselves, on the basis of data gathered from three major Green Revolution States of India, i.e., Punjab, Uttar Pradesh and Haryana.

Oral Session 4: Opportunities, Limitations and Digital Aspects of Organic Production

Khapsat Dibirova, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Lecture Title: Opportunities and Constraints for the Development of Organic Production in Small-scale Farms in the North-West of Russia.

Abstract: The growth rates of organic production in small-scale farms in the North-West of Russia remain low, the potential they have for this is not being used. Therefore, the purpose of the study is to establish opportunities and barriers for expanding the production of organic products by peasant (farmer) farms, individual entrepreneurs and households. The dynamics revealed structural changes in the number of small forms of management, the volume of the area of cultivated and uncultivated lands of the region. Fallow lands are considered as resources from the point of view of their further introduction into circulation in order to comply with the requirements of organic farming and increase production volumes. It has been established that, provided that the certification procedure is simplified, cheaper and expanded, not only K(F)X and IP, but also private farms can represent strong positions in terms of mass distribution of organic production in the region, since they have large areas of fallow lands that can be used with minimal costs in the future in organic farming without observing the conversion period. The prospects for the formation of short supply chains of organic agricultural products are considered.

Petr Akmarov, Olga Abramova, Olga Knyazeva and Ekaterina Alypova, Izhevsk State Agricultural Academy, Izhevsk, Russia.
Ольга Абрамова, Government of the Udmurt Republic, Izhevsk, Russia.
Lecture Title: Development of the Labor Potential of Agricultural Production on the Basis of Improving the Digital Competencies of the Rural Population.
Abstract: The decrease in the number of rural residents is partly due to the technological transformation of agricultural production. Modern digital technologies significantly reduce the need for live labor, making new demands on its quality. Over the past decades, the number of workers in the agricultural production of our country has halved. The report discusses the activities, the implementation of which should become part of the state program for the development of rural areas, which will create a reliable basis for the formation of the labor potential of innovative agriculture.

Lyubov Vinnichek and Nadezhda Smelik, St. Petersburg State Agrarian University, St. Petersburg, Russia.
Lecture Title: Research of Regional Shifts in the Provision of Information Technologies.
Abstract: Regional shifts in the provision of information infrastructure and information technologies in the North-Western and Volga Federal Districts, as well as in the Russian Federation, have been studied on the basis of Rosstat data and own calculations. The number of organizations in the Russian Federation and the subjects under consideration is decreasing over the period 2014-2021 due to the impact of sanctions and the pandemic. In these conditions, the provision of organizations with personal computers, the use of cloud services, access to broadband Internet is more stable and the use of local computer networks and server equipment by organizations is less stable. The use of applied management information technologies by organizations in the studied subjects is characterized by the stability and predominance of enterprise resource planning software and customer relations. The domain space of the Russian Federation is recovering faster after the pandemic than in the studied regions.

Georgiy Laptev, Darya Turina, Elena Yildirim, Larisa Ilina, Kseniya Kalitkina, BIOTROF+ LTD, St. Petersburg State Agrarian University, Pushkin, St. Petersburg, Russia.
Valentina Filippova, Andrey Dubrovin, Natalya Novikova, Ekaterina Ponomareva, BIOTROF LTD, Pushkin, St Petersburg, Russia.
Khairullamin Bashir, Tatyana Smetannikova, Ivan Malakhov, St. Petersburg State Agrarian University, St. Petersburg, Russia.
Michael Romanov, School of Biosciences, University of Kent, Canterbury, UK.
Lecture Title: Effect of a Probiotic Strain Administration in Different Feeding Phases on α- and β-diversity and Gene Expression of the Rumen Microbiome in Lactating Cows.
Abstract: In cows, there is a drastic metabolic stress caused by violations of the rumen microbiome composition during lactation. The aim of the present study was to investigate the α-and β-diversity of the rumen microbiome of lactating cows using next generation sequencing (NGS) and gene expression assessed by qPCR, as well as evaluation of the corrective properties of a probiotic strain introduced into the rumen. The results showed that the addition of the probiotic to the diet contributed to an effective increase in the fat content of milk during early lactation period (P≤0.05). The NGS-based analysis of the rumen microbiome of the studied cows using the 16S rRNA gene sequences showed that the Shannon and Chao1 indices of α-diversity of prokaryotic communities remained unchanged during various feeding phases, as well as due to the probiotic effects. In the early lactation period and under the

probiotic's impact, the number of representatives of the Clostridia_UCG-014 and Clostridiaceae families declined by 2.4 and 1.6 times, respectively (in Group 2 as compared to Group 1, $P \leq 0.05$). Expression of the bacterial Ldh-L and ldhD genes was lower by 2.9 and 13.5 times, respectively ($P \leq 0.05$), when adding the probiotic to the diet in the early lactation period.

Sophya Popletaeva, Denis Erokhin, and Vitaly Dzhavakhiya, All-Russian Research Institute of Phytopathology, Bolshie Vyazemy, Moscow regions, Russia.

Lecture Title: Comparison of the Protective Activity of Elicitor Proteins MF2 and MF3 Applied Individually or in Combination Against Tobacco Mosaic Virus on Tobacco Leaves.

Abstract: Proteins inducing plant resistance to diseases represent a promising base for plant protection in organic agriculture. We identified and studied two promising proteins, a cold shock protein from Bacillus thuringiensis (MF2) and a FKBP-type peptidyl prolyl cis/trans isomerase from Pseudomonas fluorescens (MF3). Structures of these proteins and their active centers responsible for their protecting activity are different suggesting they may have different targets in plant tissues and their combined action may improve the plant protection against various pathogens including plant viruses. To examine this hypothesis, the protective effect of MF2, MF3, and their combination against tobacco mosaic virus (TMV) was compared on detached tobacco leaves. Each of the proteins was applied on one leaf half, while the mix of equal volumes of MF2 and MF3 solutions was applied on the second half. The final concentration of each protein in the mix was twice lower than in individual solutions. The MF1+MF2 mix more efficiently reduced the number of TMV-induced leaf necroses than individual proteins taken at twice higher concentrations. This fact may evidence good prospects for the development of a hybrid protein or polypeptide based on MF2 and MF3 or their active centers as a basis for plant-defense-inducing preparations.

Oral Session 5: Robotics and Digital Technologies in Agriculture

Viktor Smelik, Alexandr Perekopskiy and Anton Zakharov, Federal Scientific Agroengineering Center VIM, St. Petersburg, Russia.

Lecture Title: Prerequisites and Effectiveness of the Introduction of Precision Farming Elements in the Sowing of Grain Crops.

Abstract: Effective farming is the basis of Russia's food security. At the present stage, the agricultural industry, and in particular crop production, is experiencing a constant shortage of qualified machine operators, high-performance equipment, there is no developed infrastructure, etc. The main direction of agricultural production in the North-Western region of the Russian Federation should be resource conservation and technological modernization, including through the use of "precision agriculture" (PA). It has been revealed that there are prerequisites for this: there are enterprises in the Leningrad Region where PA elements have been introduced. The analysis of the sowing campaign on a specific example of an enterprise for soil preparation and sowing of grain crops revealed factors affecting the productivity of aggregates and additional costs. The prerequisites for the introduction of PA elements in the sowing of grain crops were: large overlap on the aisles of the units, work on the incomplete width of the guns, curved movement of the units across the field, incorrect rotation scheme of the unit with manual control. Fuel overspending on soil preparation and sowing of grain crops in monetary terms amounts to 513632 rubles with manual control of the units, and with an automatic control system of 2.5 cm and an RTK station will amount to 20496 rubles.

Marina Astapova, Mikhail Uzdiaev, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Lecture Title: Classification and Segmentation of Agricultural Land Using Linear Discriminant Analysis for Soil Sensors Installation.

Abstract: An urgent problem of soil state monitoring implies the search of appropriate places on the terrain for the specific soil sensors installation. This task can be fulfilled using computer vision techniques, which require appropriate features, that represent significant properties of the terrain. The established values and intervals of widespread multispectral indices may not always represent the valid properties of the terrain, because of various distortion factors, then the interval must be justified on exact task. This work is devoted to statistical analysis of NDVI and NDBI and defining the statistically justified intervals of these indices for the following terrain classes on the satellite images, that may be suitable (class Soil) and unsuitable (classes Swamp, Water, Urban Objects, Forest) for soil sensors installation. The data is collected from various regions in Russia from Sentinel-2 images. Mann-Whitney U test has shown statistically significant difference in all the considering classes ($p<0.001$). The intervals of the considering indices have been obtain using LDA. The results of segmentation using established criteria for the Soil class is 0.63 according to IoU metric. Classification of Soil class has shown 0.76, 0.78 and 0.77 according to recall, precision, and F1-score metrics correspondingly.

Vera Riksen, Vladimir Shpak, Siberian Federal Research Centre of Agrobiotechnologies of the Russian Academy of Sciences, Krasnoobsk, Novosibirsk region, Russia.
Lecture Title: Deep Convolutional Neural Network Model for Weed Identification in Oil Flax Crops.

Abstract: Traditional methods of monitoring weeds in crops are not suitable for integration with modern "smart" agricultural machinery. Automating the process of accurately identifying the species composition of weeds in each field will be an important step for the development of a plant protection system, contributing to higher yields. Deep learning (DL) models, which have become widespread in recent years, are successfully helping to solve this complex agricultural problem. In this study, we built a classifier based on the ResNet-18 deep learning model, which is able to detect weeds with the corresponding weediness gradations in photographs from field plots with oil flax (Linum usitatissimum L.). There are 4 types of weeds in crops of oil flax with different intensity - field bindweed (Convolvulus arvensis), white goosefoot (Chenopodium album), leafy spurge (Euphorbia virgata) and wild buckwheat (Fallopia convolvulus). The task of the classifier is to recognize these weeds in the photograph and determine one of the two gradations of weediness of the plot - the number of weeds exceeds the economic injury level (EIL) or does not exceed. The models were trained with different epoch values (10, 20, 30), the accuracy of which ranged from 72.5 to 93.3%.

Lyubov Illarionova, Konstantin Dubrovin, Computing Center of the Far Eastern Branch of the Russian Academy of Sciences, Khabarovsk, Russia.
Alexey Stepanov, and Tatiana Aseeva, Far-Eastern Agriculture Research Institute, Vostochnoe, Russia.
Lecture Title: Using NDVI Time Series for Interannual Cropland Classification in the Khabarovsk District.

Abstract: The collection and validation of ground reference crop distribution data are quite complex tasks for agricultural departments. That's why automated crop mapping using multiannual remote sensing data is one of the main tasks in digital agriculture. Approach, using Normal Difference Vegetation Index (NDVI) time series and Random Forest (RF) classifier, was developed. Time series function-fitting using Fourier series was performed to align sample quantity and bring series for 2021 and 2022 to the same timeline. Approximated weekly frequency NDVI time series were used as input to the classifier. Time series labeled with one of the three classes (soybean, oat, perennial grasses) for 2021 were used to train the classifier. The labeled NDVI time series for 2022 was used as a test set. The overall accuracy of interannual transfer learning was 88.5%. The f1 for soybean was 0.93, for oat – 0.68, and for perennial grasses – 0.53. The Jaccard index for soybean was 0.87, for oat – 0.51 and for perennial grasses – 0.36. This approach can be used for crop mapping in regions with the same crops, crop phenology and climatic conditions.

Alena Zakharova, V.A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences, Moscow, Russia.
Aleksandr Podvesovskii, Bryansk State Technical University, Bryansk, Russia.
Lecture Title: Model for Optimization of Heterogeneous Cargo Transportation Using UAVs, Taking into Account the Priority of Delivery Tasks.

Abstract: The current level of development of unmanned transport aviation makes it possible to use it widely for automation and robotization of many processes in agriculture. One of the promising applications of unmanned aerial vehicles is the delivery of essential supplies to remote areas cut off from land transportation routes. The urgent task here is creation of mobile solutions that enable to quickly organize transportation of cargo, including heterogeneous ones, under conditions of shortage of certain types of cargo and the need to prioritize requests for delivery. The report proposes a model for creating an optimal transportation plan of heterogeneous cargo between sources and destinations for the route network of arbitrary structure. The model contains mechanisms for formalizing and taking into account the priority of cargo delivery tasks for the different types of priority, as well as a mechanism for balancing the priority of delivery tasks and the transportation cost. The results of testing the proposed optimization model for planning the process of cargo delivery to remote areas, with visualization of the transportation plan based on a digital terrain model are presented. The directions for further development and improvement of the proposed approach are discussed.

Kantemir Bzhikhatlov, Inna Pshenokova, Federal State Institution of Science Federal Scientific Center Kabardino-Balkarian Scientific Center of Russian Academy of Sciences, Nalchik, Russia.
Lecture Title: Intelligent Spraying System of Autonomous Mobile Agricultural Robot.

Abstract: For pest and weed control, most agrochemicals are applied evenly, even though their distribution is usually uneven. The result of uniform spraying is the loss of agrochemicals, which leads to increased costs, the risk of damage to crops, pollution of the environment and products. Applying herbicides only where weeds are found can reduce costs, the risk of crop damage and excess pesticide residue, and potentially reduce environmental impact. In order to find

weeds in real time and provide spot spraying, the sprayer was designed and developed using an intelligent system based on multi-agent neurocognitive architectures. The report presents the design of the spraying system for an autonomous mobile robot for agricultural purposes. A block diagram of a plant spraying system for an autonomous robot and an algorithm for the operation of the autonomous robot control system are presented. The developed scheme of the spraying system will provide spot spraying of several plants simultaneously with the possibility of regulating the height of the nozzles and the flow density of the active substance. Further work will be to test the presented algorithm in field conditions for accurate weed control, in particular, in the process of combating cotton bollworm on corn crops.

Peter Kazakievich, Presidium of the National Academy of Sciences of Belarus, Minsk, Belarus.
Dmitry Komlach, Anton Yuryn, Alexander Verabei, Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization, Minsk, Belarus.
Lecture Title: Optical-Electronic System for Apple Sorting Line: Development and Implementation.
Abstract: The article is devoted to the relevance of developing a tool for automatic sorting of apples, in particular, its main element – an optical-electronic system. Studies have shown that for sorting apples, it is important not only to determine their size, but also the presence of defects. Existing machines do not implement the above functions, which requires additional labor, reduces productivity and quality. A classification of quality recognition systems is given and a technological scheme of an optical-electronic system consisting of an optical module and a video camera, a control unit and a conveyor is substantiated. In the course of the research, a single-flow type of fruit flow with forced rotation and a constructive-technological scheme of the machine were substantiated. Software has been developed based on segmentation and tracking algorithms, as well as training a neural network that determines the diameter and recognizes fruit defects and sorts them into three product classes. The system was introduced into the LSP-4 sorting and packaging machine, which was successfully tested at Ostromechevo OJSC. Tests of LSP-4 showed that it provides labor productivity – up to 1.8 t / h, sorting accuracy by size – 75.4%, by the presence of marriage – 73.1%.

Svetlana Ulbasheva, Dmitry Vorobyev, Natalia Statsyuk, Maria Kuznetsova, All-Russian Research Institute of Phytopathology, Bolshie Vyazemy, Moscow region, Russia.
Lecture Title: Pre-Planting and Post-Harvest Treatment of Potato with Low-Frequency Pulse Electric Field Suppresses the Development of the Leaf and Tuber Blight.
Abstract: Organic potato production deals with a very limited choice of tools to control late blight. One of the alternative ways to protect potato against this disease is a plant immunity stimulation. A study of the effect of pre-planting and post-harvest treatment of five potato cultivars (Sante, Arizona, Aluett, Vektor, and Sarpo Mira) with low-frequency pulse electric field (LF-PEF) on the main yield parameters (total number/weight of tubers, number/weight of marketable tubers) and the level of disease development on artificially inoculated leaves and tuber tissues has been performed in 2020–2021. The pre-planting treatment of seed tubers showed a tendency to reliably increase the number of marketable tubers (10–48%), total weight of tubers (11.4–53.9%), and weight of marketable tubers (13.7–89.3%). The disease development and sporulation intensity on leaves of susceptible cultivars grown from treated tubers was suppressed by 17.1–35.7% and 10.9–30.1%, respectively. The level

of disease suppression in tissues of treated tubers varied within 13.4–45.2%, and a decreased sporulation was observed in three of five cultivars. Thus, the LF-PEF treatment represents a promising environmentally friendly tool for organic agriculture to increase potato resistance to the late blight and improve the yield.

Aslan Leshkenov, Vladislav Shuganov, Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences, Nalchik, Russia.
Lecture Title: Resource-Saving Spraying Method Using the "Agroprotector-Robot".
Abstract: This article discusses the problem of improving chemical protection against weeds, diseases, pests in the cultivation of corn in order to improve the quality of processing, to minimize: the consumption of pesticides, environmental damage and the cost of production. The authors reveal the disadvantages of existing spraying methods today and propose a new unique approach to its implementation, based on constant monitoring of corn crops to detect weeds, diseases and pests in the most favorable and probable periods of their appearance and simultaneous local (spot-on) treatment of the affected area. The parameters of the external environment that affect the quality of spraying corn crops in the conditions of the steppe zone of southern Russia. The article presents the main pesticides, their classification, purpose, consumption rates, processing conditions, methods and time of application used against weeds, diseases, and pests on corn crops in the conditions of the steppe zone of the Kabardino-Balkarian Republic. The analysis of economic efficiency in carrying out spraying of corn (against weeds) in terms of the costs of chemicals per unit area (1 ha) by various methods is presented: traditional, using aviation, drones and an autonomous multifunctional mobile "Agroprotector-robot" of the KBSC RAS.

Maad Al-Rukabi, Vladimir Leunov, Ivan Tarakanov, Russian State Agrarian University-Timiryazev, Moscow, Russia.
Tatiana Tereshonkova, Alexander Khovrin, All-Russian Research Institute of Vegetable Production, Moscow region, Russia.
Alexander Selyansky, Project Manager of Phytopyramide technology, Moscow region, Russia.
Lecture Title: Reaction of Tomato Hybrids to Different Ripeness in Conditions of a Multi-tube Hydroponic, Soil and Lighting Options.
Abstract: The aim of the study was response tomato hybrids in a multi-tube hydroponic technology in a polycarbonate greenhouse and the effect of different lighting in a phytotron on tomato plants. Eleven tomato hybrids were studied, differing in ripeness groups, by comparing their reactions in a hydroponic system (Phyto-pyramide) and a greenhouse system (soil). The effect of seven different spectral lighting modes on four hybrids under phytotron conditions (growth chamber) was also studied. Observations revealed a significant effect of hydroponic on maturation period. Elf F1 accession was the earliest (77.00 days) compared to (101.67 days) soil greenhouse cultivation. Hydroponic vertical cultivation has shown excellent results in obtaining an early tomato harvest and an increase in yield per m2 compared to a ground greenhouse. A higher marketable production was obtained with Ruddy ball F1 (25.51 kg/m2) compared to (9.92 kg/m2) in the soil greenhouse. Dichromatic light had the greatest effect on photosynthesis, while monochromatic light had the greatest effect on height growth. An increase in leaf chlorophyll content (SPAD) was obtained with (blue+red) light (620.06) compared to monochromatic green light (319.88). Monochromatic red (23.81 cm) had the greatest lighting effect on plant height compared to monochromatic blue (12.62 cm) the least.

Oral Session 6: Robotics and Digital Technologies in Aquaculture and Environmental Management

Alexander Bekarev, Evgeny Ivashko, and Valentina Ivashko, Laboratory for Digital Technologies in Regional Development, Karelian Research Centre of Russian Academy of Sciences, Petrozavodsk, Russia.
Evgeny Ivashko, Institute of Applied Mathematical Research, Karelian Research Centre of Russian Academy of Sciences, Petrozavodsk State University, Petrozavodsk, Russia.

Lecture Title: Aquaculture Digitalization: Polling Karelian Fish Farmers.

Abstract: Digitalization brings valuable advantages to the aquaculture industry. Such technologies as the Internet of Things, artificial intelligence, Big Data, unmanned vehicles, and others give new opportunities to develop smart equipment and software for aquaculture. Emerging new solutions help to reduce risks, increase labor productivity, and improve the manageability of fish farms. However, the demand for new digital solutions is directly connected to the readiness of companies for digital transformation. In this report, we present the results of polling among the fish farmers in the Karelia region (Russia). The survey was aimed at exploring the current technological level of aquaculture enterprises and their readiness to adopt new smart digital technologies. The survey was performed among 43 Karelian trout producers, covering the entire operational spectrum from fish eggs incubation to the production of commodity fish. We found clear differences between fish farms with self-assessed high, medium, and low technological levels in their actual adoption of modern technologies. The results show the high level of readiness of fish farmers for digital transformation and the need for governmental support for the industry's digitalization.

Evgeny Savinov and Evgeny Ivashko, Karelian Research Centre of Russian Academy of Sciences, Petrozavodsk, Russia.

Lecture Title: Modern Systems for Non-Contact Fish Weighing. A Review.

Abstract: Aquaculture is actively evolving, requiring constant improvements in efficiency and new research. Regular weighing of experimental fish is one of the most important parts of research in the development of new fish farming methods and technologies. Conventional - manual - weighing is labor-intensive and causes high stress to the fish. An alternative way is automatic non-contact weighing using video cameras and different types of sensors. This report presents an analytical review of non-contact weighing technologies. The review is based on an analysis of 43 scientific publications published in international journals. In reviewing the scientific publications, preference was given to methods that are most suitable for use in research laboratory aquariums and small tanks. The first part of the report is devoted to justifying the relevance of the problem and analyzing the available reviews. The second part presents and compares different hardware installations for contactless weighing, such as single or multiple camera systems, sonar systems, different sensors, and combinations thereof. A qualitative comparison of hardware solutions is presented in terms of range, accuracy, applicability, and affordability. Due to different experimental conditions, no numerical data are given for method comparison.

Roman Meshcheryakov, Konstantin Rusakov, Gleb Tevyashov, V.A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences, Moscow, Russia.

Aleksej Myshkin, Branch for the Freshwater Fisheries of VNIRO ("VNIIPRKh"), Rybnoe, Dmitrovskij district, Moscow region, Russia.

Lecture Title: Detection and Characterization of Caviar Using a Neural Network Algorithm.

Abstract: Conservation and increase of fish resources is one of the priority tasks of modern society. Due to agricultural activities, the impact of the construction of hydroelectric power stations, as well as the widespread presence of poachers have led to the fact that fish resources need to be replenished in special fisheries. The article points out the importance and conservation of fish resources around the world, as well as the priority of caviar counting in the breeding of sturgeon species. Conducting such activities on the farms is necessary to monitor the impact and effectiveness of the use of various feeds, changing conditions, etc. Traditionally, two methods are used at enterprises to count caviar - by weight and volume, in addition, the von Bayer method with the use of a special tool is used in practice to count red caviar. The report also considers high-performance digital methods of caviar counting, outstanding and requiring technical solutions to perform a design for automatic counting using neural network algorithms. An original design using a camera with Internet access is proposed. Results of experimental systems for sturgeon fish caviar reproduction are presented.

Andrey Lazukin, Anton Saveliev, Konstantin Krestovnikov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Nikita Volchenko, Federal State Budgetary Educational Institution of Higher Education (KubSU), Krasnodar, Russia.

Sergey Maslennikov, A.V. Zhirmunsky National Scientific Center of Marine Biology Far Eastern Branch, Russian Academy of Sciences (NSCMB FEB RAS); Far Eastern Federal University (FEFU), Vladivostok; Sakhalin State University, Yuzhno-Sakhalinsk, Russia.

Lecture Title: Automated Coastal Monitoring of Aquaculture Areas Using Microbial Fuel Cell Technology.

Abstract: Hydrological monitoring is necessary for successful aquaculture management. In this article, the technology of microbial fuel cells (MFC) for powering hydrological monitoring sensors is tested. The device operated at a depth of two meters on the territory of the Zapad biostation of the A.V. Zhirmunsky National Scientific Center of Marine Biology Far Eastern Branch of the Russian Academy of Sciences in the Quiet Backwater Bay of the Vostok Bay, Peter the Great Bay. The device was equipped with a temperature and light sensor. This was a demonstrator of useful data that can be obtained from the energy of microbial electricity. This data was transmitted over a radio signal. The total capacity of the manufactured MFC was 1.7 mW. It took 46 MJ to send the signal. The frequency of sending was 6 times per minute in laboratory conditions and in the range from 2 to 4 minutes in field conditions. The power consumption of the entire system was 276 mW. The LoRA protocol was used to transmit the signal. The transmission distance was 950 meters. The results obtained indicate the practical possibility of using the energy of microbial fuel cells. This is applicable for the power supply of environmental monitoring sensors.

Andrey Ronzhin, Andrey Lazukin, Anton Saveliev, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Elchin Khalilov, Zhenlin Ma, Min Wang, Wenzhou University, Wenzhou City, Zhejiang Province, China.
Lecture Title: Theoretical and Technological Foundations for Water Blooming Prevention Using Laser Radiation.
Abstract: Currently, a lot of attention is being paid to the fight against water blooming. This report presents a theoretical basis for combating cyanobacteria using laser radiation. The obtained models show that it is possible to carry out effective control of cyanobacteria in reservoirs even of a very large area. Controlling cyano-bacteria is achieved by irradiating them with a laser installation located on the basis of USV. It can determine the trajectory of movement along the reservoir and destroy cyanobacteria in the most promising areas of the fight. The analysis of cyanobacteria concentrations and reservoir characteristics is carried out by aerial photography using an UAV, which is an integral part of the complex. The use of laser radiation makes it possible to exclude the use of chemicals to combat algae and thereby eliminate the environmental pollution factor. The report presents the parameters necessary for calculating the parameters of the UAV flight, as well as a method for finding a way for an USV. It also presents the concept of mapping places with the most intensive rate of reproduction of cyanobacteria. Calculations demonstrate the potential for the destruction of cyanobacteria on an area of 155.52 m2 using a 7110 W laser installation with a wavelength of 650 nm.
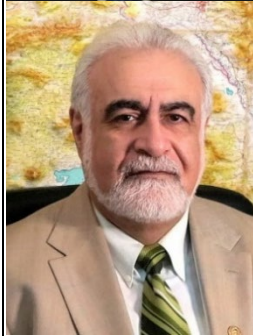
Elchin Khalilov, Yubao Li, Farid Khalilov, Wenzhou University, Wenzhou City, Zhejiang Province, China.
Elmar Allahverdiyev, Scientific Research Institute of Vegetable Growing of Ministry of Agriculture of Azerbaijan, Baku, Republic of Azerbaijan.
Javanshir Talai, Agricultural Research Institute of Ministry of Agriculture of Azerbaijan, Baku, Republic of Azerbaijan.
Anar Khalilov, MAGMATRIX Systems LTD, Baku, Republic of Azerbaijan.
Lecture Title: Experience in Using Magmatrix Technology to Increase Productivity of Plants.
Abstract: The authors conducted a series of experimental studies that allowed them to come to the conclusion about increasing yields, as well as quantitative and qualitative indicators of vegetable, berry and grain crops when watering with magnetized water using MAGMATRIX AGRO technology. The studies were conducted on the example of tomatoes, sweet peppers, strawberries, edible greens and wheat. It was found that the highest increase in yield is observed in vegetable and berry crops, as well as food greens. Grain crops showed a smaller increase in yield, but an increase in their quality characteristics was definitely recorded. Studies of changes in some physicochemical properties of magnetized water have shown that after magnetization, the concentration of dissolved oxygen in the water increases. In addition, the research results showed a decrease in the hardness of magnetized water by 40% compared to ordinary water and an increase in the surface tension of water by 3-5%. It has been experimentally established that when magnetized water is heated to boiling, aragonite crystals form in it as a result of a change in the crystal lattice of calcite (calcium bicarbonate).

Natalya Sevostyanova, NovBiotech LLC, Veliky Novgorod, Russia.
Elena Shkodina, Maria Zhukova, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Novgorod Region, Russia.
Olga Trezorova, NovBiotech LLC, Yaroslav the Wise Novgorod state University, Veliky Novgorod, Russia.

Lecture Title: Effect of Laser Radiation on the Growth and Yield of Forage Grasses.

Abstract: The report presents the results of field tests of laser stimulation of fodder crops in the North-West of Russia. The method is based on exposure to red light with a wavelength of 638 nm, a radiation power of 300 MW and an exposure of several seconds from an unmanned aerial vehicle (UAV). The objects of research are new lines and varieties of filmy and naked oats for green fodder and seeds, combined oat crops with spring vetch for green fodder, as well as introduced annual fodder crops of millet and sorghum. It was revealed that stimulation should be carried out in the early phases of plant development and an important condition for the effectiveness of the technology is a sufficient amount of moisture in the soil. There was an increase in the yield of the green mass of naked varieties of oats by 5%, the green mass and seeds of the grass mixture of wiki Mega and Nemchinovsky 61 oats, late varieties of annual introduced forage crops (on average by 5-18%). There was a decrease in the contamination of vico-oat grass mixtures in the experimental groups. The proposed technology can be adapted in organic farming to improve the feed base.

Victor Gornyy, Olga Balun, Andrei Kiselev, Sergei Kritsuk, Iscander Latypov, and Andrei Tronin, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Lecture Title: Signs of a Significant Endogenous Component in the Thermal Regime of Soils on Agricultural Lands of the Novgorod Region.

Abstract: This study aims to identify a suitable test site for investigating the significance of the endogenous component of the soil energy budget in the natural conditions of the Novgorod region. It was shown that in the non-chernozem zone an arrangement of local areas of nemoral vegetation is placed at areas with high values of convective heat flow. We used metrologically supported digital remote sensing data from Terra / Aqua (MODIS), Terra (ASTER), and Landsat 8 satellites were used to select a test site based on signs of lands with additional endogenous heating from weak temperature thermal waters or exothermic chemical reactions. Our analysis identified agricultural fields located in the coastal zone of Lake Ilmen, about 10 km from the Novgorod Research Agriculture Institute, as meeting all the criteria. Importantly, advancing snowmelt has been observed in these fields during the spring period. To confirm our hypothesis, a comprehensive experiment should be conducted to monitor all temperature-forming factors and control the cultivation of heat-loving crops. This research could contribute to a better understanding of the role of endogenous heating in the soil energy budget and its impact on agriculture.

Rashid Kurbanov, Natalia Zakharova, Maxim Litvinov и Alexander Fokin, Federal Scientific Agroengineering Center VIM, Moscow, Russia.

Lecture Title: Identification of Sosnovsky's Hogweed Plants According to Aerial Photography.

Abstract: Detection and mapping of invasive plants Sosnovsky's hogweed is effectively solved with the use of Earth's remote sensing data. There are problems in the identification, localization, and elimination of growth and spread areas of Sosnovsky's hogweed, in particular in the territories of urban districts and regions. Complete and reliable data on its spread areas are needed to monitor the growth and destruction of Sosnovsky's hogweed, as well as to control the implementation of these measures. Mapping the dynamics of the distribution of this plant using satellite data is not always possible. Unmanned aerial vehicles (UAVs) with high-resolution spatial data represent a promising tool for detecting and mapping Sosnovsky's hogweed. The purpose of the study is to develop a method for detecting and mapping the growth areas of Sosnovsky's hogweed plants based on the proposed algorithm for thematic processing of multispectral aerial photography data. A DJI Matrice 200 v2 quadcopter and a MicaSense Altum multispectral camera were used to collect multispectral data. Monitoring of 146 sites in the Moscow region, Russia, with an area of 304.631 hectares during 2020–2022, was carried out. Based on the results of monitoring, digital maps of all sites have been created. 19 digital maps (orthophotoplan, 5 spectral maps, and 13 vegetation indices) were created at four experimental sites. The sample consisted of 1080 points in three categories (Sosnovsky's hogweed, grass cover, and trees). Based on the Student's t-test, significant differences were revealed between the values of the vegetation indices of Sosnovsky's hogweed, grass, and trees. A method has been developed for determining and mapping Sosnovsky's hogweed growth areas, taking into account the selected vegetation indices (NDVI, MCARI, BS1 user index, and the Green spectral channel). Using this algorithm, Sosnovsky's hogweed was found on an area of 146.664 hectares. This method can be used to monitor and map the dynamics of the spread of Sosnovsky's hogweed in the Central region of the Russian Federation, calculate the exact Sosnovsky's hogweed growth areas, and plan the necessary amount of pesticides for its destruction.

Format of the Conference

The conference is held in a hybrid format: in person at the St. Petersburg Federal Research Center of the Russian Academy of Sciences (39, 14th line, St. Petersburg, Russia) and in the format of videoconference. A single link to the video conference for the opening ceremony, plenary sessions, oral sessions, closing ceremony for participants and listeners: https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09.

The time of the videoconference is indicated in the time zone of St. Petersburg/Moscow (UTC + 3): https://www.worldtimebuddy.com/utc-to-russia-moscow.

Contacts

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