ADOP 2025

Fifth International Conference on
Agriculture Digitalization and Organic Production

ADOP 2025

Conference Programme and Abstracts

June 3–6, 2025
Barnaul, Altai Region, Russia

SPC RAS

Altai state agricultural university

Springer

Organizer

- Altai State Agricultural University (ASAU, Barnaul, Russia)
- St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS, St. Petersburg, Russia)

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- Andrey Ronzhin, SPC RAS

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Conference at a glance

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<tr><th colspan="3">Tuesday, June 3, 2025</th></tr>
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https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1
Cochairs: Oksana Ogij and Roman Meshcheryakov</td><td>Online Oral Session 2: Organic Production and Sustainable Agriculture
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<tr><td>15:00-15:15</td><td colspan="2">On-line Joint Photography of Conference Participants
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<tr><td>16:00-18:00</td><td colspan="2">Dinner</td></tr>
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<tr><td>09:00-12:30</td><td>Oral Session 3: Biologization of Animal Husbandry
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Cochairs: Roman Nekrasov, Georgy Laptev, and Vladimir Surovtsev</td><td>Online Oral Session 4: Mathematical Support and Remote Monitoring
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Cochairs:</td><td>Online Oral Session 6: Application of Ground and Air Robots
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Cochairs: Andrey Ronzhin and Mikhail Tatur</td></tr>
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Friday, June 6, 2025	
09:00-20:00	**Visit to an Organic Farm**

Conference Programme

Tuesday, June 3, 2025	
08:30-09:00	**On-line Registration**
09:00-12:30	**Oral Session 1: Digital Technologies, Aquaculture and Bioinformatics** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Cochairs:** Oksana Ogij, Roman Meshcheryakov
	Roman Meshcheryakov, Konstantin Rusakov, and Gleb Tevyashov. Determining Average Size and Average Speed of Fish Using Deep Learning Technologies
	Van Le, Quyen Vu, and Andrey Ronzhin. Real-time Fish Detection and Counting with YOLOv11
	Sergei Maslennikov, Darya Borisova, and Tigran Gevorgian. The Potential of Mariculture and Artificial Reproduction of the Red King Crab Paralithodes Camtschaticus for the Stabilization of Biological Resources
	Al-Mamoori Loay Mohammed Mazbin, Lina Lagutkina, Alexander Martyanov, and Viktor Kryuchkov. Stimulation of Carp Spawning Using OVASIS Hormone and Pituitary Extract under Iraqi Conditions
	Alexander Bekarev. Digital Maturity of the Fisheries Sector: The Regional Aspect
	P. Gourkhede, A. Naikwadi, Gopal Shinde, M. Pendke, B. Wankhede. Digital Tools in Soil Health Diagnostic and Organic Farming: A Sustainable Way
	Petr Akmarov, Olga Knyazeva, Dmitry Kondratiev, and Natalia Gorbyshina. Regional Features and Problems of Production Digital Transformation in Russia
	Mariya Golovko and Maksim Belousov. Digitalization of Agriculture: Prospects and Threats
	Abusupyan Dibirov. The Impact of Digitalization on the Sustainability of the Food Supply Chain
	Gregory Komlatsky. Digital Transformation in Russian Beekeeping
	Elena Yildirim, Georgi Laptev, Daria Tiurina, Valentina Filippova, Larisa Ilina, Natalia Novikova, Kseniya Sokolova, Ekaterina Ponomareva, Vasiliy Zaikin, Irina Klyuchnikova, Elena Korochkina, Darren Griffin, and Michael Romanov. Bioinformatic Data Analysis from Metagenomic Whole Genome Sequencing of Endometrial Microorganisms in Cows with Normal and Pathological Conditions
	Elena Yildirim, Georgi Laptev, Daria Tiurina, Vitaliy Morozov, Valentina Filippova, Larisa Ilina, Natalia Novikova, Kseniya Sokolova, Ekaterina Ponomareva, Vasiliy Zaikin, Alesya Savicheva, Darren Griffin, and Michael Romanov. Bioinformatic Analysis of NGS Sequencing Data of the Intestinal Microbiome in Broilers Fed Supplements of Glyphosate, Probiotic Bacterial Strains and Antibiotics
	Vyacheslav Shalamov. Trends and Cases of AI Implementation for Agriculture and Agro-Industry Based on the Company's Requests and Cases
	Olga Prozorovskaya. Competencies of the 21st Century: The Relevance of Digital Knowledge and Skills for a Successful Career in the Agricultural Sector
09:00-12:30	**Online Oral Session 2: Organic Production and Sustainable Agriculture** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Cochairs:** Valentina Kundius and Olga Cherepanova
	Vladimir Semenov and Alexander Semenov. Organic Production as a Competitive Advantage of Rural Development
	Rahul Kamble, Kailash Gadhe, Bhagwan Asewar, Vidhya Wadmare, Prasad Gangakhedkar, Kishor Anerao, Pratyush Kumari Rath, and Gopal Shinde. Organic Food and Farming: Regulations, Challenges and Market Evolution in India and Worldwide
	Alexander Bykov, Natalya Sergeyeva, and Ekaterina Malykha. The Development of the Global Organic Market and the Possibility of Exporting It From Siberia

	Anatoly Tingaev, Yulia Cheprunova, and Alexander Davydov. Organic Waste Assessment for Land Fertility Improvement Using Information Technology
	Aleksandr Perekopskiy, Anton Zakharov, Nikolay Kostyuchenkov, Aleksey Mishanov, and Alexey Komoedov. Theoretical Background for the Development of Organic Crop Production Technologies
	Olga Antonova, Lilia Stupina, and Valentina Kursakova. Use of Straw and Destructors in Resource-Saving Technologies of Organic Farming and Its Influence on the Microbiome and Qualitative Composition of Humus
	Sergey Medvedev, Aleskander Semenov, and Elena Semenova. Organic Gardening
	Mehak Rai Sethi and Poonam Gulati. The Interplay between Innovations in Plant Breeding and Climate Change: Trailing Their Mottled Range of Impressions upon Each Other
	Vishal Keshaorao Ingle, Harishchandra Wamanrao Awari, Sumant Baburao Jadhav, Uday Manoharrao Khodke, and Gopal Uttamrao Shinde. Estimation of Crop Evapotranspiration for Groundnut Crop in Semiarid Region of Maharashtra, India
	Natalia Tsatsenko, Alexey Tolmachev, Arkadiy Moiseev, and Ludmila Tsatsenko. Insight into the Living Lab Methodology in Sustainable Agriculture: A Review
	Prasad Gangakhedkar, Hemant Deshpande, Vaibhav Jadhav, Sachin Giri, Govind Desai, Rahul Kamble, Vidhya Wadmare, Bhagwan Asewar, and Gopal Shinde. The Smart Food Revolution: Industry 4.0 Tools and Their Impact
	Pratyush Kumari Rath, Digambar Shivram Perke, Srinivas Bharti, Ranjit Chavan, Dheeraj Pathrikar, Prasad Gangakhedkar, Rahul Kamble, Bhagwan Asewar. A Review on Optimization of Farm Revenue to Mitigate Global Food Insecurity Dynamics
	Elena Pauyrova. Assessment of Greenhouse Gas Emissions from Agricultural Food Losses
	Gayane Gasparyan, Albert Markosyan, Sose Markosyan, Surik Hunanyan, Hovhannes Yeritsyan, and Tatevik Jhangiryan. Intraprofile Distribution of Mobile Forms of Some Heavy Metals in Eroded Mountain Chernozems
	Song Zengyi and Viktar Lemiasheuski. The Influence of Roadside Plants on Urban Ecology and the Treatment of Lead Pollution
	Ludmila Bakina, Yulia Polyak, Alexander Gerasimov, and Natalya Mayachkina. Dynamics of Agrophysical Properties of Agricultural Soil Contaminated with Oil
12:30-13:00	**Lunch break**
13:00-13:30	**Opening Ceremony** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Cochairs:** Vladimir Pleshakov and Andrey Ronzhin
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	Keynote speech 1: *Aleksandra Figurek, Elena Semenova, and Aleksandr Semenov*. Digital and Artificial Inteligence Marketing in the Food Industry
	Keynote speech 2: *Valentina Kundius, Vladimir Chernyshkov, Olga Cherepanova.* Development of organic agriculture based on the biologization of agricultural technologies
	Keynote speech 3: *Vladimir Surovtsev and Khapsat Dibirova*. Opportunities and limitations of the development of organic food production: world experience and the situation in Russia
15:00-15:15	**On-line Joint Photography of Conference Participants** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1
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	Susanna Mirzabekyan, Marine Balayan, Anahit Manvelyan, Lilit Malkhasyan, Haykush Batikyan, Astghik Pepoyan, and Natalya Harutyunyan. Pathogenic and Antimicrobial Resistance Profiles of Bacterial Strains in Bovine Mastitis: Insights from the Stepanavan Region of Armenia
	Yan Li, Viktar Lemiasheuski, and Svetlana Maksimova. Effects of Earthworms on Livestock and Poultry Manure Composting and Its Environmental and Economic Significance: A Meta-Analysis
	Roman Nekrasov, Alexei Butenko, Evgenia Tuaeva, Magomed Chabaev, Konstantin Ostrenko, Ivan Kutyin, Nadezhda Bogolyubova, and Julia Bogolyubova. Prospects for BSFL Conversion of Grain Wastes into Pig Feedstuffs
	Antonina Afanaseva, Vladislav Sarychev, Georgi Laptev, Larisa Ilina, Elena Yildirim, and Valentina Filippova. Influence of the Feed Additive "Profort" on the Rumen Microbiome of Black-pied Holstein Cows
	Valentina Filippova, Larisa Ilina, Elena Yildirim, Andrei Dubrovin, Kseniya Sokolova, Ekaterina Ponomareva, Alisa Dubrovina, Irina Klyuchnikova, Vasiliy Zaikin, Ivan Malakhov, Georgi Laptev, Darren Griffin, and Michael Romanov. Effectiveness Evaluation of Microbiological Preparations for Preserving Ensiled Plant Feeds in a Model Experiment Using Microbiomic and Bioinformatic Tools
	Konstantin Ostrenko, Natalia Nevkrytaya, Anastasia Ovcharova, Ivan Kutyin, Kirill Koltsov, Alexander Deltsov, and Vladimir Maximov. The Effect of Coriander and Fennel Fruits on the Digestibility and Digestibility of Feed in Bull Calves During Rearing
	Tatiana Lashkova. Preparation of Lake Sapropel in Cow Diets in Novgorod Region
	Susanna Mirzabekyan, Marine Balayan, Lilit Malkhasyan, Syuzanna Abrahamyan, Haykush Batikyan, Natalya Harutyunyan, Astghik Pepoyan, Sergeyi Tspnetsyan, and Anahit Manvelyan. Correlation between Physicochemical Parameters of Milk and Risk of Bacterial Contamination: A Case Study in Armenia
	Konstantin Ostrenko. Essential Oil Crops in Animal Husbandry as Digestive and Immune Stimulants
	Alexandra Dydykina. Monitoring of Milk Quality of Kholmogorsky Cows in the Arkhangelsk Region
	Viktar Lemiasheuski. Provision of Substrates for Energy Processes in Bulls at Different Levels of Metabolizable Protein
09:00-12:30	**Online Oral Session 4: Mathematical Support and Remote Monitoring** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Cochairs:** Boris Sokolov and Alexey Stepanov
	Valentina Maksimova, Tatiana Makarovskikh, Alexander Zhulev, and Nikita Levchenko. Algorithms for Detecting of Forested Overgrown Lands of a Region Using NDVI Data
	Viktor Gornyy, Olga Balun, Andrew Kiserlev, Igor Smirnov, Andrew Tronin, and Elena Shkodina. Satellite Mapping of Soil Enthalpy for the Introduction of Sorghum Crop in the Non-Chernozem Zone (Using the Novgorod Oblast as a Case Study)
	Evgenii Mitrofanov, Ivan Blekanov, Aleksey Martemyanov, Evgenii Kruchinin, Rodion Akhrameev, Mikhail Arkhipov, and Olga Mitrofanova. A Multi-Agent Agricultural Robot System for Precision Crop Monitoring
	Alexey Stepanov, Elizaveta Fomina, Artem Bordakov, Konstantin Dubrovin, and Lyubov Illarionova. Use of Satellite Imagery and UAV to Assess Weed Infestation of Soybean Crops
	Viacheslav Zelentsov, Viktor Mochalov, and Natallia Lapitskaya. Methodology for

	Assessing the Quality of Multispectral Space Imaging Data in Landscape Element Monitoring
	Su Jian, Lai Ning, Geng Qinglong, Li Qingjun, Zhao Haiyan, and Chen Shuhuang. Research on the Application of Multispectral Remote Sensing Technology Based on NDVI and NDRE with Case Analysis of Precision Nitrogen Management in Drip-Irrigated Winter Wheat
	Valerii Zakharov, Boris Sokolov, Andrey Mironov, and Minglei Fu. Feed Wheat Yield Multifactorial Forecasting
	Boris Sokolov, Alexander Spesivtsev, Natallia Lapitskaya, and Alexander Semyonov. Consideration of NON-factors in Complex Models of Agricultural Production
	Alexander Machikhin. Remote Sensing of Plant Health Using Spectral Imaging Systems
	Su Jian. Monitoring and Diagnosis of Nitrogen Nutrition and Powdery Mildew in Drip-Irrigated Winter Wheat Using UAV Remote Sensing
	Rashid Kurbanov, Natalya Zakharova, Alexander Fokin. Method of Soil Surface Profile Estimation from Aerial Photography Data
	Aliaksandr Zheshka. Investigation of Physical-Mechanical Properties of fertilizers for DEM modeling
	Natalia Ivanova. Optimization of Agricultural Surfactants Application Using IR Thermography and Computer Processing Methods
	Alexander Spesivtsev. Expert Knowledge Peculiarities of "Fuzzy Assessments" and "Fuzzy Measurements" for Modeling the State of Complex Agricultural Objects
12:30-13:00	**Lunch break**
13:00-15:00	**Plenary Session 2** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Chair:** Nadezhda Bogolyubova and Georgy Laptev
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	Keynote speech 5: *Georgy Laptev*. Bioinformatics methods in zootechnical and veterinary research
	Keynote speech 6: *Anatoly Shulakov*. Artificial intelligence technologies as a tool for solving labor shortage problems in dairy farming
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Thursday, June 5, 2025	
09:00-12:30	**Oral Session 5: Biologization of Plant Growing** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Cochairs:**
	Tatyana Zyubanova, Oksana Minaeva, Elena Akimova, Egor Dyukarev, and Natalia Tereshchenko. Effect of Plant Residues and Eisenia Fetida Earthworms on Lettuce Productivity
	Andrey Kukharenko. Biologized Farming Technology as a Factor in the Development of Rural Areas of the Krasnodar Territory
	Lyudmila Tiranova, Alexander Tiranov, and Alexander Grigoriev. The Effect of New Microbiological Fertilizers Arcsoil Nitrogen and Arcsoil Phosphorus on the Yield and Quality of Potato Tubers
	Oksana Kremneva, Alena Nesterova, Artem Ponomarev, Daria Nazarenko, and Igor Davletbaev. Efficiency of Biological Preparations against a Complex of Winter Wheat Fungal Diseases
	Ksenia Gasiyan and Oksana Kremneva. Study of the Correlation between the Level of Spore Infestation and the Development of Fungal Leaf Diseases in Winter Wheat Crops
	Yihe Ji, Viktar Lemiasheuski, and Ying Li. Determination of Components and Properties of Fennel Essential Oil
	Viktar Lemiasheuski, Yu Ting, Zhao Xiaoping, and Zhu Yu. Exploring Potato Extract as a Multifunctional Drug Carrier. Pharmacophore Mapping and Anticancer Targeting via Network Pharmacology and Molecular Docking
	Valeria Allahverdyan. The Effect of Bacteria of the Genus Bacillus on the Accumulation of Mycotoxins Fusarium Graminearum
	Elena Gyrnets. Identification and Biocontrol Properties of Bacterial Strains Promising for Protection of Apple Trees from Diseases and Pests
	Marina Sidorenko. Phosphate-solubilising Bacteria Are Promising Agents in Organic Farming
	Meisam Zargar and Maryam Bayat. A Global Perspective of Herbicide-Resistant Weeds and Management Options
	Tatiana Sidorova. Bacteria of the Genus Pseudomonas as Producers of Biofungicides Effective Against Toxin-Producing Fungi
	Vasiliy Kuznetsov, Liudmila Sokolova, and Vladimir Belyaev. Evaluation of the Effectiveness of the Use of the Preparations "Azofit N" and "Azofit P" Against the Background of Various Doses of Mineral Fertilizers in the Fertility Zones of the Field and Their Aftereffects in the Cultivation of Spring Wheat in the Steppe Zone of Altai Krai
	Aleksandra Tsygichko. Development of New Bioinsecticides Based on Insect Baculoviruses against Lepidoptera Pests
	Anna Homyak. Preservatives as a Way to Stabilize and Extend the Shelf Life of a Biofungicide Based on the Strain Bacillus Subtilis BZR 336g
09:00-12:30	**Online Oral Session 6: Application of Ground and Air Robots** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Cochairs:** Andrey Ronzhin and Mikhail Tatur
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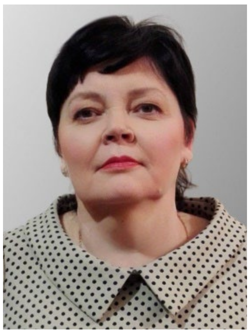
	Roman Meshcheryakov, Alexander Salomatin, and Aleksandr Shirokov. A Method for Task Allocation Among Heterogeneous Group Robots for Automated Operation of a Fruit Orchard
	Ramil Faizullin, Niyaz Imamov, Tatyana Tsoy, Edgar Martinez-Garcia, and Evgeni Magid. Agricultural Field Coverage with a Group of Mobile Robots Considering a

	Soil Compaction Risk and Energy Efficiency
	Elena Shkodina, Andrey Ronzhin, and Hongbiao Ding. Using UAVs in Potato Growing: Diseases Diagnostics, Liquid Spraying
	Peter Kazakievich, Dmitry Komlach, Anton Yurin, Alexander Verabei, Aliaksandr Kroshchanka, and Sergey Bushuk. Toward Finding Methods for Identifying Internal and External Defects in Potato Tubers
	Gombo Gantulga, Nyamdorj Ganbat, Ulziikhutag Ganbat, Davaasambuu Undarmaa, Luvsan Lkhagvasuren, and Tserendorj Ulziibaatar. Study on Designing a Multifunctional Agro Robot Platform for Weed Controlling in Vegetable Field
	Vladimir Azarenko, Maksim Kurylovich, Viktor Goldyban, Nikolay Bakach, Uladzislau Sychev, and Valeria Selivanova. Use of Technical Vision for Automatic Separation of Defective Potato Tubers
	Peter Kazakievich, Anton Yuryn, and Dmitry Komlach. Justification of the Rational Parameters of the Fruit Flow Divider during Sorting
	Aliaxandr Zheshka, Vladimir Azarenko, and Dmitry Komlach. Justification of the Parameters of the Robotic Spreader by Studying the Properties of Fertilizers
	Vladimir Azarenko, Valeria Selivanova, Dmitry Komlach, Uladzislau Sychev, Tatyana Kim, Viktor Goldyban, and Maksim Kurylovich. Robotic Platform for Autonomous Application of Pesticide
	Vladimir Belyaev, Dmitry Pirozhkov, and Alexey Kovalev. Evaluation of the Effectiveness of Quadcopter Operation Parameters and Modes When Spraying Spring Wheat Crops
	Mikhail Uzdiaev, Marina Astapova, and Elchin Khalilov. A Comparative Study of YOLO Architectures for Poles Detection on Agricultural Land UAVs Images
	Kantemir Bzhikhatlov, Aslan Zammoev, and Inna Pshenokova. Autonomous System for Monitoring and Managing Cattle Behavior
	Timur Gamberov, Ramil Safin, Tatyana Tsoy, Hongbing Li, and Evgeni Magid. Holistic Digital Human Models in Gazebo: A Case Study on Agricultural Workflows
	Alexey Komoedov and Anton Zakharov. Development and Research of an Automated Sectional Working Unit for Weed Removal in Organic Potato Production
	Stanislav Krivko. Aerial Vehicles to Monitor Crops in Large Production Fields
12:30-13:00	**Lunch break**
13:00-15:00	**Plenary Session 3** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Chair:** Vitaly Dzhavakhiya and Igor Smirnov
	Keynote speech 8: *Sergey Zhevora*. Experimental and Theoretical Substantiation of the Elements of Biologized Potato Cultivation Technology in the Regions of the Russian Federation
	Keynote speech 9: *Vitaly Dzhavakhiya*. Potential Uses of Induced Plant Resistance to Pathogens and Pests in Organic Farming
	Keynote speech 10: *Kirill Golokhvast*. Prospects of Agricultural Research Organizations as the Real Market Players
	Keynote speech 11: *Alexey Dorokhov and Igor Smirnov*. Digital Monitoring and Robotic Means Technologies for Horticulture and Plant Nurseries
15:00-15:30	**Closing Ceremony** https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 **Chair:** Vladimir Pleshakov and Andrey Ronzhin

Abstracts

Plenary Session 1

Keynote speech 1



Aleksandra Figurek, Dr.Sci., GNOSIS Mediterranean Institute for Management Science, School of Business, University of Nicosia, Nicosia, Cyprus.
Elena Semenova, Chief Researcher, Department of Economic Relations in Agro-Industrial Complex Organizations, Federal State Budgetary Scientific Institution "Federal Research Center of Agrarian Economy and Social Development of Rural Areas – All Russian Research Institute of Agricultural Economics", Doctor of Economics, Professor, Moscow, Russia.
Aleksandr Semenov, Associate Professor of the Department of Technological Development of Rural Life Support Systems, Vernadsky Russian State University of National Economy, Balashikha, Moscow region, Russia.

Lecture Title: Digital and Artificial Inteligence Marketing in the Food Industry.

Abstract: Artificial intelligence (AI), is having a significant impact on the upcoming era of corporate business developments. The next priorities for digitalisation adoption result from the tasks the food industry needs to accomplish: – the food industry's management system as a whole should be concentrated on speeding up its digital transformation to enhance producers' economic sustainability and social growth; on the development and implementation of the nation's food strategy, the recruitment of sector unions, organisations for collaboration and tracking their own to engage independently in the field of digitisation, the provision of skilled IT workers to the industrial complex, the integration of modern information technologies into the public administration of the agricultural sector, and the improvement of divisional control over the sector's informatisation procedures. The aim of the paper is to present development the Artificial Intelligence related, consumer-focused aspects of strategic marketing in the Cypriot food industry. The following research objectives will be addressed: Identification of appropriate consumer-focused digital technologies' and artificial intelligence tool in the Cypriot food industry; Development of the most appropriate consumer-focused digital marketing strategy for the Cypriot food industry; Examination of the practises utilised for gathering both internal and external data connected with consumer-oriented marketing; Integration of digital and artificial intelligence performance measurements, and provision of recommendations for the Cypriot food sector.

Keynote speech 2

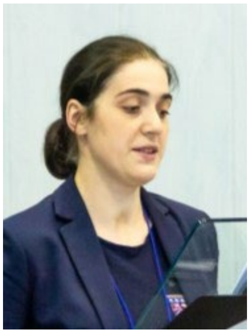
Valentina Kundius, Doctor of Economics, Professor, Altai State University, Barnaul, Russia.
Vladimir Chernyshkov, Candidate of Agricultural Sciences, Associate Professor, Altai State University, Barnaul, Russia.
Olga Cherepanova, Candidate of Agricultural Sciences, Associate Professor, Altai State University, Barnaul, Russia.

Lecture Title: Development of Organic Agriculture Based on the Biologization of Agricultural Technologies.

Abstract: Organic agriculture is recognized as a strategic vector for the development of agricultural production in almost all countries of the world due to the negative consequences of the use of intensive technologies of agriculture for nature and society, consumers of non-organic food products. Due to limited resources and problems of food supply to the population in

some countries, agricultural scientists will have to solve important problems of food security without excessive chemicalization of agriculture and the use of aggressive herbicides. The article presents the results of scientific research and testing of technologies for the production of organic products based on the application of organizational techniques and biologization of agricultural technologies. Special attention is paid to plant protection and increasing soil fertility based on biologization, digitalization of business processes, and the use of unmanned aerial vehicles in organic farming. An integrated system of protection against diseases, pests and weeds is recommended, including the use of entomophages, biological pest control methods and organic farming. To replenish and increase soil fertility, and improve soil structure, it is recommended to use scientifically based crop rotation, automated technical and technological techniques, and show the dynamics of the economic effectiveness of using organic technologies in agriculture and the mechanisms for achieving socio-ecological and economic effects.

Keynote speech 3



Vladimir Surovtsev, Leading Researcher, Institute of Agricultural Economics and Rural Development (IAERD) – structural division at St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Candidate of Economics, Associate Professor, St. Petersburg, Russia.

Khapsat Dibirova, Junior Researcher, Institute of Agricultural Economics and Rural Development (IAERD) – St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Lecture Title: Opportunities and Limitations of the Development of Organic Food Production: World Experience and the Situation in Russia.

Abstract: This article analyzes potentialities, positive and negative externalities, factors and limitations for the development of organic production in Russia and beyond, and considers the risks of organic agriculture that arise when ensuring food security. Worldwide experience shows that both positive and negative externalities affect the production of organic products. On the one hand, rural employment is supported, ethnographic, rural and wellness tourism is developing, and the environmental burden is reduced in places the principles of organic farming are applied to. On the other hand, veterinary and phytosanitary risks are growing, food security is being threatened, the intensity of permitted pesticides' use is growing, and the environmental burden is increasing in the regions of well-developed agriculture. Organic farming, as a rule, less affects the environment per unit area, though the "environmental costs" per production unit may increase, and therefore on the total volume of production. Sustainable development of organic food production in Russia is possible through the development and widespread implementation of domestic labor-saving technologies that combine the potentialities of biologization and digitalization, based on advanced research in biotechnology, agricultural science and digital technologies, what requires an increased support for interdisciplinary research.

Plenary Session 2

Keynote speech 4

Nadezhda Bogolyubova, Leading researcher, Head of the Department of Physiology and Biochemistry of Farm Animals, Federal Research Center for Animal Husbandry named after Academy Member L.K. Ernst, Dubrovitsy, Moscow region, Russia.

Lecture Title: Animal and poultry nutrition factors are the basis for maintaining health and obtaining high-quality livestock and poultry products.

Abstract: Animals and poultry of modern genotypes have a high genetic productivity potential, but it often cannot be fully realized due to the impact of stress of various nature on the body. Animal health is an integral part of their well-being, it serves as a prerequisite for both high productivity and the safety of the resulting products for humans. Feed factors of additional nutrition of various nature (antioxidants, vitamins, their complexes, etc.) help reduce the negative impact of stress on the body, increase adaptive capabilities, which helps to increase immunity, improve antioxidant status, and improve product quality. This method of preventing negative effects of stress in livestock and poultry farming is discussed as the most acceptable and cheapest.

Keynote speech 5

Georgy Laptev, Director General of BIOTROF LLC, Chair of the “Fodder Biotechnology” Department at the St. Petersburg State Agricultural University (SPbGAU) production, Doctor of Biological Sciences, Professor, Pushkin, St. Petersburg, Russia.

Lecture Title: Bioinformatics methods in zootechnical and veterinary research.

Abstract: Based on a symbiosis of molecular genetic methods (including the metagenomic NGS-sequencing) and the use of bio-informatics databases (PICRUSt2 (v.2.3.0), KEGG Pathway, etc.) an unambiguous relationship between disorders in the predicted metabolic pathways of the microbiome for the farm’s animals and birds against the intensive and highly productive livestock farming that exhibited a deterioration in their health, productivity and life expectancy has been revealed. A number of probiotics has proven effective in solving this problem. So, the restoration of the rumen microbiota against the AntiKloss probiotic reduced the severity of 4 metabolic pathways of microbial estrogen degradation in the endometrium of cows by 31-100%, thus, preventing the development of postpartum endometritis. Due to the RNF project funding, as based on the analysis of the differential expression of all genes by high-performance RNA-seq, a conclusion has been arrived at, that the herbicide glyphosate contained in feed causes a "breakdown of the genetic program" in birds, negatively affecting the expression of over 11 thousand genes.

Keynote speech 6

Anatoly Shulakov, Director General of SIBAGROCOMPLEX Group of Companies, Master of Animal Science, Omsk, Russia.

Lecture Title: Artificial intelligence technologies as a tool for solving labor shortage problems in dairy farming.

Abstract: The shortage of qualified specialists in dairy farming is a serious problem negatively affecting the farms’ productivity and efficiency. Given the personnel’ shortage, the introduction of artificial intelligence (AI) technologies turn out a key tool for optimizing processes and increasing the competitiveness of the industry. Under the presentation framework, some successful examples of the AI technologies' introduction to dairy farming will be considered at the example of a specific farm.

Keynote speech 7

Plenary Session 3

Keynote speech 8

Sergey Zhevora, Director of the Russian Potato Research Centre, Doctor of Agricultural Sciences, Professor of the Russian Academy of Sciences, Lyubertsy, Moscow Region, Russia.

Lecture Title: Experimental and Theoretical Substantiation of the Elements of Biologized Potato Cultivation Technology in the Regions of the Russian Federation.

Keynote speech 9

Vitaly Dzhavakhiya, Head of the Department, Department of Molecular Biology, All-Russian Research Institute of Phytopathology, Candidate of Biological Sciences, Bolshye Vyazemye, Moscow Region, Russia.

Lecture Title: Potential uses of induced plant resistance to pathogens and pests in organic farming.

Abstract: Induced resistance (IR) allows plants to more actively protect themselves from phytopathogens and pests. Accumulated experimental data indicate the prospects of using IR, along with other strategies, for the development of sustainable, environmentally friendly and economically profitable crop production, especially in the field of organic farming. At the same time, the use of IR in plant protection remains insignificant, compared to pesticides and the cultivation of resistant varieties. The report will attempt to shed light on the reasons for this and discuss such advantages of IR as the ability to provide protection against a wide range of phytopathogens and increase the nutritional and nutraceutical value of crops, as well as preserve biodiversity.

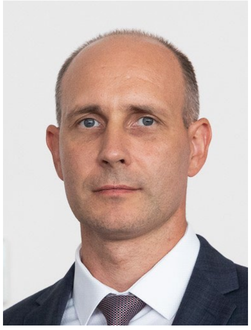
Keynote speech 10

Kirill Golokhvast, Director of the Siberian Federal Research Centre of Agro-BioTechnologies of the Russian Academy of Sciences (SFSCA RAS); Director of the Advanced Engineering School "Agrobiotek" at the Tomsk State University; Corresponding Member of the Russian Academy of Education (RAE), Doctor of Biological Sciences, Professor of the Russian Academy of Sciences, Krasnoobsk, Novosibirsk Region, Russia.

Lecture Title: Prospects of agricultural research organizations as the real market players.

Abstract: Cultivation of agricultural crops using "Speed breeding" technology. State-of-the-Art agriculture considers extremely important the cultivation of high-quality seed material. Siberian Branch of the Russian Academy of Sciences (SB RAS) has acquired an extensive experience in growing many crops including potatoes, wheat, oats, soybeans, rapeseed and dandelion of Taraxacum kok-saghyz brand in an artificial climate. According to the research results, it has been revealed that all crops in optimal microclimate conditions (full-spectrum LED lighting, temperature, humidity) have sufficiently intensive growth and development of aboveground organs and root system. Due to these properties became possible the seed material cultivation. Particularly, for the wheat case this phenomenon led to four harvests a year, thus, the breeding process was speeded up conspicuously.

Keynote speech 11



Alexey Dorokhov, Deputy Director for Research and Managerial Work, FGBNU FNATS VIM, Full member of the Russian Academy of Sciences, Doctor of Technical Sciences, Professor, Moscow, Russia.

Igor Smirnov, Chief Researcher, Head of the Department for Technologies and Machines for Horticulture, Viticulture and Plant Nurseries, FGBNU FNATS VIM, Doctor of Technical Sciences, Associate Professor, Moscow, Russia.

Alexey Kutyrev, Leading Researcher, Head of the Laboratory of Intelligent Digital Systems for Monitoring, Diagnostics and Process Management in Agricultural Production, FGBNU FNATS VIM, Candidate of Technical Sciences, Moscow, Russia.

Lecture Title: Autonomous Navigation of Robotic Platforms in Orchards: Semantic Segmentation and Path Planning.

Abstract: The article is devoted to the development of a method for autonomous navigation of robotic platforms for industrial horticulture using semantic segmentation based on the SegFormer architecture. For training the models, a dataset including 1200 RGB images of orchard rows was used. The data were augmented (rotation ±15°, brightness correction ±15%) to enhance the model's robustness to variations in shooting conditions. Annotation was carried out by marking six classes of objects, including «Track» (motion trajectory) and «Tree» (trees), with class distribution balanced (70/15/15 for training/validation/testing). A comparative analysis of six model variants (B0-B5) was conducted, which revealed the optimal balance between accuracy (SegFormer-B5: Val mIoU = 0.59) and speed (SegFormer-B0: 1.52 FPS). The employed image processing methods (median filtering, spline approximation) ensured the smoothing of the motion trajectory. The proposed approach enables real-time trajectory planning and obstacle avoidance, ensuring safe and efficient navigation in dynamic orchard environments. Practical recommendations based on the study results include the use of SegFormer-B0/B1 for real-time navigation and SegFormer-B4/B5 for mapping tasks. The results of the work confirm the potential of applying SegFormer models in agricultural robotics for autonomous navigation in orchard rows.

Oral Session 1: Digital Technologies, Aquaculture and Bioinformatics

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

Lecture Title: Determining Average Size and Average Speed of Fish Using Deep Learning Technologies.

Abstract: Aquaculture in modern conditions is one of the priority directions of human economic activity, aimed at rational use of aquatic biological resources and maintenance of ecological balance in freshwater and marine ecosystems, provid-ing reproduction and cultivation of various hydrobionts, including fish, mollusks, crustaceans and algae, under controlled conditions, allowing to regulate both the quality and quantity of raw materials. In recent years, given the significant number of water areas in Russia actively developing fish farms fish farms and biological laboratories for breeding and research of fish. Many tasks in fish production facilities that are performed by staff and are often time-consuming and resource-consuming are effectively handled with the use and development of digital technology. Tasks aimed at analyzing visual information with the help of artificial intelligence technologies and deep learning networks are presented in a wide range of directions. An automatic fish monitoring system was developed that uses the YOLOv9 neural network detector and StrongSORT tracking to measure the length, mass and speed of each individual in real time, and to construct full distributions of these parameters. In an experiment with 100 catfish fry, the system showed high accuracy (the measurement error does not exceed a few percent), while allowing the detection of extreme values and behavioral anomalies that are inaccessible with traditional manual methods.

Van Le and Andrey Ronzhin, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Quyen Vu, Le Quy Don Technical University (LQDTU), Ha Noi, Viet Nam.

Lecture Title: Real-time Fish Detection and Counting with YOLOv11.

Abstract: As the population grows, so does the demand for protein and fish resources. The fishing industry faces the challenge of striking a balance between environmental protection and meeting the demand for food through fish products. Industrial aquaculture technologies, leveraging artificial intelligence (AI) and robotics, address this issue. While traditional methods rely primarily on manual labor, the integration of real-time fish detection and counting technologies demonstrates promising practical results. This article analyzes a fish detection and counting system based on the YOLOv11 model, distinguished by its ability to recognize and localize fish in complex aquatic environments. On the Deepfish dataset with a single fish class, the model achieved 96.4% mAP50, 93.2% precision, and 90.3% recall. The system not only delivers high accuracy in real-world conditions but also processes data in real time, effectively supporting the monitoring and management of fish resources. These findings highlight the potential of applying AI technologies in the fishing industry, laying the groundwork for future intelligent solutions. Due to its scalability, the YOLOv11 model can be further optimized to meet the growing needs of the industry and scientific research.

Sergei Maslennikov, Advanced engineering school "Institute of Biotechnology, Bioengineering and Food Systems"; A.V. Zhirmunsky National Scientific Center of Marine Biology, Far Eastern Branch, Russian Academy of Sciences, Vladivostok, Russia.

Darya Borisova and Tigran Gevorgian, A.V. Zhirmunsky National Scientific Center of Marine Biology, Far Eastern Branch, Russian Academy of Sciences, Vladivostok, Russia.

Lecture Title: The Potential of Mariculture and Artificial Reproduction of the Red King Crab Paralithodes Camtschaticus for the Stabilization of Biological Resources.

Abstract: Based on the assessment of the natural population of the red king crab, the work on the biotechnology of artificial reproduction of this valuable commercial species is especially important. The paper presents the results of a study of the effect of stocking density and water temperature on the survival of red king crab fry at early stages of development (less than one year). Studies were conducted to assess the survival of yearlings and the rate of weight growth depending on the temperature conditions of maintenance. Three temperature ranges were tested: 1 – between sublethal 15°C and lethal 24°C; 2 – between sublethal 15°C and optimal 8-10°C; 3 – optimal from 8 to 10°C.

Al-Mamoori Loay Mohammed Mazbin, Astrakhan State Technical University, Astrakhan, Russia; Ministry of Agriculture of Iraq, Iraq.

Lina Lagutkina, Alexander Martyanov, and Viktor Kryuchkov, Astrakhan State Technical University, Astrakhan, Russia.

Lecture Title: Stimulation of Carp Spawning Using OVASIS Hormone and Pituitary Extract under Iraqi Conditions.

Abstract: The study investigates the efficacy of OVASIS hormone in stimulating reproduction in Cyprinus carpio under controlled conditions in Iraq. The study was conducted at the Al-Suwaira Central Government Fish Hatchery, and included 16 female and 16 male parent fish, divided into four groups (A, B, C, D) that received different hormone treatments. The results showed that the group given a single dose of 100% OVASIS hormone (group D) showed the shortest latency period (14 hours), the highest egg production (1050 grams per female), and fertilization (94%) and hatching (92%) rates, outperforming other groups using pituitary extracts alone or in combination with OVASIS. The study highlights OVASIS hormone as an effective and cost-effective alternative to conventional pituitary extracts, simplifying hormone administration while enhancing reproductive performance. In addition, the study emphasizes the importance of environmental factors such as temperature and water quality in improving the success of induced spawning. By significantly improving reproductive efficiency, OVASIS offers a promising strategy to increase the productivity of fish farms and meet the growing global demand for aquaculture. These findings support the adoption of synthetic hormonal technologies to promote sustainable fish farming, especially in areas facing challenges in natural reproduction. The research concludes that OVASIS not only accelerates sexual maturation but also improves egg quality, making it a viable solution for large-scale aquaculture operations.

	**Alexander Bekarev**, KarRC RAS, Petrozavodsk, Russia. **Lecture Title:** Digital Maturity of the Fisheries Sector: The Regional Aspect. **Abstract:** The report examines the concept of digital maturity of the fisheries sector with an emphasis on regional specifics. The key factors contributing to the introduction of digital technologies in the fishing industry, including infrastructure and the level of training, are analyzed. The advantages of digitalization are identified, such as increased production efficiency and resilience to external challenges. The conclusion underlines the need for an integrated approach to achieve optimal results in the development of the fisheries sector at the regional level.
	**P.H. Gourkhede, A.B. Naikwadi, Wankhede B.D.**, Department of Soil Science and Agricultural Chemistry, COA, VNMKV, Parbhani, Maharashtra, India. **Gopal Shinde**, Department of farm Machinery and Power Engineering, CAET, VNMKV, Parbhani, Maharashtra, India. **M.S. Pendke**, All India coordinated Research Project on Dryland Agriculture (AICRPDA), VNMKV, Parbhani, Maharashtra, India. **Lecture Title:** Digital Tools in Soil Health Diagnostic and Organic Farming: A Sustainable Way. **Abstract:** Currently, a lot of attention is being paid to the fight against water blooming. This paper 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 cyanobacteria 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 paper 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.
	**Petr Akmarov, Olga Knyazeva, Dmitry Kondratiev, and Natalia Gorbyshina**, Udmurt State Agrarian University, Izhevsk, Russia. **Lecture Title:** Regional Features and Problems of Production Digital Transformation in Russia. **Abstract:** The article considers regional and industry-specific features of production digital transformation in modern Russia. It shows trends in increasing inter-industry and interregional gaps in the innovative development level, which are caused by the industries specifics and regions differentiation by the state support level. In particular, the agriculture digital transformation is significantly lagging behind other industries. The existing trends lead to the infrastructure accelerated development and population living standards of individual regions, while the development of most other regions lags behind. Lagging regions become less attractive for people to live in, which causes negative migration in such regions and an population outflow to territories of advanced development. The main reasons causing different levels of production digital transformation are shown, among which the most important are the historical features of territorial development and production industry specifics. Each industry has specific areas of digital transformation and technologies that ensure production effective

	development. The paper proposes measures to equalize territorial development based on deepening the production digitalization level as the main factor in increasing its efficiency and, as a consequence, increasing the region socio-economic development level.
	**Mariya Golovko and Maksim Belousov**, Kuban State Agrarian University, Krasnodar, Russia. **Lecture Title:** Digitalization of Agriculture: Prospects and Threats. **Abstract:** The digital transformation of agriculture offers significant opportunities to enhance productivity, reduce costs, minimize environmental impact, and address the issue of workforce outflow from the industry. However, this process also presents substantial challenges, particularly in the areas of social equity and access to technology. This article examines current trends in the digitalization of agriculture in Russia, including the adoption of technologies such as the Internet of Things (IoT), artificial intelligence (AI), drones, and industrial robots. The economic benefits of digitalization, supported by case studies from leading agricultural enterprises, are highlighted, while barriers to technology adoption – such as high costs, regional disparities, and a shortage of skilled labor – are analyzed. The article also explores the social implications of digitalization, including increased inequality and job displacement, and provides recommendations for fostering a more inclusive and sustainable digital transformation in the agricultural sector.
	**Abusupyan Dibirov**, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia. **Lecture Title:** The Impact of Digitalization on the Sustainability of the Food Supply Chain. **Abstract:** In the food supply chain, digitalization in all links of production and promotion of products to the consumer is of an unsystematic and disjointed nature. Most of the used computer programs, applications and electronic means of accounting and control of activity parameters are poorly integrated with each other. Digital transformation is most successfully carried out in long supply chains, mainly in retail and product processing, but less actively in the production link based on large agribusiness operating on an industrial basis. End-to-end integrated digitalization of the process of creating product value from the field to the end consumer is at the initial stage of its emergence. Creation of institutional conditions for the systematic implementation of digital solutions in food supply chains based on the creation of interorganizational information systems operating on a single digital platform contributes to a significant increase in trust between participants, transparency of business ties, equivalence of exchange, efficiency and sustainability of the supply chain as an economic system. The study was conducted to examine the state of the digitalization process of supply chains in the agro-industrial complex, identify problems of interorganizational interaction and cooperation in the supply chain, assess development prospects, and develop measures to stimulate the development of digital technologies. As the level of digitalization increases, business relationships in the supply chain will become regular, which will contribute to increasing the sustainability of food supply chains.

Gregory Komlatsky, Kuban State Agrarian University, Krasnodar, Russia.

Lecture Title: Digital Transformation in Russian Beekeeping.

Abstract: The current state of Russian beekeeping has been analyzed. It has been established that 95% of all enterprises consist of small-scale private and farm operations that rely on outdated technologies and a high degree of manual labor. Based on the conducted research, the technological level of beekeeping corresponds to the second and third technological paradigms. In the context of implementing the Agriculture 4.0 concept, beekeeping requires transformation through the integration of artificial intelligence. A review of existing digital solutions highlights the lack of a comprehensive approach to digitalization within the industry. The initial stage of building a digital infrastructure involves computerization through technical tools for collecting, storing, and transmitting information. Given that one of the key challenges is monitoring bee populations within hives, the use of in-hive sensors and IoT devices allows beekeepers to gather real-time data on microclimate conditions, colony strength, overall hive health, and honey productivity – enabling them to make timely and informed decisions. Artificial intelligence and machine learning can be applied to analyze collected data, identify patterns and trends, and help beekeepers prevent issues while optimizing hive management. Machine vision systems can process images captured by sensors to assess bee health, monitor behavior, and detect diseases and pests. Additionally, satellite imagery can be used to determine the blooming periods of entomophilous agricultural crops, ensuring the timely deployment of bees for pollination. The study identifies key challenges hindering digitalization in the beekeeping sector. It has been established that the development of digital resources is constrained by a lack of necessary financial resources among beekeepers, an underdeveloped information and communication network, the absence of widespread broadband internet access, a lack of experience in digital technologies, insufficient knowledge among specialists, and weak motivation. The study concludes that there is a critical need for a unified platform for data processing, storage, and decision-making based on collected information.

Elena Yildirim, Valentina Filippova, Larisa Ilina, and Kseniya Sokolova, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin; Federal State Budgetary Educational Institution of Higher Educa-tion "St. Petersburg State Agrarian University", Pushkin, St. Petersburg, Russia.

Georgi Laptev, Daria Tiurina, Natalia Novikova, Ekaterina Ponomareva, Vasiliy Zaikin, and Irina Klyuchnikova, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin, St. Petersburg, Russia.

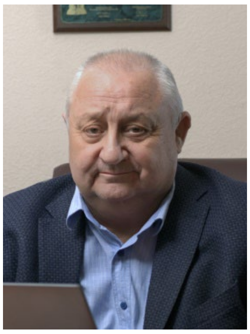
Elena Korochkina, Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State University of Veterinary Medicine", St. Petersburg, Russia.

Darren Griffin, School of Natural Sciences, University of Kent, Canterbury, Kent, UK; Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University, Chatuchak, Bangkok, Thailand.

Michael Romanov, Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg; L.K. Ernst Federal Research Center for Animal Husbandry, Dubrovitsy, Podolsk, Moscow Oblast, Russia; School of Natural Sciences, University of Kent, Canterbury, Kent, UK; Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University, Chatuchak, Bangkok, Thailand.

Lecture Title: Bioinformatic Data Analysis from Metagenomic Whole Genome Sequencing of Endometrial Microorganisms in Cows with Normal and Pathological Conditions.

Abstract: There remains no consensus on the microbiological causes of endometritis in cows. The aim of this study, therefore, was to analyze the endometrial microbiome using metagenomic whole genome sequencing (WGS) with subsequent bioinformatic data analysis using high-yielding cows kept on an organic farm (Group 1A) compared to animals kept on a large industrial complex as follows: clinically healthy (Group 2A), with subclinical (Group 2B), or purulent-catarrhal endometritis (Group 2C). Using Illumina MiSeq platform, WGS results revealed that the dominant bacterial phyla were Bacillota in Groups 2A, 2B and 2C, as well as Bacteroidota, Fusobacteriota and Bacillota in Group 1A. In industrial farm conditions, subclinical and clinical endometritis was associated with an increase in the amount of *Clostridium botulinum* in the uterus ($p < 0.05$). In contrast to Group 2A, the dominant bacterial species in the organic eco-farm Group 1A were *Bacteroides fragilis* ($55.1 \pm 3.92\%$) and *Fusobacterium necrophorum* ($28.8 \pm 2.63\%$). The use of bioinformatic techniques demonstrated that the endometrial microbiome of clinically healthy cows kept in eco-farm conditions (Group 1A) was enriched in bacteriocin genes compared to other studied animal Groups 2A, 2B and 2C. Thus, the standards of feeding and cattle husbandry adopted to eco-farm conditions imply a different composition and functionality of the cattle endometrial microbiome compared to the more common industrial approaches.



Elena Yildirim, Valentina Filippova, Larisa Ilina, and Kseniya Sokolova, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin; Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg, Russia.

Vitaliy Morozov, Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg, Russia.

Georgi Laptev, Daria Tiurina, Natalia Novikova, Ekaterina Ponomareva, Vasiliy Zaikin, and Alesya Savicheva, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin, St. Petersburg, Russia.

Elena Korochkina, Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State University of Veterinary Medicine", St. Petersburg, Russia.

Darren Griffin, School of Natural Sciences, University of Kent, Canterbury, Kent, UK; Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University, Chatuchak, Bangkok, Thailand.

Michael Romanov, Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg; L.K. Ernst Federal Research Center for Animal Husbandry, Dubrovitsy, Podolsk, Moscow Oblast, Russia; School of Natural Sciences, University of Kent, Canterbury, Kent, UK; Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University, Chatuchak, Bangkok, Thailand.

Lecture Title: Bioinformatic Analysis of NGS Sequencing Data of the Intestinal Microbiome in Broilers Fed Supplements of Glyphosate, Probiotic Bacterial Strains and Antibiotics.

Abstract: Xenobiotics have a negative impact on the composition and function of the intestinal microbiome; this requires measures to correct these disorders. The aim of the study was thus to conduct bioinformatic processing and analysis of NGS sequencing data of the intestinal (caecum) microbiome in broiler chickens, including the analysis of the taxonomic composition and predicted metabolic pathways. Experimental groups of broilers included:

	Group I fed the basic diet (BD); experimental Group II received BD and glyphosate; experimental Group III fed BD, glyphosate and probiotic bacterial strains; and experimental Group IV received BD along with a combination of glyphosate, antibiotics and probiotic bacterial strains. As a result, a reduction in the live weight of broilers by 4.2% ($p < 0.05$) was observed in Group II (against the background of glyphosate pre-sent in feed). Introduction of a mixture of probiotic bacteria into feed (Group III) resulted in an increased body weight compared to Group II ($p < 0.05$). In Group II, dysbiotic changes in the composition of the caecum microbiome were observed: an 8.7-fold increase in the number of Streptococcus genus members compared to the control Group I ($p < 0.05$). In Group IV, an increase in Bacteroidota by 6.2% was observed compared to Group II ($p < 0.05$). In birds from Group II, compared to Group I, a decline ($p < 0.05$) in the intensity of various types of predicted metabolic pathways of the mi-crobiome in the intestinal chyme was established. In particular, those associated with energy, carbohydrate, protein types of metabolism, methanogenesis, synthesis of cofactors, etc. were noted.
	**Vyacheslav Shalamov**, Statanly, LLC, St. Petersburg, Russia. **Lecture Title:** Trends and Cases of AI Implementation for Agriculture and Agro-Industry Based on the Company's Requests and Cases. **Abstract:** In recent years, agro-industrial enterprises, along with the mining and energy sectors, have become leaders in digitalization and the implementation of solutions based on artificial intelligence technologies. Using the example of company requests, the most popular cases of implementing AI for livestock complexes, poultry farms, as well as unique requests, as well as the difficulties, nuances and risks of implementation will be analyzed. Trends and forecasts for the digitalization of agriculture in the coming years will be determined.
	**Olga Prozorovskaya**, recruitment agency, Moscow region, Pushkin city, Russia. **Lecture Title:** Competencies of the 21st century: the relevance of digital knowledge and skills for a successful career in the agricultural sector. **Abstract:** Digital technologies are transforming the agricultural sector, including the use of drones, sensors and precision farming systems to improve production efficiency and reduce costs. It should be emphasized that mastering the skills of working with data, analyzing and interpreting information is becoming critical for future professionals, as decision-making is often based on large amounts of data. Discussion of the role of cloud technologies and Internet of Things (IoT) in agricultural business will also prove relevant, as they provide new opportunities for monitoring and management of agricultural processes. Attention should be paid to the need to develop soft skills such as adaptability and teamwork, which become important in a rapidly changing work environment. Finally, the importance of integrating new technologies into educational programs should not be overlooked so that students can practically apply the acquired knowledge and skills, which in turn will contribute to their successful career in the agricultural sector.

Online Oral Session 2: Organic Production and Sustainable Agriculture


Vladimir Semenov and Alexander Semenov, Vernadsky Russian State University of National Economy, Balashikha, Russia.

Lecture Title: Organic Production as a Competitive Advantage of Rural Development.

Abstract: Achieving and maintaining competitive advantages are one of the goals of economic development. Therefore, it is necessary to take measures to form and maintain competitive advantages at different levels (organization, territory, and region), including through the production of products with special quality. This research explores the theoretical foundations for creating competitive advantages in rural areas by developing organic production. Organic agriculture is a contemporary global trend. The research discusses the peculiarities of organic production and defines competitive advantages for products and rural areas. Analyzing the characteristics of the production of organic products revealed how these factors contribute to creating competitive advantages in rural areas. The authors organized the competitive advantages of rural areas using the criteria of the "rhombus of competitive advantages" by M. Porter. The identified competitive advantages of rural areas associated with the development of organic production can become the basis for making strategic decisions aimed at the socio-economic development of rural areas.

Rahul Kamble, Kailash Gadhe, and Vidhya Wadmare, Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani, Maharashtra, India.

Bhagwan Asewar, Department of Agronomy, College of Agriculture, VNMKV, Parbhani, Maharashtra, India.

Prasad Gangakhedkar and Kishor Anerao, Department of Food Microbiology and Safety, College of Food Technology, VNMKV, Parbhani, Maharashtra, India.

Pratyush Kumari Rath, Department of Agricultural Economics, CoA, VNMKV, Parbhani, Maharashtra, India.

Gopal Shinde, Department of Farm Machinery and Power Engineering, CAET, VNMKV, Parbhani, Maharashtra, India.

Lecture Title: Organic Food and Farming: Regulations, Challenges and Market Evolution in India and Worldwide.

Abstract: With root causes ranging from environmental sustainability to food safety to consumer health, organic farming has become a proven alternative to conventional agricultural practices. The study focusses to give a brief overview of organic agriculture at a glance, a historical perspective, regulatory and market forces, and challenges in adoption, with focus on Indian and International markets. It also sheds light on the Green Revolution's contribution to contemporary agricultural practices as well as the growing global organic farming movement in the context of soil degradation, biodiversity reduction and health concerns related to chemical agricultural practices. It eventually addresses regulatory stakeholders in India, such as the National Programme for Organic Production (NPOP) and Participatory Guarantee System (PGS-India), and relevant international certifications like USDA Organic, EU Organic, and IFOAM-accredited certifications. Although Organic India holds tremendous potential for export but local policy gaps have reduced this potential. An international comparative analysis recommends measures such as strengthening financial support mechanisms, streamlining various certification processes, and improving consumer awareness to reinforce the growth of this sector. Given the higher GDP per capita in developed countries, promoting organic agriculture through inclusion in national policy planning and execution of supply chains (and further separated from traditional scientifically researched agriculture) can potentially strengthen food security, support

	environmentally sustainable agricultural growth, and most importantly, provide India with an upper hand as a leading player in the international organic produce market.
	**Alexander Bykov, Natalya Sergeyeva, and Ekaterina Malykha**, Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Moscow, Russia. **Lecture Title:** The Development of the Global Organic Market and the Possibility of Exporting It From Siberia. **Abstract:** The article examines and systematizes the indicators characterizing the development of organic farming and the market of organic products in different countries of the world, allowing us to build new trends in the development of ex-port-import relations, including from the Siberian Federal District of the Russian Federation. The novelty of the study lies in identifying the factors of the internal (agrotechnical, technological, administrative-legal, organizational, and cognitive) and external environment (soil-climatic, biological, social, institutional, and market conditions) that influence the development of the market and determine the volumes and commodity structure of organic product exports. The research uses monographic, economic-statistical, abstract-logical, and analytical methods. The dynamics of the development of organic agriculture in the countries of the world and the structure of the organic market are revealed, Russia's place in it is deter-mined. The factors hindering the development of the organic products market have been identified. A system of measures has been proposed to promote the export of organic products from the Siberian Federal District with higher added value. The research results can be used by government officials, managers and specialists of the agro-industrial complex, researchers and teachers of higher and secondary educational institutions.
	**Anatoly Tingaev and Alexander Davydov**, Altai State Agricultural University, Barnaul, Russia. **Yulia Cheprunova**, Altai State Pedagogical University, Barnaul, Russia. **Lecture Title:** Organic Waste Assessment for Land Fertility Improvement Using Information Technology. **Abstract:** To improve soil fertility it is necessary to apply organic waste taking into account its chemical composition, sanitary and bacteriological characteristics and environmental impact. In Kalmansky district of Altai Krai on black soil of ordinary low-moisture medium humus medium loamy was carried out the development of methods of assessment and safe application of organic wastes, such as sewage sludge from municipal sewage treatment plants of Barnaul city and poultry manure from poultry farm "Molodezhnaya". To assess organic wastes and their suitability for improving soil quality, a decision support information technology "Recultivant" was created. It was developed in the integrated development environment Visual Studio on Python programming language. To verify the obtained data, field experience was incorporated into the ITPPD "Recultivant". Poultry litter and sewage sludge applied as fertilisers for fertility improvement had an effect on the agrochemical characteristics of the soil. In the field experiment, actual yields were obtained and compared with the calculated yields from IPPI Recultivant. The content of all heavy metals and arsenic in green mass of oilseed radish does not exceed the maximum permissible concentrations. Based on the results of the assessment of sewage sludge from the city of Barnaul and caged chicken litter obtained from JSC "Molodezhnaya Poultry Farm", the ITPPD "Recultivant" formulated a recommendation on their use as organic fertiliser and recultivant of degraded and unproductive soils without additional preparation.

Aleksandr Perekopskiy, Anton Zakharov, Aleksey Mishanov, and Komoedov Alexey, Federal Scientific Agroengineering Center VIM, branch in Saint Petersburg, Saint Petersburg, Russia.
Nikolay Kostyuchenkov, S.Seifullin Kazakh Agro Technical Research University, Astana, Kazakhstan.

Lecture Title: Theoretical Background for the Development of Organic Crop Production Technologies.

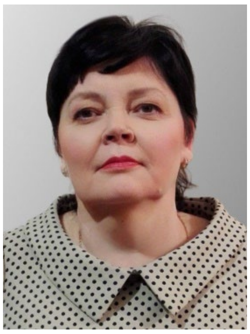
Abstract: Adaptive organic production technologies are developed and introduced within integrated farming systems with a good scientific basis. The intensity of such technologies depends on the materials and machinery on which the technology operates and the resources available to the technology user. For a uniform assessment of the intensity of these technologies, they are classified into three categories: traditional, normal and intensive. The design of technologies for the organic production of crop products must comply with the requirements of legislative and regulatory documents, be aimed at ensuring a favorable state of the environment and reducing negative environmental effects on it, preserve human health and ensure the preservation and restoration of soil fertility. High-tech agricultural technologies using the latest technical means and the modern level of scientific and technological development, well-founded scientific principles and scientific and methodological foundations should serve as a tool for this. This will make it possible to combine advanced scientific developments and modern technical solutions to achieve the maximum biological potential of plants in obtaining high yields of cultivated plants with minimal negative impact on the environment. This is a complex innovative procedure. It uses an interdisciplinary approach that requires the accumulation and synthesis of numerous knowledge areas forming specific requirements for technological processes and individual production units.

Olga Antonova, Lilia Stupina, and Valentina Kursakova, Altai State Agricultural University, Barnaul, Russia.

Lecture Title: Use of Straw and Destructors in Resource-Saving Technologies of Organic Farming and Its Influence on the Microbiome and Qualitative Composition of Humus.

Abstract: It is known that about 120 million tons of straw are produced in the Russian Federation per year, of which 80% is accounted for by straw from grain and leguminous crops, which has a wide carbon-to-nitrogen ratio, which delays its transformation, creating a nitrogen deficiency in the soil and accumulating phytopathogens and phytotoxins. To accelerate its transformation, both in Russia and abroad, it is proposed to use microbiological preparations containing active strains of cellulose and lignin-destroying bacteria or fungi. Recently, organomineral drugs have appeared on the market that have a complex effect on epiphytic and soil microflora, accelerating the decomposition of straw residues. The effect of these drugs has been little studied. In the laboratory (incubation) experiment, we studied the effect of different doses of winter wheat straw, both separately and with inoculation with Mycotope biologics based on the Trichoderma viridi fungus and the NaturAgro EcoGrow organomineral complex with active silicon, on changes in the microbiome, the direction of the processes of transformation and humification of organic matter, the content of total and labile humus, and the qualitative composition of humic substances. An increase in the number of saprophytic, amylolytic, and oligotrophic microorganisms, as well as protease activity during the introduction of straw, both separately and with its treatment with destructors, has been established. The more effective effect of one straw on the qualitative composition of microorganisms is manifested at a dose of 6 t/ha, and when straw is inoculated with a Mycotope at a dose of 4 t/ha, and from EcoGrow at a dose of 6 t/ha. Active mineralization of organic matter was observed with inoculation of 4 tons of EcoGrow straw

and in single-straw variants, while more active nitrogen immobilization was detected in the control. The active transformation of organic matter into humic substances was noted in the variant with the addition of straw of 4 t/ha treated with Mycotope, as well as 6 t/ha of straw treated with EcoGrow. The content of mobile humic acids increases with increasing dose of straw, both alone and when inoculated with its destructors, and the content of mobile fulvic acids is more significant at a dose of straw of 6 t/ha inoculated with EcoGrow. The biopreparation Mycotope had a more significant effect on the degree of decomposition of straw and the formation of humus as a result of the humification of straw in both doses.



Sergey Medvedev, Aleskander Semenov, and Elena Semenova, Federal State Budgetary Scientific Organization "Federal Horticultural Center for Breeding, Agrotechnology and Nursery", Moscow, Russia.

Lecture Title: Organic Gardening.

Abstract: Rationalization of nutrition of the population is associated with a reduction in the consumption of saturated fats and an increase in the proportion of fruit and berry products. Gardening provides the population with food products that have medicinal properties and contribute to the prevention of many diseases, therefore, the greening of this particular industry and the development of organic gardening are urgent tasks. The development of organic gardening corresponds to the priority direction of the Strategy for Scientific and Technological Development of the Russian Federation - the transition to highly productive and environmentally friendly agro management, the development and implementation of systems for the rational use of chemical and biological protection of agricultural products, the creation of safe and high-quality, including functional, food. In terms of the supply of fruits, the Russian Federation is significantly inferior to economically developed countries, the actual consumption of fruits per capita per year is 63 kg at the recommended rate of 100 kg. Organic gardening is an alternative to intensive production, which is due to the negative consequences for humans and the environment of the use of chemical means of protection, mineral fertilizers, hormones, plant growth regulators, antibiotics. The development of organic production reflects the conscious and careful attitude of the population towards the environment and health. The development of organic production is characterized by low specific weight of sown areas using organic production technologies and production technologies with improved characteristics. Organic horticulture products can be obtained from wild resources or from industrial horticulture. Forest wild plants are distinguished by a large species diversity and wide distribution in Russia. The biological reserve of wild apple trees is estimated at 174.7 thousand tons. The global export of wild apple products of the Other Apple Juice group is growing, which indicates an increase in the importance of this product for consumers. The article summarizes the experience of introducing industrial organic gardening in Russia, shows the features of technology, advantages and disadvantages, development opportunities in households. Industrial organic gardening technologies use semi-dwarf and medium-sized rootstocks. The method for laying uterine-cutting and industrial plantings is Shown, developed at the Federal Scientific Center for Horticulture. The created scientific and technological potential contributes to the development of organic gardening in different climatic zones of the country.


Mehak Rai Sethi and Poonam Gulati, Amity University, Mohali, Punjab, India.

Lecture Title: The Interplay between Innovations in Plant Breeding and Climate Change: Trailing Their Mottled Range of Impressions Upon Each Other.

Abstract: The process of plant breeding and evolving newer varieties of plants requires great skills, efforts, time, and experimentation on the part of the Breeders and, in some instances, even farmers. This process involves the employment of a certain degree of modification, either in the genetic makeup of the plants or in the process of their cultivation. This makes it possible for breeders to effectively combat the elements that lead to the degeneration or deterioration of plants and guarantees that the elements that adversely affect their growth are minimised to the greatest possible extent. The climate of the nations where new plant breeding techniques are used can be observed to have both beneficial and detrimental effects. Plant breeding enhances plant quality, but it may also be considered as occupying a medium ground between the two extremes of climate change. At one end of the continuum, plant breeding has a number of positive implications, like an improved agricultural output and resultantly, a boost in the economies of the nations they are developed in. Additionally, by utilising cutting-edge production techniques, the environment is not overworked throughout the plant-generation process. Albeit, on the other extreme, not all changes it brings about are positive. Some of the negative implications include a rise in chemical production, a decline in biodiversity, and excessive water and land consumption. These aspects merely cover the tip of the iceberg. This paper is, therefore, an attempt to shed light over all the grey areas in the domain of plant breeding and highlight the black as opposed to the white. This is an attempt at familiarizing the readers with all the positive and negative implications that plant breeding has the potential to cast over the climate. The researchers suggest ways in which the plant breeders modify their praxes in ways that can minimize the negative impacts on the environment without compromising the production of new varieties of plants.

Vishal Keshaorao Ingle, Harishchandra Wamanrao Awari, Sumant Baburao Jadhav and Uday Manoharrao Khodke, Department of Irrigation and drainage Engineering, CAET, VNMKV, Parbhani, Maharashtra, India.

Gopal Uttamrao Shinde, Department of Farm Machinery and Power Engineering, CAET, VNMKV, Parbhani, Maharashtra, India.

Lecture Title: Estimation of Crop Evapotranspiration for Groundnut Crop in Semiarid Region of Maharashtra, India.

Abstract: Efficient irrigation water management, driven by precise estimation of crop water requirements, is pivotal for ensuring food security. Water, a critical input for agricultural production globally, significantly influences crop yield. Despite its importance, locally available data on crop water requirements for field crops in the Marathwada region is lacking. This investigation focuses on quantifying the crop water requirement of crops in Marathwada by calculating crop evapotranspiration based on established crop coefficients and reference evapotranspiration. Over a 31-year period (1990 to 2021), daily weather data for eight districts in Marathwada was collected to determine reference evapotranspiration using DSS-ET software. The analysis reveals a specific pattern in the daily evapotranspiration of groundnut across all districts. During the initial growth stage (5th to 9th crop week), there is a consistent, albeit slight, demand for water. Subsequently, water requirements gradually increase from the mid-season (9th to 13th crop week) to the seasonal stage (16th to 20th crop week). Jalna District stands out with the highest crop evapotranspiration at 7.32 mm/day. The highest water requirement for groundnut is observed in Jalna (1038 mm), followed

by Hingoli (1020 mm), Parbhani (1007 mm), Nanded (1004 mm), Sambhajinagar (999 mm), Beed (974 mm), and Latur (940 mm), while Dharashiv requires the least water (961 mm) due to its lower temperatures. Spatially, crop evapotranspiration (ETc) for groundnut exhibits regional variations among the eight districts. The southwest and some parts of the southern east of Marathwada have higher ETc, while the northern west regions exhibit lower ETc values. A comprehensive analysis of meteorological data across seven districts using the Mann-Kendall trend test indicates a statistically significant and consistent increasing trend in groundnut meteorological conditions. This promising shift towards more favorable conditions for groundnut cultivation offers valuable insights for farmers and developmental agencies to optimize irrigation water management. Farmers in the Marathwada region can use this data as a guide to determine the appropriate amount and frequency of irrigation for their crops, contributing to sustainable agricultural practices and enhancing food security. The study's findings underscore a positive trajectory in meteorological conditions for groundnut cultivation in Marathwada, emphasizing the importance of adapting agricultural practices to changing climate dynamics for long-term sustainability.

Natalia Tsatsenko, Federal State Budget Scientific Organization "National Center of Grain named after P.P. Lukyanenko", Krasnodar, Russia.
Alexey Tolmachev, Arkadiy Moiseev, and Ludmila Tsatsenko, Kuban State Agrarian University named after I.T. Trubilin, Krasnodar, Russia.
Lecture Title: Insight into the Living Lab Methodology in Sustainable Agriculture: A Review.
Abstract: Living Lab (LL) is one of the important innovation options to tackle a set of agricultural challenges in the nearest future, such as reduction of pesticide application, environmental pollution, soil erosion, reduction of water contamination, mitigation of the impact of climate change on agricultural landscapes, the adaptation of agricultural ecosystems to climate change, maintaining and increasing the biodiversity in the landscape, and securing nutritious food. It is expected that benefits from the effective Living Labs can bring diversity of innovation and also enhance knowledge exchange and knowledge co-creation. The number of living lab projects related to agricultural systems has smoothly grown across the world. Living lab is connected to multistakeholder participation, collaborative design practices, and the iterative process of activities and experimentation in the real-life context. The research of living lab is "in the development" stage. There is still a gap in measuring the effectiveness and expanding the best practices. There is a growing demand for generalized knowledge about LL in agriculture, especially LL methodology. This article highlights the current stage of LL research by conducting the literature review. This work fills the gap in existing knowledge by the systematization and analysis of relevant publications related to LL methodology and evaluation of LL projects.

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Vaibhav Jadhav and Sachin Giri, Department of Food Engineering, VNMKV, Parbhani, Maharashtra, India.
Govind Desai, Department of Food Microbiology and Safety, College of Food Technology, VNMKV, Parbhani, Maharashtra, India.
Rahul Kamble and Vidhya Wadmare, Department of Food Chemistry and Nutrition, VNMKV, Parbhani, Maharashtra, India.
Bhagwan Asewar, VNMKV, Parbhani, Maharashtra, India.
Gopal Shinde, Department of Farm Machinery and Power Engineering, CAET, VNMKV, Parbhani, Maharashtra, India.
Lecture Title: The Smart Food Revolution: Industry 4.0 Tools and Their Impact.

Abstract: Digital technologies are fundamentally transforming the food industry by enhancing operational efficiency, fostering transparency and promoting sustainability. Innovations such as Artificial Intelligence (AI), Internet of Things (IoT), blockchain technology, big data analytics and automation are redefining the methods of food production, processing, distribution and retail. These technological advancements facilitate improved traceability, minimize waste, optimize resource utilization and enhance food safety measures. Nevertheless, the transition towards comprehensive digitalization is fraught with challenges. Elevated costs, cybersecurity vulnerabilities, concerns regarding data privacy and resistance to change may hinder widespread adoption. The implementation of intelligent systems necessitates adherence to regulatory frameworks, infrastructure enhancements and the reskilling of the workforce to effectively engage with novel technologies. In spite of these impediments, digital transformation unveils promising opportunities. It establishes a foundation for more sustainable food systems, more intelligent supply chains and enhanced consumer experiences. This review investigates the principal drivers challenges and prospective future of digitalization within the food sector underscoring the significance of strategic implementation to cultivate a more resilient and innovative industry. Ultimately, digitalization contributes to the establishment of a more resilient and sustainable global food system, ensuring quality and safety whilst addressing the dynamic demands of the market.

Pratyush Kumari Rath, Digambar Shivram Perke, Srinivas Bharti, Ranjit Chavan, and Dheeraj Pathrikar, College of Dharashiv, VNMKV, Parbhani, Maharashtra, India.
Prasad Gangakhedkar and Rahul Kamble, College of Food technology, VNMKV, Parbhani, Maharashtra, India.
Bhagwan Asewar, VNMKV, Parbhani, Maharashtra, India.

Lecture Title: A Review on Optimization of Farm Revenue to Mitigate Global Food Insecurity Dynamics.

Abstract: This review assesses the relationship between agriculture, farmers' income, world hunger and food security concerns in the context of the Sustainable Development Goals. It is known that agriculture plays a vital role in fighting against hunger as well as increasing food safety. Farm income is an important factor towards enhancing sustainability and improving food security among rural people. This paper seeks to demonstrate an interrelationship between hunger, agricultural resources and food security by evaluating three major indicators: the Global Hun-ger Index, the Sustainability Index and the Food Security Index which are instru-mental in sustainable development of mankind. Farm income enhancement has been stressed as one of the key components for building resilient food systems and environmentally sustainable agricultural systems that practice enabling access to safe and nutritious food. It is said that sound policies facilitating market opportunities, improved technology and sustainable agriculture can resolve economic, environmental and hunger issues. And this balanced view is in compliance with the SDG 2 (End Hunger) and SDG 12 (Ensure sustainable consumption and production patterns), thus providing proposals for food security in a climatically and economically challenged available environment.

Elena Pauyrova, Institute of Agrarian Research, National Research University Higher School of Economics, Moscow, Russia.

Lecture Title: Assessment of Greenhouse Gas Emissions from Agricultural Food Losses.

Abstract: About a third of the world's food production intended for human consumption is lost or wasted. Food losses and food waste (FLW) lead to a decrease in the availability of products, a reduction in the income of agricultural producers and have a negative impact on the environment. According to FAO, FLW are one of the main anthropogenic contributors to climate change. From the point of view of environmental sustainability, food losses lead to the irrational use of resources (land, water) and unreasonable emissions of greenhouse gases (GHG) due to the production of goods that ultimately do not fall into consumption. The authors of the study assessed the contribution of individual types of crop and livestock products to the generation of losses based on the calculated data and compared the results with the contribution to GHG emissions from these losses. GHG emissions by product are estimated in accordance with the Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories. According to the calculations, the economic cost of losses of the studied types of products at the stage of production and primary processing can reach 204 billion rubles (in prices of agricultural producers in 2021), which is 2.7% of the cost of gross agricultural output. These losses generate GHG emissions equivalent to 2 million tonnes of CO2, representing 1.7% of total GHG emissions in the agriculture sector. The largest volume of total emissions at the stage of agricultural production is associated with grain losses, despite the fact that the intensity of CO2 emissions per unit of livestock products is higher than grain products. The findings demonstrate potential for mitigating the impact of agriculture on climate change by reducing food losses.

Gayane Gasparyan, Albert Markosyan, Surik Hunanyan, Hovhannes Yeritsyan, and Tatevik Jhangiryan, Armenian National Agrarian University, Scientific Center of Soil Science, Agrochemistry and Melioration named after H. Petrosyan, Yerevan, Armenia.

Sose Markosyan, Yerevan State University, Faculty of Biology, Yerevan, Armenia.

Lecture Title: Intraprofile Distribution of Mobile Forms of Some Heavy Metals in Eroded Mountain Chernozems.

Abstract: Microelements, which are mainly found in soil, play an important role in plants' normal growth and development. Their excess or deficiency disrupts the normal growth and development of living organisms. Consequently, the study of the content and patterns of distribution of microelements in soils, including eroded ones, is of scientific and practical importance. The article discusses the distribution and content of mobile forms of microelements, including manganese (Mn), cobalt (Co), and copper (Cu), in eroded mountain chernozems. A connection has been revealed between erosion and the content of mobile microelements in the soil. The content of mobile microelements decreases as the degree of erodibility of mountain chernozems increases. In strongly eroded chernozems, compared to non-eroded ones, the reserves of mobile manganese are reduced by 62-89%, copper by 64-95%, and cobalt by 49-94%. The amount of mobile copper in slightly eroded, typical chernozems sometimes increases. In typical chernozems, the patterns of microelement distribution within the soil profile also change depending on cultivation and the degree of erosion. It should be noted that the copper content in the upper horizons of non-eroded and slightly eroded arable lands is significantly higher (9.9–10.6 mg/kg) than in their virgin counterparts (7.0–7.7 mg/kg). Regarding manganese and cobalt content, typical chernozems under cultivation differ little from virgin soils.

Song Zengyi, International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus.

Viktar Lemiasheuski, Polessky State University, Pinsk, Republic of 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: The Influence of Roadside Plants on Urban Ecology and the Treatment of Lead Pollution.

Abstract: Due to the rapid development of urbanization and industrialization, lead pollution has become increasingly severe, posing a serious threat to the ecological environment and causing certain harm to human health. The management of lead pollution is also a popular research direction in todays ecological field. Phytoremediation technology, due to its economic efficiency (costs are 15% to 30% of engineering methods), sustainability (carbon footprint reduced by 73%), and ecological friendliness (increase in biodiversity by 58%), has become a core approach for global lead pollution control. Comparative studies between China and Russia show that using a fig tree-biochar composite system in southern China reduces lead leaching risk by 52%, while in the Arctic region of Russia, cold-resistant mycorrhizal willow-wood joint remediation maintains an 89% lead fixation rate even at-30°C, providing a model reference for different climate zones. This paper aims to highlight the important role of roadside plants in urban ecology and their effectiveness in managing urban lead pollution. By reviewing extensive research and analyzing actual cases from multiple countries and regions, it emphasizes that roadside plants are essential components of urban ecological environments and play a crucial role in urban ecological protection. The approach of phytoremediation demonstrates high efficiency, sustainability, economic viability, ecological friendliness, and foresight in addressing lead pollution.

Ludmila Bakina, Yulia Polyak, Alexander Gerasimov, and Natalya Mayachkina, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Lecture Title: Dynamics of Agrophysical Properties of Agricultural Soil Contaminated with Oil.

Abstract: Transportation of oil and petroleum products, their consumption and discharge into the environment of petroleum wastes lead to pollution and degradation of agricultural soils, contribute to a decrease in their fertility. Oil pollution causes disturbances in the morphological, physical, physico-chemical and biological properties of the soil. The influence of oil on the water-physical properties of agricultural soddy podzolic soil of loamy granulometric composition was investigated in long-term field experiment. Oil pollution caused a decrease in soil moisture and specific density at doses of oil 4 L/m2 or more during the first three years after the oil spill. It has been established that in oil-contaminated soils there is a significant increase in the number of soil water-stable aggregates. The increase in the aggregate stability occurs due to a decrease in small fractions (microaggregates and particles) <0.25 mm. The formation of a water-stable structure occurs immediately after soil contamination and is typical for all tested oil doses, including minimal dose (0.7 L/m2). In the coming years, there has been a fragmentation and gradual destruction of the soil water-stable aggregates, but the differences be-tween the control and polluted soils persist until the end of the fifth year of observations.

Oral Session 3: Biologization of Animal Husbandry

Susanna Mirzabekyan, Marine Balayan, Anahit Manvelyan, Lilit Malkhasyan, and Astghik Pepoyan, Armenian National Agrarian University; International Association for Human and Animals Health Improvement, Yerevan, Armenia.

Haykush Batikyan, Natalya Harutyunyan, Armenian National Agrarian University, Yerevan, Armenia.

Lecture Title: Pathogenic and Antimicrobial Resistance Profiles of Bacterial Strains in Bovine Mastitis: Insights from the Stepanavan Region of Armenia.

Abstract: Mastitis is a major concern in the dairy industry, impacting milk quality and economic stability. This study investigates the bacterial composition and antimicrobial resistance (AMR) profiles of raw milk samples from cows with subclinical mastitis in the Stepanavan region of Armenia. Raw milk samples were collected from three local farms and analyzed microbiologically to identify pathogenic bacteria and assess their resistance to common antibiotics using the Kirby-Bauer disk diffusion method. The most prevalent bacterial strains identified include Staphylococcus aureus, Enterococcus faecalis, and Pantoea agglomerans. The results reveal significant antimicrobial resistance, with strains showing resistance to Cephalosporin, Amoxicillin, Doxycycline, Erythromycin, and Tetracycline. The study highlights the complex nature of AMR in Armenian dairy farming, particularly in Lori province, and underscores the urgent need for improved diagnostic and management strategies to address both mastitis and AMR. Additionally, the role of biofilm formation and hemolytic activity in the pathogenicity and resistance mechanisms of mastitis-causing bacteria is discussed. This research provides valuable insights into the microbiological landscape of subclinical mastitis and AMR in Armenia, offering recommendations for future research and disease control strategies to mitigate the risks associated with antimicrobial resistance in dairy farming.

Yan Li, International Sakharov Environmental Institute of Belarusian State University, Minsk, Republic of Belarus.

Viktar Lemiasheuski, Polessky State University, Pinsk, Republic of 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.

Svetlana Maksimova, Republican Institute for Vocational Education Resource Center "EcoTech-noPark – Volma", Minsk, Republic of Belarus.

Lecture Title: Effects of Earthworms on Livestock and Poultry Manure Composting and Its Environmental and Economic Significance: A Meta-Analysis.

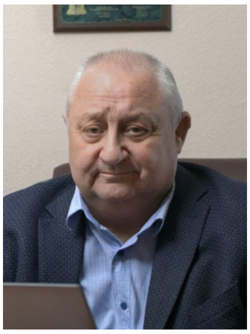
Abstract: The rapid accumulation of organic solid waste, particularly livestock and poultry manure, poses significant environmental challenges. As the need for sustainable waste management grows, composting and vermicomposting have emerged as promising biological treatment methods. This meta-analysis aims to evaluate the role of earthworms in enhancing the composting of livestock and poultry manure, focusing on both the environmental and economic impacts. By examining numerous studies, the analysis highlights the effectiveness of earthworm-assisted composting (vermicomposting) in accelerating the degradation of organic waste, improving nutrient recovery, and reducing harmful emissions. While the composting and vermicomposting processes contribute to greenhouse gas emissions, the presence of earthworms, coupled with proper management practices such as intermittent aeration and the addition of bulking agents, can mitigate these emissions. The economic viability of livestock and poultry manure composting is also assessed, revealing that while the technology is generally economically feasible, its success is influenced by factors such as

the market value of organic fertilizers and system-specific costs. Furthermore, the value of organic fertilizers and the availability of carbon offsets for nutrient recycling are crucial in determining the economic sustainability of these processes. This meta-analysis underscores the importance of integrating earthworms into manure composting as a strategy to improve both environmental sustainability and economic returns.

Roman Nekrasov, Alexei Butenko, Evgenia Tuaeva, Magomed Chabaev, Konstantin Ostrenko, Ivan Kutyin, Nadezhda Bogolyubova, and Julia Bogolyubova, L.K. Ernst Federal Research Center for Animal Husbandry, Podolsk Municipal District, Moscow region, Russia.

Lecture Title: Prospects for BSFL Conversion of Grain Wastes into Pig Feedstuffs.

Abstract: Circular economy offers innovative opportunities to convert agricultural waste into valuable products and feedstocks. We established a high level of bioconversion of nutrients from grain wastes into BSFL biomass (FCR 2.56; per DM). The dried samples were found to have high crude protein (35.1%) and crude fat (40.8%) contents, suggesting the use of BSFL biomass as a feedstock for pigs. The inclusion of a high protein dietary component (CP 58.6%, lysine 1.30%) prepared from dried BSFL stimulated feed intake of pigs by 8.93% ($p<0.05$). There was a high degree of correlation between ADG-ADFI ($r=0.83$, $p<0.001$) as well as FCR-ADFI ($r=0.74$, $p<0.001$). The result of fattening pigs using BSFL meal is effective as the final ADG, carcass pair weight, slaughter yield were higher than the control ($p<0.05$). Thus, the use of grain wastes in the BSFL rearing technology creates prerequisites for further development of circular economy of waste processing with the help of insect technology and increases the sustainability of the feed base in pig breeding. In the long term, this approach significantly reduces the costs of production of final products, reduces waste and its negative impact on the environment.



Antonina Afanaseva and Vladislav Sarychev, Altai State Agricultural University, Barnaul, Russia.
Georgi Laptev, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin, St. Petersburg, Russia.
Larisa Ilina, Elena Yildirim, and Valentina Filippova, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin; Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg, Russia.

Lecture Title: Influence of the Feed Additive "Profort" on the Rumen Microbiome of Black-pied Holstein Cows.

Abstract: The use of additives in the diet, including those based on probiotic preparations, helps to improve digestion processes, normalize the balance of microflora, metabolism and increase animal productivity. The aim of this work was to analyze the rumen microbiome of Black-and-White Holstein cows using the enzyme-probiotic feed additive "Profort". The cows of the experimental group were fed 30.0 g of probiotic three times for 15 days, with a break of 15 days (total days of experiment – 75). As a result, at the end of the experiment, in the experimental group, at the family level, significant reliable differences were found in the number of cellulolytic bacteria taxa: Oscillospiraceae, SR 1, Flavobacteriaceae and Weeksellaceae, as well as taxa of lactate-fermenting bacteria. Thus, the use of the feed additive "Profort" in the diet of highly productive lactating cows helps to increase the concentration of beneficial microorganisms (cellulolytic, lactate-utilizing) in the rumen, fermenting the intermediate products of the breakdown of feed components to form volatile fatty acids necessary for the synthesis of milk components.

Valentina Filippova, Larisa Ilina, and Elena Yildirim, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin; Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg, Russia.

Vitaliy Morozov and Ivan Malakhov, Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg, Russia.

Kseniya Sokolova, Ekaterina Ponomareva, Alisa Dubrovina, Irina Klyuchnikova, Vasiliy Zaikin, and Georgi Laptev, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Pushkin, St. Petersburg, Russia.

Andrei Dubrovin, Information Technologies, Mechanics and Optics (ITMO) University, St. Petersburg, Russia.

Darren Griffin, School of Natural Sciences, University of Kent, Canterbury, Kent, UK; Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University, Chatuchak, Bangkok, Thailand.

Michael Romanov, Federal State Budgetary Educational Institution of Higher Education "St. Petersburg State Agrarian University", Pushkin, St. Petersburg; L.K. Ernst Federal Research Center for Animal Husbandry, Dubrovitsy, Podolsk, Moscow Oblast, Russia; School of Natural Sciences, University of Kent, Canterbury, Kent, UK; Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University, Chatuchak, Bangkok, Thailand.

Lecture Title: Effectiveness Evaluation of Microbiological Preparations for Preserving Ensiled Plant Feeds in a Model Experiment Using Microbiomic and Bioinformatic Tools.

Abstract: Ensiling is the main method of preparing bulk forages for cattle in the conditions of the risk farming zone. This zone includes St. Petersburg and the Leningrad Oblast due to their geographical location and high humidity. To improve the efficiency of enzymatic processes during ensiling, various biopreparations of lactic acid bacteria that consist of one or more strains are used. However, the biotechnological potential of lactic acid bacteria involved in silage fermentation remains insufficiently studied. Thus, the selection of microorganisms for use in silages should always be carried out with all rigor and meet certain criteria. The aim of this study using metagenomic next-generation sequencing (NGS) and bioinformatics was to assess the efficiency of applying monocultures of lactic acid bacteria strains (Lactobacillus plantarum 50 and Enterococcus faecium 46). We further evaluated combining these strains for the ensiling process in a model laboratory experiment. As a result, it was shown that the greatest stability of microbiome and a high proportion of lactobacilli in the ensiled feeds, the best pH levels and silage quality were achieved using a combination of strains (L. plantarum 50 + E. faecium 46).

Konstantin Ostrenko, Anastasia Ovcharova, Ivan Kutyin, and 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.

Alexander Deltsov and Vladimir Maximov, Moscow State Academy of Veterinary Medicine and Biotechnology – MVA named after K.I. Skryabin Akademika, Moscow, Russia.

Lecture Title: The Effect of Coriander and Fennel Fruits on the Digestibility and Digestibility of Feed in Bull Calves During Rearing.

Abstract: High profitability in animal husbandry can be achieved using modern technologies in feeding, physiology and the rational use of natural

resources. Experiments with vegetable essential oils demonstrate the possibility of using natural products, in particular, plant secondary metabolites, to influence the fermentation processes in the rumen by selectively suppressing certain types of microorganisms, while intensively stimulating the immune system of the calves. The aim of the study was to study the effect of feed additives of technically processed coriander and fennel fruits on the digestibility and nitrogen retention of feed. The data obtained in the study showed that the inclusion of a mixture of technologically processed coriander and fennel fruits in various ratios in the technological cycle of fattening improves the growth rates of Holstein bulls. These data indicate that fruits and the essential and fatty oils contained in them affect the effectiveness of feed use. Thus, the weight values of bulls at 7 months of age in the 3rd experimental group (9 g of fennel fruits and 32 g of coriander fruits), the average daily increase was significantly higher by 81.0% ($p < 0.05$), the gross increase by 83.0% ($p < 0.05$) and the increase in body weight was higher by 35.6% ($p < 0.05$), compared with the control group. The highest digestibility of feed nutrients was also observed in the bulls of this experimental group. The bulls of this group outperformed their peers from the control groups in terms of digestibility of dry matter, respectively, by 3.89% ($p < 0.05$), crude protein – by 2.66% ($p < 0.05$), crude fat – by 2.01%, crude fiber – by 4.78% ($p < 0.05$) and nitrogen-free extractives (BEV) – by 2.72% ($p < 0.05$). Thus, the use of technically processed coriander and fennel fruits usually has an effective effect on the main indicators of digestibility and digestibility of feed nutrients, which ensures intensive growth and development.

Tatiana Lashkova, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Lecture Title: Preparation of Lake Sapropel in Cow Diets in Novgorod Region.

Abstract: A positive effect of fulvic acid on digestion processes was established, especially in the second group. The digestibility of dry matter, crude protein, and crude fat was higher than the control values. The use of the feed additive in the diet reduced the number of pathologies in the post-calving period, shortened the res-toration of reproductive functions by 24 days, and reduced the number of diarrhea cases in newborn calves by 40% relative to the control values. The results of the studies showed that the concentration of the studied metabolic products in the blood of animals was generally within normal values, but there were intergroup differences. Thus, the analysis of the protein index parameters showed that the use of fulvic acid in the diet at a dosage of 25 ml led to a decrease in its indicator below the recommended values, and amounted to 0.84 versus 0.9 in the control and first experimental groups. A decrease in the AST to ALT ratio in the experimental groups, especially in the first one, can be regarded as a reduction in pathological changes in the liver and the manifestation of the hepatoprotective therapeutic effect of fulvic acid. A study of the experimental data allows us to conclude that the use of fulvic acid in the diets of deeply pregnant cows did not have a critical effect on the composition of the blood serum. The results obtained allow us to recommend fulvic acid for use in the diets of deeply pregnant cows on farms in the North-West region in the amount of 20 ml per head per day. Key words: fulvic acid, pregnant dry cows, diet, post-calving period, blood biochemistry; reproductive functions.

Susanna Mirzabekyan, Marine Balayan, Lilit Malkhasyan, Syuzanna Abrahamyan, Astghik Pepoyan, and Anahit Manvelyan, Food Safety and Biotechnology Department, Armenian National Agrarian University; International Association for Human and Animals Health Improvement, Yerevan, Armenia.
Haykush Batikyan, Natalya Harutyunyan, and Sergeyi Tspnetsyan, Food Safety and Biotechnology Department, Armenian National Agrarian University, Yerevan, Armenia.

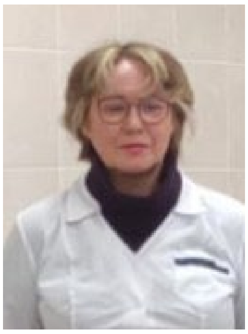
Lecture Title: Correlation between Physicochemical Parameters of Milk and Risk of Bacterial Contamination: A Case Study in Armenia.

Abstract: Milk is an essential component of human nutrition, and its safety and quality are influenced by its physicochemical parameters, including pH, fat and protein content, lactose concentration, and freezing point. These factors affect microbial stability and the risk of bacterial contamination. This study investigates the correlation between milk composition and microbial contamination risk by analyzing 70 milk samples from Armenian supermarkets. The physicochemical properties of the samples were evaluated using the Lactoscan Milkanalyzer, while microbial composition was determined through classical bacterial enumeration methods and VITEK® 2 compact ID/AST system. The results indicate that lower pH levels (e.g., 6.64–6.67) favor Lactic Acid Bacteria, which may contribute to natural preservation, whereas higher pH levels (e.g., 6.78–6.87) increase susceptibility to spoilage bacteria such as Pseudomonas spp. and Bacillus spp. Additionally, higher lactose content correlated with the presence of Lactobacillus and Bifidobacterium species, which are considered beneficial. Importantly, no pathogenic bacteria (e.g., Salmonella, E. coli, Listeria monocytogenes) were detected in any of the samples, confirming the effectiveness of pasteurization and commercial processing. These findings highlight the importance of physicochemical properties in influencing microbial composition and emphasize the need for strict storage conditions to minimize spoilage risks.

Konstantin Ostrenko, VNIIFBiP, Borovsk, Russia.

Lecture Title: Essential Oil Crops in Animal Husbandry as Digestive and Immune Stimulants.

Abstract: Intensive animal husbandry is impossible to imagine without the use of new biological substances of natural, biotechnological and chemical origin. To obtain high-quality products, priority must be given to products of biotechnological and natural origin obtained using modern technologies. Recently, many studies have been conducted to evaluate the use of products obtained from essential oil cultures to stimulate the immune system, digestive system and affect the microbiota of animals. Secondary plant metabolites, including essential oils (EM), as well as fatty oils contained in fruits, as natural feed additives for ruminants and to use their potential to increase the efficiency of rumen fermentation. Secondary metabolites of essential oil cultures have proven to be very promising compounds, as they selectively affect the rumen microbiome in ruminants and activate protein breakdown in both in vitro and in vivo studies. Research on the main components of essential oil crops should focus on identifying active and beneficial compounds and their trained combinations, optimizing doses, and using an integrated approach at the farm level with a focus on animal welfare, productivity, and economic benefits.

	**Alexandra Dydykina**, FGBUN FITSKIA Ural Branch of the Russian Academy of Sciences, Arkhangelsk, Russia. **Lecture Title:** Monitoring of Milk Quality of Kholmogorsky Cows in the Arkhangelsk Region. **Abstract:** Monitoring of the milk quality of Kholmogorsky cows in the Arkhangelsk region was carried out under conditions of year-round tethered keeping and feeding of cows according to the schedule. The mass fractions of fat, protein, lactose, dry matter, SOMO, urea, and somatic cells were determined in average daily milk samples. It was found that the mass fraction of fat and protein in the milk of Kholmogorsky cows varied depending on the season of the year and the stage of lactation. There was a tendency to decrease the fat content of milk in the summer by 0.19%, which is probably due to a change in the structure of the diet and an increase in the proportion of succulent feeds. The increased content of somatic cells in a number of samples over 250 thousand/ml indicated the presence of subclinical mastitis, requiring diagnostic and therapeutic measures. The urea content in milk, as an indicator of protein nutrition, also showed fluctuations. High urea values (up to 49 mg%) indicated an overabundance of protein in the diet, which can negatively affect.
	**Viktar Lemiasheuski**, Polessky state university, Pinsk, Republic of Belarus. **Lecture Title:** Provision of Substrates for Energy Processes in Bulls at Different Levels of Metabolizable Protein. **Abstract:** Animal productivity and product quality depend on the composition of the final products of feed digestion in the gastrointestinal tract, which, when entering the body tissues, are used as substrates for tissue enzymes that form a certain direction of metabolic processes. Purpose of the study: to study the features of the use of substrates in energy metabolism at different levels and ratios of nitro-gen-containing substances in the diet of Kholmogory bulls. Materials and methods. The research was carried out on 4 bulls of the Kholmogory breed using the latin square method at the age of 7-8 months and the initial live weight of the bulls was 147.3 kg. The animals received 4 different levels of metabolizable protein in their diet: 7.80; 8.06; 8.40 and 8.60 g/MJ of metabolizable energy. At the end of each monthly period of the experiment, before feeding and 3 hours after it, the indicators of gas-energy exchange were studied using the mask method and the quantitative contribution of the main groups of substrates to energy metabolism (to the amount of heat production). Results. The effectiveness of using substrates in energy metabolism was assessed based on the results of studying the influence of different levels of metabolizable protein in the diet of Kholmogory bulls during the growing period. The effective use of metabolizable energy and amino acids for live weight gain has been established at a level of metabolizable protein in the diet of 8.2 g/MJ of metabolizable energy. A decrease in the contribution of metabolizable energy and amino acids to the increase in production was shown at a metabolizable protein value of 8.5 g/MJ of metabolizable energy.
Online Oral Session 4: Mathematical Support and Remote Monitoring	
	**Valentina Maksimova, Tatiana Makarovskikh, Alexander Zhulev, and Nikita Levchenko**, South Ural State University, Chelyabinsk, Russia. **Lecture Title:** Algorithms for Detecting of Forested Overgrown Lands of a Region Using NDVI Data. **Abstract:** In recent decades, due to an increase in the average daily air temperature and lack of precipitation, cases of forest fires in Siberia and the Urals have become more frequent. As a result, there is a need to replenish the balance of forest fund lands using operational tools for it. It is also known that agriculture has quite large areas of overgrown land, which is one of the most significant economic and environmental issues. The article considers the intelligent information system named "UralGIS-Agro", designed for

	information and analytical support of the agricultural industry of Chelyabinsk region. Algorithms for searching for overgrown agricultural lands and recognizing areas overgrown with coniferous forests are proposed, based on an analysis of the dynamics of vegetation index changes according to remote sensing data. Based on the results of the module, we determined the areas of overgrown agricultural land and calculated the benefits for the region if these lands if they are transferred to the forest fund, as well as we estimated the possible costs of restoring these lands for agriculture. The availability of up-to-date information on agricultural lands overgrown with coniferous vegetation will determine the further development of the analytical module "Rational use of overgrown agricultural lands".
	**Viktor Gornyy, Olga Balun, Andrew Kiserlev, Andrew Tronin, and Elena Shkodina**, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia. **Igor Smirnov**, Yaroslav-the-Wise Novgorod State University, Veliky Novgorod, Russia. **Lecture Title:** Satellite Mapping of Soil Enthalpy for the Introduction of Sorghum Crop in the Non-Chernozem Zone (Using the Novgorod Oblast as a Case Study). **Abstract:** Climate change has led to the possibility to introduce heat-loving, high-yielding crops in the non-chernozem region of Russia. However, not all areas of this region have reached the required growing degree-days for these crops. The goal of this study is to use satellite thermal imagery to identify areas with increased soil enthalpy as a step towards introducing these crops in the region. It is known that the heat supply of soil depends on many factors. Therefore, it is important to identify the most suitable agricultural lands for introducing heat-loving plants in a cost-effective way. Since 2016 agroecological trials of heat-loving sorghum crops in this region. These data from long-term studies form the basis for compiling forecast maps of the potential yield of sorghum crops on agricultural land and identifying promising sites for cultivation. In creating these forecast maps, we have used long-term archives of digital data from thermal satellite imagery conducted in the Novgorod Oblast over the past 20 years. Patterns of spatio-temporal variability of heat supply of agricultural lands in the Novgorod Region were revealed. It was concluded that the developed technology can be applied to other heat-loving agricultural crops.
	**Evgenii Mitrofanov, Ivan Blekanov, Aleksey Martemyanov, Evgenii Kruchinin, Rodion Akhrameev, and Olga Mitrofanova**, **S**aint Petersburg State University, St. Petersburg, Russia. **Mikhail Arkhipov**, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia. **Lecture Title:** A Multi-Agent Agricultural Robot System for Precision Crop Monitoring. **Abstract:** This paper focuses on automating crop production by proposing an integrated robotic based system for collecting and analyzing data from agro-industrial fields. The system comprises a robot, a computer or tablet application for managing the robots and viewing analytical information, and a server equipped with advanced artificial intelligence models for in-depth analysis of data received from the robots, facilitating the generation of agronomic recommendations. This work aims to create a comprehensive system that automatically collects data using modern sensors, processes it, and analyzes it in real time. The prototype is being developed taking into account its further use in agricultural fields before sowing, with potato or wheat crops. The paper details the robot's structural features, its components, and the technical solutions employed during development. A 3D model of robot construction with deformation properties was developed. It also presents the software architecture that unifies the entire system into a

cohesive operational mechanism, addressing various aspects, including safety considerations. In addition, the general robot work pipeline was proposed.

Alexey Stepanov, Far Eastern Agriculture Research Institute, Khabarovsk, Russia.

Elizaveta Fomina, Far Eastern Agriculture Research Institute; Computing Center Far Eastern Branch of the Russian Academy of Sciences, Khabarovsk, Russia.

Artem Bordakov, Konstantin Dubrovin, and Lyubov Illarionova, Computing Center Far Eastern Branch of the Russian Academy of Sciences, Khabarovsk, Russia.

Lecture Title: Use of Satellite Imagery and UAV to Assess Weed Infestation of Soybean Crops.

Abstract: Estimating crop heterogeneities, including those caused by weed infestation, is an important task in precision agriculture. Sentinel-2 data from 2022 to 2024 and monthly DJI Mavic 3M imagery from 2024 were used to assess weed infestation in soybean fields in Khabarovsk Krai. Weekly NDVI time series were generated using Fourier series fitting. To identify weed-infested soybean fields, the characteristics of the NDVI seasonal curve were evaluated – specifically, the width of the peak at half (d1/2) and at three-quarters of the height (d3/4). It was found that in Khabarovsk Krai, the average d1/2 ranged from 119.3 to 128.4 for weed-infested fields and from 81.1 to 92.2 for lightly weed-infested fields. Meanwhile, d3/4 ranged from 72.6 to 84.2 for weed-infested fields and from 50.1 to 57.8 for lightly infested fields. These differences were found to be statistically significant ($p < 0.05$). Experimental results from weed-infested soybean plots in Primorsky Krai indicated that NDVI curve peaks were consistent with these specified ranges. Using monthly DJI Mavic 3M imagery of an experimental soybean site in 2024, located in Khabarovsk Krai, it was observed that heterogeneities associated with weed infestation could be identified in late June to early July, prior to crop row-joining. Fitted NDVI time series for the experimental field revealed differences in d1/2 and d3/4 between the control and herbicide-treated plots. Further development of this method will focus on the early prediction of NDVI curve parameters and their comparison with lightly weed-infested fields from previous years.

Viacheslav Zelentsov and Viktor Mochalov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Natallia Lapitskaya, Belarusian State University of Informatics and Radioelectronics, Minsk, Republic of Belarus.

Lecture Title: Methodology for Assessing the Quality of Multispectral Space Imaging Data in Landscape Element Monitoring.

Abstract: To determine the types and current condition of agricultural fields, methods of automated processing of multispectral space imagery are increasingly being used. One of the most relevant tasks is semantic segmentation of landscape elements within the studied scene based on machine learning algorithms. Various algorithms are known for addressing this task, but the problem of evaluating the quality of processing results requires a better approach for solving. This paper discusses the indicators that characterize the quality of results of imagery data thematic processing when monitoring the condition of agricultural fields, using fields designated for forage preparation as an example. The methodology for assessing the quality of processed multispectral space imagery data is presented. A list and numerical values of basic quality indicators for identifying the condition of agricultural fields, considering ground survey data and hyperparameter values in machine learning algorithms, are provided. Generalized quality indicators for processing results are proposed. The role of a well-founded

choice of initial data for evaluating the quality of processed imagery results is highlighted. The mathematical apparatus of fuzzy clustering is applied when forming the initial data, and the degree of membership of landscape elements to a selected cluster is taken into account when refining the initial data. The presented methodology can also be applied to determining the types and forecasting the yield of agricultural crops, detecting diseases, and solving other agricultural production issues.

Su Jian, Agricultural Equipment Research Institute, Xinjiang Academy of Agricultural Sciences, Urumqi, China.
Lai Ning, Geng Qinglong, Li Qingjun, and Chen Shuhuang, Institute of Soil Fertilizer and Agricultural Water Saving, Xinjiang Academy of Agricultural Sciences, Urumqi, China.
Zhao Haiyan, Xinjiang Jiushenghe Seed Standard Research Institute Co., Ltd., Changji, China.
Lecture Title: Research on the Application of Multispectral Remote Sensing Technology Based on NDVI and NDRE with Case Analysis of Precision Nitrogen Management in Drip-Irrigated Winter Wheat.
Abstract: The need for rapid crop fertilization is pronounced in a growing and changing world. With the continuous advancement in imaging resolution of multispectral cameras and the growing sophistication of spectral analysis software, spectral analysis technology has been increasingly adopted in agricultural production. This paper introduces to readers a research method that determines crop growth conditions by analyzing spectral images of cultivated areas and calculating vegetation indices (NDVI and NDRE values) of the planting regions. By integrating canopy spectral data with quantitative relationships between fertilization rates and crop yield, the approach provides scientific fertilization recommendations for different growth stages. Case analysis demonstrates significant positive correlations between NDVI/NDRE values and nitrogen application rates in drip-irrigated winter wheat. Specifically, NDVI exhibits stronger linear relationships with nitrogen levels during the reviving and flowering stages, while NDRE shows superior performance from stem elongation to ripening stages (stem elongation, leaf development, kernel development, and ripening). Based on the findings of this study, it can be confirmed that NDVI and NDRE indices obtained from imagery can effectively predict and analyze crop nitrogen status. Furthermore, this method is adaptable to other crops (e.g., corn, soybeans) and The UAV-mounted multispectral cameras enable large-scale optical image acquisition, Researchers could subsequently develop localized fertilizer recommendation software tailored to regional cultivation conditions, thereby establishing a comprehensive technical system encompassing fertilization monitoring and precision control – providing robust technical support for precision agriculture.

Valerii Zakharov and Boris Sokolov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.
Andrey Mironov, Federal State Budgetary Military Educational Institution of Higher Education "A.F. Mozhaisky Military Space Academy" of the Ministry of Defense of the Russian Federation, St. Petersburg, Russia.
Minglei Fu, College of Information Engineering, Zhejiang University of Technology, Hangzhou, China.
Lecture Title: Feed Wheat Yield Multifactorial Forecasting.
Abstract: The paper proposes a transition from reactive states monitoring of complex agrobiotechnical objects (CABO) to proactive monitoring. It involves either preventive assessment of CABO states (with predetermined monitoring intervals) or predictive (continuous) assessment, analysis, diagnostics, and anticipatory mul-tivariate forecasting. The goal is to detect, localize, and prevent unexpected dis-ruptions in the vital functions of

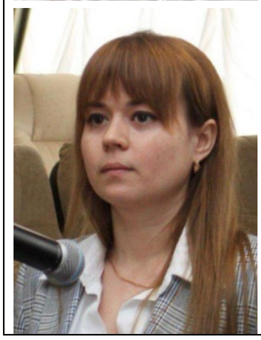
agrobiological and technical elements and sub-systems of CABO due to diseases (for agrobiological objects), failures, and malfunctions (for technical objects). A key component of both proactive control and CABO state monitoring is multivariate forecasting, considering inherent de-lays in the feedback loops of proactive monitoring and control systems. The paper introduces a new concept of multifactorial multi-model adaptive forecasting of CABO state parameters. This concept assumes: first, unification of monitoring information heterogeneous in acquisition methods and presentation; second, application of a multi-model approach to constructing a combined multifactorial model for forecasting CABO state indicators; third, adaptability of the multi-model complex structure for multifactorial adaptive forecasting to the quantity and quality of initial monitoring data and forecasted processes properties. An example of implementing the concept in forecasting fodder wheat yield is provided.

Boris Sokolov, Alexander Spesivtsev, and Alexander Semyonov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Natallia Lapitskaya, Belarusian State University of Informatics and Radioelectronics, Minsk, Republic of Belarus.

Lecture Title: Consideration of NON-factors in Complex Models of Agricultural Production.

Abstract: Using a specific example of solving the problem of creating and using an integrated planning model for the functioning of a difficult-to-formalize agricultural process for harvesting grass feed, an analysis of the causes of the manifestation of a range of NON-factors that significantly affect the sustainability of the feed production process under consideration has been carried out. The combination of an operational-calendar logical-dynamic model represented by a system of differential equations with fuzzy-probability models describing volume-resource planning and synthesized on the basis of expert knowledge for predicting yield and quality of grasses allows solving a large-scale multiparametric problem of the theory of schedules for individual stages of harvesting grasses for silage. The following NON-factors are recorded in the modeling: uncertainty, fuzziness, underdeterminacy, inaccuracy, etc. At the level of the general description of the complex model, the following properties were additionally highlighted and formally described: incorrectness, inaccuracy, inadequacy of the model and ambiguity of interpretation of modeling results. In the field of artificial intelligence, the modeling of NON-factors is of paramount importance. This is due to the fact that intelligent technologies are aimed at solving creative problems in conditions of significant uncertainty, incompleteness, inaccuracy, and fuzziness of the source data and the relationships between them when modeling complex objects in various subject areas. Such objects are fairly classified as difficult to formalize and poorly structured. It is shown and justified that the use of fuzzy-probabilistic and logical-dynamic approaches makes it possible to successfully identify, recognize the causes of manifestation and overcome the negative impact of most NON-factors, which significantly improves the quality of modeling difficult-to-formalize agricultural production in general and operational and calendar planning of grass harvesting processes for silage in particular.

	**Alexander Machikhin**, Scientific and Technological Centre of Unique Instrumentation of the Russian Academy of Sciences, Moscow, Russia. **Lecture Title:** Remote sensing of plant health using spectral imaging systems. **Abstract:** Timely assessment of agroecosystem parameters is essential for optimizing agricultural practices, enhancing crop nutritional value, improving economic efficiency, and minimizing environmental impact. Large-scale monitoring requires high-throughput, non-invasive methods and advanced tools to evaluate plant health throughout growth and development. This presentation highlights the results of testing domestic video spectrometers (hyperspectral and multispectral cameras) for various agricultural applications, including mapping the spatial distribution of plant pigments, assessing photosynthetic activity, detecting early stress responses and disease onset in crops, and analyzing soil agrochemical properties.
	**Su Jian**, Institute of Agricultural Equipment, Xinjiang Uygur Autonomous Region Academy of Agricultural Sciences, Urumqi, China. **Lecture Title:** Monitoring and Diagnosis of Nitrogen Nutrition and Powdery Mildew in Drip-Irrigated Winter Wheat Using UAV Remote Sensing. **Abstract:** We present a method for monitoring nitrogen status and powdery mildew in farmland using UAV-mounted multispectral cameras for optical remote sensing, followed by spectral image analysis. Using drip-irrigated winter wheat as a case study, we will explain the research methodology in detail.
  	**Rashid Kurbanov, Natalya Zakharova, Alexander Fokin**, FGBNU FNAC VIM, Moscow, Russia. **Lecture Title:** Method of soil surface profile estimation from aerial photography data. **Abstract:** The method presents an algorithm for estimating the soil surface profile based on aerial photography data. The proposed method is a significant step forward in the field of research on monitoring of soil tillage by remote sensing. The method is based on the use of BVS, which significantly expands the possibilities of collecting data on soil and its characteristics. This method is important for effective implementation of digital technologies in agriculture.

Aliaksandr Zheshka, RUE «SPC of the National Academy of Sciences of Belarus for Agricultural Mechanization», Minsk, Republic of Belarus.

Lecture Title: Investigation of Physical-Mechanical Properties of fertilizers for DEM modeling.

Abstract: The effective use of solid mineral fertilizers is one of the most urgent tasks of our time and its solution will guarantee the food security of the population. One of the most significant resources for increasing the efficiency of mineral fertilizers is their qualitative distribution over the field surface. Modern machines equipped with centrifugal discs are capable of evenly applying fertilizers, however, the rod-type working bodies are more efficient, which makes it possible to distribute fertilizers with a coefficient of variation not exceeding 7%. The most important advantage of standard machines is their suitability for compensatory fertilization with a change in the application rate not only along the movement of the aggregate, but also along the width of the grip. Another promising way to increase the effectiveness of mineral fertilizers is to apply them in-soil, which minimizes wind drift and reduces nitrogen and phosphorus losses. To improve the quality of fertilizer distribution by working bodies, it is necessary to implement experimental and theoretical studies to substantiate the main design and technological parameters of working bodies, taking into account their interaction with the flow of fertilizer particles. Irreplaceable tools for these purposes are software applications of discrete element modeling. The most important input data affecting the accuracy of calculations is information on the physical-mechanical properties of currently used solid mineral fertilizers. In this regard, the purpose of this work was to study the missing physical and mechanical properties for modeling.

Natalia Ivanova, University of Tyumen, Institut X-BIO, Photonics and Microfluidics Laboratory, Tyumen, Russia.

Lecture Title: Optimization of Agricultural Surfactants Application Using IR Thermography and Computer Processing Methods.

Abstract: The rational use of surfactants in pesticide formulations is an important step towards reducing environmental risks and ensuring food safety. Accurate measurement of leaf wetting area by sprayed droplets and droplet lifetime is the basis for optimizing surfactant consumption and correct application under given conditions. However, the uneven distribution of droplets on rough, chemically heterogeneous leaf surfaces makes it difficult to determine the coverage area using optical video/photo methods, resulting in an inaccurate assessment of surfactant activity and the overall formulations. In addition, the lack of a unified complex for the measurement, processing and storage of experimental data complicates the optimization of surfactant screening. We offer a comprehensive solution to the problem based on infrared (IR) thermography tools and algorithms for image processing and determination of optimum surfactant dosage, implemented in a modular computer program with database. The high sensitivity of IR detectors to temperature changes caused by the evaporation of spray droplets allows the detection of film wetting regions that are invisible in the optical range. Using the example of organosilicon surfactants in fungicide and insecticide formulations on barley leaves, we have shown that IR thermography detects almost 5 times the wetting area compared to that measured in the visible spectral range, and 1.5 times the lifetime of the wetting film of preparations. This allows us to significantly adjust the optimal surfactant dosage, which is defined as the intersection of linear approximations of the dependence of effective wetted area and droplet lifetime on surfactant concentration. The range of optimal dosages of organosilicon surfactants for fungicides evaluated on barley leaves turned out to be two times lower than that recommended by the manufacturers, and for insecticides - below the recommended level. The proposed approach is

implemented in a software package including a module for measuring leaf wetting area using optical and IR images, a module for constructing and analyzing wetting curves and measuring parameters of total drop lifetime, boundary velocity, relative time parameters for each wetting stage, a database module with all source materials and the possibility of their systematization. The proposed methodology for determining optimal surfactant concentrations based on IR thermography and the software package for data processing, analysis and storage can be used to clarify and adapt the regulatory framework for the use of organosilicon surfactants in pesticide solutions.

Alexander Spesivtsev, St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences – structural division of St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPIIRAS – SPC RAS), St. Petersburg, Russia.

Lecture Title: Expert Knowledge Peculiarities of "Fuzzy Assessments" and "Fuzzy Measurements" for Modeling the State of Complex Agricultural Objects.

Abstract: In the context of digitalization of agriculture, new approaches to scientific research are needed in constructing analytical expressions as the most conducive to computerization of a wide range of specific applied problems. Significant uncertainty of agricultural information forces decisions to be made mainly by humans. This situation leads to the use of expert knowledge as a material for constructing mathematical models. For this purpose, the most convenient is the fuzzy-possibility approach, which is capable of formalizing verbal expert information with an analytical expression. In this paper, it is used to construct a fuzzy-possibility model of the state of environmental safety of a cattle farm. At each stage of model construction, the concepts of "fuzzy estimates", "fuzzy measurements" and NON-factors were identified and interpreted as inevitable attributes of the study. The resulting adequate model allowed us to conclude that the degree of nitrogen preservation during disposal and use is a universal quantitative indicator of the farm's environmental sustainability.

Oral Session 5: Biologization of Plant Growing

Tatyana Zyubanova and Elena Akimova, Siberian Research Institute of Agriculture and Peat, Branch of the Federal State Budgetary Institution of Science Siberian Federal Scientific Center of Agrobiotechnologies, Russian Academy of Sciences, Tomsk, Russia.

Oksana Minaeva, Siberian Research Institute of Agriculture and Peat, Branch of the Federal State Budgetary Institution of Science, Siberian Federal Scientific Center of Agrobiotechnologies, Russian Academy of Sciences; Tomsk State University, Tomsk, Russia.

Egor Dyukarev, Institute of Monitoring of Climatic and Ecological Systems, Siberian Branch of the Russian Academy of Sciences (IMCES SB RAS), Tomsk, Russia.

Natalia Tereshchenko, Tomsk State University of Control Systems and Radioelectronics, Tomsk, Russia.

Lecture Title: Effect of Plant Residues and *Eisenia Fetida* Earthworms on Lettuce Productivity.

Abstract: Current trends for increased crop production and, consequently, increased volumes of plant residues require studying the possibility of combining organic waste mineralization and obtaining agricultural yield. The aim of the study was to evaluate the productivity of lettuce in microcosms depending on the applied plant residues in the peat substrate and the presence of *Eisenia fetida* earthworms in microcosms. Experiments were conducted under laboratory-controlled conditions (temperature, moisture, light intensity and photoperiod). Microcosms were containers (2000 ml volume) with peat (800 grams), into which plant residues (7%) were applied, along with initial

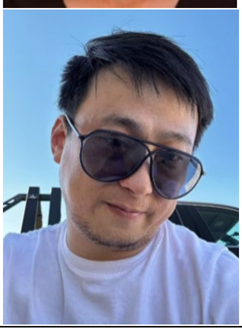
	populations of *Eisenia fetida* earthworms (twelve psc. per microcosm). Parameters of plant development, lettuce yield, earthworm populations and CO_2 emissions from the substrate surface were assessed in the experiment. It was discovered that applying plant residues such as wheat straw, potato tops and cabbage leaves, as well as *E. fetida* earthworms into microcosms increased lettuce productivity. Application of plant residues and earthworms simultaneously during lettuce growth did not substantially decrease plant system productivity. Acceleration of plant residue mineralization in the presence of earthworms was observed due to increased CO_2 emissions from substrate surfaces with earthworms. The highest lettuce productivity, an increase in earthworm populations and the production of vermicast were achieved in microcosms with application of potato and cabbage residues in peat substrate.
	**Andrey Kukharenko**, Kuban State Agrarian University, Krasnodar, Russia. **Lecture Title:** Biologized Farming Technology as a Factor in the Development of Rural Areas of the Krasnodar Territory. **Abstract:** The author analyzes the current stage of agricultural culture development. It was found that during the period from 1990 to 2022 in the Russian Federation, there was a decrease in the volume of mineral fertilizers applied to agricultural land – from 9.9 million tons to 3.4 million tons, the volume of organic fertilizers during this period decreased by more than five times – from 389.5 million tons to 70.2 million tons, which indicates reduction of measures to increase soil fertility. Uncontrolled disposal of biological waste from agricultural and forestry industries endangers the environmental and sanitary-epidemiological safety of the territories where they are located. In this regard, it is a promising branch of biotechnology related to the composting of organic waste. As a result of processing, livestock and poultry waste is converted into vermicompost or compost. The author conducted experiments to analyze the growth of nutrient reserves using a biologized technology for growing grain crops, sugar beet, sunflower, corn, as well as the effectiveness of a biological method for processing straw and plant residues. In addition, a comparison of the economic effect of biologized and industrial technology of growing grain crops was made. Based on the results of the research, a technology for the use of biological products has been developed using the example of various agricultural crops, in addition, a biologized farming technology has been introduced for processing post-harvest residues.
	**Lyudmila Tiranova, Alexander Tiranov, and Alexander Grigoriev**, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia. **Lecture Title:** The Effect of New Microbiological Fertilizers Arcsoil Nitrogen and Arcsoil Phosphorus on the Yield and Quality of Potato Tubers. **Abstract:** We studied the effectiveness of two methods of using microbiological preparations Arksoil Nitrogen and Arksoil Phosphorus (treatment of tubers before planting, spraying of vegetative plants at a height of up to 30 cm) in the Novgorod region on sod-podzolic soil (84% of the arable land area). It was found that the use of biofertilizers in technologies made it possible to increase the yield of potato tubers and starch content in them in the Memphis variety by 16 and 20% and 1.8 and 1.6%, in the Columbo variety by 17 and 22% and 0.8 and 1.0% relative to the control, respectively. Potato tubers with a nitrate content in crude products below 108 mg/kg were obtained. The largest yield increase in the cultivation of medium-early potato varieties Memphis and Colombo – 5.5 and 6.1 t/ha in relation to the control was obtained by non-root treatment of plants with biological preparations. In these experimental variants, a high cost recovery of biofertilizers of 13.7 and 14.8 rubles per 1 rub of costs was obtained. In addition, the marketability of tubers and the yield of edible potatoes

	increased in the Memphis variety by 6.0% and 9.0%, in the Colombo variety by 7.1% and 9.1% with a production margin of 99% and 106%, respectively. The processing of potato tubers before planting with biofertilizers costs 1.5 times the cost of non-root treatment, while the payback of one ruble of biofertilizer costs for processing was 5.8 rubles. according to the Memphis variety and 6.5 rubles. according to the Colombo variety.
	**Oksana Kremneva, Alena Nesterova, and Artem Ponomarev**, Federal State Budgetary Scientific Institution "Federal Research Center of Biological Plant Protection", Krasnodar, Russia. **Daria Nazarenko and Igor Davletbaev**, Bionovatik Group of Companies, Krasnodar, Russia. **Lecture Title:** Efficiency of Biological Preparations against a Complex of Winter Wheat Fungal Diseases. **Abstract:** Traditional chemical methods of combating wheat pathogens have a negative impact on the environment. Therefore, alternative methods of plant protection are needed, for example, the use of environmentally friendly biopreparations based on microorganisms. The purpose of this research was to study the biological effectiveness of microorganism-based fungicides against a complex of fungal diseases on winter wheat. The studies were conducted in 2023-2024 in the experimental fields of the Federal State Budgetary Scientific Institution "Federal Scientific Center of Biological Plant Protection" (FSBSI FSCBPP), on winter wheat varieties Alekseich and GROM. The studies showed sufficient effectiveness of biological fungicides against a complex of foliar diseases on winter wheat. The effectiveness of the preparations against powdery mildew was from 45% for Or-gamika F to 64% for Pseudobacterin-3 and Sistemika M. The most effective preparation against septoria leaf spot was Orgamika F (60%), the effectiveness of Pseudobacterin-3 and Orgamika C was 40 and 47%, respectively. The prepara-tions showed sufficient effectiveness against the causative agent of yellow spot (Tan spopt): Orgamika F up to 74%, Pseudobacterin-3 up to 66%, Sistemika M up to 64%, Orgamika S up to 56%. Against brown rust, the best effectiveness was shown for Sistemika M - up to 56% and Orgamika F up to 49.7%. As a result of using the preparations, an increase in yield was noted for all variants: from 2.9% (for Orgamika C) to 9.3% (for Orgamika F). Thus, the preparations Pseudobacte-rin-3, Orgamika C, Sistemika M, Orgamika F are sufficiently effective against a complex of foliar diseases when applied 3 times on winter wheat crops.
 	**Ksenia Gasiyan and Oksana Kremneva**, Federal State Budgetary Scientific Institution "Federal Research Center of Biological Plant Protection", Krasnodar, Russia. **Lecture Title:** Study of the Correlation between the Level of Spore Infestation and the Development of Fungal Leaf Diseases in Winter Wheat Crops. **Abstract:** Wheat is the most important and most widespread agricultural crop in the world. Leaf diseases caused by fungal pathogens annually lead to a decrease in wheat yield by 15-20%, and in epiphytotic years by 40-70%. Traditional monitoring based on visual assessment of the development and spread of diseases of agricultural crops requires a lot of time and labor and is not always highly accurate due to the large areas of production. The use of technical means and information programs into agriculture will significantly speed up the process of forecasting and developing protective measures. Using data on the number of phytopathogen spores in crops as a threshold value for preventive treatments with fungicides will help solve this problem. With early detection of infection in small quantities, it is possible to use biological fungicides that can suppress the development of diseases and preserve the environment. The aim of the research is to determine the correlation between the level of spore infestation and the development of fungal leaf diseases in winter wheat crops.

Yihe Ji, International Sakharov Environmental Institute of Belarusian State University, Minsk, Belarus.
Viktar Lemiasheuski, 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; Polessky State University, Pinsk, Republic of Belarus.
Ying Li, Inner Mongolia Baogang Hospital, Inner Mongolia, China.

Lecture Title: Determination of Components and Properties of Fennel Essential Oil.

Abstract: This paper studies the composition and properties of fennel (Foeniculum vulgare Mill.) essential oil. Fennel essential oil was extracted by steam distillation, and its composite components were qualitatively and quantitatively analyzed by Gas Chromatography-Mass Spectrometry (GC-MS); the stability of the main components under different illumination times was studied by Fourier Transform Infrared Spectroscopy (FTIR). We found that the main chemical component in fennel essential oil was trans-anethole, with a content of up to 92.03%. In addition, the antibacterial effects of fennel essential oil and its main components on opportunistic microorganisms were tested. Fennel essential oil had a good inhibitory effect on the two selected Gram-positive opportunistic microorgan-isms, while the inhibitory effect on the two Gram-negative opportunistic microorganisms was second. The research results provide an experimental basis for the further development and utilization of fennel.



Viktar Lemiasheuski, 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; Polessky State University, Pinsk, Republic of Belarus.
Yu Ting, Zhao Xiaoping, and Zhu Yu, Polessky State University, Pinsk, Republic of Belarus.

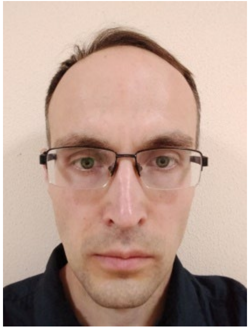
Lecture Title: Exploring Potato Extract as a Multifunctional Drug Carrier. Pharmacophore Mapping and Anticancer Targeting via Network Pharmacology and Molecular Docking.

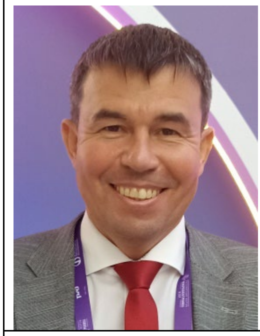
Abstract: In recent years, natural drug carriers have received extensive attention due to their biocompatibility and versatility. Potato extract, which is rich in polysaccharides and phenolic compounds, has the potential for both drug delivery and anti – cancer activity. However, the structural characteristics of its pharmacophore and the multi – target anti – cancer mechanism remain unclear this study systemat-ically analyzed the carrier function and anti – cancer targeting mechanism of potato extract based on network pharmacology and molecular docking techniques. By constructing three – dimensional pharmacophore models of glycoalkaloids (such as α – solanine) and polyphenolic compounds, and combining molecular docking, molecular dynamics simulation, and ADME/T prediction, the molecular mechanism of their synergistic effect with anti – cancer drugs was elucidated. The research results show that the active ingredients in potato extract can precisely target key anti – cancer targets such as EGFR, ACHE, TOP2A, and PIK3CA through hydrogen bonds, hydrophobic interactions, and π – π stacking, and reverse P – gp – mediated multidrug resistance. In addition, the synergistic effect of its cationic properties and the EPR effect enhances tumor targeting, providing theoretical support for the rational design of natural drug carriers.

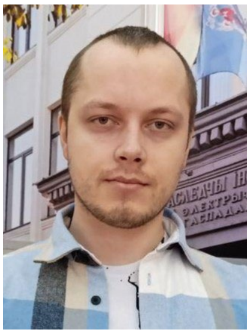
	
	**Valeria Allahverdyan**, Federal State Budgetary Scientific Institution «Federal Research Center of Biological Plant Protection» (FSBSI FRCBPP), Krasnodar, Russia. **Lecture Title:** The effect of bacteria of the genus Bacillus on the accumulation of mycotoxins Fusarium graminearum. **Abstract:** The use of biological control agents against fungi of the Fusarium genus is a common alternative to reduce its harmfulness. Bacteria of the genus Bacillus have effective antagonistic activity and can be used for biocontrol of fusarium fungi. It was found that B. velezensis bacteria inhibit the growth of the F.graminearum 60318 fungus strain in vitro.
	**Elena Gyrnets**, Federal State Budgetary Scientific Institution «Federal Research Center of Biological Plant Protection» (FSBSI FRCBPP), Krasnodar, Russia. **Lecture Title:** Identification and biocontrol properties of bacterial strains promising for protection of apple trees from diseases and pests. **Abstract:** A comprehensive step-by-step study of bacterial strains from the bioresource collection of Federal Research Center of Biological Plant Protection was carried out. A number of strains demonstrated significant efficiency in suppressing key pathogens and pests of apple trees. In the course of the study, bacterial strains with potential polyfunctional properties were identified.
	**Marina Sidorenko**, Federal Scientific Center of the East Asia Terrestrial Biodiversity FEB RAS, Far Eastern Federal University, Vladivostok, Russia. **Lecture Title:** Phosphate-solubilising bacteria are promising agents in organic farming. **Abstract:** One of the most acute problems in farming is phosphorus nutrition of plants. On average, the phosphorus content in the soil is about 0.05% (by mass), but only 0.1% of this phosphorus is available to plants. Eliminating phosphorus deficiency in soils using phosphate-solubilising microorganisms is a promising strategy to improve global food production without causing any environmental damage. However, the effectiveness of introduced preparations strongly depends on the factors of the new environment and the ability of the introduced microorganisms to survive among indigenic members of the soil microflora. The paper will present successful examples of the use of phosphate-solubilising bacteria of indigeneous origin in cereal crops.
	**Meisam Zargar and Maryam Bayat**, Department of AgroBiotechnology, Institute of Agriculture, RUDN University, Moscow, Russia. **Lecture Title:** A Global Perspective of Herbicide-Resistant Weeds and Management Options. **Abstract:** Herbicide-resistant weeds (HR) are global problem in agricultural habitats including crops grown under dryland and irrigated conditions. Lack of crop rotation results in repeated use of herbicides with the same mode of action resulted in a selection pressure that facilitated the evolution of herbicide-resistant grass and broadleaved weeds. The wide spread of herbicide resistant weeds associated with low profit commodity crops and lack of alternative chemical weed management practices pose a real threat to

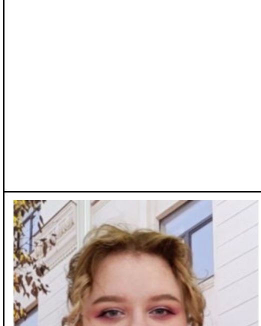
	the farming system. Because of the intensive use of herbicides with the same mode of action, several weeds have developed resistance to commonly used herbicides. Management of these weeds needs to be based on integrated systems. Chemical and non-chemical control measures need to be integrated to achieve effective and sustainable weed control. Some examples of non-chemical control methods are crop competition, crop rotations, harvest weed seed control, targeted tillage, etc. This presentation will provide a brief overview of the tactics available to control herbicide-resistant weeds in cropping systems.
	**Tatiana Sidorova**, Federal State Budgetary Scientific Institution «Federal Research Center of Biological Plant Protection» (FSBSI FRCBPP), Krasnodar, Russia. **Lecture Title:** Bacteria of the Genus Pseudomonas As Producers of Biofungicides Effective against Toxin-Producing Fungi. **Abstract:** The ability of the strains P. chlororaphis BZR 245-F and Pseudomonas sp. BZR 523-2 to produce antifungal metabolites was detected, while growth inhibition and mycotoxin accumulation of the fungus F. graminearum 60318 occurred in vitro. The content of deoxynivalenol was reduced by both the liquid culture and supernatant of P. chlororaphis BZR 245-F bacteria by 60% and 70%, respectively, and by the liquid culture and supernatant of Pseudomonas sp.BZR 523-2 bacteria by 75% and 90%, respectively. The amount of zearalenone was reduced by the liquid culture and supernatant of P. chlororaphis BZR 245-F bacteria by 80% and 95%, respectively. Liquid culture and supernatant of Pseudomonas sp. BZR 523-2 inhibit ZEN accumulation by 60% and 84%, respectively.
 	**Vasiliy Kuznetsov, Liudmila Sokolova, and Vladimir Belyaev**, Altai State Agricultural University, Barnaul, Russia. **Lecture Title:** Evaluation of the Effectiveness of the Use of the Preparations "Azofit N" and "Azofit P" Against the Background of Various Doses of Mineral Fertilizers in the Fertility Zones of the Field and Their Aftereffects in the Cultivation of Spring Wheat in the Steppe Zone of Altai Krai. **Abstract:** The article presents the results of a field experiment to study the effect of using agricultural biologicals "Azofit N" and "Azofit P" against the background of different rates of application of mineral fertilizers in field fertility zones and their aftereffect on the yield of spring wheat and economic efficiency. The experiment was laid down on the APC "Kolos" in the Romanovsky district of the steppe zone of Altai Krai in 2023 at three levels of fertilizer doses (85%, 70% and 50% of the control) in three field fertility zones (low, medium and high). The control one was the farm technology variant with the basic dose of mineral nutrition (100%) without the use of biopreparations. Field productivity zones were identified based on the "Cropio" digital platform. In 2024, the aftereffect of using the 2023' experimental variants was studied by observing crops on the same basic sites, but without biopreparations and with the same dose of mineral nutrition. Based on the results of the experiments, the biological yield of spring wheat and the economic efficiency of the experimental variants were assessed over two years of observations.
	**Aleksandra Tsygichko**, Federal State Budgetary Scientific Institution «Federal Research Center of Biological Plant Protection» (FSBSI FRCBPP), Krasnodar, Russia. **Lecture Title:** Development of new bioinsecticides based on insect baculoviruses against Lepidoptera pests. **Abstract:** Crop production is an integral part of the Russian economy. As a result, large areas of monoculture attract a number of insect pests. Traditionally, phytophagous pests are controlled using insecticides of various types, including those based on insect baculoviruses. The efficacy of such drugs against the target species can reach 95-98%. However, today only

	foreign baculovirus drugs are allowed for use on the territory of the Russian Federation: Karpovirusin, SK and Helicovex, SK. Active strains of insect viruses with insecticidal properties are needed to develop domestic analogues. Therefore, the purpose of our work is a comprehensive study of baculovirus cultures from the bioresource collection of the Federal State Budgetary Scientific Institution «Federal Research Center of Biological Plant Protection» «State Collection of Entomocarifages and Microorganisms» (BRC FSBSI FRCBPP).
	**Anna Homyak**, Federal State Budgetary Scientific Institution «Federal Research Center of Biological Plant Protection» (FSBSI FRCBPP), Krasnodar, Russia. **Lecture Title:** Preservatives as a way to stabilize and extend the shelf life of a biofungicide based on the strain Bacillus subtilis BZR 336g. **Abstract:** The report considers the possibility of extending the shelf life of a biofungicide based on the Bacillus subtilis BZR 336g strain for successful application in agricultural practice. The effect on the number of colony-forming units and antifungal activity of the Bacillus subtilis BZR 336g strain during 12 months of storage is established.
Online Oral Session 6: Application of Ground and Air Robots	
	**Mikhail Kuzmenkov and Ilya Guzband**, Cropfleet Robotics, Minsk, Republic of Belarus. **Mikhail Tatur**, Belarusian State University of Informatics and Radioelectronics, Minsk, Republic of Belarus. **Lecture Title:** System Design Methodology and Preliminary Design of a Robotic Service System for Agricultural Drones. **Abstract:** The article announces a project to create a robotic system for servicing a fleet of agricultural drones. The system includes a ground station, a group of drones, and an external control panel, developed as a unified automated complex. The ground station is designed to transport drones in a special compartment and automatically deliver them from this compartment to the takeoff and landing platform located above the station. A payload module with a tank filled with spraying liquid and a charged battery is automatically attached to the drone. The equipped drone departs on its spraying mission, while another drone is brought to the platform from the compartment. Flights are conducted in fully automatic mode. Upon mission completion, the drone lands automatically on the platform, where a robotic manipulator removes the used module and replaces it with a loaded one. External system control by an operator includes inputting initial data for creating flight tasks for the drone fleet and monitoring the technological process, such as flight schedules, mission execution by drones, and technical condition checks of all subsystems. In case of conflicts, options for automatic and semi-automatic responses are provided. A systematic analysis of the automatic servicing pipeline for the drone fleet has been conducted, indicating significant improvements in efficiency for aerial agricultural treatment compared to traditional manual methods of servicing and managing drones.
	**Roman Meshcheryakov, Alexander Salomatin, and Aleksandr Shirokov**, V.A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences, Moscow, Russia. **Lecture Title:** A Method for Task Allocation Among Heterogeneous Group Robots for Automated Operation of a Fruit Orchard. **Abstract:** The paper deals with the automated maintenance of a fruit orchard using a heterogeneous group of robots including ground robots and unmanned aerial vehicles. A method of task distribution between robots is proposed, taking into account climatic and time constraints, orchard topology, robot parameters and priorities of operations. It describes the division of the cycle into a sequence of time intervals, each of which takes

	into account the type of technology used and required to perform the planned tasks. Monitoring, irrigation, fertilizer application with their priorities for each fruit-tree in the orchard are considered as tasks. The formation of a route network is proposed, as well as the search for a rational scenario of mission fulfillment on the investigated time interval using heuristic and meta-heuristic algorithms. Constraints that take into account the autonomy of the robots, the duration of the interval, the number of consecutive flights/moves, etc. are considered. Adjustment of tasks at time intervals is presented, taking into account unresolved tasks at previous time intervals. The developed method allows optimizing the use of resources and increasing the efficiency of automated plant care.
	**Ramil Faizullin, Niyaz Imamov, and Tatyana Tsoy**, Kazan Federal University, Kazan, Russia. **Edgar Martinez-Garcia**, Autonomous University of Ciudad Juarez, Cd Juárez, Mexico. **Evgeni Magid**, Kazan Federal University, Kazan; HSE University, Moscow, Russia. **Lecture Title:** Agricultural Field Coverage with a Group of Mobile Robots Considering a Soil Compaction Risk and Energy Efficiency. **Abstract:** This article considers a dual problem of optimizing field coverage while minimizing a soil compaction and managing energy constraints of agricultural robots. The soil compaction in precision agriculture is a major challenge, as mobile robots are becoming increasingly common in field operations. A proposed optimization combines a soil compaction risk assessment with energy-efficient trajectory planning for a fleet of mobile agricultural robots. The algorithm uses a grid representation of a field, where each cell is assigned a compaction risk value using a function, which allows to cluster cells into zones with similar characteristics of the soil compaction risk. Within these zones, maximum permissible velocities of agricultural robots are determined. The Boustrophedon algorithm generates optimal coverage paths for each zone to minimize turns and ensure complete coverage. A fitness function balances multiple objectives, including soil impact, a path length, and energy constraints. To eliminate energy constraints, a genetic algorithm is used that simultaneously optimizes a placement of static charging stations and a distribution of cover paths among a tractors' fleet. The system balances soil conservation and requirements by adapting a robot velocity to each zone. The computational experiments for various types and sizes of agricultural fields demonstrated effectiveness of the proposed approach.
	**Elena Shkodina and Andrey Ronzhin**, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia. **Hongbiao Ding**, Feed Research Institute, Chinese Academy of Agricultural Sciences, Beijing, Peoples' Republic of China. **Lecture Title:** Using UAVs in Potato Growing: Diseases Diagnostics, Liquid Spraying. **Abstract:** The paper considers agricultural unmanned aerial vehicles in growing potatoes for monitoring soil relief, calculating plant biomass, diagnosing diseases, and applying liquid preparations. When using UAVs, it will be necessary to change the concentration of solutions of active substances used in classic versions of agricultural technologies based on ground sprayers. Also relevant is the development of artificial intelligence technologies for computer processing of data recorded by onboard lidars and video cameras to assess soil relief, the quality of potato tops, and diagnose diseases. The results of 2024 work on the creation of the Novgorod experimental field for testing new digital and robotic agricultural technologies are presented. A plan for conducting experimental work on

	potatoes has been formulated, which provides for growing potatoes using standard technology using ground-based equipment, as well as options in which the treatment of plantings using UAVs will be tested in operations for treating diseases, pests, and desiccating tops. For the application of liquid substances and field monitoring, our own agricultural unmanned aerial vehicles with a payload weight of 12 kg, a flight range of up to 25 km, a flight time of up to 20 minutes, equipped with quick-release specialized nozzles, video cameras are used.
	**Peter Kazakievich**, Presidium of the National Academy of Sciences of Belarus, Minsk, Republic of Belarus. **Anton Yuryn and Dmitry Komlach**, Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. **Lecture Title:** Justification of the Rational Parameters of the Fruit Flow Divider during Sorting. **Abstract:** The paper presents an experimental substantiation of the operating parameters of a device for separating a fruit flow during sorting using a machine vision system (MVS). A laboratory setup consisting of a MVS with a video camera, lens, and structural illumination, as well as a computing module, was created to conduct the research. The Box-Behnken design was chosen to obtain the regression equation. The main objective of the experiment was to obtain a regression equation that would allow one to evaluate the influence of the influencing factors on the accuracy of separating sorted apples. The following were chosen as optimization factors: main conveyor speed, carriage plate inclination angle, and number of solenoid valve holding steps. As a result of the experimental research, a regression equation was obtained to determine the accuracy of fruit separation. Analysis of the response surfaces made it possible to establish the optimal values of main conveyor speed = 0.41 m/s, carriage plate inclination angle = 27 degrees and the number of steps of holding the valve by the solenoid = 93 steps, at which the sorting accuracy is more than 95%.
	**Gombo Gantulga**, Mongolian University of life Sciences; Mongolian Academy of Agricultural Sciences, 13th khoroo, Ulaanbaatar, Mongolia. **Nyamdorj Ganbat, Ulziikhutag Ganbat, Luvsan Lkhagvasuren, and Tserendorj Ulziibaatar**, Mongolian University of life Sciences, 13th khoroo, Ulaanbaatar, Mongolia. **Davaasambuu Undarmaa**, Mongolian Academy of Agricultural Sciences, 13th khoroo, Ulaanbaatar, Mongolia. **Lecture Title:** Study on Designing a Multifunctional Agro Robot Platform for Weed Controlling in Vegetable Field. **Abstract:** The purpose of this research study was to design an agro robot plat- form for timely monitoring and control of weeds, crop diseases, and pests in vegetable fields, and to develop technical and technological solutions and concepts for combating them with precision technology. In this paper presented are key results of the research and development studies on developing machine vision system for recognizing and identification of the main plants based on their morphological parameters including vegetable leaf color appearance. Using the MATLAB program, based on the CNN method, machine training process results were received and the reliability of recognizing the main crops of the field, from weeds growing in the field and plants damaged by the disease by their shape and external color changes was high enough (0.98-1.0). Robot guidance system is developed including main sensor system based on a specialized GPS receiver providing position information, cameras system image before a robot that allows precise entry robot between the rows of plants and to correct and proper movement of the

	robot in the vegetable filed, cameras image immediately before sprayer. Units of the IMU (Inertial Measurement Unit) used to determine the angular acceleration of an agro robot platform. In this way a concept on designing a multifunctional agro robot platform for precise control of weeds in vegetable fields is developed and formulated. The robot platform consists of the main component modules, such as a carrier or chassis, which are the main parts for assembling and placing the components and mechanisms on the robot platform. The structure of the carrier or chassis is designed based on the necessary calculations and studies depending on the functions and working conditions. It is designed to be able to move freely along the path of potatoes and vegetables without damaging the main crop, and to be able to work in different field conditions.
 	**Vladimir Azarenko**, Department of Agrarian Sciences of the National Academy of Sciences of Belarus, Minsk, Republic of Belarus. **Maksim Kurylovich, Viktor Goldyban, Nikolay Bakach, and Valeria Selivanova**, Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. **Uladzislau Sychev**, United Institute of Informatics Problems of the National Academy of Sciences of Belarus, Minsk, Republic of Belarus. **Lecture Title:** Use of Technical Vision for Automatic Separation of Defective Potato Tubers. **Abstract:** The paper describes a mock-up of an automatic sorting machine designed to detect external defects in potato tubers, perform automatic inspection, and remove defective tubers from the processing flow using a jet of compressed air. The stationary machine analyzes a single working flow, ensuring uniform tuber distribution through a controlled feeding mechanism. The developed vision and inspection system is based on regulatory standards for food potato quality control. The recognition process consists of three main modules: segmentation, tracking, and classification. Segmentation is performed using color threshold analysis, which distinguishes defective areas from the conveyor belt background. This method enhances real-time defect detection by comparing tubers with reference samples. Tracking relies on a centroid tracking algorithm, which continuously identifies tuber coordinates and predicts movement, ensuring precise timing for defect removal. Classification is conducted using an artificial neural network trained on a proprietary dataset containing images of both marketable and defective tubers. The deep learning model effectively identifies various defects, including mechanical damage, rot, and disease. The combination of these methods enhances sorting accuracy, reduces errors, and improves overall inspection efficiency, making the system a reliable solution for automated potato quality control.
	**Peter Kazakievich**, Presidium of the National Academy of Sciences of Belarus, Minsk, Republic of Belarus. **Dmitry Komlach, Anton Yurin, and Alexander Verabei**, Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. **Aliaksandr Kroshchanka**, Brest State Technical University, Brest, Republic of Belarus. **Sergey Bushuk**, State Scientific and Production Association "Optics, Optoelectronics and Laser Technology", Minsk, Republic of Belarus. **Lecture Title:** Toward Finding Methods for Identifying Internal and External Defects in Potato Tubers. **Abstract:** The article is devoted to the relevance of developing a means of universal automatic sorting of potato tubers by external and internal defects, in particular, its main element – an optoelectronic system. Studies have shown that for sorting potato tubers it is important not only to determine

	their size, but also the presence of defects. The existing machines do not implement the above functions, which requires additional labor, reduces productivity and quality. The classification of quality recognition systems is given and the technological scheme of the optoelectronic system consisting of an optical module and a video camera, a control unit and a conveyor is justified. In the course of research, the two-flow type of potato flow with forced rotation and the design and technological scheme of the machine are justified. The software is developed on the basis of segmentation and tracking algorithms, as well as training of a neural network that recognizes defects of potato tubers (external and internal).
	**Aliaxandr Zheshka and Dmitry Komlach**, Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization, Minsk, Belarus. **Vladimir Azarenko**, Department of Agrarian Sciences of the National Academy of Sciences of Belarus, Minsk, Belarus. **Lecture Title:** Justification of the Parameters of the Robotic Spreader by Studying the Properties of Fertilizers. **Abstract:** The use of robotic platforms in agricultural production is becoming an increasingly popular area of scientific research. A particularly relevant area is the use of robotic platforms for the application of pesticides and mineral fertilizers, since human work with these preparations is associated with health risks and is limited in duration. Replacing human labor with robot work is an important direction and makes it possible to increase the economic efficiency of fertilizers and pesticides by adjusting the components of shift time. In addition to the economic component, an important issue is to increase the uniformity of the distribution of fertilizers over the surface, as well as the application of specified doses in accordance with the nutrient cartogram in the soil, while differentiated application should be carried out not only in the direction of movement of the robotic platform, but also in the working width, which can be achieved by using a screw distributor with controlled fertilizer dispenser. The application of these principles on robotic platforms will reduce the unjustified consumption of solid mineral fertilizers and reduce the environmental impact, increasing the environmental efficiency of fertilizer application. To improve the quality of fertilizer distribution by the robotic platform, it is necessary to carry out experimental and theoretical research to substantiate the main design and technological parameters of the distribution element of the robotic platform, taking into account their interaction with the flow of fertilizer particles. Software applications for modeling the discrete element method (DEM) are most important tools for these purposes. The most important initial data affecting the accuracy of calculations is information on the properties of solid mineral fertilizers, such as coefficients of internal and external friction, granulometric composition, dimensional characteristics, density and bulk mass. In this regard, the purpose of this work was to study the missing physical and mechanical properties for DEM modeling.
	**Vladimir Azarenko**, Department of Agrarian Sciences of the National Academy of Sciences of Belarus, Minsk, Belarus. **Valeria Selivanova, Dmitry Komlach, Viktor Goldyban, and Maksim Kurylovich**, Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization, Minsk, Belarus. **Uladzislau Sychev and Tatyana Kim**, United Institute of Informatics Problems of the National Academy of Sciences of Belarus, Minsk, Belarus. **Lecture Title:** Robotic Platform for Autonomous Application of Pesticide. **Abstract:** This article presents statistical data, which indicate the problem of labor shortage in agricultural organizations of the Republic of Belarus. The problem of detrimental impact of pesticides on operators directly working with chemical crop protection agents is considered. The authors propose a

strategy for the introduction of robotic platforms for pesticide application in autonomous mode, which helps to solve both these problems. The impact of the introduction of precision farming technologies on attracting young specialists to work in the agro-industrial complex has been studied. The use of robotic equipment for application of chemical plant protection agents in autonomous mode will allow to exclude or minimize the contact of agro-industrial complex worker with harmful compounds. The article summarizes the results of the development of a prototype of a robotic platform for the application of pesticides in autonomous mode. The technical characteristics of the prototype of the robotic platform are presented. The results of investigation of the influence of technical parameters of the mobile robotic system on its operational characteristics are presented. The structural scheme of the control system of the robotic platform is developed.

Vladimir Belyaev, Dmitry Pirozhkov, and Alexey Kovalev, Altai State Agricultural University, Barnaul, Russia.

Lecture Title: Evaluation of the Effectiveness of Quadcopter Operation Parameters and Modes When Spraying Spring Wheat Crops.

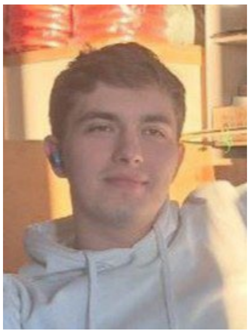
Abstract: The aim of this study is to investigate the technology of applying liquid preparations to crops using an unmanned aerial vehicle (UAV). Spring wheat were treated using an XAG P100 quadcopter. The following factors were evaluated: flight height, flight speed, droplet size, application rate, and operating width. Spraying effectiveness was assessed using the area of wheat leaf surface covered with the solution, measured with DropSight® technology. A coloring agent that fluoresces under ultraviolet light was added to the water solution. The leaves of the plants, after the flight of the quadcopter were covered in a solution. They were collected and placed in a special chamber with an ultraviolet lamp. Using special software, the area covered by the solution was measured as a percentage of the total leaf area. Based on the results of the experiment, a regression equation was created to assess the significance of different factors. The two most significant factors were the dose of the drug and the distance from the flight path axis to the sampling point. These factors had the greatest impact on the uniformity of solution distribution over the leaf.

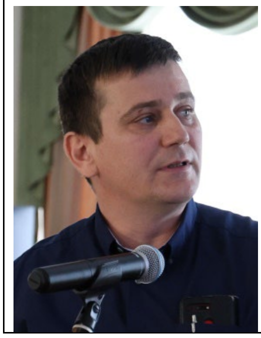
Mikhail Uzdiaev and Marina Astapova, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Elchin Khalilov, Wenzhou University, Chashan University Town, Zhejiang Province, Wenzhou City, China.

Lecture Title: A Comparative Study of YOLO Architectures for Poles Detection on Agricultural Land UAVs Images.

Abstract: Using unmanned aerial vehicles (UAVs) in modern agriculture faces with the problem of overcoming obstacles. One of the most widespread type of these obstacles on the agricultural land is powerlines and aerial communication lines, which are crucial for agriculture itself as well as for other economic activities, and thus could not be removed from the agricultural lands. The initial subtask in overcoming poles is detection of such objects. Recent neural network detection architectures such as YOLO has shown promising results in general object detection task, however, the results of comparative studies of YOLO architectures in a specific task of poles detection are not presented in scientific literature. In this work, we present results of comparative study of a set of YOLO architectures performance on a custom dataset of powerlines and aerial communication lines poles on the agricultural land obtained using UAV. The dataset consists of 3508 images with 1691 wooden poles and 1750 concrete poles. We consider five recent YOLO architectures from v8 to v12. Comparative analysis of the considering architectures has shown that YOLOv11 achieved the best performance in average according to recall (0.765), precision

	(0.798), mAP@50 (0.809) and mAP@50-90 (0.484) metrics. This results along with the least required computational resources (6.5 GFLOPS) makes YOLOv11 the most appropriate architecture for poles detection on the agricultural land.
	**Kantemir Bzhikhatlov, Aslan Zammoev, and Inna Pshenokova**, The Federal State Institution of Science Federal Scientific Center Kabardino-Balkarian Scientific Center of Russian Academy of Sciences, Nalchik, Russia. **Lecture Title:** Autonomous System for Monitoring and Managing Cattle Behavior. **Abstract:** Behavior and health monitoring systems are designed to improve herd management and animal welfare through data collection and analysis. Such systems allow for online detection of changes in animal activity and behavior, optimization of feeding systems, management of reproduction procedures, remote monitoring of cattle, and improvement of overall herd management through data-driven analytics and AI-based predictive analytics. In this paper, we propose a concept for using an intelligent wearable device on an animal not only to collect data, but also to influence cattle through various effectors. Such influence will allow for the formation of complex conditioned reflexes that ensure animal behavior consistent with the state and operating modes of the technical system of the production environment. In our opinion, this will allow for automated animal training ("intelligent training") by reinforcing the required behavior, which in turn will allow for setting the most effective behavior (feeding and movement patterns) for the animal to achieve the required economically significant parameters. To test the capabilities of the developed system for monitoring and managing cattle behavior, a prototype of a wearable device in the form of a collar for cows was developed and manufactured.
	**Timur Gamberov, Ramil Safin, and Tatyana Tsoy**, Kazan Federal University, Kazan, Russia. **Hongbing Li**, Shanghai Jiao Tong University, Shanghai, China. **Evgeni Magid**, Kazan Federal University, Kazan; HSE University, Moscow, Russia. **Lecture Title:** Holistic Digital Human Models in Gazebo: A Case Study on Agricultural Workflows. **Abstract:** The agricultural sector is undergoing a digital transformation due to modern automation, robotics, sensing, and simulation technologies. This research explores a use of digital human models (DHMs) in the Gazebo virtual environment to enhance agricultural workflows, improve human-robot interaction, and ensure safety. We propose a framework that models typical agricultural scenarios, such as field mapping, harvesting efficiency control, crop inspection, obstacle avoidance, and theft detection. DHMs represent farm workers interacting with mobile autonomous systems, stationary sensors and sensor networks. The DHMs are equipped with generic and task-specific animations; the latter includes such activities as crop harvesting and field inspection. The simulation environment features agricultural settings with dynamic obstacles and predefined work zones. Performance in each scenario is proposed to evaluate using metrics such as a task's completion time and obstacle avoidance rate. Results of preliminary simulation of the proposed simplified scenarios in the Gazebo simulator demonstrated a high potential of DHMs and Gazebo to optimize agricultural workflows and improve human-robot interaction. This study provides a foundation for leveraging simulation technologies to address practical challenges in agriculture and to support de-sign and validation of intelligent agricultural systems.

	**Alexey Komoedov and Anton Zakharov**, Institute for Engineering and Environmental Problems in Agricultural Production (IEEP) – branch of FSAC VIM, Saint Petersburg, Russia. **Lecture Title:** Development and Research of an Automated Sectional Working Unit for Weed Removal in Organic Potato Production. **Abstract:** Today, one of the urgent directions of development of agro-industrial complex is the production of organic crop production, which solves the problem of providing the population with environmentally friendly and high-quality products and reduces the negative impact on the environment from agriculture. The development of this direction determines the strategy for the development of organic production in the Russian Federation until 2030. Since the production of crop production in organic production in accordance with the Federal Law № 280 'On Organic Products and Amendments to Certain Legislative Acts of the Russian Federation' prohibits the use of agrochemicals and pesticides to control weeds, it requires the use of modern machine technology, built in accordance with the advanced achievements of modern science.
	**Stanislav Krivko**, Federal Scientific Agroengineering Center VIM, Moscow, Russia. **Lecture Title:** Aerial Vehicles to Monitor Crops in Large Production Fields. **Abstract:** The current level of technical development and accessibility makes it possible to consider unmanned aerial vehicles (UAVs) as a reliable means of operational monitoring of farmlands. The battery pack is a limiting factor in the efficient use of flight time. Power plants based on hydrogen fuel cells can significantly increase the flight time of UAVs compared to modern lithiumion batteries.

Format of the Conference

The conference is held in a hybrid format: on site of Altai State Agricultural University (ASAU, 98 Krasnoarmeysky Ave., Barnaul, 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**: connection to Oral sessions is carried out in the Halls in accordance with the names of the sessions.

The time of the videoconference is indicated in the time zone of Barnaul (UTC + 7): **https://www.worldtimebuddy.com/**.

Contacts

E-mail: **conf@spcras.ru** Web: **http://adop.nw.ru/**

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