VI International Conference on

Agriculture Digitalization and Organic Production

ADOP 2026

Conference Programme and Abstracts

June 1-5, 2026

Kaliningrad, Russia

SPC RAS

КГТУ

КАЛИНИНГРАДСКИЙ ГОСУДАРСТВЕННЫЙ ТЕХНИЧЕСКИЙ УНИВЕРСИТЕТ

Springer

Co-Organizers

- Kaliningrad State Technical University (KSTU, Kaliningrad, Russia)
- St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS, St. Petersburg, Russia)

Conference Co-Chairs

- Oksana Ogij, KSTU
- Andrey Ronzhin, SPC RAS

Committees

Program Committee Chair

- Vladimir Surovtsev, SPC RAS

Program Committee Members

- Mikhail Arkhipov, Russia
- Anna Barkova, Russia
- Olga Bedareva, Russia
- Vladimir Belyaev, Russia
- Olga Cherepanova, Russia
- Vladimir Chernyshkov, Russia
- Lyudmila Chizhikova, Russia
- Vlado Delik, Serbia
- Vadzim Demidchuk, Belarus
- Abusupyan Dibirov, Russia
- Eduard Dyba, Belarus
- Vitaly Dzhavakhiya, Russia
- Ivan Ermolov, Russia
- Aleksandra Figurek, Cyprus
- Gombo Gantulga, Mongolia
- Oksana Glibko, Russia
- Mehmet Guzey, Turkey
- Viktar Haldyban, Belarus
- Dmitry Hort, Russia
- Larisa Ilyina, Russia
- Evgeny Ivashko, Russia
- Evgeny Khrustalev, Russia
- Vladimir Klybik, Belarus
- Alyona Kodolova, Russia
- Sergey Kosogor, Russia
- Valentina Kundius, Russia
- Georgy Laptev, Russia
- Nikolay Lepeshkin, Belarus
- Roman Meshcheryakov, Russia
- Vadim Mikulski, Belarus
- Murtuzali Murtuzaliev, Russia
- Alexander Nedostup, Russia
- Roman Nekrasov, Russia
- Oleg Novozhilov, Russia
- Konstantin Ostrenko, Russia
- Adalat Pashayev, Azerbaijan
- Francesco Pieri, Italy
- Mirko Rakovic, Serbia
- Elena Semenova, Russia
- Tatyana Snytnikova, Russia
- Mikhail Tatur, Belarus
- Alexander Tristanov, Russia
- Daria Tyurina, Russia
- Elena Ulrich, Russia
- Elena Yildirim, Russia
- Anton Yurin, Belarus

Organizing Committee Co-Chairs

- Natalya Kostrikova, KSTU
- Alyona Viktorova, SPC RAS

Organizing Committee Members

- Elena Bezborodova, KSTU
- Vasilisa Ganicheva, SPC RAS
- Natalia Dormidontova, SPC RAS
- Alina Mikhailus, SPC RAS
- Irina Podnozova, SPC RAS
- Ruslan Polyakov, KSTU
- Alexandr Smerchansky, SPC RAS
- Yuliana Cherepanova, SPC RAS

Conference at a glance

Monday, June 1, 2026		
08:30-09:00	**On-line Registration**	
10:00-10:30	**Opening Ceremony** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Oksana Ogij, Andrey Ronzhin	
10:30-12:30	**Plenary Session 1** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair:** Andrey Ronzhin	
12:30-12:45	**On-line Joint Photography of Conference Participants** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09	
12:45-14:00	**Lunch break**	
14:00-17:00	**Oral Session 1: Artificial Intelligence in Crop Production** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Dmitriy Khort, Ekaterina Cherskikh	**Oral Session 2: Artificial Intelligence in Aquaculture** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Viktor Klimov, Evgeny Ivashko
17:00-20:00	**Dinner**	
Tuesday, June 2, 2026		
09:00-11:00	**Oral Session 3: Artificial Intelligence in Aquaculture - 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Alexander Nedostup, Marina Solovey	**Oral Session 4: Economic and Organizational Aspects** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Mariya Golovko, Khapsat Dibirova
11:00-13:00	**Plenary Session 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair:** Vladimir Surovtsev	
13:00-14:00	**Lunch break**	
14:00-17:00	**Oral Session 5: Economic and Organizational Aspects - 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Olga Cherepanova, Marina Ermolina	**Oral Session 6: Biologization of Livestock Production** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Vladimir Surovtsev, Roman Nekrasov
Wednesday, June 3, 2026		
09:00-13:00	**Oral Session 7: Robotics in Agriculture** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Mikhail Tatur, Evgeni Magid	**Oral Session 8: Biologization of Crop Production** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Myagmarsuren Yadamsuren, Larisa Shcherbakova
13:00-14:00	**Lunch break**	

14:00-16:30	**Oral Session 9: Biologization of Crop Production - 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Yan Puhalsky, Yuri Maksimenko	**Oral Session 10: Artificial Intelligence in Agriculture** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Aleksandra Figurek, Nicklay Shilov
16:30-17:00	**Closing Ceremony** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair:** Natalya Kostrikova, Vladimir Surovtsev	
Thursday, June 4, 2026		
09:00-20:00	**Cultural Program**	

Conference Programme

Monday, June 1, 2026	
08:30-09:00	**On-line Registration**
10:00-10:30	**Opening Ceremony** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Oksana Ogij, Andrey Ronzhin
10:30-12:30	**Plenary Session 1** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair:** Andrey Ronzhin
	Keynote speech 1: *Otari Didmanidze.* Hybrid Tractor as an Energy and Digital Accelerator for the Technical Transformation of the Agro-Industrial Complex
	Keynote speech 2: *Alexander Bryukhanov*. High-Tech Technical Systems for Ensuring Environmental Safety of Processing and Use of by-Products of Animal Husbandry
	Keynote speech 3: *Azret Kochkarov*. Lecture Title: Experience in the Application and Prospects of Using AI in Agrobiotechnology
	Keynote speech 4: *Vladimir Belyaev*. Status and Prospects for the Introduction of Digital Technologies to Grow Crops under the Changing Climate (Altai Krai Example)
12:30-12:45	**On-line Joint Photography of Conference Participants** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09
12:45-14:00	**Lunch break**
14:00-17:00	**Oral Session 1: Artificial Intelligence in Crop Production** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Dmitriy Khort, Ekaterina Cherskikh
	Igor Smirnov, Alexey Kutyrev, and Dmitriy Khort. Computer Vision for Precision Orchard Inventory: Tree Detection and Planting Density Mapping.
	Alexey Stepanov, Elizaveta Fomina, and Konstantin Dubrovin. Formation of Seasonal Vegetation Indices Time Series for Information Support of Cropland Monitoring.
	Marina Solovey, Evgenii Mironov, and Martina Nahtigal. Development of a Robotic Platform for Pollination of Garden Strawberry in City-Farm Conditions Using Neural Network Object Detection.
	Evgenii Mitrofanov, Ivan Blekanov, Evgenii Kruchinin, Rodion Akhrameev, Olga Mitrofanova, and Arkhipov Mikhail. Real-Time CNN-Based Detection System for an Autonomous Agricultural Robot in Open-Field Conditions.
	Artem Ryabinov, Elena Shkodina, Anton Saveliev, and Ekaterina Cherskikh. Field Trials of UAVs for Pesticide Treatments to Control Weed Vegetation on Agricultural Lands.
	Kochkarov Azret, Shevkunov Andrey, Skudin Maksim, and Kulikov Andre. Intelligent Early Warning System for Basil Disease Detection in Vertical Farming Using Deep Learning and Morphological Analysis.

	Alexey Melnikov and Egor Loktionov. Solar-Powered Robotic Irrigation Systems for Agricultural Crops: Analysis and Economic Efficiency.
	Valerii Zakharov, Vadim Skobtsov, Boris Sokolov, Medvedeva Angela, Andrey Mironov, and Minglei Fu. Models and Technologies for Applying Neuro-Symbolic Intelligence to Multifactor Forecasting of Feed Wheat Yield
	Azret Kochkarov. Plant stress control and experience of using AI in agrobiotechnology.
14:00-17:00	**Oral Session 2: Artificial Intelligence in Aquaculture** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Viktor Klimov, Evgeny Ivashko
	Sergey Belikov and Viktor Klimov. Physico-Mathematical Model of an Ultrasonic Flow-Through System Based on Fuzzy Logic for Automated Counting of Shrimp Eggs in Aquaculture.
	Roman Borzin and Alla Kravets. Development and Experimental Validation of a Cyber-Physical System for Adaptive Control in Pond Aquaculture.
	Alexander Martyanov, Ksenia Kuzmina, Lina Lagutkina, Ekaterina Sokolova, and Elena Pershina. Regression Analysis and Machine Learning Models for Finding Optimal Growth Parameters of Cherax quadricarinatus in Closed Water Supply Installations.
	Le Van Nghia, Dmitry Shalgin, Pham Trong Khanh, and Nguyen Huy Liem. Efficient Neural Network Model Training for Fish Species Classification Using Attention-Enhanced MobileNetV3 in Aquaculture Applications.
	Roman Meshcheryakov, Konstantin Rusakov, Gleb Tevyashov, and Nikita Prihodko. Deep Learning–Based Sturgeon Counting and Length Estimation Using Segmentation and Skeletonization.
	Miroslava Romanova, Aleksandr Stukalin, and Vadim Demichev. A Computer Vision Pipeline for Real-Time Fish Population Monitoring in Aquaculture: From Dataset Curation to Deployment with YOLOv5s.
	Vladimir Demanov Irina Kvyatkovskaya, and Salamat Idrissov. Computer Vision as a Measurement Channel in an AIoT Cyber-Physical Pond Aquaculture System: A System Analysis Approach.
	Evgeny Ivashko. Practical aspects of analyzing the effectiveness of cultivation in cage fish farming.
17:00-20:00	**Dinner**

Tuesday, June 2, 2026	
09:00-11:00	**Oral Session 3: Artificial Intelligence in Aquaculture - 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Alexander Nedostup, Marina Solovey
	Olga Mezenova, Svetlana Agafonova, Natalia Romanenko, Natalia Kalinina, Vladimir Volkov, and Kachanova Angelika, and Natalia Zhila. The Effect of Enzymatic Hydrolysis of Fish Waste on the Degree of Oil Extraction and its Composition.
	Maria Shendo, Marina Kogan, Elena Sviridova, Tatyana Luneva, and Dzhumanov Dilshod. Ways to Develop Russia's Fisheries Sector on the Regional Level.
	Alexander Nedostup, Alexey Razhev, Pavel Nasenkov, and Karina Konovalova. The Influence of Hydrobionts on Net Construction.
	Alexander Nedostup, Alexey Razhev, Leonid Kondrashov, Voloshin Artur, Pavel Nasenkov, and Karina Konovalova. Multiphysical Similarity of Behavioral Characteristics of Hydrobiont in the World Ocean.
	Danil Litvishchenko, Tatyana Snytnikova, and Marina Solovey. Artificial Intelligence Applications for Automating Fish Age.
	Valentina Ivashko. Analysis of the dynamics of aquaculture sector.
	Alexander Bekarev. Digitalization of aquaculture: the key to sustainable regional development.
	Prasad Shridharrao Gangakhedkar. Artificial Intelligence and Emerging Technologies in Agricultural Product Processing.
09:00-11:00	**Oral Session 4: Economic and Organizational Aspects** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Mariya Golovko, Khapsat Dibirova
	Mariya Golovko and Denis Brazhnichenko. Digital Technologies as a Driver for the Green Transformation of the Agro-Industrial Complex: A Systemic-Institutional Approach
	Artur Davletshin and Yuliya Chutcheva. Digital Transformation of the Grain Sub-Complex of Russia.
	Valentina Maksimova, Tatiana Makarovskikh, and Anatoly Panyukov. An Intelligent Module for Estimating the Investment Attractiveness of Agricultural Lands in a Region.
	Sergey Shirokov and Irina Trushkina. Assessment of Food Supply Using the Potential of the Digital Environment.
	Kirill Goncharov. The Impact of Digitalization on the Sustainable Development of the Regional Agri-Food System: A Case Study of the Leningrad Region.
	Evgenia Rakhimova and Khapsat Dibirova. Features of Digitalization of Farms in the Leningrad Region.
	Svetlana Kalitko. Digitalization as a Factor in the Development of Agriculture in the Krasnodar Urban Agglomeration.

	Grigory Komlatsky, Galina Tereshchenko, and Maria Komlatskaya. Digital Platform in the Context of a Multifactor Model for Ecologized Industrial Beekeeping.
	Ruslan Polyakov. Principles of Self-Organization of Industrial Ecosystems as a Basis for a Digital Platform for Waste Management in the Agro-Industrial Complex: Inter-Industry Technology Transfer.
11:00-13:00	**Plenary Session 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair:** Vladimir Surovtsev
	Keynote speech 5: *Spiros Paramithiotis*. Plant Growth-Promoting Rhizobacteria: Advantages, Limitations and Future Directions
	Keynote speech 6: *Maria Karelina, Vladimir Filatov, and Denis Serdechny.* Lecture Title: Digital Integration of Full-Cycle Agricultural Economic Systems while Ensuring Food Security
	Keynote speech 7: *Viktor Klimov and Alexey Nikiforov-Nikishin*. Automatic Segmentation of Hepatocyte Nuclei in Fish Liver Histological Images Using the U-Net Convolutional Neural Network
	Keynote speech 8: *Elena Ulrikh*. Processing of White Lupine into Biotechnological Products for the Prevention of Cardiovascular Diseases in Seafarers
13:00-14:00	**Lunch break**
14:00-17:00	**Oral Session 5: Economic and Organizational Aspects - 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Olga Cherepanova, Marina Ermolina
	Valentina Kundius, Vladimir Chernyshkov, and Olga Cherepanova. Development of Organic Agriculture Based on Efficient Resource-Saving Agrobiotechnologies
	S*ergey Medvedev, Aleksander Semenov, and Elena Semenova.* Organic Berry Production.
	Nikonova Natalia and Nikonov Alexey. China's Experience and Success in the Organic Market.
	Marina Ermolina and Tatyana Perelekhova. A Study of the Mechanisms of Legal Regulation of Organic Agriculture in China, Taking into Account the Possibility of Their Adaptation in Russia.
	Elena Kovaleva. Problems of digital transformation of agriculture in Russian regions.
	Serik Nurbaev. Mathematical Modeling of Honey Bee Population Dynamics Using Complex Variables: Balancing Breed Conservation and Genetic Diversity with Inbreeding.
	Konstantin Ermakov. Analysis of the Limitations of Classical Air Traffic Management Systems fot the Integration of Unmanned Aircraft Systems in Agriculture.
	Ekaterina Russakova On digital platforms for managing unmanned aerial systems in the agro-industrial complex.
	Irina Shevchenko. Development of virtual museums of Altai State Agrarian University for the preservation of scientific collections.

14:00-17:00	**Oral Session 6: Biologization of Livestock Production** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Vladimir Surovtsev, Roman Nekrasov
	Valentina Filippova, Georgi Laptev, Larisa Ilina, Elena Yildirim, Kseniya Sokolova, Daria Tiurina, Ekaterina Ponomareva, Evgeniy Brazhnik, Vasiliy Zaikin, and Kristina Kanz. Effect of Glyphosate on Gut Microbiome Biomarkers Associated with Reproductive Longevity in Laying Hens.
	Roman Nekrasov, Alexei Butenko, Ivan Pishulin, Artem Studenkov, Konstantin Ostrenko, Nadezhda Bogolyubova, and Julia Bogolyubova. Efficiency of BSFL Conversion of Grain Waste Into Protein Meal for Animals.
	Elena Yildirim, Valentina Filippova, Larisa Ilina, and Kseniya Sokolova, Georgi Laptev, Daria Tiurina, Natalia Novikova, Nataliia Patiukova, Alesya Savicheva, Vasiliy Zaikin, and Vladislav Bolshakov, Irina Klyuchnikova and Anna Fisenko, Elena Korochkina, Darren Griffin, and Michael Romanov. Bioinformatics Analysis of the Genome of E. Faecalis E-10 Strain Isolated from Cow Endometrium.
	Tatiana Lashkova. Use of a Biologically Active Lake Sapropel–Based Preparation in Calf Feeding Under the Conditions of the Novgorod Region.
	Anton Utkin, Gleb Sutula, Jan Puhalsky, Svyatoslav Loskutov, Alyona Kondrat'eva, and Alexey Eremin. Black Soldier Fly (Hermetia Illucens) as a Source of New Biologically Active Substances of Protein Nature.
	Svyatoslav Loskutov, Jan Puhalsky, Lyudmila Molodkina, and Maria Andrianova. Dispersed State Evaluation by Dynamic Light Scattering for Alkaline Suspension of Black Lioness Fly Frass (Zoohumus) after Its Mineralization.
	Mikayel Mikayelyan, Gurgen Karapetyan, Valery Grigoryan, Astghik Pepoyan, Liana Grigoryan, Zhanna Melkonyan, and Spartak Yeribekyan. Eco-Epidemiology of Poultry Parasitic Diseases in Armenia: A National Synthesis and Implications for Sustainable Control.
	Su Jian, Ma Juan, Li Hao, and Kong Lingzhuo. Experimental Study on Physical Properties of Co-composting Cow Manure and Walnut Branches and Load Calculation of Compost Turner.
	Aloyna Zelenchenkova. The Effect of the Adaptogen Complex on the Immune Status and Intestinal Microbiocenosis of Broiler Chickens under Simulated Environmental Conditions.
	Nadezhda Bogolyubova, An alimentary complex of adaptogens for maintaining the productive health of poultry and obtaining high-quality poultry products.
	Vladimir Surovtsev. Digitalization as a Factor of Production Biologization and Sustainable Development of Dairy Farming in the Leningrad Region.

Wednesday, June 3, 2026	
09:00-13:00	**Oral Session 7: Robotics in Agriculture** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Mikhail Tatur, Evgeni Magid
	Vladimir Azarenko, Viktor Goldyban, Aliaksandr Zheshka, Dmitry Komlach, Maksim Kurylovich, and Valeria Selivanova. Route planning for a robotic platform for applying mineral fertilizers.
	Dmitry Moskvichev, Alexey Evgrafov, and Artembek Guzalov. Experimental Study of the Efficiency of a Robotic System for Precise Fertilizer Application to Increase Recource Efficiency in Crop Production
	Viktor Goldyban, Aliaksandr Zheshka, Maksim Kurylovich, Nikolay Bakach, Valeria Selivanova, Vladimir Azarenko, and Siarhei Herasiuta. Operator's Server Development for Controlling the Movement of a robotic Platform.
	Yulia Chutcheva and Pavel Kosov. Prospects for the Use of Natural Gas Motor Fuel in Agriculture in the Context of Enhancing Environmental Performance and Sustainable Development.
	Vladimir Dashevsky, Yuri Galykin, Andrey Ronzhin, and Aleksandra Figurek. Multi-Channel System of Liquid Solution Mixing for Refueling Agricultural UAVs.
	Artem Ryabinov and Ekaterina Cherskikh. Methodology for Operating Agricultural UAVs with Automatic Calibration and Semantic Layout of Flight Missions.
	Mikhail Tatur, Mikhail Kuzmenkov, Chen Jike, and Ilya Mashkou. Model-Based Design of a Control System for a Group of Agricultural Drones and a Robotic Swap Station.
	Ranil Salimov, Elvira Chebotareva, Hongbing Li, Mikhail Svinin, and Evgeni Magid. Development of a Low-Cost Monocular Vision System for Robotic Grasping of Dairy Bottles on Flexible Conveyor Lines.
	Aidar Khasanyanov and Elvira Chebotareva, Alexander Chetvergov, Edgar A. Martinez-Garcia, and Evgeni Magid. Experimental Evaluation of SLAM Performance Under Computational Constraints for Agricultural Indoor Facilities.
	Stanislav Krivko, Maxim Litvinov. The use of UAVs with a hydrogen fuel cell-based power supply system for monitoring large agricultural fields.
09:00-13:00	**Oral Session 8: Biologization of Crop Production** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Myagmarsuren Yadamsuren, Larisa Shcherbakova
	Larisa Shcherbakova, Maksim Kartashov, Yuliya Zuyeva, Vitaly Dzhavakhiya, and Sergey Zavriev. A Pilot Study of Antifungal and Chemosensitizing Activities of Two Microbial Metabolites to Assess Their Applicability in Organic Crop Production as Potential Biologicals Controlling Some Fusarium Fungi.
	Kamova Aleksandra. Sward Formation in Variegated Alfalfa upon Seed Inoculation with Root-Nodule Bacteria Sinorhizobium Meliloti in Karelia.

	Susanna Mirzabekyan, Anahit Manvelyan, Natalya Aram Harutyunyan, Marine Harutyun Balayan, Astghik Pepoyan, Haykush Batikyan, Anna Hovhannes Tadevosyan, and Mahsa Khalegh Daryadar. Preliminary Characterization of Cultivable Epiphytic Microorganisms Associated with Eryngium caucasicum Trautv.
	Dmitry Vorobyev. Evaluation of Statins as Potential Bioagents Suppressing the Development of Insect Pests.
	Olga Antonova, Liliya Stupina, Valentina Kursakova, and Danil Avdeev. The Role of Straw and Biological Products in Increasing the Biological Activity of Soils and the Productivity of Spring Wheat.
	Lyudmila Tiranova. Effect of Arksoil Nitrogen and Arksoil Phosphorus Biofertilizers on the Productivity and Nutritional Value of Winter Rye Grain in the Novgorod Region.
	Myagmarsuren Yadamsuren, Noov Bayarsukh, and Batmunkh Javzandulam. The Wheat Breeding in Mongolia.
	Javzandulam Batmunkh, Myagmarsuren Yadamsuren. Climate Effects on Barley Yield in Mongolia.
	Nyamgerel Khashbaatar, Oyun-Erdene Smirnov, Myagmarsuren Yadamsuren. Results of Potato Hybridization Research in Mongolia.
13:00-14:00	**Lunch break**
13:00-15:00	**Oral Session 9: Biologization of Crop Production - 2** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Yan Puhalsky, Yuri Maksimenko
	Yuri Maksimenko, Olga Konnova, Anton Ostapenko, and Martik Vardanyan, Natalia Nevinnykh. Technological and Design Solutions for Combined Microwave-Ultrasonic Inulin Extraction.
	Ludmila Bakina, Yulia Polyak, and Alexander Gerasimov. The Nitrogen Cycle Processes as an Indicator of Oil Pollution in Agricultural Soils.
	Marina Chugunova, Ludmila Bakina, Alexander Gerasimov, and Evgeniya Gorbunova. Microbial Respiration as an Indicator of the Efficiency of Biopreparations for Oil-Contaminated Soil Purification.
	Radik Safin. Evaluation of the role of biopreparations based on endophytic bacteria in organic farming.
	Lidia Silaeva. Digital Technologies in Russia Grain Production.
	Yan Puhalsky. Evaluation of particle coagulation in an alkaline suspension of black soldier fly zoohumus by dynamic light scattering after mineralization
	Pratyush Kumari Rath, Digambar Shivram Perke, Prasad Sridharrao Gangakhedkar, Kishor Anerao, Sachin Giri, and Akshay Puri, Shantanu Konde, Aseema Chhabra, and Ayaz Mukarram Sheikh. Water Pricing and Irrigation Economics: An Overall Assessment of Policy, Practice, and Sustainability in Agriculture.

	Buddhabhushan. D. Wankhade, Avte Shubhangi Basveshwar, Syed Ibrahim Syed Ismail, Muley Pooja Anil, Meena Gajveer M.. Microbial Consortium Mediated Soil Health Improvement in Turmeric: A Focus on Physio-Chemical Properties and Nutrient Dynamics.
	Natalia Zakharova, Rashid Kurbanov. The use of UAS for monitoring agricultural biological objects.
14:00-16:30	**Oral Session 10: Artificial Intelligence in Agriculture** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Cochairs:** Aleksandra Figurek, Nicklay Shilov
	Anton Smirnov and Tatyana Snytnikova. Conceptual Multimodal AI Architecture for the Early Diagnosis of Pig Respiratory Diseases.
	Sergey Kuleshov, Alexandra Zaytseva, and Alexey Aksenov. Technology of Hybrid Cattle Monitoring Using Local Positioning and Video Surveillance.
	Aleksandra Figurek, Andrey Ronzhin, and Vladimir Milovanović. AI-Based Decision Support System for Sustainable Agriculture in Cyprus: Integrating Data Analytics and Resource Optimization.
	Vladislav Sobolevskii, Boris Sokolov, Valerii Zakharov, and Fedor Gaponiako, and Olga Golda. An Automated Tool for Generating Monitoring Models for Complex Agrobiotechnical Systems.
	Alexander Smirnov, Tatiana Levashova, Nicklay Shilov, and Andrew Ponomarev, and Leonid Sheremetov. Dynamic Configuration in Cognitive Cyber-Agriculture Using Multi-Aspect Ontology.
	Vladislav Skripnik, Irina Veselkova, and Valentina Kuznetsova. Application of Modular Retrieval-Augmented Generation System to Support Agricultural Decision-Making.
	Valentina Kuznetsova, Timur Yagafarov, Valery Laptev, and Irina Kvyatkovskaya. Design and Experimental Evaluation of a Voice Control System for Autonomous Robotic Agricultural Systems.
	Rahul Kamble, Archana Khandare, Pratyush Kumari Rath, Prasad Shridharrao Gangakhedkar, and Kishor Anerao. IoT-Enabled Smart Packaging for Real-Time Freshness Monitoring of Processed Foods.
	Stanislav Gerasimenko. Research on seed calibration in a gravity separator.
16:30-17:00	**Closing Ceremony** https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09 **Chair:** Natalya Kostrikova, Vladimir Surovtsev
Thursday, June 4, 2026	
09:00-20:00	**Cultural Program**

Abstracts

Plenary Session 1

Keynote speech 1

Otari Didmanidze, Head of the Department of Tractors and Automobiles Institute of Mechanical and Power Engineering named after V.P. Goryachkin, Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Doctor of Technical Sciences, Professor, Academician of the Russian Academy of Sciences, Moscow, Russia.

Lecture Title: Hybrid Tractor as an Energy and Digital Accelerator for the Technical Transformation of the Agro-Industrial Complex.

Abstract: Out of over 5,200 tractors annually produced in Russia, approximately 90% have a capacity exceeding 220 hp. These are vehicles of traction class 4 and above. At the same time, 63% of them are tractors with a capacity exceeding 380 hp, and produced just at two plants – PTZ and Rostselmash. The predominance of machines of such power is associated with the initial and, by current standards, irrational trend in the development of tractor construction by increasing capacity and energy saturation. This approach does not allow for optimizing the energy consumption and leads to negative environmental and economic consequences. Current development trends require a systematic departure from the tractor idea as a purely mechanical object, with a transition to a digital object configured to work in the external information field. Only a hybrid tractor of a small traction class, owing to its active adaptive functions, can raise an idea of the impact object and operate these data in a general information flow, thus, allowing it for an inclusion in the concept of a digital twin of an agricultural enterprise. This is a necessary technological step towards the development of fully autonomous unmanned robotic systems and the transition to proactive resource conservation in agriculture.

Keynote speech 2

Alexander Bryukhanov, Director of IEEP – branch of FSAC VIM, Doctor of Technical Sciences, Academician of the Russian Academy of Sciences, St. Petersburg, Russia.

Lecture Title: High-Tech Technical Systems for Ensuring Environmental Safety of Processing and Use of by-Products of Animal Husbandry.

Abstract: In Russia, more than 500 million tons of secondary organic resources are generated annually, of which less than 50% is returned to agricultural turnover in the form of by-products of animal husbandry and crop production. This leads to loss of soil fertility, potential harvest, and risks of environmental pollution. The solution to this problem requires the introduction of high-tech technologies and digital systems that ensure the effective involvement of livestock by-products in a closed-loop economy in the form of highly effective organic and organomineral fertilizers with soil-restoring properties. According to minimal estimates, the introduction of high-tech technologies for involving livestock by-products into agricultural turnover as highly effective fertilizers will increase the gross grain harvest by 12 million tons. tons per year, and the ecological and economic effect of reducing the risks of environmental pollution and improving the health of citizens is estimated at 500 to 1,500 billion rubles.

Keynote speech 3

Azret Kochkarov, Deputy Director for Innovation, Research Centre of Biotechnology RAS; Professor of the Artificial Intelligence Department, Financial University under the Government of the Russian Federation; Professor of the Biotechnology and Biosystems Engineering Department, Moscow Institute of Physics and Technology (State University), Moscow, Russia.

Lecture Title: Experience in the Application and Prospects of Using AI in Agrobiotechnology.

Abstract: The article considers current trends in digitalization and intellectualization of the production direction of agriculture. It offers an analysis and experience of using artificial intelligence technologies when working with autonomous vertical farms, as one of the types of urban agricultural production in an autonomous artificial and controlled environment. A number of issues requiring further research to improve the efficiency of urban agricultural production are highlighted. The issues of changing the growing time, size, weight, concentration of required (useful) substances, and the content of secondary metabolites of plants grown in controlled and managed conditions of autonomous urban agricultural production are considered separately. A synergetic hypothesis of "plant stress management" is also proposed, as identifying order parameters in managing the vegetation (development) of plants to achieve target indicators of their productivity.

Keynote speech 4

Vladimir Belyaev, Head of the Department of Agricultural Machinery and Technology, Altai State Agricultural University, Doctor of Technical Sciences, Professor, Barnaul, Russia.

Lecture Title: Status and Prospects for the Introduction of Digital Technologies to Grow Crops under the Changing Climate (Altai Krai Example).

Abstract: Modern conditions of production development require increasing efficiency in the use of agro-climatic potential of farms based on the latest advances in agricultural technologies. One such area is the development and implementation of digital crop technologies. The Alrai Krai is successfully implementing a digital weather data service based on a network of more than 100 field soil stations, which allows to carry out current analysis of the conditions of plant development in the fields and make operational management decisions. Technologies for differentiated application of seeds and fertilizers according to field productivity zones based on task-maps are used. Work is being carried out on the differentiated use of plant protection products, identification of weeds, diseases and pests based on technical vision. The implementation of digital solutions, combined with the use of the latest technology, varieties, seeds, fertilizers, and plant protection products, makes it possible to increase the efficiency of land use by 1.5–2 times, ensuring the long-term economic sustainability of farms.

Plenary Session 2

Keynote speech 5

Spiros Paramithiotis, Assistant Professor, Laboratory of Microbiology, Department of Biological Applications and Technology, University of Ioannina, Ioannina, Greece.

Lecture Title: Plant Growth-Promoting Rhizobacteria: Advantages, Limitations and Future Directions.

Abstract: Research in plant growth-promoting rhizobacteria (PGPR) has been intensified over the last decade due to the benefits that their application may confer in the sustainability of agricultural production and food security. PGPR are soil bacteria that colonize the rhizosphere and interact directly and indirectly with the plants, enhancing their ability to withstand adverse conditions and, therefore, their productivity. More specifically, a large amount of strains belonging to quite diverse genera such as Azospirillum, Bacillus, Brevundimonas, Enterobacter, Exiguobacterium, Falsibacillus, Klebsiella, Paraburkholderia, Priestia, Pseudomonas, Rhizobium, Rossellorea, Serratia, Streptomyces, etc., have been reported confer multiple benefits, including the increase of nutrient bioavailability through a variety of activities such as nitrogen fixation, phosphorus and potassium solubilization, production of siderophore compounds that improve iron availability for the plant and at the same time reduce the toxicity of heavy metals, the production of diverse metabolites that either possess antimicrobial activity and/or induce systemic resistance against bacterial and fungal pathogens, phytormones that stimulate root and shoot development, exopolysaccharides that improve water holding capacity of the soil and concomitantly water uptake by the plant, etc. This intensive assessment has also facilitated the exposure of the limitations of PGPR application and the needs for future research. The most important limitation is the strain-dependent character of these activities, which are also affected by the soil physicochemical parameters, the indigenous microecosystem and the compatibility between PGPR strain and plant. Other equally important aspects include the stability of the strains during culture preparation and storage, and regulatory issues that have been reported for some regions and may hinder PGPR application. Thus, future research should focus on addressing this inconsistency of PGPR performance, either through improved screening procedures or through genetic modification or editing approaches.

Keynote speech 6

Maria Karelina, Vice-Rector of The State University of Management, Doctor of Technical Sciences, Doctor of Pedagogical Sciences, Professor, Moscow, Russia.
Vladimir Filatov, Leading Researcher at the Laboratory of Reverse Engineering of The State University of Management, Candidate of Technical Sciences, Associate Professor, Moscow, Russia.
Denis Serdechny, Associate Professor of the Department of Innovation Management, Senior Researcher at the Department of Scientific Activities of the Office for the Coordination of Scientific Research of The State University of Management, Candidate of Technical Sciences, Associate Professor, Moscow, Russia.
Lecture Title: Digital Integration of Full-Cycle Agricultural Economic Systems while Ensuring Food Security.
Abstract: Digitalization of processes and the introduction of automated control systems are becoming an integral part of the development strategy of the modern agro-industrial complex of the Russian Federation. Modern technologies make it possible to optimize production processes, improve product quality and strengthen competitiveness in the global market. According to research, digitalization can increase agricultural productivity by 20-30% in the coming years. However, the level of digitalization in the Russian agro-industrial complex remains heterogeneous: existing digital solutions are disparate systems that are not integrated into a single lifecycle of the agro-industrial complex economic system. This highlights the need to develop a comprehensive digital model of the full-cycle agro-industrial complex economic system.

Keynote speech 7

Viktor Klimov, Vice-Dean for Research of Faculty of Biotechnology and Fisheries, K.G. Razumovsky Moscow State University of Technologies and Management (FCU), Candidate of Technical Science, Moscow, Russia.
Alexey Nikiforov-Nikishin, Dean of Faculty of Biotechnology and Fisheries, K.G. Razumovsky Moscow State University of Technologies and Management (FCU), Doctor of Biological Sciences, Professor, Moscow, Russia.
Lecture Title: Automatic Segmentation of Hepatocyte Nuclei in Fish Liver Histological Images Using the U-Net Convolutional Neural Network.
Abstract: Histological analysis of fish livers is an important tool for assessing their health and monitoring the impact of aquatic pollutants. This paper presents the results of the development and validation of an algorithm for the automatic segmentation of hepatocyte nuclei in digital histological images of fish livers. The algorithm is based on a U-Net convolutional neural network, which is widely used as an effective tool for solving biomedical segmentation problems. A dataset of rainbow trout liver histological sections was prepared and labeled for training the model. Implementation of this tool can improve the objectivity and productivity of research in ichthyopathology and ecotoxicology.

Keynote speech 8

Elena Ulrikh, Director of the Chemical Analytical Resource Center of Kaliningrad State Technical University, Doctor of Technical Sciences, Kaliningrad, Russia.

Lecture Title: Processing of White Lupine into Biotechnological Products for the Prevention of Cardiovascular Diseases in Seafarers.

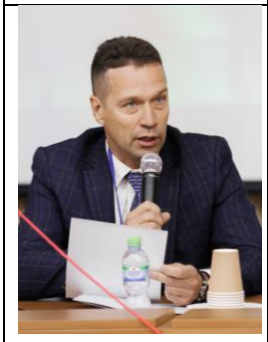
Abstract: The main method of obtaining squalene from white lupine seeds will be the Soxlet extraction method. This method of isolation is quite effective, simple, economical, and promotes the release of a lipid complex. This method can be used for almost unlimited volumes and types of plants. It is planned to use methods of enzymatic hydrolysis, ultrafiltration, ultracentrifugation and nanofiltration. Purification and separation of the lipid complex is planned to be carried out by gas chromatography, which is a modern method of purification and separation of lipids to fatty acids and squalene. The combined use of the proposed innovative effective methods for obtaining, separating, purifying and evaluating the quality of the lipid complex will make it possible to obtain a biologically valuable component for creating a biologically active food additive. The qualitative and quantitative composition of the new biologically active additive will be determined using an effective and promising method for the study of raw materials and foodstuffs – capillary electrophoresis. The creation of a ready-made biologically active additive based on squalene obtained from white lupine is planned to be carried out using modern methods of biotechnological processing of agricultural, food and pharmaceutical products.

Oral Session 1: Artificial Intelligence in Crop Production

Igor Smirnov, Alexey Kutyrev, and Dmitriy Khort, Federal Scientific Agroengineering Center VIM.

Lecture Title: Computer Vision for Precision Orchard Inventory: Tree Detection and Planting Density Mapping.

Abstract: This article presents a comprehensive method for the automated inventory of intensive industrial orchards using computer vision. The study aims to develop and validate an integrated software solution based on the state-of-the-art YOLO26 deep learning model for counting tree trunks and trellis posts, as well as for spatial analysis of planting density and distribution uniformity. As part of the research, the YOLO26 architecture was adapted (transfer learning), and a specialized dataset reflecting commercial orchard conditions was assembled and annotated. Primary data were collected using a ground robotic platform equipped with a DJI Action 5 Pro camera and a high-precision RTK-GNSS receiver for positioning and georeferencing. The developed software not only performs object detection but also conducts statistical analysis, visualizes spatial distribution, and generates orchard status maps. Experimental testing on a model plot confirmed the system's effectiveness. The YOLO26 Medium model demonstrated a precision of 0.919 and a recall of 0.846. The software revealed an overall tree deficit of 4.95% compared to the target and a statistically significant non-uniformity in their spatial distribution, automatically identifying zones with reduced planting density. The developed system automates labor-intensive monitoring and provides an objective foundation for agronomic decision-making.



Alexey Stepanov, Far Eastern Agriculture Research Institute.

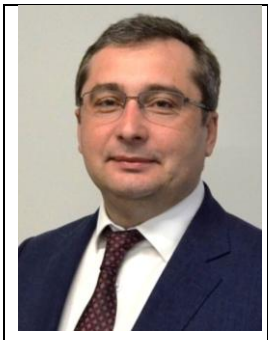
Elizaveta Fomina and Konstantin Dubrovin, Computing Center of the Far Eastern Branch of the Russian Academy of Sciences.

Lecture Title: Formation of Seasonal Vegetation Indices Time Series for Information Support of Cropland Monitoring.

Abstract: Seasonal time series of vegetation indices (VI) derived from remote sensing data play a crucial role in precision agriculture. They are widely used to analyze crop growth dynamics, monitor crop condition, forecast yields, and classify crop types. Time series generated from optical and SAR (synthetic aperture radar) satellite data, as well as from unmanned arial vehicle (UAV) imagery, often require additional preprocessing to fill data gaps and enable the derivation of daily values. This paper describes the principles of constructing seasonal VI series using nonlinear fitting functions. To assess the fitting accuracy of NDVI and DpRVI time series, data from Sentinel-2 and Landsat-8/9 (2022-2024), Sentinel-1 (2021), and monthly DJI Mavic 3M imagery (2024) were used. The following functions were tested: a linear combination of Gaussian functions (DG), a linear combination of sine functions (DS), Fourier series (DF), and a linear combination of logistic functions (DL). The study focused on three cropland classes in Khabarovsk Krai: soybean, grain crops, and fallow land. The results revealed that for NDVI curves derived from Sentinel-2 and Landsat-8/9 data, the fitting accuracy of the Fourier series (DF) was significantly higher than that of

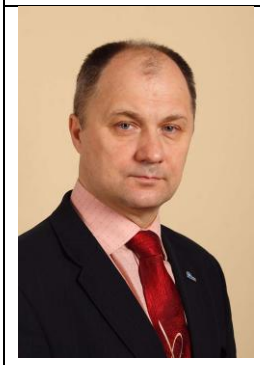
	the other functions. In contrast, the fitting of NDVI time series from DJI Mavic 3M data and DpRVI series from Sentinel-1 data yielded comparable accuracy across all tested functions. The average Mean Absolute Percentage Error (MAPE) for the three crop classes was 14.2% and 7.8% for Sentinel-2 and Landsat-8/9 data, respectively; 12.6% for Sentinel-1 data; and 7.1% for DJI Mavic 3M data. Based on the DF results, the main parameters of reference curves describing the seasonal dynamic of NDVI and DpRVI, were determined. It was found that the DOYmax values for soybean crops differed significantly from those of grain crops and fallow land, as observed in both optical and SAR data. The proposed approach for generating seasonal time series represents a key component of automated continuous digital monitoring of cropland.
	**Marina Solovey, Evgenii Mironov, and Martina Nahtigal,** Kaliningrad State Technical University **Lecture Title:** Development of a Robotic Platform for Pollination of Garden Strawberry in City-Farm Conditions Using Neural Network Object Detection. **Abstract:** Effective pollination represents a critical biotic constraint in the cultivation of garden strawberry (Fragaria × ananassa Duch.) in vertical city farms. Traditional pollination methods demonstrate low efficiency or are impractical under multi-tier protected cultivation structures. This study presents the concept of a robotic platform equipped with an integrated computer vision system based on a neural network for autonomous detection of strawberry inflorescences and their mechanical pollination. A specialized image dataset of strawberry inflorescences was compiled to train the detection model, ensuring reliable target recognition under real greenhouse lighting conditions characterized by a dual-peak red–blue spectrum and dense plant arrangement. A manipulator prototype was developed, incorporating a 3D-printed frame, stepper motors, and a control board with an embedded neural processing unit (NPU). The proposed design is expected to provide precise positioning of the end effector and gentle interaction with inflorescence. The modular architecture of the platform enables adaptation to other crops and additional agricultural tasks. The developed solution establishes a foundation for the implementation of automated pollination technologies in protected cultivation within the framework of digital transformation of the agro-industrial sector.
	**Evgenii Mitrofanov, Ivan Blekanov, Evgenii Kruchinin, Rodion Akhrameev, and Olga Mitrofanova,** Saint Petersburg State University. **Arkhipov Mikhail Vadimovich,** St. Petersburg Federal Research Center of the Russian Academy of Sciences. **Lecture Title:** Real-Time CNN-Based Detection System for an Autonomous Agricultural Robot in Open-Field Conditions. **Abstract:** The automation of weed control is critical for precision agriculture, yet its implementation on autonomous field robots faces significant challenges due to limited onboard computational resources and dynamic environmental conditions. This study presents the development and evaluation of a real-time computer vision system for an autonomous agricultural robot designed for precision crop

	monitoring. The proposed system employs an "inverted" detection strategy, where a neural network identifies target crop plants (tobacco) to allow for the subsequent localization of weeds as undetected green mass. The hardware platform is centered on the energy-efficient NVIDIA Jetson Orin Nano, integrated with a GNSS RTK receiver for centimeter-level geotagging, all orchestrated within a ROS 2 framework. The YOLOv8m model was identified as the optimal compromise, achieving a high frame rate (18 FPS, 55.6 ms inference) with robust detection quality (mAP@0.5 0.84, Recall 0.79). This performance enables the robot to process a continuous video stream at speeds up to 2 m/s, generating precise, georeferenced maps of crop locations. The trained model's efficacy was validated on field data, confirming the system's practical viability for guiding targeted interventions and contributing to significant reductions in herbicide use. The study demonstrates a scalable and efficient approach for deploying sophisticated AI on embedded hardware for precision agriculture.
	**Artem Ryabinov, Elena Shkodina, Anton Saveliev, and Ekaterina Cherskikh,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS). **Lecture Title:** Field Trials of UAVs for Pesticide Treatments to Control Weed Vegetation on Agricultural Lands. **Abstract:** This study presents the results of field experiments aimed at evaluating the effectiveness of unmanned aerial vehicles (UAVs) for broadcast herbicide applications to control weed vegetation on agricultural lands. The experiment was conducted in 2025 in the Northwestern region of the Russia on plots previously used for agricultural production, after the harvest of spring (2 ha) and winter (1 ha) crops, characterized by a high degree of infestation with annual and perennial weed species. The systemic herbicide Tornado 540, containing glyphosate (potassium salt) at a concentration of 540 g/L as the active ingredient, was used as the treatment agent. It was established that the use of UAVs achieves a phytotoxic effect comparable to the classical method, while the high concentration of the preparation caused no damage to crop plants. Fourteen days after treatment, the weed vegetation was eliminated, confirming the high biological efficacy of the method. Additionally, the absence of mechanical impact on the soil cover was noted, as well as the possibility of performing agricultural operations under conditions of high soil moisture, where the use of wheeled machinery is impossible due to the risk of soil compaction and structure damage. The obtained data demonstrates the technological, economic, and environmental feasibility of integrating UAVs into the practice of pre-sowing chemical treatment of lands.



Kochkarov Azret, Shevkunov Andrey, and Skudin Maksim, Federal Research Center of Biotechnology of the Russian Academy of Sciences.
Kulikov Andrey, Federal Research Center of Biotechnology of the Russian Academy of Sciences, Federal State Budgetary Educational Institution of Higher Education «MIREA - Russian Technological University».
Lecture Title: Intelligent Early Warning System for Basil Disease Detection in Vertical Farming Using Deep Learning and Morphological Analysis.
Abstract: This article presents the development and validation of an intelligent early warning system for plant diseases in vertical farming, situated within the broader context of digitalization and intellectualization of modern agricultural production. Using basil (Ocimum basilicum L.) as a model organism, the study integrates computer vision and morphological analysis to enable precision phytopathological monitoring in controlled urban farming environments. Experiments were conducted in a vertical farm with LED lighting across three cultivars. A YOLOv8x model trained for trichome detection (mAP@0.5 = 0.833) revealed dependencies between trichome density and spectral light composition, as well as statistically significant differences between adaxial and abaxial leaf surfaces (Mann–Whitney test, $p < 0.05$). A YOLOv11 model for disease identification (fusarium wilt, bacterial spot) achieved 74.7% precision at 69.3% recall on a dataset of 2540 annotated images. A morphological analysis module based on PlantCV enables automatic leaf measurement with 5-20% error, employing a pot-based calibration method independent of camera specifications. The article also addresses key challenges in urban agricultural production, including optimization of growing time, concentration of beneficial substances, and secondary metabolite content under managed conditions. The results confirm the strong potential of neural network technologies for advancing autonomous vertical farming.

Alexey Melnikov and Egor Loktionov, Bauman Moscow State Technical University.
Lecture Title: Solar-Powered Robotic Irrigation Systems for Agricultural Crops: Analysis and Economic Efficiency.
Abstract: Climate change and the increasing frequency of droughts are heightening the relevance of employing irrigation systems, a practice simultaneously constrained by the growing scarcity of freshwater resources. Common sprinkler systems, in their current form, perform virtually no other functions, despite their potential to provide a structural framework and energy source for various precision agriculture technologies, such as machine vision systems and manipulators. This article reviews contemporary methods of crop irrigation, including both traditional and automated systems used in agriculture. The authors propose an original concept for a robotic irrigation system powered by solar panels, detailing its design, operating principle, and key advantages compared to existing analogues. A calculation of the proposed solution's economic efficiency is performed, including an assessment of reduced costs for grid electricity and fuel resulting from the elimination of diesel generators. The obtained results confirm the feasibility of implementing

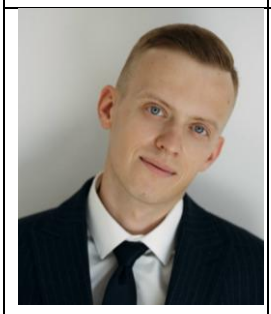
	multifunctional, solar-powered robotic systems within the context of modern agriculture.
	**Valerii Zakharov, Vadim Skobtsov, Boris Sokolov, and Medvedeva Angela,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS). **Andrey Mironov,** Federal State Budgetary Military Educational Institution of Higher Education «A.F. Mozhaisky Military Space Academy». **Minglei Fu,** College of Information Engineering, Zhejiang University of Technology. **Lecture Title:** Models and Technologies for Applying Neuro-Symbolic Intelligence to Multifactor Forecasting of Feed Wheat Yield **Abstract:**The paper examines ways to improve the quality of multifactor forecasts of feed wheat yield through the combined use of statistical initial data as well as fuzzy-possibilistic and neural network approaches and models. The problem of multifactor forecasting of temporal changes in feed wheat yield is solved by constructing a multifactor model that describes the dependence of yield on forecasted values of parameters characterizing the state of natural and climatic factors as well as on the expected agrotechnological measures. The use of expert knowledge made it possible to perform preliminary processing of the initial data by removing from consideration factors with weak influence and factors that are costly to monitor, which increased the quality of the yield forecast in the example presented in the article by approximately two times. One-dimensional convolutional neural network models, recurrent neural network models, and a hybrid neural network model based on the sequential connection of blocks of three main types of neural network layers (convolutional, recurrent, and fully connected) were also developed, studied, and tested. The conducted comparative analysis showed that the proposed hybrid model ARIMA + hybrid neural network has a significant advantage in terms of error value and coefficient of determination compared with the other models under study. Approaches to constructing a hybrid architecture that combines fuzzy-possibilistic modeling and neural network methods based on principles close to ontology-oriented neuro-symbolic intelligence are also considered.
	**Azret Kochkarov,** Research Center of Biotechnology RAS. **Lecture Title:** Plant stress control and experience of using AI in agrobiotechnology. **Abstract:** The article considers current trends in digitalization and intellectualization of the production direction of agriculture. It offers an analysis and experience of using artificial intelligence technologies when working with autonomous vertical farms, as one of the types of urban agricultural production in an autonomous artificial and controlled environment. A number of issues requiring further research to improve the efficiency of urban agricultural production are highlighted. The issues of changing the growing time, size, weight, concentration of required (useful) substances, and the content of secondary metabolites of plants grown in controlled and managed conditions of autonomous urban agricultural production are considered separately. A synergetic hypothesis of "plant stress control" is also proposed, as identifying order parameters in managing the vegetation (development) of plants to achieve target indicators of their productivity.

Oral Session 2: Artificial Intelligence in Aquaculture

Belikov Sergey and Klimov Viktor, Moscow State University of Technology and Management named after K.G. Razumovsky (FCU).

Lecture Title: Physico-Mathematical Model of an Ultrasonic Flow-Through System Based on Fuzzy Logic for Automated Counting of Shrimp Eggs in Aquaculture.

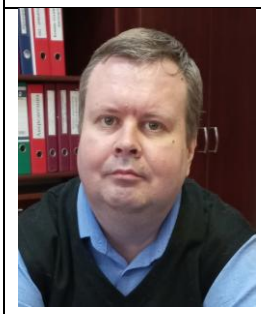
Abstract: This review article presents a theoretical foundation for the development of an ultrasonic flow-through system based on piezoelectric transducers and fuzzy logic algorithms for automated counting of giant river prawn (Macrobrachium rosenbergii) eggs in aquaculture. The study addresses the critical need for non-invasive, high-accuracy monitoring of reproductive processes under conditions of reduced water transparency, where traditional optical and mechanical methods exhibit significant limitations. A comprehensive physico-mathematical model is proposed, integrating fundamental principles of acoustics, wave scattering theory, and impedance matching to describe the amplitude of ultrasonic signals reflected from individual eggs. The model incorporates geometric diffraction coefficients, Fresnel reflection at media interfaces, and exponential attenuation according to the Bouguer-Lambert law. Key design parameters of high-frequency piezoelectric transducers (5-15 MHz) are analysed, including resonant frequency calculation and impedance matching strategies to minimise energy losses. A fuzzy logic controller architecture is introduced, utilising normalised signal amplitude and pulse duration as input variables to classify detected objects while accounting for biological variability and environmental noise. Theoretical projections suggest a ~40% reduction in false alarm rates compared to conventional threshold-based methods. Technical challenges, including temperature-induced sound speed drift and interference from air bubbles, are discussed alongside proposed mitigation strategies involving dynamic frequency correction and power spectral density analysis. The article concludes with a roadmap for experimental validation, algorithm optimisation, and system scaling, positioning the proposed approach as a promising solution for enhancing productivity and sustainability in shrimp aquaculture. All quantitative estimates (egg density, expected reduction in false positives, and accuracy) are theoretical in nature and are subject to experimental verification at the next stage of the research.



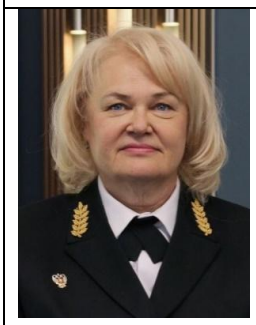
Roman Borzin and Alla Kravets, Volgograd State Technical University (VSTU).

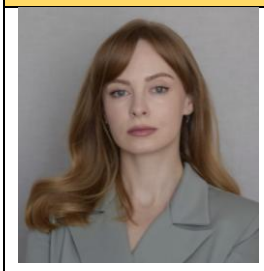
Lecture Title: Development and Experimental Validation of a Cyber-Physical System for Adaptive Control in Pond Aquaculture.

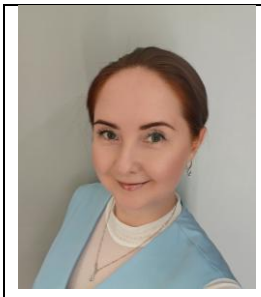
Abstract: This paper presents the development and experimental validation of a cyber-physical control system designed for pond aquaculture operating in open and dynamically changing environmental conditions. The study aims to enhance aquaculture control efficiency through automated monitoring and adaptive control of key water quality parameters. An analysis of the primary causes of high fish mortality in pond farms is conducted, highlighting the limitations of traditional manual monitoring approaches. A model of a cyber-physical system is proposed, integrating physical, cyber, and control subsystems with the

	external environment, accompanied by a formal mathematical description of their interactions. Key controlled parameters – water temperature, pH, and dissolved oxygen concentration – are defined, and a correlation analysis is performed on monitoring data. An intelligent monitoring data analysis method, based on multi-criteria decision-making and adaptive control, is implemented using IoT sensor data. A working prototype of the system was deployed and tested at operational pond farms in the Volgograd region. Experimental results demonstrate a significant reduction in monitoring time (up to 95%), an 86% decrease in the frequency of abnormal conditions, and a 9% reduction in feed consumption compared to conventional management methods. The findings confirm the effectiveness, reliability, and practical applicability of the proposed cyber-physical approach for improving the sustainability and productivity of pond aquaculture systems.
	**Alexander Martyanov, Ksenia Kuzmina, Lina Lagutkina, Ekaterina Sokolova, Elena Pershina,** Astrakhan State Technical University. **Lecture Title:** Regression Analysis and Machine Learning Models for Finding Optimal Growth Parameters of Cherax quadricarinatus in Closed Water Supply Installations. **Abstract:** The article examines the dependence of the growth value for a promising aquaculture object – Australian redclaw crayfish (Cherax quadricarinatus) – depending on a number of growing parameters in the installation of a closed water supply system recirculating aquaculture system. To analyze this dependence, the authors use methods of linear regression analysis, as well as approaches related to the creation of machine learning models based on bagging algorithms and random forest. Based on the results of the analysis, a conclusion was made regarding the best models. Thus, simple linear models were not accurate enough to build an effective predictive model, while ensemble models based on decision trees demonstrated a significantly higher degree of accuracy in constructing a regression relationship. At the same time, of the two studied algorithms of ensemble models, taking into account the sample size, the algorithm based on bagging turned out to be relatively more accurate than the algorithm based on a random forest. At the same time, both approaches are considered promising for solving aquaculture problems associated with predicting the efficiency of crayfish farming depending on the cultivation conditions.
	**Le Van Nghia, Dmitry Shalgin, and Pham Trong Khanh,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS). **Nguyen Huy Liem,** Le Quy Don Technical University (LQDTU). **Lecture Title:** Efficient Neural Network Model Training for Fish Species Classification Using Attention-Enhanced MobileNetV3 in Aquaculture Applications. **Abstract:** Accurate fish species classification constitutes a critical requirement in intelligent aquaculture management systems. Nevertheless, contemporary deep learning models continue to face significant challenges in simultaneously achieving high recognition accuracy and computational efficiency, particularly under resource-constrained deployment conditions. In this paper, we propose a

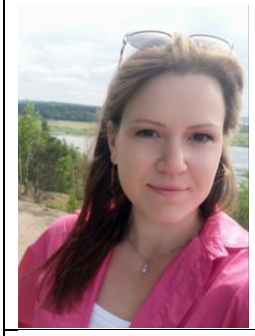
	lightweight attention-integrated classification framework that synergistically combines the Mo-bileNetV3 architecture with the Convolutional Block Attention Module (CBAM). Two model variants are developed to accommodate diverse deployment scenarios: MobileNetV3-Large+CBAM attains superior classification performance with an accuracy of 98.98%, an F1-score of 98.90%, and a Top-3 Accuracy of 99.66% within a compact model size of 17.64 MB; whereas MobileNetV3-Small+CBAM offers an ultra-lightweight alternative, achieving 98.01% accuracy with a model size of merely 6.50 MB and 1.59 G FLOPs. The CBAM mechanism demonstrates consistent effectiveness in enhancing classification performance relative to their respective baseline models, while incurring negligible additional computational overhead – introducing only 2.68–2.83% additional FLOPs and less than 3% increase in model size. Comprehensive experiments conducted on a dataset comprising 31 aquatic species across 13,304 images confirm that the proposed framework constitutes an effective and practically viable solution for intelligent aquaculture monitoring systems, with broad application potential spanning automated surveillance, quality control, biological research, and education.
 	**Roman Meshcheryakov, Konstantin Rusakov, Gleb Tevyashov, and Nikita Prihodko,** V.A. Trapeznikov Institute of Control Sciences of Russian Academy of Sciences. **Lecture Title:** Deep Learning–Based Sturgeon Counting and Length Estimation Using Segmentation and Skeletonization. **Abstract:** The article discusses the problem of contactless monitoring of sturgeon in aquaculture based on video data. The relevance of the work is related to the fact that digitalization of aquaculture is becoming one of the key areas of the industry's development: farms need to promptly and regularly obtain objective indicators on the condition and size composition of fish without laborious manual procedures. In many practical scenarios, selective trapping, measuring and weighing are still used, which increases time costs and can negatively affect fish. Therefore, solutions are needed to automatically obtain quantitative characteristics from video. An end-to-end method is proposed that combines neural network detection and instance segmentation of sturgeons with subsequent calculation of biometric metrics. According to the predicted masks, the frame is resized and morphological cleaning is performed, then the central line (skeleton) of the object and its length in pixels are calculated. The result of the algorithm is the indicators for the frame of the video stream: the number of fish detected, the lengths of individual fish, as well as the average, minimum and maximum lengths. Examples of the method's operation in real-world shooting conditions and the results of training the segmentation model are given.

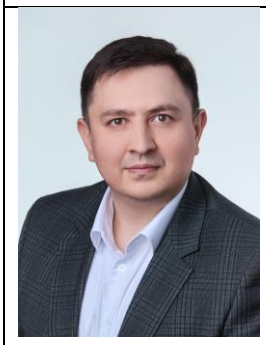
	Miroslava Romanova, Aleksandr Stukalin, and Vadim Demichev, Russian State Agrarian University - Moscow Timiryazev Agricultural Academy (RSAU – MTAA). **Lecture Title:** A Computer Vision Pipeline for Real-Time Fish Population Monitoring in Aquaculture: From Dataset Curation to Deployment with YOLOv5s. **Abstract:** Automated fish counting in Recirculating Aquaculture Systems (RAS) is essential for improving efficiency but remains difficult due to challenging visual conditions and the high cost of commercial solutions. This study presents a cost-effective computer vision pipeline developed through an iterative, data-centric methodology to overcome these barriers. An initial pilot dataset, captured in a production RAS, diagnosed pervasive issues such as water glare and low contrast. These findings informed the design of a targeted preprocessing stage using Contrast Limited Adaptive Histogram Equalization (CLAHE) and directed subsequent acquisition of an enhanced second dataset with optimized hardware. To build a robust detection model, a two-stage training strategy was employed. A YOLOv5s model was first trained on the initial challenging data, and then fine-tuned on the enhanced, preprocessed dataset. A custom lightweight tracking algorithm was developed to maintain individual fish identities for accurate counting in dense populations. The complete system was integrated into a desktop application for practical deployment. Validation on independent operational videos demonstrated a high efficiency in real-world conditions. This work delivers an affordable alternative to expensive commercial monitoring systems, providing a scalable and practical tool for data-driven management that is particularly accessible to small and medium-sized aquaculture enterprises.
	**Vladimir Demanov and Irina Kvyatkovskaya,** FSBEI HE «Astrakhan State Technical University». **Salamat Idrissov,** NJSC «Khalel Dosmukhamedov Atyrau University». **Lecture Title:** Computer Vision as a Measurement Channel in an AIoT Cyber-Physical Pond Aquaculture System: A System Analysis Approach. **Abstract:** The paper discusses the concept of hybrid cattle monitoring based on the integration of local positioning systems (UWB) and intelligent video surveillance. The limitations of traditional observation methods are highlighted, and the effectiveness of a combined approach to improve the accuracy of tracking an object's location within a frame, as well as monitoring animal behavior and physiological state, is substantiated. Methods for synchronizing data from positioning sensors and video analytics are described, along with the possibilities of using this approach to automate zootechnical processes and enable early diagnosis of cattle diseases. The system architecture includes wearable radio modules with infrared emitters and a network of stationary UWB base stations. Distance measurement is performed using the time-of-flight method, with subsequent triangulation to obtain spatial coordinates that are mapped onto video frames. The proposed approach enables the implementation of a hybrid monitoring scheme for moving objects, integrating a video surveillance subsystem

	with an indoor localization subsystem using UWB radio means. A prototype based on BU01 UWB modules and STM32 microcontrollers was developed and tested under farm conditions. This makes it possible to determine the daily motor activity of each animal, build a physiological profile.
	**Evgeny Ivashko**, Karelian Research Centre Russian Academy of Sciences. **Lecture Title:** Practical aspects of analyzing the effectiveness of cultivation in cage fish farming. **Abstract:** The report examines the issues of assessing the effectiveness of commercial trout farming in cage farms, including the assessment of biological and economic feed coefficients, absolute and relative growth rates, etc. - manually and with the help of special software for fish farmers FishWeb
Oral Session 3: Artificial Intelligence in Aquaculture - 2	
	**Olga Mezenova, Svetlana Agafonova, Natalia Romanenko, Natalia Kalinina, Vladimir Volkov, and Kachanova Angelika,** Kaliningrad State Technical University. **Natalia Zhila,** Institute of Biophysics of the Siberian Branch of the Russian Academy of Sciences. **Lecture Title:** The Effect of Enzymatic Hydrolysis of Fish Waste on the Degree of Oil Extraction and its Composition. **Abstract:** The aim is to investigate the effect of enzymatic hydrolysis modes of fish waste on the degree of oil extraction from it, the composition of its fatty acids, which are important for the microbial synthesis of biotechnology products. The raw materials used were waste from fish processing plants in the Kaliningrad region: hot-smoked sprat heads, mackerel heads and pike-perch internal organs with an oil content of 12.8-22.4%. Hydrolysis of the raw materials was carried out using the enzyme preparation Alcalase at varying temperature (50-70 ºC), duration (20-60 min.), enzyme dosage (0.025-0.6%). In the experiments, the degree of oil extraction was (% of oil content in raw materials): 60.8-73.6 for sprat; 34,4-53.1 for mackerel; 57.6-80.4 for pike-perch. At minimum values of hydrolysis parameters, the lowest oil yield was noted for all types of raw materials. The maximum parameters had different effects on the oil extraction level. No significant differences in the fatty acid composition of the oils obtained using different hydrolysis modes were found. The total content of polyunsaturated fatty acids in all oils samples was high: 25.0-27.1% in sprat; 24.4-27.0% in mackerel; in pike-perch. The maximum content of omega-3 PUFA was found in sprat oil (22.9-23.9%), and long-chain fatty acids in mackerel oil (40.7-48.5%). Taking into account the degree of oil extraction and its fatty acid composition, the following are recommended as rational parameters for fish waste enzymolysis with Alcalase: temperature 50 °C, duration 60 minutes, enzyme dosage 0.3%. Analysis of the composition of fatty acids and published data allowed us to consider the extracted oils as a favorable component for use in the composition of substrates in the microbial synthesis of biotechnology products.

	**Maria Shendo, Marina Kogan, Elena Sviridova, Tatyana Luneva, and Dzhumanov Dilshod,** Astrakhan State Technical University. **Lecture Title:** Ways to Develop Russia's Fisheries Sector on the Regional Level. **Abstract:** The paper examines the current state of the Russian fisheries complex in dynamics over the past ten years, development prospects in the face of foreign policy pressure, sanctions, changes in the domestic economy and its digitalization. The key indicators of the industry for 2014-2024 are analyzed: the volume of fish and seafood catch, the dynamics of aquaculture, export supplies and domestic consumption, and their dynamics. The factors influencing the studied indicators have been identified, including the regional heterogeneity of the industry, a partially outdated fleet, difficulties in logistics and warehousing, and sanctions pressure. The Astrakhan region is considered separately, where there is an industry decline, there is potential for the development of aquaculture and processing of local fish. In this regard, strategies for its development and increasing sustainability are proposed, which relate to focusing on current demand, modernizing production, expanding the range of semi-finished products, and optimizing logistics processes. The final part of the paper presents a multi-criteria KPI system for evaluating the effectiveness of a single industry digital platform. The assessment methodology contains five groups of indicators, an algorithm for calculating the integral indicator, and a scale for evaluating the effectiveness of the platform.
	**Alexander Nedostup, Alexey Razhev, Pavel Nasenkov, Karina Konovalova,** Kaliningrad State Technical University. **Lecture Title:** The Influence of Hydrobionts on Net Construction. **Abstract:** The study investigates the influence of hydrodynamic backwater on trawl cod-end performance. Conventional biomass-assessment models fall short in open-water fisheries, leading to the adoption of hydrodynamic backwater as a critical variable affecting catch-efficiency. A numerical framework grounded in Navier-Stokes equations and the vorticity-stream function (ω-ψ) formulation is constructed to simulate cod-end flows under varying design parameters – including inlet diameter, mesh spacing, mesh orientation, and trawling speed. Experimental simulations identify optimal geometries that minimize hydrodynamic backwater and maximize catch-efficiency. Findings reveal that a reduced inlet diameter and mesh spacing combined with a T90 mesh orientation cut hydrodynamic backwater by 15-20 %. Hydrodynamic backwater escalates sharply at higher trawling speeds, diminishing efficiency; the optimal speed window is 1.5-2.5 m/s. The ω-ψ solutions closely match hydro-channel experimental data, validating the model's accuracy. These results emphasize the necessity of incorporating hydrodynamic backwater considerations into net design and provide concrete recommendations for structural optimization to improve trawl performance. Future work should explore adaptive mesh configurations that respond to real-time hydrodynamic conditions, integrating machine-learning algorithms to predict optimal mesh spacing and orientation, thereby further reducing hydrodynamic backwater and enhancing selectivity while maintaining high catch rates across diverse pelagic species.

	**Alexander Nedostup, Alexey Razhev, Leonid Kondrashov, Voloshin Artur, Pavel Nasenkov, and Karina Konovalova,** Kaliningrad State Technical University. **Lecture Title:** Multiphysical Similarity of Behavioral Characteristics of Hydrobiont in the World Ocean. **Abstract:** This article discusses a modern approach to studying aquatic organism behavior, combining hydroacoustic methods, machine vision, and physical modeling. Currently, echo recordings are being decoded using AI to estimate biomass and allowable catch. The widespread use of hydroacoustic methods (HAM) for quantitative population census is discussed; however, these methods require high equipment costs. The authors note that direct observations are rare, requiring automation: machine vision, augmented reality, and mathematical modeling to collect statistics and understand growth dynamics. The article identifies five groups of studies: registration methods, physiology, social behavior, chemical factors, and engineering solutions. The importance of multiphysics modeling and numerical experiments is emphasized, which allow for the prediction of optimal trawl performance and resource management without expensive field observations. A review of the physical similarity criterion based on dimensional theory and the need to maintain the scale of geometry, mechanics, hydrodynamics, and light properties is provided. The authors propose a transition from integrated statistics to a full distribution analysis, which will lead to increased forecast accuracy and provide a more complete picture of population structure. Overall, the article emphasizes the integration of modern technologies and scientific approaches for sustainable fish farming management.
	**Danil Litvishchenko, Tatyana Snytnikova, and Marina Solovey,** Kaliningrad State Technical University. **Lecture Title:** Artificial Intelligence Applications for Automating Fish Age. **Abstract:** Ensuring access to high-quality, protein-rich foods like fish is vital for human nutrition, making the development of fisheries and aquaculture a global priority. Fishing faces sustainability challenges due to declining aquatic resources, while aquaculture offers scalable solutions but requires optimized growth processes. Accurate fish age assessment is crucial for both sectors: in aquaculture, it informs feeding strategies, breeding selection, and harvest planning, while in fisheries, it supports sustainable quota setting by protecting juvenile populations. Traditional methods for assessing fish age – such as analyzing scales, otoliths, or fin rays – rely on counting annual growth rings, but these methods are labor-intensive and prone to human error. Digital technologies, particularly artificial intelligence and computer vision, are transforming this process. Researchers have demonstrated that neural networks can analyze otolith and scale images with over 90% accuracy, significantly outperforming manual methods. Several software programs have been developed to address this task, but many are complex to use, limiting their accessibility. To solve this problem, Kaliningrad State Technical University has developed user-friendly software that uses a hybrid convolutional-

	regression neural network to automate age assessment from otolith images. The model achieved 92% accuracy on a test dataset, making it a practical alternative to manual counting. Future plans include adapting the tool for local fish species, creating a mobile app for field use, and integrating it with catch reporting systems. This innovation enhances the efficiency of fisheries and aquaculture.
	**Valentina Ivashko,** Karelian Research Centre Russian Academy of Sciences **Lecture Title:** Analysis of the dynamics of aquaculture sector. **Abstract:** The paper provides a brief analysis of the dynamics of the development of Russian aquaculture enterprises. The study covers the dynamics of production volumes by federal districts, changes in the number of operating enterprises by type of farm, as well as indicators of liquidation and bankruptcy in the sector.
	**Alexander Bekarev,** Laboratory of Digital Technologies for Regional Development, KarRC RAS. **Lecture Title:** Digitalization of aquaculture: the key to sustainable regional development. **Abstract:** The report focuses on the role of digitalization in improving the efficiency of fish farming both at the enterprise and regional levels. The results of a survey of existing aquaculture enterprises in the Republic of Karelia are shown, and practical examples of successful integration of digital technologies are given. The problems are highlighted and ways of solving the tasks outlined in the framework of the strategy for the development of agro-industrial and fisheries complexes, as well as government programs operating in the region, are proposed.
	**Prasad Shridharrao Gangakhedkar,** Parbhani. **Lecture Title:** Artificial Intelligence and Emerging Technologies in Agricultural Product Processing. **Abstract:** This chapter discusses recent innovations in the processing of agricultural products, with a focus on artificial intelligence and emerging digital technologies. It highlights modern processing methods, smart systems, and non-thermal technologies that improve food quality, safety, efficiency, and sustainability in the agro-food industry. The chapter also outlines future opportunities and challenges associated with adopting AI-driven processing technologies.
Oral Session 4: Economic and Organizational Aspects	
	Mariya Golovko and Denis Brazhnichenko, Kuban State Agrarian University. **Lecture Title:** Digital Technologies as a Driver for the Green Transformation of the Agro-Industrial Complex: A Systemic-Institutional Approach. **Abstract:** This paper investigates the role of digital technologies as a driver for the green transformation of the agro-industrial complex (AIC) from a systemic-institutional perspective. The authors argue that technological solutions – such as precision farming systems, big data platforms, and blockchain – serve not only as tools for enhancing efficiency but also as a key factor in overcoming the institutional barriers

	to this transition. Drawing on theories of path dependence, institutional logics, and transaction costs, the study analyzes how digitalization can reduce the costs of adopting sustainable practices and harmonize the interplay of state, market, and community logics. Based on empirical data and comparative case studies, the paper presents a multi-level model of the impact of digital technologies on the macro-, meso-, and micro-levels of the AIC. It reveals the dual nature of digitalization in Russia, where the active adoption of basic ICTs coexists with a "lock-in" in mastering integrated, "cross-cutting" technologies. The conclusion emphasizes the need for targeted institutional design that shifts the focus of state support from subsidizing assets to developing digital ecosystems and services tailored for small and medium-sized farms.
	**Artur Davletshin, Yuliya Chutcheva,** Russian State Agrarian University - Moscow Timiryazev Agricultural Academy. **Lecture Title:** Digital Transformation of the Grain Sub-Complex of Russia. **Abstract:** The article examines the digital transformation of the grain sub-complex of the Russian Federation as a systemic process affecting the production, infrastructure, and institutional elements of the grain reproduction cycle. Unlike studies that focus primarily on the technological aspects of digitalization, this work considers it in conjunction with the level of material and technical provision of the industry and the parameters of reproduction of the machine and tractor fleet. In this study, digital transformation is understood as a systemic process of structural changes in the agro-industrial complex affecting production, infrastructure, and institutional interactions based on the integration of digital technologies. Agricultural digitalization is interpreted more narrowly as the process of implementing digital tools and data-driven solutions in agricultural production, including precision farming technologies, digital platforms, and information systems aimed at improving efficiency and decision-making. It is shown that the structural deficit of machinery and the low rates of fleet renewal act as objective constraints on the digital transformation of the industry. It is substantiated that even under the condition that all newly produced machinery is equipped with digital solutions, achieving a systemic effect requires a prolonged period. A dual-contour model for accelerating digitalization is proposed, implying the simultaneous integration of digital solutions at the stage of machinery production and the modernization of the existing fleet. The economic feasibility of this approach is demonstrated: the cost of integrating digital systems during machinery production constitutes an insignificant share of its price, while the effects of implementing precision agriculture systems ensure a significant reduction in production costs and increased yield stability. It is noted that digitalization can be considered not only as a tool for improving production efficiency, but also as a factor in the structural transformation of the export-oriented model of the grain market.

Valentina Maksimova, Tatiana Makarovskikh, and Anatoly Panyukov, South Ural State University.

Lecture Title: An Intelligent Module for Estimating the Investment Attractiveness of Agricultural Lands in a Region.

Abstract: This research presents an intelligent module for estimating the investment attractiveness of agricultural lands, addressing the complex interaction of geospatial and economic factors in Russia. We developed a novel hybrid methodology combining Gower distance-based clustering with SHAP (SHapley Additive exPlanations) feature weighting to generate an interpretable investment index. Applied to a dataset of 335 land objects characterized by eight mixed-type features, our approach automatically determined an optimal two-cluster structure, effectively distinguishing high-potential objects not far from the infrastructure from remote, less attractive objects. Crucially, we derived data-driven feature weights via a surrogate Random Forest model trained on cluster pseudo-labels, overcoming the limitations of traditional linear hedonic models. The resulting system achieved exceptional performance, demonstrating 98.5% classification accuracy and an F1-score of 0.97. Furthermore, the regression component for rental rate adjustment yielded a low Root Mean Square Error (RMSE) of 15.87 rubles. Implemented in Python 3.12, this transparent, automated framework significantly enhances decision-making for land portfolio management, enabling precise, fair market valuation and optimized rental strategies for agricultural investors. Hence, the developed method can significantly simplify the management of large real estate portfolios, providing a transparent and reasonable pricing strategy.

Sergey Shirokov, Ministry of Agriculture of the Novgorod Region.

Irina Trushkina, Pushkin Leningrad State University.

Lecture Title: Assessment of Food Supply Using the Potential of the Digital Environment.

Abstract: Adequate and sufficient food provision for the population is a fundamental element of the economic, social, and political security of the state, as well as of the stability and development of the real sector of the national economy. Food supply must align with sustainable development goals and be compatible with long-term environmental requirements. Based on the research, conclusions were drawn regarding the existence of large arrays of unstructured information, which necessitates prioritizing big data processing methods and situational monitoring; the need to expand the toolkit for assessing of food supply, including using artificial intelligence (AI) capabilities in the digital environment to analyze big data, such as fiscal data operators (FDOs), Yandex.WordStat service, and others; and exploring the potential of using Federal State Information Systems (FGIS) data to develop approaches for assessing and planning food production volumes. This characterizes the current state and necessary requirements for digitalization processes when analyzing the parameters of the country's population food supply. Therefore, given the scale and complexity of these processes, close interaction between the state and business, combined with an enhanced role for economic science, should be anticipated for the effective use of modern digital technologies. Using

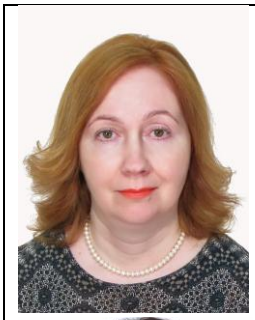
	digital environment data will enable the construction of a multi-level system for assessing population food needs, actual consumption, and substantiating food production plans. Today, addressing these challenges is impossible without integrating information resources from the state and corporate sectors, which allows transitioning to a new level of agricultural production development and food supply assessment.
	**Kirill Goncharov,** St. Petersburg Federal Research Center of the Russian Academy of Sciences. **Lecture Title:** The Impact of Digitalization on the Sustainable Development of the Regional Agri-Food System: A Case Study of the Leningrad Region. **Abstract:** This article examines the impact of digitalization on the sustainable development of the agri-food system (AFS) in the Leningrad Region. The study's relevance stems from the need to address specific regional challenges, including a high urban population density, food security requirements, and limited resources in intensive agriculture. The research aims to analyze the role of digital technologies in creating competitive advantages for the AFS and identifying pathways for sustainable food supply chain development. The authors adapt global Sustainable Development Goals (SDGs) to the regional context, identify levels of digital transformation, and systematize sustainability indicators. The methodology integrates international frameworks (SAFA), Russian strategic documents, and scientific literature. The authors propose a comprehensive indicator system organized across four key SDG dimensions: economic, social, environmental, and institutional. Findings reveal that most regional agricultural enterprises remain at the initial digitalization stage, with a direct correlation established between digital transformation depth and SDG achievement potential. The article concludes that digitalization represents not merely an optimization instrument but an essential, comprehensive element of sustainable development strategy, necessitating balanced consideration of economic, social, and environmental aspects in AFS operations.
 	**Evgenia Rakhimova and Khapsat Dibirova,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Institute of Agricultural Economics and Rural Development. **Lecture Title:** Features of Digitalization of Farms in the Leningrad Region. **Abstract:** Farms in the Leningrad Region play a significant role in providing food to the local population and surrounding areas, including St. Petersburg. The widespread adoption of digital technologies opens up new opportunities to improve the efficiency and competitiveness of these farms. This includes optimizing production processes, reducing costs, improving product quality, and increasing supply chain transparency. The purpose of this study is to identify and analyze the key features and challenges of digitalization on farms in the Leningrad Region. We used monographic and graphical methods, a survey of farm heads, analysis and synthesis, and a systems approach. The study revealed the low level of digital technology development on farms and identified the underlying causes. The undeniable advantages of new technologies and the importance of maintaining competitiveness

	necessitate finding ways to overcome these challenges. Therefore, we propose areas for improving digitalization on farms in the Leningrad Region. These areas can be implemented through a combination of state support measures and the efficient use of these resources by their recipients. The results of the study can be used by government agencies at all levels to develop policies regarding the digital transformation of agriculture.
	**Svetlana Kalitko,** Federal State Budgetary Educational Institution of Higher Education «Kuban State Agrarian University named after I.T. Trubilina». **Lecture Title:** Digitalization as a Factor in the Development of Agriculture in the Krasnodar Urban Agglomeration. **Abstract:** The article considers the aspects and prospects of digitalization of agriculture in the urban agglomeration using the Krasnodar urban agglomeration as an example. The significance of digitalization in the development of the agro-industrial complex of the Southern Federal District in accordance with the Strategy of Spatial Development of the Russian Federation is noted. The key features (proximity to the consumer; comprehensive development; pendulum migration; production specifics), problems (competition from large agroholdings, land use, logistics, preservation of rural identity) and prospects for the development of agriculture in the urban agglomeration (development of sustainable agriculture, support for small farms, integration into urban supply systems, creation of comfortable conditions for life and work in rural areas of the agglomeration) are reflected. The main modern forms, directions and key functions of agriculture in the urban agglomeration are characterized. The specialization of agriculture by districts of the Krasnodar urban agglomeration is presented. The key information technologies used in agriculture, including in the agriculture of the Krasnodar urban agglomeration, are described. The effectiveness of implementing a basic digital package for a medium-sized 1,000-hectare agricultural farm in the Krasnodar metropolitan area is determined. State support and regulatory measures for agricultural producers in the Krasnodar metropolitan area are described. Direct savings from using IT in agriculture in the Krasnodar metropolitan area are calculated. The need for widespread implementation of information technologies for the sustainable development of the agricultural sector in urban agglomeration conditions is substantiated: accumulated positive experience in the use of digital tools, a functioning system of state support, as well as the confirmed economic and social effectiveness of these innovations.

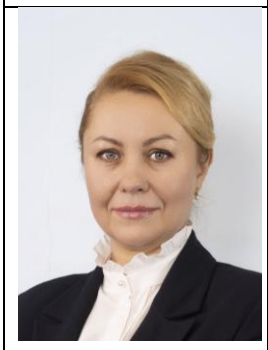
	Grigory Komlatsky, Galina Tereshchenko, and Maria Komlatskaya, Kuban State Agrarian University. **Lecture Title:** Digital Platform in the Context of a Multifactor Model for Ecologized Industrial Beekeeping. **Abstract:** The relevance and novelty of the research are determined by the need to transform beekeeping into a high-tech production through the introduction of digital technologies. The results of research by domestic and foreign scientists, as well as official regulatory and advisory documents, served as tools for searching and analyzing current ideas about the level of digitalization of the industry. Using the analytical and generalization methods, the concept of a multi-factor model of environmentally friendly industrial beekeeping was formulated, the key element of which is a unified digital platform. Biological, environmental, technological, and economic factors that make up the model's structure are determined. A platform architecture is proposed, the key functional modules of which are an apiary monitoring module (IoT); an agroecological mapping module; a digital beekeeper's journal; a bee health module; a blockchain module; a marketplace and logistics module; and an analytical module (Big Data & AI). The potential economic, environmental, and social effects of the platform implementation are identified and substantiated. The article substantiates the need for synergy among three components: accessible and adapted technologies (simplicity, offline operation), effective cooperation among beekeepers, and a comprehensive government policy in the form of financial and institutional support. The participation of scientific institutions is necessary for validating the platform's algorithms and developing forecasting models adapted to local conditions. The importance of training specialists in digital technologies at universities and through practical training centers is emphasized. Particular attention is paid to the problem of integrating small beekeeping farms, which form the basis of Russian beekeeping, into a single digital platform. The specific challenges of small businesses are analyzed. The main obstacles identified include the lack of accessible infrastructure, insufficient broadband, incomplete internet coverage, limited financial resources, and the low level of digital competence of beekeepers. Taking into account the resource constraints of small businesses, a phased integration path into the platform is proposed. The initial step includes a free basic account with access to a honey plant map and basic analytical advice.
	**Ruslan Polyakov,** Kaliningrad State Technical University. **Lecture Title:** Principles of Self-Organization of Industrial Ecosystems as a Basis for a Digital Platform for Waste Management in the Agro-Industrial Complex: Inter-Industry Technology Transfer. **Abstract:** This article examines a conceptual approach to designing a digital waste management platform for the agro-industrial complex (AIC), based on the principles of self-organization of industrial ecosystems and mechanisms for intersectoral technology transfer. The relevance of this study stems from the exhaustion of the growth potential of linear models of environmental management, as well as the need to transition to a circular economy in the agricultural sector. The

	study revealed that current approaches to AIC waste management are fragmented and do not take into account the emergent properties that arise from the network interactions of heterogeneous economic agents in the industry. The paper demonstrates that industrial ecosystems operating on self-organization principles demonstrate high adaptability and resource efficiency due to the spontaneous emergence of cooperative relationships through the exchange of both direct and by-products. The article proposes a proprietary architecture for a digital platform that, rather than prescriptively managing waste flows, creates an institutional and information environment that stimulates self-organization among participants. Particular attention is paid to mechanisms for the intersectoral transfer of organic waste processing technologies borrowed from related industries. The scientific novelty of this work lies in its synthesis of industrial symbiosis theory, the concept of self-organization of complex systems, and a platform approach to agricultural waste management. The proposed model overcomes intersectoral barriers, transforming waste disposal into a driver of economic growth and technological innovation in the agricultural sector.
Oral Session 5: Economic and Organizational Aspects - 2	
  	**Valentina Kundius, Vladimir Chernyshkov, and Olga Cherepanova,** Altai State Agrarian University. **Lecture Title:** Development of Organic Agriculture Based on Efficient Resource-Saving Agrobiotechnologies **Abstract:** The development of organic agriculture on a global scale is driven by the negative environmental and health impacts of intensive farming and livestock production. As a result, research in the areas of biologization of agriculture and agronomic practices that restore soil fertility and reduce production costs has become a priority area of scientific research. Based on a content analysis of the works of contemporary foreign and Russian scientists in the field of organic farming and on the authors' own research and data systematization, the article substantiates the feasibility and prerequisites for the development of organic farming in Russia and the Altai Territory, one of the largest agricultural regions in the Russian Federation, The region supplies high-quality agricultural and food products not only to Russian regions, but also for export. However, the distance from the agricultural markets of major industrial regions and many foreign countries makes it difficult to sell the products. In this regard, the article shows that the strategic vector of agricultural development in the region provides scientific recommendations for the use of effective resource-saving agrobiotechnologies using the One Soil online platform, unmanned aerial vehicles (UAVs), as well as organizational measures for the development of organic agriculture and the organic food market.

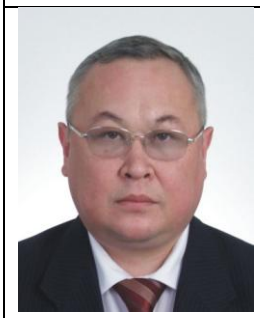
	Sergey Medvedev, Aleksander Semenov, and Elena Semenova, Federal State Budgetary Scientific Organization «Federal Horticultural Center for Breeding, Agrotechnology and Nursery». **Lecture Title:** Organic Berry Production. **Abstract:**The purpose of the study is to identify technological features, achievements and problems in the development of berries production. The article analyzes the berries production and its organic products. The development of organic production is shown, characterized by an increase in the number of certified producers. Regular consumption of berries affects human health. Berries are included in the composition of functional, healthy and full nutrition, as well as for the prevention of various diseases. There was a tendency to change the structure of berry production in favour of currants, as well as an increase in the production of berries in protected soil. In the future, the organic market is expected to increase demand for berries, the export of frozen berries, the popularization of organic products in society, the introduction of organic products in various forms of nutrition. Main advantages and disadvantages of organic berry production considered. The main problem of the development of organic products is its high price, which is 2-3 times higher than the price of ordinary products. An important part of organic technology is the use of biologics. The transition to organic production is an integral part of the sustainable development strategy of the agricultural sector. Integration of research, technological innovation and active public policy are key factors in the development of competitive organic berry production in Russia.
	**Nikonova Natalia and Nikonov Alexey,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Institute of Agricultural Economics and Rural Development. **Lecture Title:** China's Experience and Success in the Organic Market. **Abstract:** The scale of modern global organic production is combined with the steady dominance of individual states in this area. Therefore, the purpose of the study was to analyze China's practical experience in the organic market as a country with a leading position in it. Based on the systematization of strategic documents, an analysis of the prerequisites for the development of organic agriculture in China has been carried out and programmatic actions of state policy have been identified. Among its areas of focus are measures in the field of environmental innovation in general and individual measures to organize a certification system to tighten product quality requirements. Quantitative changes in the functioning of organic production in China are considered using open statistical data. The assessment of the growth of such key indicators as the area of organic land, the number of producers, the level of consumption per capita, etc. The analysis of the features of the Chinese model of production and demand for organic food is given. The types of established models of land use and the main economic system in the village are shown. The classification of consumers of organic products and the existing problems of their promotion on the market is presented. It is concluded that the necessary institutional conditions have been created in China for the successful development of the organic agriculture sector, taking into account national specifics, historical conditions, as well as effective state policy in the countryside to stimulate the active activity of peasants.



Marina Ermolina, Saint Petersburg State University.
Tatyana Perelekhova, Peter the Great St. Petersburg Polytechnic University.
Lecture Title: A Study of the Mechanisms of Legal Regulation of Organic Agriculture in China, Taking into Account the Possibility of Their Adaptation in Russia.
Abstract: The article provides a comprehensive analysis of the features of the legal regulation of organic agriculture in the People's Republic of China. The study of state measures aimed at forming effective mechanisms for regulating the organic sector in China is highly relevant from the standpoint of strengthening international cooperation, as well as creating effective tools to stimulate export-oriented production of organic products. To this end, state programs and special acts in the agricultural sector and organic farming are analyzed, including the regulatory framework for the handling of pesticides and agrochemicals. Significant attention is paid to the legal foundations of China's agricultural policy, the specifics of certification and standardization of agricultural products, protection of arable land, and etc. Among the priorities of agricultural policy, measures aimed at combating environmental pollution in agriculture are highlighted, particularly the introduction of innovative systems and mechanisms. Based on the analysis, it is concluded that studying China's experience in the agricultural sphere is necessary for creating effective legal regulation and creating effective tools to stimulate export-oriented production of organic products in Russia.



Elena Kovaleva, BIOTECH University.
Lecture Title: Problems of digital transformation of agriculture in Russian regions.
Abstract: The digital transformation of agriculture is an important area for the development of the agro-industrial complex in Russia's regions. The key problems hindering the effective implementation of digital technologies in agricultural production at the regional level have been identified.



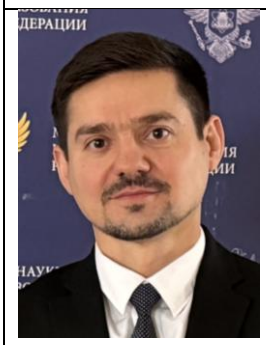
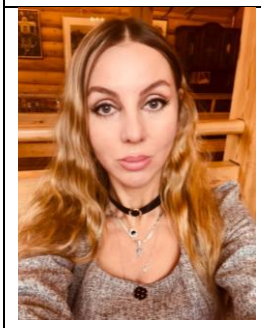
Serik Nurbaev, LLP «Altai Honey».
Lecture Title: Mathematical Modeling of Honey Bee Population Dynamics Using Complex Variables: Balancing Breed Conservation and Genetic Diversity with Inbreeding.
Abstract: The global decline of honey bee (Apis mellifera) populations poses a significant threat to biodiversity and food security. A key challenge lies in balancing the conservation of local breeds with maintaining population genetic health. We propose an innovative spatially explicit model based on complex variable theory, where the state of a population is described by a value $z \in C$ (with Re(z) representing productivity and Im(z) representing adaptability). The model introduces the concept of "population quality" (Q)—a standardized metric synthesizing a colony's (population's) productive potential and adaptive capacity, adjusted for environmental factors (population fluctuations) and genetic processes (drift, mutation,

	selection, migration). The framework incorporates a modified Ginzburg-Landau equation with dynamics for the inbreeding coefficient (F). Numerical simulations were performed on a 100×100 grid using a semi-implicit integration scheme. A systematic exploration of the parameter space revealed critical ranges: migration D=0.03±0.01 and competition g=2.8±0.2, which yield a stable balance between pure breed preservation (25–30%) and maintenance of genetic diversity (4–6% hybrids). A strong negative correlation was found between inbreeding and population quality ($r=-0.89\pm0.04$, $p<0.001$), with a critical threshold of Fcrit=0.07. The negative effects of inbreeding became statistically significant 3–4.5 years after the onset of population isolation. The model was validated against monitoring data from populations in the South Altai region. The proposed model provides a quantitative foundation for developing strategies to preserve bee genetic diversity. The identified parameters and timeframes enable optimized population management, helping to prevent inbreeding depression while sustaining breed diversity.
	**Konstantin Ermakov,** Moscow State Technical University of Civil Aviation. **Lecture Title:** Analysis of the Limitations of Classical Air Traffic Management Systems fot the Integration of Unmanned Aircraft Systems in Agriculture. **Abstract:** This report examines the fundamental limitations of the traditional air traffic management (ATM) system as it applies to the integration of unmanned aircraft systems (UAS) in agriculture. An analysis of the growth of the UAS fleet in the Russian Federation for the period 2023-2026 revealed a 187% increase in the number of registered aircraft. Key challenges hindering the effective management of unmanned traffic in lower airspace are identified: the lack of automatic deconfliction, low dispatch capacity (no more than 105 objects per hour), high C2 control channel latency, and the inability to automatically verify geofences. A comparative analysis of the effectiveness of traditional ATM and advanced air traffic management systems was conducted, demonstrating a potential reduction in the risk of conflict by 3-4 times. The obtained results form the theoretical basis for the development of a methodology for constructing a federal air traffic management system adapted to the conditions of agriculture in the Russian Federation.
	**Ekaterina Russakova,** LLC «University 2050». **Lecture Title:** On digital platforms for managing unmanned aerial systems in the agro-industrial complex. **Abstract:** The digital transformation of the Russian Federation's agro-industrial complex (AIC) is a priority area of state policy, enshrined in the Strategy for the Development of the Agro-Industrial and Fisheries Complexes until 2030 and the national project "Unmanned Aircraft Systems." A key element of this transformation is the widespread adoption of unmanned aerial systems (UAS), which enable rapid crop monitoring, targeted application of fertilizers and crop protection products, field mapping, and high-precision yield assessment. Addressing these challenges requires the creation of integrated digital UAS control platforms that integrate sensor infrastructure, UAVs, ground control centers, and centralized data processing systems.

Irina Shevchenko, Altai State Agrarian University.
Lecture Title: Development of virtual museums of Altai State Agrarian University for the preservation of scientific collections.
Abstract: Altai State Agrarian University (ASAU) has a Museum of Veterinary Medicine, a Museum of Soils and Minerals, and a Museum of Agricultural Machinery. These collections have great historical significance. They have been formed over decades by the efforts of many generations of scientists and educators. Each exhibit contains a piece of the history of the development of science in the ASAU and in the Altai Territory. For example, the anatomical museum's collection includes rare drugs created at the beginning of the 20th century, when science was just beginning to take the first steps in studying the human body and animal organisms. The creation of ASAU virtual museums is a significant contribution to the development of the educational process and the popularization of science. A website with 3D models of exhibits and their descriptions will be created for each ASAU virtual museum. 3D modeling plays a key role because it makes it possible to study the exhibits in great detail without endangering the original samples. This project opens up new opportunities for scientists, students, teachers and anyone interested in these scientific fields, demonstrating the potential of modern technologies in education and the preservation of scientific, historical and cultural heritage in the agro-industrial complex.

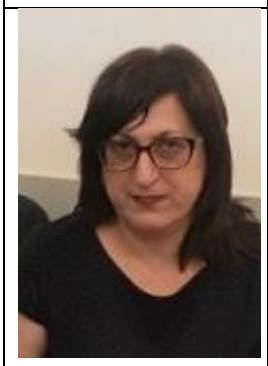
Oral Session 6: Biologization of Livestock Production

Valentina Filippova, Georgi Laptev, Larisa Ilina, Elena Yildirim, and Kseniya Sokolova, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Federal State Budgetary Educational Institution of Higher Education «St. Petersburg State Agrarian University».
Daria Tiurina, Ekaterina Ponomareva, Evgeniy Brazhnik, and Vasiliy Zaikin, Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd.
Kristina Kanz, Information Technologies, Mechanics and Optics (ITMO) University, Akhmet Baitursynuly Kostanay Regional University.
Lecture Title: Effect of Glyphosate on Gut Microbiome Biomarkers Associated with Reproductive Longevity in Laying Hens.
Abstract: Glyphosate is herbicide that is now widely used in agriculture. Glyphosate has a direct effect not only on plants but also on the gut microbiome of farm animals and poultry. This study examined the effects of glyphosate on the gut microbiome biomarkers of laying hens depending on their reproductive longevity. The results of the study revealed a relationship between glyphosate exposure, the composition of the gut microbiota, and the productive longevity of laying hens. It was found that the herbicide can induce changes in the bacterial community. Glyphosate had the most significant effect on the Firmicutes/Bacteroidota ratio. In the group with high reproductive longevity, glyphosate led to a 6.36% increase in Firmicutes and a 5.78% decrease in Bacteroidota. In the group with relatively low reproductive longevity, it increased Firmicutes by 3.44% and decreased Bacteroidota by 4.05%. These microorganisms can be considered markers reflecting the negative impact of the herbicide on the microbiome. Glyphosate reduced the proportion of groups responsible for fiber fermentation and

	short-chain fatty acid synthesis, such as Bacteroidetes and Ruminococcaceae. Furthermore, laying hens from a line with high reproductive longevity were found to exhibit significantly greater resistance to the negative impact. Dietary glyphosate broadly altered hen's gut microbiome metabolism, activating different pathways, upregulating chorismate degradation despite shikimate pathway targeting, and boosting pyrimidine biosynthesis potentially for defense against replication stress.
	**Roman Nekrasov, Alexei Butenko, Ivan Pishulin, Artem Studenkov, Konstantin Ostrenko, Nadezhda Bogolyubova, and Julia Bogolyubova,** L.K. Ernst Federal Research Center for Animal Husbandry. **Lecture Title:** Efficiency of BSFL Conversion of Grain Waste Into Protein Meal for Animals. **Abstract:** The use of grain waste in BSFL cultivation technology represents an innovative approach aimed at increasing sustainability and improving the economic performance of agribusinesses. The aim of the study was to compare the effects of different feed mixture compositions on the chemical composition of BSFL and to assess their nutritional potential for producing protein meal from dried biomass. The experiment was conducted under laboratory conditions, cultivating BSFL on a grain mixture (GM) and grain waste (GW). A significant improvement in the digestibility of organic matter, fats, and carbohydrates ($p<0.05$), as well as nitrogen deposition and assimilation, was observed in larvae when grain waste was included in the feed mixture. The final analysis demonstrated that larvae grown on GW are a more efficient option in terms of biochemical value and nutritional potential. The total protein content was higher in protein meal obtained from the biomass of GW larvae (55.14 g/100 g) compared to the group consuming the grain mixture, GM (51.18 g/100 g). Larvae reared on grain waste (GW) had better protein quality, characterized by increased levels of essential amino acids necessary for complete animal nutrition. Grain waste can serve as a basic feed in larval rearing technology and the production of high-protein concentrates to compensate for the deficiency of traditional feeds in the diets of farm animals. The obtained results open up prospects for using agricultural waste for the sustainable development of larval cultivation technologies and the creation of environmentally friendly and cost-effective methods for producing high-quality feed.
	**Elena Yildirim, Valentina Filippova, Larisa Ilina, and Kseniya Sokolova,** Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd, Federal State Budgetary Educational Institution of Higher Education «St. Petersburg State Agrarian University». **Georgi Laptev, Daria Tiurina, Natalia Novikova, Nataliia Patiukova, Alesya Savicheva, Vasiliy Zaikin, and Vladislav Bolshakov,** Molecular Genetics and Microbiomics Laboratory, BIOTROF+ Ltd. **Irina Klyuchnikova and Anna Fisenko,** Federal State Budgetary Educational Institution of Higher Education «St. Petersburg State Agrarian University».

	Elena Korochkina, Federal State Budgetary Educational Institution of Higher Education «St. Petersburg State University of Veterinary Medicine». **Darren Griffin,** School of Natural Sciences, University of Kent, Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University. **Michael Romanov,** Federal State Budgetary Educational Institution of Higher Education «St. Petersburg State Agrarian University», School of Natural Sciences, University of Kent, Animal Genomics and Bioresource Research Unit (AGB Research Unit), Faculty of Science, Kasetsart University, L.K. Ernst Federal Research Center for Animal Husbandry. **Lecture Title:** Bioinformatics Analysis of the Genome of E. Faecalis E-10 Strain Isolated from Cow Endometrium. **Abstract:** Studying the microbiome of the cow's reproductive system is crucial for maintaining the animals' reproductive capacity. In 2025, the E. faecalis E-10 strain was isolated from the endometrium of a healthy Ayrshire cow kept at the Valaam Monastery eco-farm. The aim of the study was a whole-genome analysis of the strain using the MiSeq sequencer (Illumina, Inc., USA) and bioinformatics tools, including the RAST (https://rast.nmpdr.org), KEGG (https://www.kegg.jp), and Prokka (https://github.com/tseemann/prokka) databases. Whole genome analysis of the E. faecalis E-10 strain showed that the genome consists of 108 contigs and has a total length of 2,882,409 bp. Analysis of the antimicrobial activity of the strain showed that the largest growth inhibition zones (up to 29±1.5 mm) were noted for test cultures of Clostridium perfringens, Streptococcus agalactiae, Aspergillus spp. and Penicillium spp. The genes for the synthesis of organic acids were found in the genome of E. faecalis E-10, such as ldh1 and ldh2, pta1/2 and ackA, pflA/B, and fumC, frdA, and mae. Genes for resistance to oxidative and osmotic stress were also identified. These included genes encoding glutathione biosynthesis, the CoA-disulfide thiol disulfide redox system, the choline and betaine uptake system, and betaine biosynthesis. These results indicate a potential role for E. faecalis E-10 in maintaining a favorable microbial balance in the endometrium.
	**Tatiana Lashkova,** Novgorod Research Institute of Agriculture – branch of St. Petersburg SPC RAS. **Lecture Title:** Use of a Biologically Active Lake Sapropel–Based Preparation in Calf Feeding Under the Conditions of the Novgorod Region. **Abstract:** The aim of the study was to evaluate the effectiveness of using a biologically active sapropel-based preparation in the feeding of farm animals and to assess its effect on the productivity of young stock. The study was conducted on Holstein calves aged four months after weaning at the Ermolin skoye peasant farm in the Novgorod Region. Based on the principle of analog selection, three groups (n = 10) were formed: one control group and two experimental groups. Calves in the experimental groups received, in addition to the basal diet, 5 and 10 mL of the supplement, respectively. The results showed that supplementation with 5 mL of the preparation increased the digestibility of major dietary nutrients by 1.56–3.73 percentage points and improved the protein index. The absolute and average daily weight gains of calves

	in the first experimental group exceeded those of the control group by 8.8% (P < 0.001). Administration of 5 mL of UDGSS reduced the consumption of digestible protein per 1 kg of live weight gain by 8.2%, energy feed units by 8.1%, and metabolizable energy by 9% compared with the control group. Increasing the supplement dose resulted in higher expenditures of digestible protein and metabolizable energy per unit of weight gain by 14.8% and 14.9%, respectively.
	**Anton Utkin, Gleb Sutula, Jan Puhalsky, Svyatoslav Loskutov, Alyona Kondrat'eva, and Alexey Eremin,** VNIIIPD — a branch of Gorbatov Research Center for Food Systems. **Lecture Title:** Black Soldier Fly (Hermetia Illucens) as a Source of New Biologically Active Substances of Protein Nature. **Abstract:** The black soldier fly (Hermetia illucens) is a promising organism for the bioconversion of organic waste. The symbiotic microflora of the larval gastrointestinal tract plays a key role in this process, which can also serve as a source of biologically active compounds, including antimicrobial peptides (AMP). The purpose of this work was to search for producers of biologically active substances among the saprophytic microbiota of black soldier fly (BSF) frass larvae of H. illucens, as well as to evaluate the antimicrobial activity of protein lyophilizates obtained from insect tissues. The study involved the cultivation of larvae on five different substrates, microbiological analysis of BSF frass flushes, and DNA isolation followed by sequencing of the 16S rRNA gene to identify bacterial isolates. In parallel, protein extracts were obtained from larval biomass by alkaline extraction followed by purification by dialysis and their antimicrobial activity against Escherichia coli and Bacillus subtilis was evaluated. As a result, the strains Heyndrickxia sporothermodurans and Heyndrickxia oleronia were identified, which, according to phylogenetic analysis, are potential producers of AMP (amylocyclin, fengycin). It was shown that protein fractions with a molecular weight above 20 kDa have lytic activity against test cultures, while fractions less than 20 kDa showed no pronounced effect. The data obtained indicate the prospects of using both the microbiota of frass and the larvae of the black soldier fly to search for new antimicrobial agents that can be used in medicine and the food industry as an alternative to conventional antibiotics and chemical preservatives.
	**Svyatoslav Loskutov and Jan Puhalsky,** VNIIIPD — a branch of Gorbatov Research Center for Food Systems. **Lyudmila Molodkina and Maria Andrianova,** Peter the Great St. Petersburg Polytechnic University. **Lecture Title:** Dispersed State Evaluation by Dynamic Light Scattering for Alkaline Suspension of Black Lioness Fly Frass (Zoohumus) after Its Mineralization. **Abstract:** Alkaline suspensions of zoohumus from black soldier fly (Hermetia illucens) were studied before and after its additional mineralization. Four samples of zoohumus differing in processing stage and with pH from 7.6 to 11.7, were analyzed by Zetatrac (Microtrac Inc.) particle size and zeta-potential analyzer using dynamic light scattering (DLS) in the beat light spectroscopy (Doppler) mode. It was shown that all the studied samples were in a state of colloidal instability: the ζ-potential was +3.3…+3.8 mV at high ionic strength (I ≈ 55-65 mM,

	electric conductivity 5.4-6.2 mS/cm), which led to compression of the double electric layer to $\kappa^{-1} < 1.4$ nm. Samples after mineralization (No. 1 and No. 2) were characterized by tri- and bimodal distribution of intensity with particle size from 100 to 6500 nm (and higher) at PDI of 2.418-2.960; the initial suspensions (No. 3 and No. 4) – by a bimodal distribution with particles size from 150 to 4000 nm at lower PDI (1.794-1.986). Samples 3 and 4 had higher concentration of organic carbon Corg (4.77-5.13 g/L compared to 3.17-3.43 g/L in samples 1 and 2) and exhibited pronounced organoleptic signs of active biochemical degradation. A diagnostic criterion for the completeness of suspension stabilization based on the Cinorg/Corg ratio is proposed: values >0.32 correspond to a mineralized state, while <0.19 correspond to the original suspension. Additional mineralization is shown to reduce the risk of an unpleasant odor and increase the shelf life of the preparation. However, it is associated with a partial loss of humates due to their coagulative precipitation. The obtained results have practical significance for the development of technologies for the preparation of liquid organo-mineral fertilizers based on H. illucens zoohumus.
	**Mikayel Mikayelyan, Gurgen Karapetyan, Valery Grigoryan, and Astghik Pepoyan,** Food Safety and Biotechnology Department, Armenian National Agrarian University. **Liana Grigoryan, Zhanna Melkonyan, and Spartak Yeribekyan,** Research Center for Veterinary Medicine and Veterinary Sanitary Expertise, Armenian National Agrarian University. **Lecture Title:** Eco-Epidemiology of Poultry Parasitic Diseases in Armenia: A National Synthesis and Implications for Sustainable Control. **Abstract:** Poultry farming is an important component of agricultural production and food security in the Republic of Armenia; however, information on poultry parasitic diseases in the country remains fragmented and confined to regional investigations. The present study aimed to synthesize published data on poultry parasitoses in Armenia and evaluate their epidemiological patterns, environmental determinants and current diagnostic limitations. A structured narrative review was conducted using peer-reviewed publications, regional veterinary reports and official statistical data on poultry production. Epidemiological indicators, including prevalence, geographical distribution, seasonal dynamics and diagnostic methodologies, were comparatively analyzed. The collected evidence indicates that poultry parasitic diseases in Armenia form a stable enzootic complex dominated by protozoan infections. Coccidiosis caused by Eimeria spp. was the most widespread disease and occurred across foothill, mountainous and high-altitude regions, with seasonal peaks in spring and autumn. Helminth infections, particularly Ascaridia galli, were frequent in backyard production systems and contributed to environmental contamination and mixed invasions. The predominance of smallholder poultry farming, outdoor keeping and climatic conditions supports continuous transmission. Current diagnostics rely mainly on classical microscopic methods, while molecular monitoring and resistance assessment are lacking. The study provides an integrated national overview and highlights the need for standardized surveillance and sustainable control strategies.

Su Jian, Ma Juan, Li Hao, and Kong Lingzhuo, Research Institute of Agricultural Equipment, Xinjiang Academy of Agricultural Sciences.

Lecture Title: Experimental Study on Physical Properties of Co-composting Cow Manure and Walnut Branches and Load Calculation of Compost Turner.

Abstract: To address the lack of physical property parameters during cow manure composting and the insufficient design basis for composting equipment, this study investigated the dynamic variation patterns of the physical properties of cow manure under different composting treatments and applied the measured parameters to the load calculation of the compost turner main shaft. [Methods] Three composting treatments were set up: pure cow manure, cow manure + walnut branches, and cow manure + walnut branches + microbial agent. Referring to soil mechanics test methods, the changes in moisture content, hardness, shear strength, cohesion, and the tangent of the internal friction angle during the composting process were measured. The measured strength data were then used to calculate the maximum torque on the compost turner main shaft. [Results] The study showed that the cohesion and the tangent of the internal friction angle of the compost were negatively correlated with moisture content. In the later stage of composting (moisture content 28.4%), the cohesion reached 38.412 kPa, and the tangent of the internal friction angle was 0.2982. Adding walnut branches improved the compost structure, and adding the microbial agent made the compost looser and reduced compaction. Based on the most unfavorable working condition (all mixing rods buried in the compost with one row perpendicular to the ground), the calculated maximum torque on the compost turner main shaft was 7.28 kN•m. [Conclusion] This study provides reliable basic data for the structural design and power selection of compost turners, offering guidance for the optimization of equipment for the resource utilization of livestock and poultry manure.

Aloyna Zelenchenkova, Federal Center for Animal Husbandry named after Academy Member L.K.

Lecture Title: The Effect of the Adaptogen Complex on the Immune Status and Intestinal Microbiocenosis of Broiler Chickens under Simulated Environmental Conditions.

Abstract: In order to assess the indicators of nonspecific immunity and intestinal microbiocenosis in simulated environmental conditions and using the developed complex of adaptogens in diets, an experiment was conducted on 4 groups of broiler chickens of the Smena-9 cross (1 controlled and 3 experimental). The planting density of chickens of the 2nd, 3rd and 4th experimental groups was increased by 10% from the 21st day of the bird's life. The diet of chickens of 3 (from the 21st day of life) and 4 experimental groups (from the 7th day of life) included the developed complex of adaptogens DKVEC (a combination of dihydroquercetin, vitamins E and C). At 24 days and 52 days of age, blood samples and contents of the appendages of the cecum and rectum were taken during slaughter. The indicators of nonspecific immunity and the content of individual groups of microorganisms were determined. The simulated conditions of the planting density environment

	contributed to an increase in the concentration of lysozyme and its activity, a decrease in BASCS, and an increase in the number of anaerobic vegetative bacteria and lactobacilli. DKVES contributed to an increase in the adaptive capabilities of the body, increasing the level of cellular protection. Exposure to simulated environmental conditions with age caused an increase in both humoral and cellular immunity in birds of the experimental groups. A more pronounced effect was observed with prolonged use of the DKVEC complex, which manifested itself in a decrease in lysozyme values and its activity to the control level relative to the level of indicators of other experimental groups. The group factor influenced the content of bifido- and lactobacilli, and age-related changes were manifested in the content of anaerobic vegetative, lacto- and bifidobacteria. The data obtained should be taken into account in the development of strategies for keeping and feeding poultry meat crosses.
	**Nadezhda Bogolyubova,** Federal Research Center for Animal Husbandry named after Academy Member L.K. Ernst. **Lecture Title:** An alimentary complex of adaptogens for maintaining the productive health of poultry and obtaining high-quality poultry products **Abstract:** Modern poultry crosses possess high genetic productivity potential, but this potential cannot be fully realized in practice due to the impact of stress factors—environmental, technological, nutritional, and physiological. Stress of various types negatively impacts the immune and antioxidant systems of poultry, reducing the quality of the resulting products. Analysis of stress-induced metabolic changes indicates the importance of mitigating the effects of oxidative stress in broiler production and the need for additional protection of the poultry antioxidant system. It seems advisable to use natural antioxidants, the key regulators of many physiological processes, as feed or water additives. These compounds or their complexes are used to maintain and improve immune and antioxidant status, as well as the quality of poultry products. The combined biological effects of the components of the developed DKQEC composition normalize the gastrointestinal microbiota, enhance metabolic processes, and the expression of antioxidant defense and immune genes. This contributes to increased nutrient digestibility, growth rates, and the economic efficiency of poultry farming.
	**Vladimir Surovtsev,** St. Petersburg Federal Research Center of the Russian Academy, Institute of Agricultural Economics and Rural Development. **Lecture Title:** Digitalization as a Factor of Production Biologization and Sustainable Development of Dairy Farming in the Leningrad Region. **Abstract:** The report analyzes the impact of digitalization in dairy farming in the Leningrad region on the biologization of production, as well as on production growth and economic results. The development of computer programs for breeding and feeding in the region has ensured that many characteristics of individual animals and their groups are taken into account in farm management. Modern digital sensors and video cameras, automated systems for monitoring milking, feed preparation and distribution, animal movement, and telecommunication systems generate large amounts of data. Herd management programs promptly

	analyze this information and form recommendations for specialists and managers. Robotic milking and feed distribution systems are being implemented, along with digital systems for genomic assessment. Digital monitoring of production processes increases the effectiveness of using biologics in feeding, for disease prevention, and during feed storage, which reduces the use of chemicals and antibiotics. Integrated digitalization and biologization of production improve the health of cows and their reproductive functions, leading to increased milk productivity. These processes also increase labor productivity and product quality, profitability, and farm income, supporting the sustainability and leadership of the Leningrad Region in Russian dairy farming.
Oral Session 7: Robotics in Agriculture	
	**Vladimir Azarenko,** Department of Agrarian Sciences of the National Academy of Sciences of Belarus. **Viktor Goldyban, Aliaksandr Zheshka, Dmitry Komlach, Maksim Kurylovich, and Valeria Selivanova,** Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization. **Lecture Title:** Route planning for a robotic platform for applying mineral fertilizers. **Abstract:** The implementation of technological operations for the application of fertilizers and chemical plant protection products is carried out during the cultivation of most crops, and the yield directly depends on the quality of these operations. However, the performance of these works has a negative impact on the environment and the health of people who operate chemical farming machines. In this regard, the intellectualization and robotization of the process of applying fertilizers and chemical plant protection products, which eliminates the presence of a machine operator, is an urgent scientific direction. The use of robotic platforms reduces labor costs per unit area of the cultivated crop, which is of particular relevance in the case of a shortage of machine operators who operate agricultural machinery for fertilization. Their use also makes it possible to increase the working time for fertilization and, as a result, increase productivity. The coordinate application of specified doses of mineral fertilizers in accordance with the map of nutrients in the soil makes it possible to equalize soil fertility. A promising direction is also the use of robotic machine links, where the main machine is equipped with the most powerful hardware and software base, which allows it to be used to build a map of the work area, taking into account the terrain of the field and vegetation, the other robotic machines working in the same link with the main one receive information about the trajectory from it and in parallel, fertilizers are distributed over the surface of the work area. In this paper, the specifics of planning the route of a robotic platform for the application of mineral fertilizers are considered, and the results of processing point areas obtained during the study of the characteristics of the platform's movement along the work site are presented.

	**Dmitry Moskvichev, Alexey Evgrafov, and Artembek Guzalov,** Russian State Agrarian University - Moscow Timiryazev Agricultural Academy. **Lecture Title:** Experimental Study of the Efficiency of a Robotic System for Precise Fertilizer Application to Increase Recource Efficiency in Crop Production **Abstract:** This study presents research on the effectiveness of using the autonomous robotic system «AgroBot-PN» for the spot application of liquid fertilizers during pre-sowing preparation. Improving the efficiency of mineral fertilizer use is a key component of resource-saving agriculture in the context of rising prices for agrochemicals and stricter environmental requirements. The objective of this study was to compare the agrotechnical and economic effectiveness of an autonomous robotic system for precision (pre-sowing) regulation of starter fertilizers under sunflower compared to the conservative broadcast method. In a 2025 field experiment on leached chernozem, a two-factor plan was used: the application method (robotic point and round broadcast) and fertilizer rates (N30P30K30 and N45P45K45). It was found that robotic precision application significantly reduces fertilizer consumption by ~35% while maintaining yield, increasing the fertilizer utilization coefficient by 25-30%, and increasing seed oil content by 1.5-2.0%. An analysis of variance revealed a first-stage reduction in yield ($F=87.42$; $p<0.001$). An economic analysis revealed a 33.3% reduction in fertilizer costs and an 18% increase in sunflower cultivation profitability. Practical recommendations for considering robotic systems in row crop separation processes have been developed.
	**Viktor Goldyban, Aliaksandr Zheshka, Maksim Kurylovich, Nikolay Bakach, and Valeria Selivanova,** Scientific and Practical Center of the National Academy of Sciences of Belarus for Agricultural Mechanization. **Vladimir Azarenko,** Department of Agrarian Sciences of the National Academy of Sciences of Belarus. **Siarhei Herasiuta,** LLC «Robototechnika i oblachnye technologii». **Lecture Title:** Operator's Server Development for Controlling the Movement of a robotic Platform. **Abstract:** A promising direction for the development of agricultural production is the integrated robotization of crop production processes. This is explained by the reduction of labor resources in agricultural enterprises, the performance of work in conditions of dust and gas pollution, excessive vibration and noise levels, interaction with fertilizers and pesticides, and overtime work during peak periods of crop cultivation. Autonomous agricultural machinery makes it possible to reduce the need for the number of employed operators in crop production, and minimize the negative impact of machinery on humans and the environment. An analysis of literature sources shows that there is currently positive research experience in the use of robotic platforms for fertilization and pesticides, tillage, sowing and planting crops, monitoring and care of crops, and even harvesting. This article examines the operator's server development for autonomous remote control of a robotic platform. The architecture of a multi-agent control system for the robotic platform is presented. A query typing system is implemented to ensure flexible data exchange between the server and agents. The research was conducted to organize control of the Smouz robotic platform during herbicide treatments of row crops.

Yulia Chutcheva, Russian State Agrarian University – Moscow Timiryazev Agricultural Academy.
Pavel Kosov, JSC Rosagroleasing.
Lecture Title: Prospects for the Use of Natural Gas Motor Fuel in Agriculture in the Context of Enhancing Environmental Performance and Sustainable Development.
Abstract: This paper reviews Russian and international evidence on the use of natural gas motor fuel (compressed and liquefied natural gas) in agriculture and evaluates the preconditions for its wider use in the Russian agro-industrial complex. Based on Rosstat data on agricultural machinery stocks in 2019-2024, the study identifies heterogeneous renewal dynamics across tractors, cultivators, grain harvesters, and forage harvesters and the study first introduces a baseline ITGP and then extends it into a composite ITGP indicator. Scenario calculations show that accelerated renewal supported by preferential leasing and subsidies can improve the readiness of key machinery categories for technological upgrading. At the same time, the paper argues that the environmental effect of natural gas should be treated as conditional rather than automatic: although fuel costs and tailpipe emissions may decline, lifecycle outcomes depend on methane leakage across the well-to-wheel chain, cold-start and low-load performance, and possible adverse NOx dynamics in some applications. Russian pilot materials on BELARUS MTZ 1221 GT gas-powered tractors confirm substantial operating cost savings but also reveal practical engineering and service constraints. The results suggest that CNG/LNG can function as a transitional modernization option for Russian agriculture only when fleet renewal, methane control, localized infrastructure, and maintenance capabilities develop simultaneously.

Vladimir Dashevsky, Yuri Galykin, and Andrey Ronzhin, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS).
Aleksandra Figurek, University of Nicosia, School of Business, GNOSIS Mediterranean Institute for Management Science.
Lecture Title: Multi-Channel System of Liquid Solution Mixing for Refueling Agricultural UAVs.
Abstract: The problem of automating the preparation and refueling of liquid chemical solutions for unmanned aerial vehicles used in agricultural spraying is investigated. A review of studies on the application of UAVs for spraying and the types of agricultural crops is provided. The relevance of the research is justified by the need for comprehensive field servicing of agricultural drones, including not only battery replacement but also the automatic refilling of tanks with working solution. A developed multichannel mixing module for an autonomous ground platform is presented, capable of dispensing concentrates with various dilution ratios and mixing them in a water flow. The modular architecture of the mixer includes two types of dispensers (pneumatic for large volumes and syringe-type for small volumes), a unified control unit based on an STM32F103 microcontroller with RS-485 network support, as well as a quick-release collet cap for connecting standard containers.

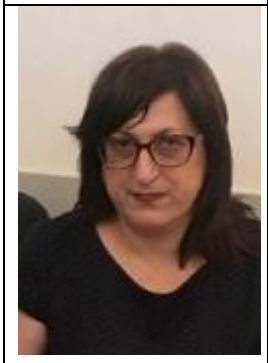
 	Research is ongoing regarding the analysis of the influence of different concentrate viscosities on dosing accuracy, as well as the automatic formulation of solutions based on agrotechnical prescriptions.
	**Artem Ryabinov and Ekaterina Cherskikh,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS). **Lecture Title:** Methodology for Operating Agricultural UAVs with Automatic Calibration and Semantic Layout of Flight Missions. **Abstract:** This paper presents a functional model of a group of unmanned aerial vehicles (UAVs) for liquid fertilizer application, as well as a method for automating the preparation and execution of flight missions formulated as a skill-based system. The first part of the study identifies the primary challenge as high cognitive workload. A model of liquid substance application is then introduced, describing a closed-loop process of planning – task allocation – synchronized execution – monitoring, considering UAV technical constraints and agronomic requirements. The theoretical foundations for mission parameter calculation are examined in detail, including application rate of the working solution, pump performance, flight speed, swath width, and pass overlap percentage. An automatic calibration algorithm for the liquid application system is proposed, in which the ground control station compares theoretical and actual flow parameters and provides a ready-to-use solution. A method for decomposing UAV missions into atomic tasks is proposed, distinguished by their automatic composition into a unified skill based on the semantics of the user request. This approach enables transferring analysis and decision-making functions from the human operator to a computational system. The practical significance of the work lies in simplifying mission preparation, minimizing human-factor errors, and improving the efficiency of cooperative UAV deployment in agricultural applications.
	**Mikhail Tatur, Mikhail Kuzmenkov, Chen Jike, Ilya Mashkou,** Belarusian State University of Informatics and Radioelectronics. **Lecture Title:** Model-Based Design of a Control System for a Group of Agricultural Drones and a Robotic Swap Station. **Abstract:** This paper investigates the principles of designing a control system for a group of agricultural spraying drones and a robotic service station for automatic refueling and battery swap. The system concept is based on a hybrid approach combining elements of centralized and decentralized control: global planning of routes and flight schedules is performed centrally, while local trajectory corrections during flight are

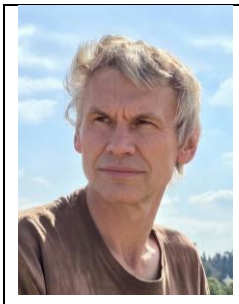
	permitted at the individual drone level. The response to abnormal (emergency) situations is distributed between central and local control levels. The technical implementation of this concept is expediently realized using a multi-agent architecture that includes drone agents, a service station agent, and an external control agent. The study develops a mathematical framework to quantify drone route deviations, considering both spatial cross-track errors and temporal scheduling offsets. Motion monitoring criteria and admissible deviation limits are introduced, with their exceedance triggering emergency operating modes. Parameters for damping temporal mismatches during approach to the station are defined: for drones arriving ahead of schedule, holding points with battery energy constraints are provided; for delayed drones, a reserved waiting interval between service operations is utilized. A simulation methodology is proposed for validating guidance algorithms and failure criteria at the conceptual design stage. Overall, it is shown that model-based design reduces the risk of errors during physical implementation of a complex robotic system and decreases development costs.
 	**Ranil Salimov and Elvira Chebotareva,** Kazan Federal University. **Hongbing Li,** Shanghai Jiao Tong University. **Mikhail Svinin,** Ritsumeikan University. **Evgeni Magid,** Kazan Federal University, HSE University. **Lecture Title:** Development of a Low-Cost Monocular Vision System for Robotic Grasping of Dairy Bottles on Flexible Conveyor Lines. **Abstract:** This paper presents a low-cost monocular computer vision system, specifically designed for robotic grasping with a KUKA KR-3 manipulator, for automated detection and 3D localization of circular objects (dairy bottle caps) on a conveyor belt. The system achieves acceptable accuracy with minimal hardware, utilizing only a single RGB camera and static ArUco calibration markers. The approach comprises two main modules: object detection based on the Hough Gradient Method for precise 2D localization, and monocular metric depth estimation using the Depth Anything V2 foundation model to generate a relative depth map, followed by scaling using ArUco markers. Experimental evaluation on a preliminary dataset of 45 images yielded a mean absolute error in depth estimation of 1.81 cm. This accuracy is considered sufficient for reliable grasping, as the error is compensated by gripping the object at its central height. The proposed solution offers a cost-effective alternative to expensive stereo or LiDAR-based systems, making it well-suited for flexible production lines in the dairy industry. The results clearly confirm the practical applicability of the monocular approach for Industry 4.0 automation in agro-industrial enterprises.

Aidar Khasanyanov and Elvira Chebotareva, Kazan Federal University.
Alexander Chetvergov, TekhnoParus LLC.
Edgar A. Martinez-Garcia, Autonomous University of Ciudad Juarez.
Evgeni Magid, Kazan Federal University, HSE University.
Lecture Title: Experimental Evaluation of SLAM Performance Under Computational Constraints for Agricultural Indoor Facilities.
Abstract: The paper considers the problem of implementing a simultaneous localization and mapping (SLAM) system for mobile robots with limited computing resources in an agro-industrial complex. The high cost of industrial navigation solutions makes them economically impractical for automating monitoring tasks in greenhouses, warehouses, and other agricultural facilities characterized by extended geometry and limited lighting. An architecture based on a Raspberry Pi 4 single-board computer, an ESP32 microcontroller and an LDROBOT LiDAR integrated into the ROS 2 ecosystem is proposed. A comparison of the SLAM Toolbox and Cartographer algorithms was performed, taking into account the computational and thermal limitations of the platform. Experiments in conditions simulating the configuration of extended indoor spaces have shown that the SLAM Toolbox ensures the metric consistency of the map, while Cartographer demonstrates systematic small-scale drift. The resulting system operates in real time with CPU utilization reaching up to 23% and temperatures peaking at 51°C, demonstrating its potential for autonomous monitoring of agricultural facilities without requiring expensive equipment. The proposed solution offers a cost-effective and practical approach for autonomous monitoring tasks in agricultural environments with limited computational resources.

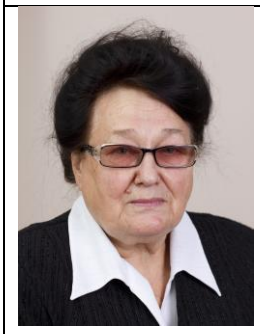
Stanislav Krivko, Maxim Litvinov, Federal Scientific Agroengineering Center VIM (FSAC VIM).
Lecture Title: The use of UAVs with a hydrogen fuel cell-based power supply system for monitoring large agricultural fields.
Abstract: The use of modern unmanned aerial vehicles (UAVs) in large production fields is limited by the energy efficiency of existing battery systems. Significant loss of working time is caused by the need for frequent returns to the take-off point to replace batteries and reload flight tasks, which reduces the overall efficiency of the crop monitoring process. The solution to the problem is UAV with a hydrogen fuel cell power supply system. The use of storage facilities with a higher energy capacity than standard batteries opens up prospects for monitoring large agricultural fields.

Oral Session 8: Biologization of Crop Production	
	**Larisa Shcherbakova, Maksim Kartashov, Yuliya Zuyeva, and Vitaly Dzhavakhiya,** Federal State Budgetary Scientific Establishment the All-Russian Scientific Research Institute of a Phytopathology (VNIIF). **Sergey Zavriev,** Shemyakin-Ovchinnikov Institute of Bioorganic Chemistry. **Lecture Title:** A Pilot Study of Antifungal and Chemosensitizing Activities of Two Microbial Metabolites to Assess Their Applicability in Organic Crop Production as Potential Biologicals Controlling Some Fusarium Fungi. **Abstract:** Chemosensitization of phytopathogenic fungi to synthetic fungicides is a promising technology that could enable disease control using reduced fungicidal dosages while maintaining the requested antifungal effect through combining fungicides and sensitizers, i. e., compounds that synergistically enhance the efficacy of reduced dosages. Usage of biogenic sensitizers, which are non-toxic or marginally toxic to fungi, aligns with sustainable agriculture principles. Earlier we demonstrated that a microbial metabolite, 6-demethylmevinolin (6-DMM), mildly inhibited the growth of Fusarium fungi and synergistically enhanced the sensitivity of other fungi to a triazole fungicide Folicur®. Another microbial metabolite, tacrolimus (FK-506), was reported to improve the action of some medical triazols. Given these data, we explored the growth inhibitory effect of FK-506 and 6-DMM towards several strains of Fusarium graminearum and F. culmorum, and evaluate their chemosensitizing activity for these species using a checkerboard assay. FK-506 was found to demonstrate high strain-specific fungitoxicity, and the species-selective chemosensitization, while 6-DMM exhibited moderate fungitoxicity and looked more promising as the sensitizer of both species. Several 6-DMM/Folicur® combinations were revealed that synergistically enhanced Folicur® effect, multiplying the fungicidal impact of its low doses. At the most effective synergistic ratios, the efficacy of the combined treatments almost doubled the additive effect.
	Aleksandra Kamova, Vilga Agrotechnology Laboratory, Karelian Research Centre, Russian Academy of Sciences. **Lecture Title:** Sward Formation in Variegated Alfalfa upon Seed Inoculation with Root-Nodule Bacteria Sinorhizobium Meliloti in Karelia. **Abstract:** A key development track for fodder and forage production today is to biologize the processes. Accordingly, much attention is being given to varietal-microbial systems, whose performance is in direct correlation with the plant community's yield and nutritive value and the efficiency of nitrogen fixation from the atmosphere. The range of forage crops in Karelia is rather narrow and a crop drawing much interest is variegated alfalfa, which boasts high yields and productive longevity combined with drought- and frost hardiness. However, as the soils lack native strains of root-nodule bacteria capable of interacting productively with this legume, seeds have to be inoculated prior to sowing. In 2022-2024, the Vilga Agrotechnology Laboratory conducted field studies of sward formation in variegated alfalfa of the following varieties: Pastbishchnaya 88, Taisiya, Agniya VIK, and Lyusya upon inoculation

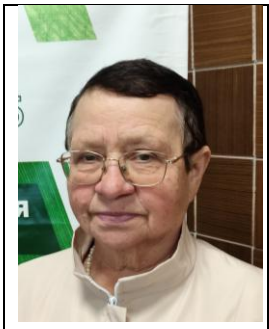
	with several strains of root-nodule bacteria S. meliloti (master seed strain 415 (control), A-1, A-5, and SKhM-1-105) to determine the inoculation effects on plant community formation and to select the varietal-microbial systems best suited for the region. The studies have demonstrated that inoculation has a tangible effect on herbage formation and that in southern parts of Karelia variegated alfalfa can form robust communities with an average yield of up to 8.8 t/ha dry weight in pure crops. The highest productivity in Karelia was exhibited by combinations of the Agniya VIK and Lyusya varieties with the A-1 and SKhM-1-105 strains.
	**Susanna Mirzabekyan, Anahit Manvelyan, Natalya Aram Harutyunyan, Marine Harutyun Balayan, and Astghik Pepoyan,** Armenian National Agrarian University; International Association for Human and Animals Health Improvement. **Haykush Batikyan,** Armenian National Agrarian University. **Anna Hovhannes Tadevosyan and Mahsa Khalegh Daryadar,** Institute of Hydroponics Problems after G.S. Davtyan NAS RA. **Lecture Title:** Preliminary Characterization of Cultivable Epiphytic Microorganisms Associated with Eryngium caucasicum Trautv. **Abstract:** Plant surfaces host diverse microbial communities that form the phyllosphere microbiota and may influence the stability and biological properties of plant raw materials. Information about cultivable epiphytic microorganisms associated with medicinal and wild edible plants of the South Caucasus region remains limited. The study aimed to obtain preliminary microbiological characteristics of microorganisms inhabiting the aerial parts of Eryngium caucasicum Trautv. Leaves of two- and three-year-old plants were washed in physiological saline to recover surface-associated microorganisms without tissue disruption. Suspensions were inoculated onto nutrient agar and MRS agar and incubated under standard conditions in triplicate.Cultivation revealed a stable community represented by several colony morphotypes, including coccoid, bacillary and yeast-like forms. Colony number and composition varied with plant age and medium. Two-year-old plants demonstrated higher counts of filamentous and bacillary colonies on nutrient agar, whereas three-year-old plants showed more coccoid forms on MRS. Microorganisms remained detectable after washing, indicating persistent surface association. Bacterial isolates also showed high antibiotic resistance, including multi-antibiotic resistance, suggesting these communities may act as environmental reservoirs.The results confirm the presence of a cultivable epiphytic microbiota on E. caucasicum and its variability under different conditions, providing a basis for further functional and taxonomic characterization.



Dmitry Vorobyev, All-Russian Research Institute of Phytopathology.
Lecture Title: Evaluation of Statins as Potential Bioagents Suppressing the Development of Insect Pests.
Abstract: This study assesses the potential of a novel plant protection strategy based on limiting the supply of essential sterols to insect pests. The approach involves treating plants with statins that inhibit sterol precursor biosynthesis. Laboratory experiments were conducted using the Colorado potato beetle (Leptinotarsa decemlineata Say) and the greenhouse whitefly (Trialeurodes vaporariorum Westw.) as model organisms. Increasing compactin concentrations significantly reduced the average weight of L. decemlineata larvae (by 40.6% at 0.1%), pupae (by 15.2% and 22.8% at 0.05% and 0.1%, respectively), and adults (by 14.9% and 22.9% at 0.05% and 0.1%, respectively). Compactin at 0.05% and 0.1% also prolonged the larval stage by 4.0 and 4.8 days, respectively. In contrast, 0.1% lovastatin had no significant effect on the beetle development. For the greenhouse whitefly, the results were inconclusive regarding the feasibility of compactin for developmental suppression. These discrepancies may be attributed to differences in the systemic transport of compactin and lovastatin within plants, differential sensitivity of HMG-CoA reductase to specific statins, or species-specific physiological traits. Overall, HMG-CoA reductase inhibitors show promise for insect pest management, although further studies are required.



Olga Antonova, Liliya Stupina, Valentina Kursakova, and Danil Avdeev, Altai State Agricultural University.
The Role of Straw and Biological Products in Increasing the Biological Activity of Soils and the Productivity of Spring Wheat.
Abstract: Wheat accounts for 27% of all grain crops produced globally. Increasing its yield depends on the use of biological preparations. Research conducted in the steppe zone of the Altai Territory to study the effect of GSN series preparations based on organic compounds, macro- and microelements, and a complex of microorganisms used in the technology of growing spring wheat using the no-till system on the soil, for seed inoculation and as top dressing during plant vegetation, made it possible to establish a positive effect on the agrochemical properties of the soil. By the end of the wheat growing season, they increased the development of saprophytic microorganisms by 1.8-4.1 times, amylolytic bacteria by 1.9-3.1 times, while the number of fungi decreased by 1.3-1.9 times. The organic matter transformation coefficient (PM) increased by 1.8-4.4 times and was in an average correlation with the humus content (r = 0.44). Applying them only to soil and seeds increased catalase activity by 1.02-1.35 times, while additional crop treatment increased it by 1.54-1.94 times. Peroxidase activity changed less significantly than polyphenol oxidase activity, and the humus formation coefficient in the treated variants was greater than or equal to 1.0. It had a close correlation with humus content (r = 0.89). The use of GSN series preparations increased spring wheat yield by 0.25-0.97 t/ha compared to 3.41 t/ha in the control. Moreover, protein content increased from 10.52% in the control by 0.66-1.49%. More significant changes in both the soil and plants were noted with consistent and repeated use of the GSN series complex of preparations.

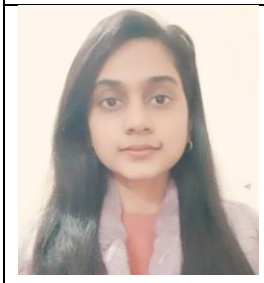
	**Lyudmila Tiranova,** Novgorod Research Institute of Agriculture – branch of St. Petersburg SPC RAS. **Lecture Title:** Effect of Arksoil Nitrogen and Arksoil Phosphorus Biofertilizers on the Productivity and Nutritional Value of Winter Rye Grain in the Novgorod Region. **Abstract:** The research was conducted in the Novgorod region in 2023-2025 on a sod-podzolic medium-cultivated soil in an experimental field at the Novgorod Research Institute of Agriculture, a branch of the St. Petersburg Federal Research Center of the Russian Academy of Sciences, on two backgrounds of mineral fertilizers (background 1 without fertilizers, background 2 based on the planned yield of winter rye grain). The object of the study was the Volkhova variety of winter rye and the biofertilizers Arksoil Nitrogen and Arksoil Phosphorus. The research demonstrated the high efficiency of the used microbial fertilizers. In the average of three years of research, in variant 8, on background 2, the best average annual grain productivity of 7.7 thousand tons of feed units per hectare was obtained when Arksoil Nitrogen and Arksoil Phosphorus were included in the technological operations twice. In this variant, the average annual nutritional value of grain fodder was 0.41 tons of digestible protein for cattle, with a content of 53.3 g per 1 feed unit, 63.0 GJ of exchange energy for cattle, and more than 5.7 tons of dry matter, with a low energy consumption of 2.7 GJ/ton and a high energy efficiency coefficient of 6.2.
	Myagmarsuren Yadamsuren, Noov Bayarsukh, and Batmunkh Javzandulam, Plant Science and Agricultural Research Institute (PSARI) of the Ministry of Economy and Development (MED). **Lecture Title:** The Wheat Breeding in Mongolia. **Abstract:** The main feature of Mongolia's climate is extreme continental nature. According to the soil, climate condition and farming system Mongolia is divided into 5 distinct crop production zones. The short growing season, low precipitation and high evaporation are the over-riding constraints in Mongolian agriculture. Particularly, unseasonable frosts and severe drought can cause crop harvest losses to 10-30%. Spring wheat is the dominant staple food crop, which is cultivated on about 90% of cropland in Mongolia. Systematic crop breeding started in the 1960s in Mongolia and cereal crop breeding has been developed through 5 steps. Wheat breeding objective mainly focused on the improvement of high grain yield, early maturity, drought tolerance, disease resistance, high nutritional value, and water use efficiency of spring and durum wheat. During 60 years of study over 110 cereals varieties have been developed. The recent achievements in wheat breeding program succeeded to release new wheat varieties such as Darkhan 144, Darkhan 131, Darkhan 160, Darkhan 193, Darkhan 212, Darkhan 172 and successfully commercialized. These new varieties occupy more than 40% of total wheat production in the country and have 15-20% higher yield in comparison to national average providing additional income of 2.8-3.1 million U$ to farmers, annually. In the future, the major target of spring wheat breeding programs in Mongolia will focus on the crop yield potential, quality and the improvement of drought and heat tolerance which have obvious negative effects to crop production in recent years.

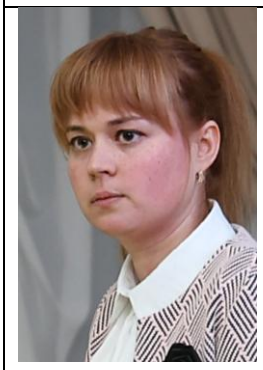
	Javzandulam Batmunkh, Mongolian University of Life Sciences. **Myagmarsuren Yadamsuren,** Plant Science Agricultural Research Institute. **Lecture Title:** Climate Effects on Barley Yield in Mongolia. **Abstract:** This study examined the influence of climatic factors – principally seasonal pre-cipitation and temperature sums – on summer barley (Hordeum vulgare L.) yield formation at the Plant Science Agricultural Research Institute, Darkhan-Uul Prov-ince, Mongolia, over the period 2003-2015. A total of 145 varieties and breeding lines were evaluated under rainfed conditions. Study years were classified by the Hydrothermal Coefficient (HTC) of Selyaninov into humid, normal, dry, and drought categories. Yield ranged from 0.11 to 4.14 t/ha with an overall mean of 1.92 t/ha. The correlation between growing-season precipitation and yield was r = 0.68 across all years, rising to r = 0.91** in drought years. Compared with normal years, yields were 7.4% higher in humid years but declined 43.6% in dry years and 82.2% in drought years. Key yield-structure components productive stem count (r = 0.82), plant height (r = 0.82), and total stem number (r = 0.75) showed the strongest correlations with yield at the 99% confidence level. Grain protein con-tent was positively correlated with June-August temperature sums (r = 0.57-0.62*), while grain starch showed an inverse relationship with late-season temper-ature. These findings highlight the overriding role of water availability on barley productivity in Mongolia's continental climate and underscore the need for drought-tolerant varieties in national breeding programs.
	**Nyamgerel Khashbaatar, Oyun-Erdene Smirnov, Myagmarsuren Yadamsuren,** Plant Science Agricultural Research Institute. **Lecture Title:** Results of Potato Hybridization Research in Mongolia. **Abstract:** Potato crossing success depends on several external factors including weather conditions, growing practices, and maintenance. To increase crossing success, breeders should have prior knowledge of the flowering intensity and duration of varieties, as well as the pollen fertility of male parents. Our experimental results demonstrated that both open-field weather and greenhouse conditions significantly influenced potato hybridization outcomes. When air humidity fell below 60 percent and temperatures exceeded +35°C, breeding success dropped below 10 percent. In 2015, the number of emasculated flowers and combinations reached their lowest values compared to other years, with flower buds drying out and dropping due to hot weather conditions. To develop superior potato varieties adapted to Mongolian agro-ecological conditions, the hybridization method has been employed in the potato breeding program since 2014. During this period, we performed 223 cross combinations and emasculated 7,780 flowers. According to our hybridization results, 1,953 flowers set berries, achieving a crossing success rate of 24.1 percent. The year 2014 was particularly successful, with a crossing rate of 47.8 percent, while 2019 showed the lowest rate at 5.8 percent. In 2018, we emasculated 2,299 flowers and harvested 742 berries – the highest numbers recorded.

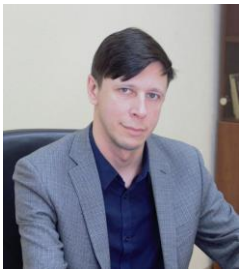
Oral Session 9: Biologization of Crop Production - 2	
	Yuri Maksimenko, Olga Konnova, Anton Ostapenko, and Martik Vardanyan, Astrakhan State Technical University, Saratov State University of Genetics. **Natalia Nepovinnykh,** Astrakhan State Technical University, Saratov State University of Genetics, Biotechnology and Engineering named after N.I. Vavilov. **Lecture Title:** Technological and Design Solutions for Combined Microwave-Ultrasonic Inulin Extraction. **Abstract:** Technological and design solutions for microwave-ultrasonic extraction of inulin from plant raw materials are considered. The aim of the work is to develop a method, operating parameters, and design and technological solutions for effective microwave-ultrasonic inulin extraction. Traditional methods of inulin production are characterized by high energy intensity, duration and risk of thermal degradation of the target product. As an alternative, a scheme is proposed that combines microwave (frequency 2450 MHz) and ultrasonic (frequency 22 kHz, intensity 50 W/cm2) exposure methods in a single recirculation circuit. Microwave heating provides rapid volumetric heating of intracellular moisture and loosening of tissues, while ultrasonic cavitation intensifies the destruction of cellular structures and mass transfer. A detailed machine and hardware scheme of the process has been developed, including the stages of raw material preparation, combined extraction, filtration, clarification, concentration and drying. The optimal process parameters have been experimentally substantiated: a 1:4-1:8 hydraulic module, a temperature of 338-348 K, a cycle duration of 20-40 minutes, and a circulation rate of 20-30 volumes/hour. The combined method reduced the extraction time by 1.5 times compared to the analog while maintaining a high inulin yield (95-98%). The finished product meets the requirements of the regulatory documentation for physico-chemical (humidity 4-6%, inulin content ≥95%, ash content <0.2%) and microbiological parameters. The technology ensures the preservation of the molecular weight and prebiotic activity of inulin due to reduced processing time and gentle temperature conditions. The proposed solutions are scalable, patent-protected and adaptable for processing various types of inulin-containing raw materials (chicory, dahlia, agave, etc.).
	**Ludmila Bakina, Yulia Polyak, and Alexander Gerasimov,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Scientific Research Centre for Ecological Safety of the Russian Academy of Sciences. **Lecture Title:** The Nitrogen Cycle Processes as an Indicator of Oil Pollution in Agricultural Soils. **Abstract:** Consumption of oil and petroleum products and emissions of their waste into the environment occur everywhere, affecting agricultural land as well. The productivity of agricultural land depends on the intensity of nitrogen nutrition. Highly toxic soil pollutants, such as oil and petroleum products, cause significant changes to the intensity and direction of biogeochemical processes, which also affect the main processes of the nitrogen cycle. In contaminated soils, the total nitrogen

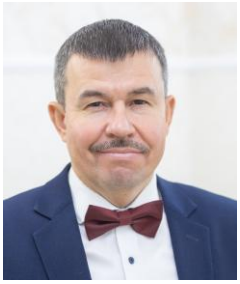
	content changes, the carbon-to-nitrogen ratio increases, and the content of labile forms of nitrogen decrease. Contaminated soils have an imbalance, with an excess of carbon and a deficiency of nitrogen and phosphorus. A decrease in bioavailable nitrogen causes changes in the functioning of soil microbial community. Nitrogen is a critical component for microbial metabolism, and it typically acts as a limiting factor in the degradation of oil, despite the fact that the abundance of microorganisms capable of metabolizing hydrocarbons may increase. When remediating soils contaminated with oil and petroleum products, the total nitrogen content in the soil rises, resulting in a decrease in the carbon-to-nitrogen ratio. Evaluation of the responses of nitrogen cycle processes to soil contamination with oil provides an opportunity to assess the ecological state of soil and the effectiveness of remediation efforts.
	**Marina Chugunova, Ludmila Bakina, Alexander Gerasimov, and Evgeniya Gorbunova,** St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Scientific Research Centre for Ecological Safety of the Russian Academy of Sciences. **Lecture Title:** Microbial Respiration as an Indicator of the Efficiency of Biopreparations for Oil-Contaminated Soil Purification. **Abstract:** This paper presents a comparative study of the efficiency of various oil-degrading preparations used to clean natural soil from old oil contamination, using the integrated indicator of microbial respiration rate. The object of the study was the natural sandy loam soil with an oil pollution lasting about 60 years. A comparative study of the effectiveness of five different biological oil-degrading preparations for cleaning soil from petroleum products was conducted in a laboratory experiment under extreme conditions – low air temperature (14-16°C) and without the addition of fertilizers and lime. The initial petroleum products content in the soil was 3400 mg *kg^-1. The indicators of the effectiveness of the biopreparations used in the experiment were the microbial respiration rate, which was determined by the intensity of the soil CO2 production using the adsorption method, as well as the content of petroleum products in the soil, which was determined using IR spectrometry. Over a 28-day experiment, depending on the preparation type, 8-16% of the petroleum products were mineralized from their original content. Two biopreparations, "Destroyl" and "Nord", did not affect the activity of biodegradation, the other studied preparations, "Devoroil", "Soyleks" and "Aborigen", intensified the process of petroleum products' degradation by 1.5, 1.8 and 2.0 times, respectively. The reason for such significant differences in the effectiveness of the studied oil-degrading biopreparations was their specific composition. Microbial respiration has been proven to be a highly informative indicator of the activity of the petroleum hydrocarbons' mineralization in soil. A strong correlation was established between the rate of microbial respiration and the dynamics of petroleum products in the soil (R > 0.80).

	**Radik Safin,** Kazan State Agrarian University. **Lecture Title:** Evaluation of the role of biopreparations based on endophytic bacteria in organic farming. **Abstract:** The results of studies evaluating the effectiveness of endophytic bacteria-based biopreparations on various agricultural crops are presented. The studied bacteria were isolated from seeds and exhibit multifaceted effects on plants. It was shown that, under field conditions, these endophytic bacteria help reduce the development of infectious plant diseases and increase resistance to abiotic stress. A positive effect of these biological products on increasing yields and improving quality characteristics of grain and leguminous crops was established. Given their comprehensive impact, it is recommended to incorporate endophyte-based products into organic crop production technologies.
	**Lidia Silaeva,** FSBSI «The Federal Research Center for Agrarian Economics and Social Development of Rural Territories - All-Russian Scientific Research Institute economy of agriculture». **Lecture Title:** Digital Technologies in Russia Grain Production. **Abstract:** In today's environment, the country's agro-industrial complex represents a complex, multi-sectoral, but organizationally undeveloped, production and socio-economic system. At the same time, it is one of the largest, multi-sectoral, and key sectors of the economy. Agriculture has long been one of the most conservative sectors of the Russian economy. Currently, it ranks last in digitalization among all business sectors. The digitalization index for the agro-industrial complex of the economy is 23 units, compared to an average of 32 units for all sectors. Digital technologies in agriculture are actively transforming the industry, increasing its efficiency, transparency, and competitiveness. They enable optimization of production processes, reduction of costs, increase in yields and productivity, and minimization of environmental impact. By 2030, digital transformation could provide an additional 15.6% increase in agricultural productivity. In Russia, digitalization of the agro-industrial complex is supported at the government level. The "Digital Agriculture" project is being implemented, including the "Efficient Hectare" (a unified land database) and "Smart Contracts" projects. In 2023, the "Grain" Federal State Information System (FGIS) was launched to collect, process, and store data on grain and its processed products. Plans call for the creation of a unified digital platform for the agro-industrial complex by 2030. In 2024, the government allocated over 3 billion rubles for the digital transformation of the agro-industrial complex, with the goal of digitizing the industry by 75% by 2027.
	**Yan Puhalsky,** All-Russian Research Institute of Food Additives - branch of the Federal Scientific Center for Food Systems named after V.M. Gorbatova **Lecture Title:** Evaluation of particle coagulation in an alkaline suspension of black soldier fly zoohumus by dynamic light scattering after mineralization **Abstract:** This paper presents the results of an experimental study of the transformation of an organic suspension of zoohumus obtained by processing organic substrates by black soldier fly larvae (Hermetia

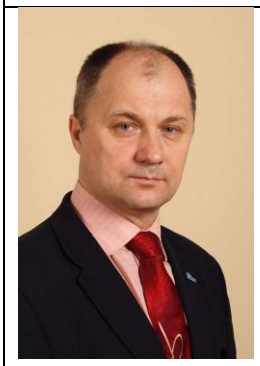
	illucens). The initial material was transformed using mineralization combined with coagulation. Using a Nanosizer Zeta Pro analyzer with an automatic titration function, a comparative analysis of the particle size distribution of two media was conducted: the initial polydisperse suspension and a suspension enriched with biogenic macro- and microelements to the level of classic hydroponic solutions. It was found that the initial medium contained particles with a normal size distribution. The introduction of alkaline earth metal cations was shown to initiate aggregation processes. This is confirmed by an increase in the proportion of particles larger than 100 nm, a change in the suspension color from black to dark brown, and the presence of fractions in the spectrum of 230–430 nm, characteristic of humic acids. It was found that aggregation leads to changes in the physicochemical properties: the suspension's stability to pH fluctuations increases, and the risk of odor development during storage and phytotoxicity is reduced. At the same time, a slight decrease in the biological activity of saprophytic microflora (responsible for the fungicidal effect) is observed, and the larger the suspended particles, the more difficult their passage through hydroponic system fittings, slowing their absorption through cell membranes. This makes the suspension more suitable for soil application due to the prolonged release of nutrients and their increased bioavailability. The obtained data opens up prospects for the development of technological protocols for the production of organomineral fertilizers with an extended shelf life and prolonged action.
	**Pratyush Kumari Rath,** Department of Agricultural Economics, COA, VNMKV Parbhani. **Digambar Shivram Perke,** Associate Dean and Principal, COA, Dharashiv, VNMKV Parbhani. **Prasad Sridharrao Gangakhedkar, Kishor Anerao, Sachin Giri, and Akshay Puri,** College of Food Technology, VNMKV Parbhani. **Shantanu Konde, Aseema Chhabra, and Ayaz Mukarram Sheikh,** Faculty of Food Technology, University of Debrecen. **Lecture Title:** Water Pricing and Irrigation Economics: An Overall Assessment of Policy, Practice, and Sustainability in Agriculture. **Abstract:** Water plays a crucial role in agricultural productivity, yet its inefficient allocation and underpricing remain major challenges for sustainable irrigation management. This paper examines the economic and policy dimensions of irrigation water pricing, with particular focus on its implications for resource efficiency, financial sustainability, and ecological balance in agriculture. Agriculture accounts for nearly 80% of total freshwater withdrawals in India, while irrigation tariffs remain significantly lower than the actual cost of water delivery, resulting in inefficient use and increasing pressure on water resources. The study reviews various irrigation water pricing mechanisms including area-based charges, volumetric pricing, block tariffs, and water markets, highlighting their advantages, limitations, and applicability in developing country contexts. It also analyzes the gap between the cost of irrigation infrastructure and the tariffs charged to farmers, emphasizing the role of subsidies and political economy constraints in shaping current pricing

	policies. The findings suggest that ineffective pricing structures, weak cost recovery, and institutional limitations contribute to unsustainable water use and declining groundwater levels. The paper argues for gradual reforms in water pricing supported by improved measurement systems, strengthened water user associations, and better alignment of agricultural policies. Such reforms can promote efficient water allocation, enhance irrigation sustainability, and contribute to achieving long-term agricultural and environmental goals.
	Buddhabhushan. D. Wankhade, Avte Shubhangi Basveshwar, Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Agricultural University. **Syed Ibrahim Syed Ismail,** Associate Dean, College of Agriculture. **Muley Pooja Anil,** Department of Soil Science and Agricultural Chemistry, Dr. Rajendra Gode College of Agriculture. **Meena Gajveer M.,** Division of Soil Science, Sher-E_Kashmir University of Agriculture Science and Technology, Shalimar Campus. **Lecture Title:** Microbial Consortium Mediated Soil Health Improvement in Turmeric: A Focus on Physio-Chemical Properties and Nutrient Dynamics. **Abstract:** An experiment was conducted at the Vegetable Research Center, Vasantrao Naik Marathwada Agriculture University, Parbhani, Maharashtra, India, during the Kharif seasons of 2022 and 2023 to explore the impact of microbial consortia on the physicochemical and nutrient dynamics of the soil in turmeric (Curcuma longa L.) cv. Selum. Ten different treatment combinations were used in the experiments, which included different microbial cultures and their consortia. It was observed that the treatment T10, i.e., RDF + Azotophos + ZnSB inoculation (Consortium-VII), was found to be better in improving the soil parameters, including organic carbon percentage, available N, P, and K content of soil, and soil microbial population, and was found to be significantly superior to other treatments. Likewise, soil pH and electrical conductivity also had significant moderation under this treatment. The treatment T8, i.e., RDF + Azotophos + KSB inoculation (Consortium-V), was next in order in its impact on vegetative growth and developmental parameters of turmeric, besides better soil parameters. The study concludes that the recommended dose of fertilizers with microbial consortia helped in improving the physiochemical properties and nutrient dynamics in turmeric-grown soil.
	**Natalia Zakharova, Rashid Kurbanov,** Federal Scientific Agroengineering Center VIM (FSAC VIM). **Lecture Title:** The use of UAS for monitoring agricultural biological objects. **Abstract:** Unmanned aerial systems (UAS) are actively used in agriculture to monitor agricultural land and optimize agrotechnological processes. Agricultural crops require differentiated approaches to monitoring and data processing. Existing algorithms and methods for interpreting UAS multispectral aerial photography data need to be improved or new approaches created for automated analysis of crop conditions. The use of UAS for monitoring will make it possible to assess the condition of crops and reduce time costs compared to traditional methods.

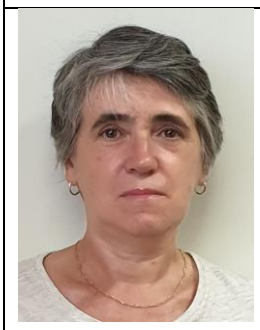
Oral Session 10: Artificial Intelligence in Agriculture	
	**Anton Smirnov and Tatyana Snytnikova,** Kaliningrad State Technical University. **Lecture Title:** Conceptual Multimodal AI Architecture for the Early Diagnosis of Pig Respiratory Diseases. **Abstract:** This paper explores the development of a conceptual multimodal hardware and software architecture for the early detection of respiratory diseases in pigs at the PMK-3 pig-breeding complex (LLC Pribaltiyskaya Myasnaya Kompaniya Tri). Modern precision livestock farming (PLF) technologies, including acoustic monitoring, computer vision, and infrared thermography, are considered. The advantages and limitations of existing techniques for use in industrial environments are investigated. It is shown that the existing monomodal approaches are insufficient for effectively automating the process of registering sick animals. Laboratory models are poorly suited to industrial pig farm conditions and do not support integration with ERP systems, including 1C. The proposed architecture is based on edge devices fitted with microphone arrays and thermal imaging cameras. Cascade analysis (an acoustic trigger activates visual and thermal imaging verification) enables highly accurate identification of sick animals, reducing the risk of false alarms and diagnostic delays. The proposed architecture minimizes computing resource consumption and reduces the load on the network infrastructure by transferring only structured metadata to the «1C: Enterprise 8. Livestock Breeding. Pig Farming» ERP system. This approach helps to improve the management efficiency of large farms.
	**Sergey Kuleshov, Alexandra Zaytseva, and Alexey Aksenov,** Institute for Informatics and Automation, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS). **Lecture Title:** Technology of Hybrid Cattle Monitoring Using Local Positioning and Video Surveillance. **Abstract:** The paper discusses the concept of hybrid cattle monitoring based on the integration of local positioning systems (UWB) and intelligent video surveillance. The limitations of traditional observation methods are highlighted, and the effectiveness of a combined approach to improve the accuracy of tracking an object's location within a frame, as well as monitoring animal behavior and physiological state, is substantiated. Methods for synchronizing data from positioning sensors and video analytics are described, along with the possibilities of using this approach to automate zootechnical processes and enable early diagnosis of cattle diseases. The system architecture includes wearable radio modules with infrared emitters and a network of stationary UWB base stations. Distance measurement is performed using the time-of-flight method, with subsequent triangulation to obtain spatial coordinates that are mapped onto video frames. The proposed approach enables the implementation of a hybrid monitoring scheme for moving objects, integrating a video surveillance subsystem with an indoor localization subsystem using UWB radio means. A prototype based on BU01 UWB modules and STM32 microcontrollers was developed and tested under farm conditions. This makes it possible to determine the daily motor activity of each animal, build a physiological profile.

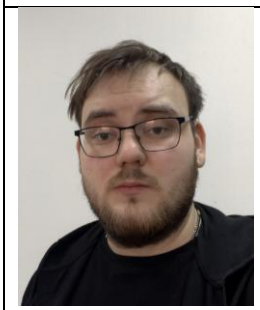


Aleksandra Figurek, University of Nicosia, School of Business, GNOSIS Mediterranean Institute for Management Science.
Andrey Ronzhin, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS).
Vladimir Milovanović, Faculty of Engineering, University of Kragujevac.
Lecture Title: AI-Based Decision Support System for Sustainable Agriculture in Cyprus: Integrating Data Analytics and Resource Optimization.
Abstract: Agriculture in the Mediterranean regions is exposed to the pressures of climate change, limited water resources and the need for more efficient production systems. Cyprus represents a relevant example due to the pronounced scarcity of water, the fragmented structure of farms and the significant role of irrigation in crop production. The scientific contribution of the work is reflected in the methodological integration of open and verified statistical data with formal optimization logic, within a framework adapted to the specifics of Cypriot agriculture. This paper proposes a conceptual AI-based decision support system (AI-DSS) for sustainable agriculture in Cyprus, which links the analysis of agricultural data with the logic of resource allocation optimization. The proposed framework is based on publicly available and verified statistical data from the CYSTAT, Eurostat and FAOSTAT databases, while the optimization component is conceptually connected to the General Algebraic Modelling System (GAMS) platform in order to illustrate the possibility of distributing limited water resources within a decision support system. The research relies on official data on farm structure, land use, irrigation and production of key crops in Cyprus, with a particular focus on potatoes, citrus, grapes and olives as representative crops for analytical and optimization purposes. Analytical scenarios of different levels of water availability were developed to examine how the proposed system could support adaptive planning of agricultural production under conditions of increased resource pressure. The results confirm that Cypriot agriculture combines a small average farm size with a significant dependence of certain crops on irrigation, which makes water distribution one of the key sustainability issues of the sector.



Vladislav Sobolevskii, Boris Sokolov, Valerii Zakharov, and Fedor Gaponiako, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS).
Olga Golda, Belarusian State University of Informatics and Radioelectronics.
Lecture Title: An Automated Tool for Generating Monitoring Models for Complex Agrobiotechnical Systems.
Abstract: This paper presents an implementation of an algorithm for the automatic structural-parametric synthesis of domain-specific models based on a modified genetic algorithm. The proposed approach addresses the limitations of manual inspection, such as high labor intensity and human subjectivity. The YOLO (You Only Look Once) architecture is used as the core framework, enabling high-

	speed image analysis on mobile devices. By utilizing specialized crossover and mutation operators, the system constructs fundamentally new neural network configurations. The proposed approach provides agricultural specialists with a tool for independently creating and deploying models and software solutions by uploading appropriate datasets to the AutoGenNet system for automatic neural network generation, without the involvement of machine learning experts. The architectural separation between server-side synthesis and the mobile application ensures that intensive training remains separate from local model operation. Verification and validation of the developed software were performed on a binary classification task using a dataset of 3,601 images of cucumbers, carrots, and potatoes. The experimental results showed high accuracy achieving an overall mAP50 of 0.971. The resulting model size is 10 MB, and the inference time on a mobile device is 1–2 seconds, which enables real-time assessment of the target object class in practical applications.
	**Alexander Smirnov, Tatiana Levashova, Nicklay Shilov, and Andrew Ponomarev,** St. Petersburg Federal Research Center of the Russian Academy of Sciences. **Leonid Sheremetov,** Mexican Petroleum Institute. **Lecture Title:** Dynamic Configuration in Cognitive Cyber-Agriculture Using Multi-Aspect Ontology. **Abstract:** The transition to Agriculture 5.0 led to the emergence of cognitive cyber-agricultural systems (CCASs) that incorporate human intelligence into the digital framework to create intelligent, adaptive, and efficient farming. This paper introduces a conceptual model for configuration of a CCAS supported by the mechanism of multi-aspect ontologies. The model offers a way to adapt CCAS behavior to an ever-changing environment through reconfiguration. Within this model, the dynamic configuration problem is solved through a collaborative decision-making process. The multi-aspect ontology integrates heterogeneous aspects representing knowledge from multiple domains and providing reusable methods that can be employed for solving the configuration problem. The ontology's mechanism provides interoperability for independent aspects represented using their internal formalisms, while also capturing the knowledge related to the CCAS configuration problem. With respect to the dynamic configuration problem, the ontology incorporates the aspects of CCAS, dynamic configuration, plan, human-machine team, decision support, profile, and context. An example from first-mile agriculture logistics – in which a human-machine team dynamically configures a CCAS – illustrates the key ideas introduced in the paper. This example demonstrates that the proposed model effectively tackles crucial agricultural challenges involving dynamic configuration.

	**Vladislav Skripnik, Irina Veselkova, and Valentina Kuznetsova,** Federal State Budgetary Educational Institution of Higher Education «Astrakhan State University named after V.N. Tatishchev». **Lecture Title:** Application of Modular Retrieval-Augmented Generation System to Support Agricultural Decision-Making. **Abstract:** The paper examines the application of the Retrieval-Augmented Generation (RAG) architecture for intelligent decision support in agriculture. Agriculture is a complex domain where effective decision-making depends on many interconnected factors, including climate conditions, soil characteristics, biological properties of crops, and applied agricultural technologies. Accessing reliable and structured knowledge in this field is often difficult for practitioners, as relevant information may be scattered across numerous scientific publications, guidelines, and expert materials. To address this problem, the study proposes a modular RAG-based system designed to improve the accessibility and quality of knowledge retrieval for agricultural applications. The proposed approach combines large language models with external knowledge sources, allowing the system to generate answers based on verified information rather than relying solely on internal model knowledge. The architecture includes document indexing, chunking, keyword extraction, and embedding generation, with all data stored in a vector database together with metadata. In contrast to naive RAG implementations, the proposed system employs a multi-stage retrieval pipeline that includes hybrid search, query reformulation, and reranking of retrieved documents. This approach improves the relevance and completeness of the retrieved context and reduces the risk of generating inaccurate or incomplete responses. The paper describes the system architecture, methods used to enhance search quality, and practical application scenarios, including agronomic decision support, farmer education, and plant problem diagnostics. The results demonstrate that the modular approach provides higher relevance and reliability of retrieved information compared to naive RAG implementations.
	**Valentina Kuznetsova, Timur Yagafarov, Valery Laptev, and Irina Kvyatkovskaya,** Federal State Budgetary Educational Institution of Higher Education «Astrakhan State Technical University». **Lecture Title:** Design and Experimental Evaluation of a Voice Control System for Autonomous Robotic Agricultural Systems. **Abstract:** This paper presents a multilingual voice control system for autonomous agricultural machinery, addressing the need for intuitive human–machine interfaces in precision farming. The proposed architecture integrates audio capture with a configurable speech recognition module based on Faster Whisper, which transcribes commands and optionally translates from one language to another. Recognized text is processed by a hybrid natural language understanding pipeline combining intent-and-slot-filling models (BERT/T5), and a local large language model (Qwen) for commands of varying complexity. Experimental evaluation shows that medium-sized Whisper models maintain 85-90% accuracy under noise levels up to 13 dBFS, while tiny and base models degrade significantly. The

	Russian-to-English translation capability of medium models yields satisfactory results without fine-tuning. In the NLP stage, BERT with T5-based error correction achieves 92.7% correct command recognition at 12% Word Error Rate, while a 14B-parameter LLM reaches 96.3% accuracy at higher computational cost. Performance measurements on CPU with INT8 mode confirm feasibility for resource-constrained edge devices. The proposed solution offers a flexible trade-off between accuracy, latency, and memory consumption, making it suitable for real-world agricultural environments with variable noise levels and mixed-language operators.
	**Rahul Kamble,** Ministry of Micro Small and Medium Entreprises, Govt of India. **Archana Khandare,** Synechron India Pvt. Ltd. **Pratyush Kumari Rath,** Department of Agricultural Economics, College of Agriculture, VNMKV. **Prasad Shridharrao Gangakhedkar and Kishor Anerao,** Department of Food Microbiology and Safety, College of Food Technology, VNMKV. **Lecture Title:** IoT-Enabled Smart Packaging for Real-Time Freshness Monitoring of Processed Foods. **Abstract:** Smart packaging combines sensor technology and connectivity to actively track food quality, aiming to extend shelf life and reduce waste. We propose and survey an IoT-based system that uses carbon dioxide (CO_2) and ethylene gas sensors integrated into food packaging, communicating data via a microcontroller running Python. The system continuously monitors gas levels (along with temperature/humidity), processes the data (potentially with a machine-learning model), and alerts consumers via a smartphone app when freshness declines. Technical review of CO_2 and ethylene sensor modules (e.g. NDIR CO_2 sensors and electrochemical ethylene sensors) shows they can detect spoilage-related gases at relevant levels (hundreds to thousands of ppm for CO_2; tens of ppm for ethylene). We detail an architecture: sensors → Raspberry Pi (running Python scripts for data acquisition, MQTT communication, and ML inference) → cloud backend → mobile alerts. Experiments on sample perishable items demonstrate that this IoT-enabled smart packaging can predict spoilage and send timely alerts, empowering consumers and retailers to act before food goes bad. With user-friendly APIs and open-source libraries (e.g. Paho-MQTT, Flask, scikit-learn), the system is designed to be low-cost and extensible. In summary, the proposed smart packaging prototype leverages inexpensive sensors and Python-driven analytics to make “breakfast safe and hassle-free” (literally) – ensuring that food stays fresher longer.

Stanislav Gerasimenko, Federal Scientific Agroengineering Center VIM

Lecture Title: Research on seed calibration in a gravity separator.

Abstract: To improve the quality of the seed material, it is necessary to calibrate the seeds. In this regard, an experimental model of a gravity installation with a new shape of the comb bars has been developed for selecting seeds of the same size. The design of the gravity unit and its working parts are made using additive technologies.

Format of the Conference

The conference is held in a hybrid format: on the basis of the Kaliningrad state technical university (KSTU, 1, Sovetsky Av., Kaliningrad 236022, Kaliningrad кegion, Russia) and in videoconference format. 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 St. Petersburg/Moscow (UTC + 3): **https://www.worldtimebuddy.com/utc-to-russia-moscow/**. The time in Moscow is **1 hours ahead** of the time in Kaliningrad.

Contacts

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

Co-Organizers and Information Partners

Российская Академия Наук
Отделение сельскохозяйственных наук

ФЕДЕРАЛЬНОЕ АГЕНТСТВО ПО РЫБОЛОВСТВУ

Российская Академия Наук
Отделение наук о Земле

Министерство сельского хозяйства Новгородской области

DOZAVGRO комбикормовые заводы

журнал для специалистов агропромышленного комплекса
СЕЛЬСКОХОЗЯЙСТВЕННЫЕ ВЕСТИ

ТЕЛЕКАНАЛ ИНТЕРНЕТ-САЙТ
БОЛЬШАЯ АЗИЯ
BIG ASIA
TV CHANNEL INTERNET SITE
BIGASIA.RU
ОТКРЫВАЕМ АЗИЮ ДЛЯ РОССИИ

НАЦИОНАЛЬНОЕ АГРАРНОЕ АГЕНТСТВО

Алтайская нива

AGRO JOB Работа в АПК

dia
DAIRY INTELLIGENCE AGENCY

thedairynews

СОЮЗ ОРГАНИЧЕСКОГО ЗЕМЛЕДЕЛИЯ

V-BRAND marketing agency

ЗА БОКАЛОМ БЕЛОГО подкаст

ISSN 2070-6286

ЭКОНОМИКА СЕЛЬСКОГО ХОЗЯЙСТВА РОССИИ

наше сельское ХОЗЯЙСТВО

МОЛОЧНОЕ И МЯСНОЕ СКОТОВОДСТВО