



Fourth International Conference on
**Agriculture Digitalization
and Organic Production**

ADOP 2024

**Conference
Programme
and Abstracts**

**June 5–8, 2024
Minsk,
Republic of Belarus**



Organizer

- Republican Unitary Enterprise "Scientific and Practical Center of the National Academy of Sciences of Belarus on Agricultural Mechanization" (RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus)
- St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS, St. Petersburg, Russia)

Conference Chair

- Dmitry Komlach, RUE SPC of the NAS of Belarus for Agricultural Mechanization
- Academician Alexander Kostyaev, SPC RAS

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- Andrey Ronzhin, SPC RAS

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- Adalat Pashayev, Azerbaijan
- Francesco Pieri, Italy
- Mirko Rakovic, Serbia
- Elena Semenova, Russia
- Svetlana Shchepetkina, Russia
- Mikhail Tatur, Belarus
- Alexander Tristanov, Russia
- Noah Velasquez, Mexico
- Elena Yildirim, Russia
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- Alexandr Smerchansky, SPC RAS
- Evgeniy Zhilich, RUE SPC of the NAS of Belarus for Agricultural Mechanization

Conference at a glance

Wednesday, June 5, 2024			
09:00-09:30	On-line Registration		
09:30-09:45	Opening Ceremony https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Nikolay Bakach, Andrey Ronzhin		
09:45-12:45	Plenary Session 1 https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Chair: Nikolay Bakach, Andrey Ronzhin		
12:45-13:00	On-line Joint Photography of Conference Participants https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1		
13:00-14:00	Lunch break		
14:00-17:30	Oral Session 1: Digital Technologies, Robotics and Organic Crop Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Boris Sokolov, Victor Goldyban	Online Oral Session 2: Interdisciplinary Aspects of Organic Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Galina Nikonova, Anton Yurin	
18:00-20:00	Dinner		
Thursday, June 6, 2024			
09:00-13:00	Oral Session 3: Digitalization and Organic Animal Husbandry: Poultry Farming, Dairy Production and Aquaculture https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Vladimir Surovtsev, Evgeniy Zhilich	Online Oral Session 4: Digital Technologies and Robotics in Crop and Livestock Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Anton Saveliev, Igor Pylilo	
13:00-14:00	Lunch break		
14:00-17:30	Oral Session 5: Economic and Legal Aspects of Organic Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Valentina Kundius, Vladimir Lensky	Online Oral Session 6: Interdisciplinary Aspects of Organic Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Oksana Glibko, Andrey Shah	«BELAGRO» Exhibition
18:00-20:00	Dinner		

Friday, June 7, 2024

09:30-12:00	Oral Session 7: Digital Technologies and Robotics in Crop and Livestock Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Anton Yurin, Evgeniy Zhilich
12:00-12:30	Closing Ceremony https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1 Cochairs: Andrey Ronzhin, Nikolay Bakach
12:30-16:00	Historical and cultural complex “Stalin Line”. Presentation “Immortal Regiment”, dedicated to the 80th anniversary of the liberation of Belarus from Nazi invaders: “Development of memory culture in rural settlements of Russia and agro-towns of Belarus” (interregional public project “Memory of the Earth”). Banquet.

Conference Programme

Wednesday, June 5, 2024	
09:00-09:30	On-line Registration
09:30-09:45	Opening Ceremony https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnlIn.1 Cochairs: Nikolay Bakach, Andrey Ronzhin
09:45-12:45	Plenary Session 1 https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnlIn.1 Chair: Nikolay Bakach, Andrey Ronzhin
	Keynote speech 1: <i>Dmitry Komlach and Nikolay Bakach.</i> General Approaches and Ways of Implementing Digital Technologies in the Agro-Industrial Complex of Belarus
	Keynote speech 2: <i>Agipar Bakyei and Gombo Gantulga.</i> The Necessity and Potential for Integrating Digital Technology into the Mongolian Pastoral Livestock Sector
	Keynote speech 3: <i>Shinde Gopal.</i> Digital Farming Solution by Automation using Agri-Bots, Agri-Drones, Agri-AGVs
	Keynote speech 4: <i>Viktor Yakushev and Vyacheslav Yakushev.</i> Scalable Potential of Information Support for Modern Agriculture
	Keynote speech 5: <i>Alexander Bryukhanov.</i> Scientific and Technical Support for the Development of Digital and Engineering Solutions for Managing the Environmental Safety of Agroecosystems
	Keynote speech 6: <i>Alyona Kodolova.</i> Digitalization of Agriculture in Russia and Belarus: Problems of Legal Regulation
12:45-13:00	On-line Joint Photography of Conference Participants https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnlIn.1
13:00-14:00	Lunch break
14:00-17:30	Oral Session 1: Digital Technologies, Robotics and Organic Crop Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnlIn.1 Cochairs: Boris Sokolov, Victor Goldyban
	<i>Kavin Sundarr, Rohan Inamdar, and Gopal U Shinde.</i> Voice-Controlled Autonomous Agri-Robot for Organic Farming Pest and Disease Monitoring
	<i>Nosyrev I.N., Andrey Savchits, Mikhail Tatur, and Dmitry Pertsev.</i> Open Architecture of the Mobile Robotic Platform Control System: From Ontology to Technical Solution
	<i>Alexey Stepanov, Lyubov Illarionova, Tatyana Aseeva, and Artem Polyakov.</i> The Use of Satellite Monitoring and Aerial Photography Data to Assess the Heterogeneity of Agricultural Crops in the Khabarovsk Territory
	<i>Alexey Petrushin.</i> Methodological Approaches to Determining the State of Drainage Systems Based on Remote Sensing
	<i>Vladislav Minin, Anton Zakharov, and Sergey Melnikov.</i> Optimization of Organic Potato Cultivation Technology with due Account for Changing Weather Conditions on Northern Territories
	<i>Alexander Spesivtsev, Boris Sokolov, and Alexander Semenov.</i> Models and Algorithms for Proactive Planning of Grass Feed Production
	<i>Yuri Blokhin.</i> Wireless Hybrid Sensor Network for Agriculture Monitoring
<i>Oleg Mikityuk, Natalia Statsyuk, Tatyana Nazarova, Yuri Denisenko, and Arkady Sinitsyn.</i> Enzymatic Detoxification of Zearalenone-Contaminated Wheat and Corn Grain Using a Recombinant Zearalenone Hydrolase from <i>Clonostachys Rosea</i>	

	<p><i>Oleg Mikityuk, Tatyana Nazarova, Igor Sinelnikov, and Larisa Shcherbakova.</i> Post-Harvest Biodegradation of Aflatoxin B1 in Rice Grain and Peanut Seeds Infected with <i>Aspergillus Flavus</i> Using a Recombinant Oxidase from <i>Armillaria Tabescens</i></p> <p><i>Buddhabhushan Wankhade, Syed Ismail, and P.H. Gourkhede.</i> Smart Agriculture in Southeast State of Brazil: An Overview of Technology and Adoption</p> <p><i>Tekale Dayanand Devidasrao.</i> Smart Portable Machinery for Organic Farming</p> <p><i>Bhagwan Asewar.</i> Plant Health Management in Bt. Cotton through Foliar Nutrition Using SPAD Meter</p>
	<p>Online Oral Session 2: Interdisciplinary Aspects of Organic Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNs397bfd8KBrWAPVL7DbnlN.1 Cochairs: Galina Nikonova, Anton Yurin</p>
	<p><i>Evgenia Rakhimova.</i> Organic Beef Production in Russia: Overview of Development Opportunities</p> <p><i>Dmitry Komlach, Zheshko A.A., and Lensky A.V.</i> Results of the Development of an Algorithm for Digitalization of Economic Accounting and Planning in Agricultural Production Using the Example of the Cultivation of Grain Crops</p> <p><i>Petr Akmarov, Olga Knyazeva, Dmitry Kondratiev, and Mircharip Gazetdinov.</i> Econometric Method for Assessing the Level of Digitalization of Regional Agriculture</p> <p><i>Khapsat Dibirova and Natalya Osipova.</i> Increasing the Investment Activity of Organic Producers in Russia</p> <p><i>Natalia Nikonova and Aleksey Nikonov.</i> Pricing Strategy in the Activities of Organic Producers</p>
14:00-17:30	<p><i>Zinaida Kotova, Leonid Danilov, and Tatiana Danilova.</i> Biological Protection of <i>Solanum Tuberosum</i> L from Pathogens Using Symbiotic Bacteria <i>Xenorhabdus Bovienii</i> Entomopathogenic Nematodes</p> <p><i>Maria Kuznetsova.</i> Use of Biological and Chemical Fungicides and Biostimulators for Potato Protection Against Early and Late Blights</p> <p><i>Irina Mikheeva.</i> Information and Digital Methods for Assessing Soil Transformation of Agroecosystems under Anthropogenic Influence and Climate Change</p> <p><i>Victoria Bardina, Alexander Gerasimov, Tamara Bardina, and Evgeniya Gorbunova.</i> Investigation of the Use of Organic Additives to Improve the Fertile Properties of Soil after Screening</p> <p><i>Yan Li, Svetlana Maksimova, and Viktor Lemeshevsky.</i> Utilization and Recycling of Agricultural Waste with the Help of Biological Objects</p> <p><i>Anna Ukolova and Denis Bykov.</i> Clustering of Household Plots Using Self-Organizing Maps</p> <p><i>Pritam Bhutada.</i> Study on Nutrient Management in Upland Rice Intercropping System in Rainfed Region of Maharashtra</p>
18:00-20:00	Dinner

Thursday, June 6, 2024

Oral Session 3: Digitalization and Organic Animal Husbandry: Poultry Farming, Dairy Production and Aquaculture

<https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1>

Cochairs: Vladimir Surovtsev, Evgeniy Zhilich

Roman Nekrasov, Evgenia Tuaeve, Magomed Chabaev, and Nadezhda Bogoluybova. Use of *Hermetia Illucens* Larvae Fat in Feeding of Calves

Vladimir Surovtsev, Yulia Nikulina, Alexandra Zaytseva, and Sergey Kuleshov. Evaluation Model for Digital Technology Efficiency: the Example of Intelligent Digital Video Monitoring of Early Disease Diagnosis and Physiological Cows Condition

Konstantin Ostrenko, Anastasia Ovcharova, Nadezhda Belova, Ivan Kutyin, Kirill Koltsov, Vyacheslav Rastashansky, and Natalia Nevkrytaya. The Effect of an Emulsion Based on Coriander (*Coriándrum Sátivum*) and Fennel (*Foenículum Vulgáre*) on the Expression of Genes Forming the Immune Status of Dairy Calves

Elena Yildirim, Larisa Ilina, Georgi Laptev, Daria Tyurina, Valentina Filippova, Andrei Dubrovin, Natalia Novikova, Kseniya Kalitkina, Ogulgerek Djepbarova, Ekaterina Ponomareva, Alisa Dubrovina, Irina Klyuchnikova, Natalya Patyukova, Darren Griffin, and Michael Romanov. The Search for Sources of Enterobacteria and Clostridia Endotoxins in Russian Dairy Farms: Possible Transfer of Endotoxins through the Feed-Cow-Milk Chain

Anastasia Ovcharova, Konstantin Ostrenko, and Andrey Gavrikov. The Effect of *Lactobacillus Reuteri* Probiotic Strains on Productivity and Basic Physiological Parameters of Laying Hens

Victar Lemeshevsky. Provision of Substrates for Energy Processes in Bulls at Different Levels of Metabolizable Protein

Vitaly Javakhia. Antiviral and Antifungal Protective Activity of a Cold-Shock Protein fFrom *Bacillus Thuringiensis*

Nadezhda Bogolyubova. The use of Melanin in the Nutrition of Broilers to Preserve the Health of Birds and Obtain High-Quality Poultry Products

Georgi Laptev, Daria Tyurina, Elena Yildirim, Elena Gorfunkel, Larisa Ilina, Valentina Filippova, Andrei Dubrovin, Alisa Dubrovina, Natalia Novikova, Veronika Melikidi, Kseniya Kalitkina, Ekaterina Ponomareva, Vasiliy Zaikin, Irina Klyuchnikova, Darren Griffin, and Michael Romanov. Effects of Glyphosate and Antibiotics on the Expression of Genes Related to Performance, Antioxidant Protection and Histological Barrier in the Cecum of Broilers

Georgi Laptev, Daria Tyurina, Valentina Filippova, Elena Yildirim, Larisa Ilina, Elena Gorfunkel, Veronika Melikidi, Andrei Dubrovin, Kseniya Kalitkina, Ekaterina Ponomareva, Vasiliy Zaikin, Irina Klyuchnikova, Alisa Dubrovina, Ogulgerek Jepbarova, and Jie Zhu. The Influence of Glyphosate in Combination with Antibiotics on the Microbial Community of Broiler's Cecum According to Whole Genome Sequencing

Roman Meshcheryakov, Gleb Tevyashov, and Konstantin Rusakov. Automatic Determination of Sturgeon Size Using Deep Learning Technologies

Evgeniy Ivashko. Mathematical Model of a Cage Fish Farm

Marina Solovey, Alexey Snytnikov, Aleksandr Tristanov, and Pavel Chernyshkov. Forecasting the SAM Index Value Using Fourier Series and Neural Networks

Online Oral Session 4: Digital Technologies and Robotics in Crop and Livestock Production

<https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbnln.1>

Cochairs: Anton Saveliev, Igor Pylilo

Artem Popov, Ivan Blekanov, Mikhail Arkhipov, and Olga Mitrofanova. Improving the Quality of X-Ray Images of Seeds in Smart Farming Using Deep Learning

09:00-
13:00

09:00-
13:00

	<i>Azarenko V.V., Goldyban V.V., Kurilovich M.I., and Antipovich N.A.</i> Determination of Internal Defects of Potato Tubers Using Nuclear Magnetic Resonance and Computed Tomography Methods
	<i>Anton Yurin.</i> Development of Screen Forms for the Control Program of the Technical Vision System for Optical Fruit Sorting
	<i>Marina Astapova, Anton Saveliev, and Artem Ryabinov.</i> Application of Unmanned Aerial Vehicles for Precision Spraying of Chemicals in Agronomic Operations: A Case Study of Potato Desiccation
	<i>Mikhail Tatur, Maksim Buren, Sergey Bushuk, Adalat Pashayev, Elkhan Sabziev, and Minglei Fu.</i> Local Positioning of an Agricultural Mobile Robot Based on a Vision System
	<i>Kantemir Bzhikhatlov.</i> Methods for Building Ontologies to Ensure Coordinated Behavior of Autonomous Intellectual Systems in Agriculture
	<i>Andrey Perepechaev, Pylilo I.S., and Koleshko S.P.</i> Experimental studies of a mock-up sample of a device for forming the density of a flax press with a self-propelled baler PLC-1
	<i>Olga Mitrofanova, Evgenii Mitrofanov, Ivan Blekanov, Vladimir Bure, and Alexander Molin.</i> Approach for Long-Term Forecasting of Frosts and Droughts in Smart Agriculture
	<i>Anton Yurin and Ignatchik A.A.</i> Design and Working Process of the Unit for Mechanical Removal of the Crown of Berry Bushes AUK-1
	<i>Anton Yurin.</i> Development of a Computer Vision System Control Program for Optical Fruit Sorting (APPLECTL)
	<i>Larisa Zelenina, Lyudmila Khaimina, Ekaterina Demenkova, Maksim Demenkov, Inga Zashikhina, and Eugenii Khaimin.</i> Research of Reindeer Migration Routes Based on Tracking Technologies
	<i>Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., and Nikonchuk V.V.</i> Research And Analysis of Microclimate Formation Parameters in Livestock Buildings
13:00-14:00	Lunch break
	Oral Session 5: Economic and Legal Aspects of Organic Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7Dbrln.1 Cochairs: Valentina Kundius, Vladimir Lensky
	<i>Elena Semenova.</i> Agricultural Production Technologies with Special Quality
	<i>Tamara Makarova, Veranika Saskevich, and Iryna Kuzmich.</i> Legal Support for the Development of Organic Production in the Republic of Belarus
	<i>Valentina Kundius and Nina Petsukh.</i> Efficiency of Organic Production
	<i>Azhgirevich A.N. and Iovik L.N.</i> Analysis of the state of organic production in the Republic of Belarus
	<i>Valeria Chesnokova.</i> Formation of a methodology for the use of artificial intelligence in agro-industrial enterprises
14:00-17:30	<i>Alexander Solntsev.</i> Issues of The use of Pesticides in Agriculture and the Protection of Human Rights in Accordance with International Law
	<i>Maria Gurieva.</i> Organic farming, ethical farming and terroir products as the basis of quality of life development
	<i>Zakirova Elina.</i> Practical application of the methodology for the formation of sustainable financial development of agricultural enterprises based on optimization of financing sources
	<i>Pratyush Kumari Rath, Digambar Perke, Dheeraj Pathrikar, and Buddhabhushan Wankhade.</i> Ag-IoT: Empowering Sustainable and Economic Organic Agriculture
	<i>Sangram S. Wandhekar, Aboli R. Bhatlawande, Gopal U. Shinde, Kshirsagar R.B., Agarkar B.S. and Ghatage P.U.</i> A look at digitalization of the sustainable organic food supply chain

	<i>Elena Nikiforova, Marina Ermolina.</i> Improving the legal framework for digitalisation of the agro-industrial complex as a condition for ensuring Russia's national security
	<i>Anna Osetrova.</i> Rural Territories as an Object of Urban Development
	<i>Tavrykina O.M., Gromadskaya E.I., Semenenko L.V., and Kochik E.N.</i> Development of the Information and Analytical System “Water Protection Zones” as the Basis for Digital Transformation in the Field of Surface Water Protection
	Online Oral Session 6: Interdisciplinary Aspects of Organic Production https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1
	Cochairs: Oksana Glibko, Andrey Shah
	<i>Anahit Manvelyan, Astghik Pepoyan, Liana Grigoryan, and Michae Chikindas.</i> Fishery in Armenia and Aqua-Probiotics
	<i>Alina Guzeva and Artem Lapenkov.</i> Seasonal Dynamics and Vertical Distribution of Phosphorus in Sediments under Trout Cage Farms in Lake Ladoga
	<i>Tuyen Tran, Bien Duong, Quyen Vu, Van Le, Oksana Glibko, and Andrey Ronzhin.</i> Methods and Technical Means of Nonintrusive Assessment of Fish Biomass and Robotic Maintenance of Cage Aquaculture
	<i>Alexander Bekarev.</i> Aquaculture Human Resources in Russia: The Regional Dimension
	<i>Vidhya Baban Wadmare, Rahul Eknath Kamble, Kailash S Gadhe, Prasad Shridharrao Gangakhedkar, Gopal U. Shinde.</i> Organic Farming in the Era of Artificial Intelligence: Towards Sustainable Agriculture and Environmental Resilience
14:00-17:30	<i>Amardeep Singh Sandhu, Mehak Rai Sethi.</i> A Critical Analysis of the Interaction Between Biotechnology and Intellectual Property Law in India.
	<i>Prasad Shridharrao Gangakhedkar, Hemant W. Deshpande, Rahul Eknath Kamble, Vidhya Baban Wadmare, Vaibhav Jadhav, Gopal U. Shinde.</i> From Farm to Fork: Digital Evolution of Food Industry through AI and other Digital Technologies
	<i>Pritam Bhutada.</i> Response of Sorghum Crop Towards Organic Manure under Climate Change
	<i>S.U. Pawar, Sneha Bhise, Apeksha Thombre, and Bhagwan Asewar.</i> Organic and Inorganic Weed Management Practices in Soybean under Different Land Configurations
	<i>Monica Shinde, Kavita Suryawanshi, Kanchan Kakade, and V.A. More.</i> Digital Maize Crop Guardian: Automated Identification of Fall Armyworm Infestation Using Computer Vision
	<i>Kalbande Vishal Dashrathrao.</i> Grafting Robot Technology – A Review
	<i>Sushant R. Bhalerao, Francisco Rovira-Mas, Indra Mani, B.V. Asewar, O.D. Kakade, S.V. Muley, and D.V. Samindre.</i> Deep Learning for Pink Bollworm Detection and Management in Organic Cotton Farming Practices
	<i>Zheshko A.A. and Lensky A.V.</i> Software Module for Calculating the Technical and Economic Indicators of Agricultural Chemicalization Machines
14:00-17:30	«BELAGRO» Exhibition
18:00-20:00	Dinner

Friday, June 7, 2024

Oral Session 7: Digital Technologies and Robotics in Crop and Livestock Production	
https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1	
Cochairs: Anton Yurin, Evgeniy Zhilich	
	<i>Dmitry Komlach, Evgeniy Zhilich, Rogalskaya Yu.N., and Nikonchuk V.V.</i> Research on improving the domestic herd management system
	<i>Evgeniy Zhilich and Rogalskaya Yu.N.</i> Research and Development of a Milking Equipment Positioning System for Robotic Milking Technology
	<i>Nikolay Bakach, Andrey Perepechaev, Volodkevich V.I., and Shakh A.V.</i> Scientific support for the creation of promising mechanization tools for agricultural production based on the implementation of a system of promising machines
	<i>Evgeniy Zhilich, Rogalskaya Yu.N., and Nikonchuk V.V.</i> Principles of development of robotic milking systems
	<i>Evgeniy Zhilich, Getsman S.A., Rogalskaya Yu.N., and Nikonchuk V.V.</i> Teat Detection Method for Developing Robotic Milking Systems
	<i>Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., Nikonchuk V.V., and Ekelchik O.L.</i> On the Issue of Intensifying the Mixing Process in the Preparation of Mixed Feed and Feed Mixtures
09:30-12:00	<i>Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., and Nikonchuk V.V.</i> Set of Equipment for the Production of Easily Digestible Feed for Cattle of Various Sex and Age Groups KOBK-1.5
	<i>Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., and Nikonchuk V.V.</i> Analysis of Mobile Technical Equipment for Preparing Feed for Feeding and Distribution
	<i>Anton Yurin and Viktorovich V.V.</i> The Relevance of the Development of a Wide-Spread Sprinkler System for the Natural Production Conditions of the Republic of Belarus
	<i>Dmitry Komlach, Vorobey A.S., and Anton Yurin.</i> An Electronic Analyzing Device for Setting Design Parameters and Operating Modes of Lines for Pre-Realization Preparation of Potatoes
	<i>Zheshko A.A.</i> Prospects for the Development of Robotic Technical Means for Applying Fertilizers and Chemical Plant Protection Products
	<i>Zheshko A.A., Lensky A.V., Volodkevich V.I., and Shah A.V.</i> Digitalization of the Process of Forming the Structure of the Fleet of Mobile Forage Harvesters
	<i>Azarenko V.V. and Zheshko A.A.</i> Analysis of Digital Tools for Studying the Properties of Solid Mineral Fertilizers and Other Bulk Materials
	<i>Dmitry Komlach, Goldyban V.V., and Selivanova V.P.</i> Requirements for Autonomous Mobile Units for Applying Plant Protection Products
	<i>Alexander Fokin, Natalya Zakharova, and Rashid Kurbanov.</i> Methodology for Determination of Agrotechnological and Physical-Mechanical Parameters of Soil Using UAV
12:00-12:30	Closing Ceremony https://us06web.zoom.us/j/88319865873?pwd=sVQzdjNgs397bfd8KBrWAPVL7DbnIn.1 Chair: Andrey Ronzhin, Nikolay Bakach
12:30-16:00	Historical and cultural complex “Stalin Line”. Presentation “Immortal Regiment”, dedicated to the 80th anniversary of the liberation of Belarus from Nazi invaders: “Development of memory culture in rural settlements of Russia and agro-towns of Belarus” (interregional public project “Memory of the Earth”). Banquet.

Abstracts

Plenary Session 1

Keynote speech 1



Dmitry Komlach, General Director of Republican Unitary Enterprise “Scientific and Practical Center of the National Academy of Sciences of Belarus on Agricultural Mechanization”, Candidate of Technical Sciences, Associate Professor, Minsk, Republic of Belarus.

Nikolay Bakach, Deputy General Director for Research of Republican Unitary Enterprise “Scientific and Practical Center of the National Academy of Sciences of Belarus on Agricultural Mechanization”, Candidate of Technical Sciences, Associate Professor, Minsk, Republic of Belarus.

Lecture Title: General Approaches and Ways of Implementing Digital Technologies in the Agro-Industrial Complex of Belarus.

Abstract: Technical re-equipment of the branch should become the basis for increasing the efficiency of agricultural production in the republic, and aimed at 1.2-1.3 times reduction of products’ energy and resource intensity, ensuring comprehensive mechanization of technological processes and release workers in agriculture from hard work, negatively affecting the living standards and health of the rural population. Automation and robotization of crop cultivation processes should play an important role in this. The presentation discusses the main directions of scientific and technological progress in the agriculture digitalization. Here presented the results of innovative developments at RUE “NPTS of the National Academy of Sciences of Belarus on agricultural mechanization” that implement technical vision, deep learning neural networks and elements of robotics.



Keynote speech 2



Agipar Bakyei, President of Mongolian Academy of Agricultural Sciences, Director of Research Center for Agricultural Economics and Development, Mongolian University of Life Sciences, Academician, Doctor of Economic Sciences, Ulaanbaatar, Mongolia.

Gombo Gantulga, Chief Scientific Secretary of the Mongolian Academy of Agrarian Sciences, Doctor of Technical Sciences, Ulaanbaatar, Mongolia.

Lecture Title: The Necessity and Potential for Integrating Digital Technology into the Mongolian Pastoral Livestock Sector.

Abstract: The traditional pastoral livestock sector serves as a fundamental cornerstone in Mongolia's economy. During the last three decades, fluctuating economic conditions, socio-political dynamics, and eco-climatic factors have exerted diverse influences on the state of this crucial industry. As an illustration, when comparing the year 2023 to 1990, the population of livestock has nearly tripled. Nonetheless, the primary resource crucial to pasture livestock farming the state and quality of pasture lands – is progressively declining from year to year. In present conditions of climate change, major tasks to ensure sustainable development of agriculture and food security for each country can only be solved by relying on scientific and technological achievements. The introduction of modern digital technology is highly significant in ensuring the optimal utilization of pasture resources, proper monitoring animal movements, and improving animal health services. The implementation of digital technologies in pastoralism faces several challenges, including 1) issues associated with the unique aspects of pastoral livestock herding methods and technologies; 2) inadequate development of infrastructure to support the implementation of smart technologies in animal husbandry; and 3) a lack of fully prepared professional human resources proficient in digital technology. This includes using satellite and sensor data to 1) test modern remote sensing methods for grassland monitoring; 2) creating a map of grassland biomass distribution; 3) some studies have been



conducted on the comparison and analysis of the relationship between pasture biomass and other factors. This presentation will introduce the main ways of introducing digital technology in Mongolian pastoralism.

Keynote speech 3



Shinde Gopal, Principal Investigator, NAHEP, World-Bank Project Centre and Govt. of India and Associate Professor of Mechanical Engineering, FMPE, CAET, VNMKV, Parbhani, India.

Lecture Title: Digital Farming Solution by Automation Using Agri-Bots, Agri-Drones, Agri-AGVs.

Abstract: Digital Farming Solutions (DFS) by Robot, Drones and AGVs in agricultural automation systems. The development of smart portable technologies with low-cost automation is one of the objectives as to support to a small and marginal farmer. The cotton-picking automation, camera-based pest detection, 3-D printing for drone and robot components, smart agricultural automation are current exercises of the world bank and Indian Council of Agricultural Research (ICAR) funded Centre of Excellence Project Centre in India for digital solutions in precision agriculture targeting the productivity enhancement. The practical experience shared while working with field robot, Drones (UAV), AGVs for farm operations using AI and ML which can be optimistic solutions in developing Decision Support System (DSS). Automation in agriculture using hybrid energy for automated field operational devices and machines are the new research field in agribusiness. The use of sensors using mechatronics system for precision agriculture can be beneficial to develop the low-cost technology-based devices for farmers or researchers. The present discussion focusing on digital technology with advancement in agriculture. The overall presently developed technologies and digital farming practices using Agri-bots, Agri-Drones and Agri-AGVs in precision farming system will be explained and exercised to best fitting purpose with commercialization opportunities at global level attention. The centre of excellence facilitating 6 field robots, 20 Agri-Drones, 10 AGVs, more than 20 digital technologies developed by centre of excellence to promote digital farming society in India. (<https://nahep.vnmkv.org.in>).

Keynote speech 4



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

Vyacheslav Yakushev, Head of the Laboratory of Information Support for Precision Agriculture, Agrophysical Research Institute, Candidate of Technical Sciences, Doctor of Agricultural Sciences, Corresponding Member of the Russian Academy of Sciences, St. Petersburg, Russia.

Lecture Title: Scalable Potential of Information Support for Modern Agriculture.

Abstract: Information support level substantially determines the validity and effectiveness of the choice of adaptive agricultural technologies in the production of crop products. The higher the level of intensification of agricultural technologies (normal (NT), intensive (IT), precision farming technologies (TK=PFT)), the more perfect should be the information support, envisioning a quantitative and qualitative growth in the volume of spatial and attribute data in the modern agriculture management. Application of NT, IT and PFT depends on the degree of intra-field heterogeneity. The higher the variability of intra-field changeability, the less effective NT and IT are (they are effective if the field is homogeneous), and the expediency of using agricultural PF methods in such a case increases. The presentation proposes to solve this problem using the Earth remote sensing data (RSD). The potential of RSD allows for the intelligent analysis of information characterizing the condition of crops over large areas, what is practically impossible when using ground-based measurements. There exists no



alternative as for remote sensing methods, tools and technologies. Developed by AFI functional of two new methods aimed at detecting and isolating boundaries of intra-field heterogeneity based on RSD data is considered. The first method uses geostatistics' tools, the other is based on an integral assessment of dynamics' changes in optical characteristics of agricultural plants. By the specialized computational experiments, the prospective role of their conjugate use is emphasized.

Keynote speech 5

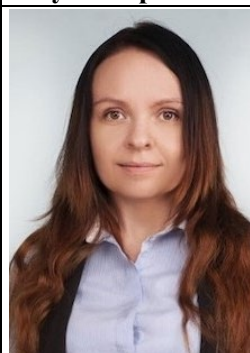


Alexander Bryukhanov, Director of IEEP – branch of FSAC VIM, Doctor of Technical Sciences, Corresponding Member of the Russian Academy of Sciences, St. Petersburg, Russia.

Lecture Title: Scientific and Technical Support for the Development of Digital and Engineering Solutions for Managing the Environmental Safety of Agroecosystems.

Abstract: Agriculture at the present stage plays a significant role in shaping the global environmental sustainability of the planet. The world production of agricultural products occupies 37.2% of the entire land area of the earth, uses 60-70% of fresh water out of global consumption, emits 15% of total greenhouse gas entering the atmosphere. Intensification of agricultural production allows to successfully solve the tasks of the food security doctrine, however, it creates a significant burden on the environment (increased waste generation, greenhouse gas emissions, emissions into water bodies, imbalance of agroecosystems in individual regions). The concept of an intelligent analytical software platform has been developed at FSBI FNAC VIM, which allows for solving the tasks of monitoring and assessing the environmental safety of agroecosystems, forecasting environmental impacts depending on scenarios of technological development of agricultural production and proactive management through the design and implementation of the energy-saving technologies (the best available technologies). Separate blocks have been developed and tested to assess and predict the diffuse impact on water bodies as a result of agricultural activities, a digital program for monitoring, evaluating and logistics of the use of organic fertilizers, an algorithm and a program for designing the best available technologies to process and use organic waste.

Keynote speech 6



Alyona Kodolova, Senior Researcher, Acting Deputy Director for Scientific Work of SRCES RAS – SPC RAS, Candidate of Law, St. Petersburg, Russia.

Lecture Title: Digitalization of Agriculture in Russia and Belarus: Problems of Legal Regulation.

Abstract: Global processes of implementing digital solutions in agriculture allow to state that the digital transformation of agriculture is no longer a plan for the future; it is rather an actively developing process for today. Innovative digital technologies help agricultural businesses to enhance labor productivity, optimize costs, and increase the competitiveness of agricultural products. The law often does not outstrip, but "follows" and often lags behind the digital technologies being introduced in agro-industrial production. The main task of legislative regulation in the agriculture's digitalization is to create a regulatory framework that corresponds to current trends and contains conditions for the further development of digital technologies in the agro-industrial sector. The presentation proposes a comparative legal analysis of the current legislation of the Russian Federation and the Republic of Belarus in the agriculture digital transformation, including strategic documents setting targets for the government programs aimed at digitalization of agriculture, laws and regulations governing various areas for application of digital technologies, starting from the development and the use of automated information systems to the use of unmanned aerial vehicles and artificial intelligence at the production of agricultural products.

Oral Session 1: Digital Technologies, Robotics and Organic Crop Production



Kavin Sundarr, Rohan Inamdar, SENSE, Vellore Institute of Technology, Chennai, Tamil Nadu, India.

Gopal Shinde, VNMKV, Parbhani, India.

Lecture Title: Voice-Controlled Autonomous Agri-Robot for Organic Farming Pest and Disease Monitoring.

Abstract: Safeguarding agricultural crops, particularly against threats such as pink bollworm infestations, is paramount for sustaining agricultural productivity. Our research paper proposes a novel solution for autonomous crop monitoring and protection by integrating the Robot Operating System (ROS) and a robust detection model. The study introduces an autonomous robot capable of identifying pink bollworm infestations and tracking diseases impacting cotton yields. Leveraging drones for field assessment, the robot's path planning is intricately linked to this process. Additionally, a customized dataset is created to enhance the robot's detection abilities, using which a YOLOV8 model is trained, exhibiting a performance metrics: mean Average Precision (mAP) of 67.1%, Precision of 67.9%, and Recall of 61.8%. Furthermore, the paper proposes integrating voice command control for the robot to address challenges posed by difficult terrains. This feature allows for guided navigation and recovery using voice commands when encountering obstacles or challenging environments. By incorporating voice control, the system minimizes the need for human intervention in robot recovery, enhancing operational efficiency and reducing labour requirements. The integrated system represents a digital solution tailored for organic farming, offering flexibility beyond cotton crops to address diverse agricultural challenges. This research presents a novel and comprehensive approach to autonomous crop monitoring and protection, addressing specific challenges posed by pink bollworm infestations and crop diseases in cotton cultivation.



Nosyrev I.N., State Scientific Institution "The Joint Institute of Mechanical Engineering of the National Academy of Sciences of Belarus", Minsk, Republic of Belarus.

Andrey Savchits, "MAZ" OJSC – management company of the BELAVTOMAZ Holding, Minsk, Republic of Belarus.

Mikhail Tatur, Dmitry Pertsev, Belarusian State University of Informatics and Radioelectronics, Minsk, Republic of Belarus.



Lecture Title: Open architecture of the control system of a mobile robotic platform: from ontology to technical solution

Abstract: Approaches to the design and construction of open architectures and problems arising at the systemic design are considered. A distributed control system for an electric motor vehicle is proposed as an element of an open architecture.



Alexey Stepanov, Lyubov Illarionova, Tatyana Aseeva, Artem Polyakov,
Lecture Title: The Use of Satellite Monitoring and Aerial Photography Data to Assess the Heterogeneity of Agricultural Crops in the Khabarovsk Territory.

Abstract: Assessment of crop heterogeneity using remote sensing data is an urgent task of digital agriculture. NDVI values were calculated for arable lands of the Khabarovsk Territory from Sentinel-2 images with a resolution of 10m. A cluster analysis of NDVI time series in 2022 was carried out to assess the heterogeneity of soybean, oat, corn and buckwheat crops at the regional level. Two clusters were described for soybeans, one of which represented clogged fields in 2022, and the average seasonal course of NDVI in this cluster in July-August corresponded to fallow lands. For four crops of the Khabarovsk Territory, the characteristics (NDVImax, DOYmax) of the average seasonal course of NDVI and the time series of each cluster were established. A comparative assessment of the heterogeneity of crop development within the same field was carried out using UAV and satellite data, while the NDVI distribution obtained from satellite images corresponds

	<p>to the spatial distribution of NDVI according to the DJI Mavic3M UAV data. At the next stage of the research, it is planned to analyze the within field heterogeneity of crops for other crops of the Khabarovsk Territory using satellite monitoring, which will significantly reduce the cost of obtaining and analyzing UAV images.</p>
	<p>Alexey Petrushin, Agrophysical Research Institute, St. Petersburg, Russia. Lecture Title: Methodological approaches to determining the state of drainage systems based on remote sensing. Abstract: The condition of the reclamation infrastructure facilities directly affects the effectiveness of the management of the use of agricultural reclaimed lands and represents a serious productive and environmental problem of society in cases of their degradation. One of the key factors in these processes is the decline and inefficient use of existing drainage systems. As an inexpensive and promising method for assessing the condition of drainage systems of an agricultural field, it is recommended to use data from remote sensing of the earth, an application is being considered that allows obtaining operational and high-quality information. The paper describes the main stages of obtaining and processing remote sensing data using an automated unmanned aircraft (Geoscan 401 quadcopter), which are used to solve the following tasks: determining the location of a closed drainage system of an agricultural field, localizing its malfunctions; determining the degree of overgrowth of an open drainage system, evaluating the effectiveness of drain-age systems and fixing the boundaries of field sections, subject to water erosion. Specific examples of solving these problems are given, as well as approaches to using aerial photography data to compile orthophotographs linked to the global positioning system for the formation of terrain models, models of water flows in agricultural fields.</p>
	<p>Vladislav Minin, Anton Zakharov, Institute for Engineering and Environmental Problems in Agricultural Production – Branch of Federal Scientific Agro Engineering Centre VIM, Moscow, Russia. Sergey Melnikov, St. Petersburg State Agrarian University, Pushkin, St. Petersburg, Russia. Lecture Title: Optimization of Organic Potato Cultivation Technology with due Account for Changing Weather Conditions on Northern Territories. Abstract: The research aimed developing a cultivation method of organic potato in the northern territories. The field experiment with Udacha potato variety was a part of the crop rotation started on experimental facilities of IEEP. The test field had a soddy-podzolic, light loamy, gleyic soil with neutral reaction and high organic matter content. The technology of organic potato cultivation was developed in IEEP. It included application of one or two doses (from 60 to 160 kg N ha⁻¹) of BIAGUM compost, prepared from poultry manure, and polyfunctional biologic Kartofin. Weather conditions differed by the experiment years (2019-2023). The driest summer period was in 2021. The dependence of nitrification rate on the air temperature and precipitation for the period from the end May to the end June was found statistically reliable. Potato productivity depended on weather conditions too. The maximum yield (more than 30 or about 30 t ha⁻¹) was achieved when using the maximum dose of compost in 2019, 2020 and 2023. The study established statistically reliable dependence of the standard tuber yield on the soil nitrate con-tent, compost application dose and hydrothermal coefficient in some summer months. The Biologic Kartofin was most efficient against a complex of fungal dis-eases.</p>



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

Lecture Title: Models and algorithms for proactive planning of grass feed production.

Abstract: To solve the problems of proactive operational planning of grass feed production (GFP), a special model-algorithmic software has been developed, based on complex modeling, where technologies of proactive management of various types of resources are applied, thus, providing decision makers with the opportunity to perform multivariate forecasting, ensuring prediction and prevention of possible adverse situations caused by disturbing environmental influences. The logical-dynamic models of proactive planning proposed in the report are complemented by fuzzy-probability models, the synthesis of which uses explicit and implicit expert knowledge, which makes it possible to constructively transform the available qualitative information into quantitative information when describing complex spatial-temporal, technical and technological constraints. For concretization, the article does not consider all stages of the GFP process, but only the final stage, at which grasses are harvested for subsequent harvesting of specific types of feed. The effect of the proposed approach is demonstrated by the example of solving the problem of operational planning of GFP processes for cattle.



Yuri Blokhin, Agrophysical Research Institute, St. Petersburg, Russia.

Lecture Title: Wireless hybrid sensor network for agriculture monitoring.

Abstract: In this paper, the development of a hybrid wireless sensor network (WSN) for agriculture monitoring is presented. The system was set up to monitor crop state, weather conditions and soil characteristics in real time in accordance with the application's needs of three communication technologies: IEEE 802.15.4/ZigBee, WIFI and LTE 4G as a part of Internet of Things (IoT). Two types of sensor nodes were developed: a mobile sensor node with an optical camera and a sensor node with a soil moisture and temperature sensors. A base station operating as network coordinator was developed to monitor meteorological characteristics. Server with the necessary functionality was constructed for data collection, structuring and storage. The database software provides the search and downloading the information necessary for verification of models and the decision-making process. All subsystems used in this study were developed using commercial components and free or open-source software libraries. The developed hybrid WSN realizes the possibility of creating a modular system using inexpensive off-the-shelf components. Moreover, this paper presents design details of the proposed system and field experiment results for function validation. The developed WSN system with Internet of Things (IoT) support had laid a foundation for smart farming. For future applications, the system could be further modified and developed for precision agriculture.



Oleg Mikityuk, Natalia Statsyuk, Tatyana Nazarova, Federal State Budgetary Scientific Institution "All-Russian Research Institute of Phytopathology", Bolshie Vyazemy, Moscow region, Russia.

Yuri Denisenko, Arkady Sinitsyn, Federal State Budgetary Scientific Institution "All-Russian Research Institute of Phytopathology", Bolshie Vyazemy, Moscow region; Federal State Institution "Federal Research Center "Fundamentals of Biotechnology" of the Russian Academy of Sciences", Moscow, Russia.

Lecture Title: Enzymatic Detoxification of Zearalenone-Contaminated Wheat and Corn Grain Using a Recombinant Zearalenone Hydrolase from *Clonostachys Rosea*.

Abstract: Zearalenone (ZEN) produced by some *Fusarium* fungi is one of the most prevalent mycotoxins in forage. Due to restrictions in the organic

agriculture, biodegradation of this and other mycotoxins is more preferable way to control these contaminants. Here, a purified recombinant ZEN-specific lactonohydrolase (rZHD) from *Clonostachys rosea* expressed in *Penicillium canescens* PCA-10 was evaluated for its ZEN-degrading activity in both model solutions and naturally infected wheat and corn grain under optimal conditions (30°C, pH 8.5). ZEN degradation dynamics in a model solution containing purified rZHD showed the most part of the toxin was degraded after 3 h of incubation; no residual ZEN was revealed after 12 h of incubation. Inoculation of wheat and corn grain with toxigenic *F. Culmorum* strain BR-03-21 resulted in ZEN accumulation up to 15–25 mg/kg. The subsequent 12-h enzymatic treatment provided degradation of 63 (wheat) and 55% (corn) of accumulated ZEN; to the end of a 24-h treatment, only 2.0 and 9.5% of ZEN remained in these samples, respectively. A complete ZEN removal from both samples was revealed after 48 h of the treatment. Due to such activity and the earlier revealed ability to work at low-temperature (10°C) conditions, the enzyme is promising for practical application.



Oleg Mikityuk, Tatyana Nazarova, Larisa Shcherbakova, All-Russian Research Institute of Phytopathology, Bolshie Vyazemy, Moscow region, Russia.

Igor Sinelnikov, All-Russian Research Institute of Phytopathology, Bolshie Vyazemy, Moscow region; Federal Research Centre “Fundamentals of Biotechnology”, Russian Academy of Sciences, Moscow, Russia.

Lecture Title: Post-Harvest Biodegradation of Aflatoxin B1 in Rice Grain and Peanut Seeds Infected with *Aspergillus Flavus* Using a Recombinant Oxidase from *Armillaria Tabescens*.

Abstract: Post-harvest contamination of agroproducts including rice and peanut with aflatoxin B1 (AFB1) produced by *Aspergillus flavus* is a global problem in conventional and sustainable agriculture. AFB1 degradation by microbial enzymes, which convert this dangerous compound to non-toxic or less toxic derivatives, is considered as a promising detoxification approach that meets the main principles of organic farming. Advanced technologies of protein heterologous expression open wide avenues for large-scale production of such enzymes. In this study, we used a recombinant extracellular AFB1 oxidase (rAFO) from *Armillaria tabescens* expressed in *Pichia pastoris* yeast cells to degrade AFB1 in rice grain and peanut seeds artificially inoculated with a toxigenic *A. flavus* strain. The homogenous enzyme was purified from cell-free culture liquid using immobilized metal affinity chromatography. Treatments of the infected samples with an aqueous solution of freeze-dried rAFO preparation for 72 h at 30 or 20–22°C resulted in a significant (2.5- and 3-fold) reduction in the mycotoxin contamination of peanut and rice, respectively. The obtained results showed rAFO may be promising as an environment-friendly tool for providing the safety of organic agricultural production. The possibilities to improve some rAFO characteristics to promote the practical application of the enzyme are discussed.





Buddhabhushan D. Wankhade, Department of Soil Science and Agricultural Chemistry, COA, VNMKV, Parbhani, Maharashtra, India.




Syed Ismail, College of Agriculture, Parbhani, Maharashtra, India.

P.H. Gourkhede, Department of Soil Science and Agricultural Chemistry, COA, Parbhani, Maharashtra, India.

Lecture Title: Smart Agriculture in Southeast State of Brazil: An Overview of Technology and Adoption.

Abstract: At the second decade of the 21st century, the use of a new set of agricultural technologies, such as smart farming (SF), emerge among agribusiness organizations and agents. This study aims to identify the smart farming technologies used in grain production systems in Brazil and to verify the perception of the farmers regarding technical assistance for SF. A survey was conducted with farmers and 119 valid observations were collected. The

	<p>study used non-probabilistic sampling, since it considered grain farmers whose farms produced more than 50% of their gross revenue in grains. Descriptive and content analysis were used to analyze the data. The results indicate that soil sampling is the main precision agriculture technology adopted by the production systems assessed, while smartphone applications to assist in agricultural management are the most used information technology. The machines used in grain production systems are undergoing a digitization process, especially due to the increase in availability of equipment with sensors and automated processes. However, the question remains about the capacity of farmers and assistance agents to monitor and take advantage of the potential of SF technologies in farms.</p>
	<p>Tekale Dayanand Devidasrao, VNMKV, Parbhani, India. Lecture Title: Smart Portable Machinery for Organic Farming. Abstract:</p>
	<p>Bhagwan Asewar, Department of Agronomy, VNMKV, Parbhani, India. Lecture Title: Plant health management in Bt. cotton through foliar nutrition using SPAD meter. Abstract: In India Bt. Cotton is cultivated on 122 lakh ha with production of 361 lakh bales and productivity is 501 kg lint ha⁻¹. In Maharashtra it is grown on 41 lakh ha area with productivity of 81 lakh bales and productivity is 334 kg lint ha⁻¹. Bt cotton is predominately grown under rainfed condition in Marathwada region of Maharashtra state which is cash crop of the region. The productivity of rainfed Bt. Cotton particularly in Marathwada region is highly influenced by occurrence of dry spells during crop growth period. Hence to overcome the moisture stress under dryspells condition and to obtain the sustainability in productivity, the measures like foliar application of potassium nitrate, water spray and other micronutrients are very essential for reducing the effect of dryspells. Keeping this view in consideration an experiment was conducted during kharif season of 2017 to 2019 at All India Coordinated Research Project for Dryland Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra. The experiment was laid out in split plot design with three replications. Main plots were assigned with foliar spray during dry spell and foliar spray after relieving of stress/ dry spell and in subplot there were eight different foliar sprays treatments. The experimental soil was medium black with ph 8.1, organic carbon 0.50 % and contained low nitrogen (150 kg ha⁻¹), low phosphorous (12.1 kg ha⁻¹) and high potassium (498 kg ha⁻¹). The cotton hybrid Ajit 155 was used for sowing. Bt. Cotton was sown with recommended spacing of 120 cm X 45 cm and recommended dose of fertilizers (120:60:60 NPK kg ha⁻¹). The nitrogen dose was applied in three splits. The full dose of phosphorous and potassium was applied at the time of sowing. The foliar sprays were undertaken as per the treatments. Chlorophyll content was determined using SPAD meter, normalized difference vegetative index was determined using Hand Held Green Seeker and percent relative water content was determined by standard formula. The data on Bt. Cotton seed yield was collected and accordingly net monetary returns and benefit cost ration were worked out. The results revealed that application of foliar spray of KNO₃ was significantly superior in respect of increase in cotton seed yield as well as net returns as compared to other treatments. Similarly, application of foliar spray during dryspell was</p>

	<p>found superior than application of foliar spray after dry spells. The chlorophyll content, percent relative water content and normalized difference vegetative index were also found higher under application of foliar spray which reflected in enhancing Bt. cotton productivity.</p>
<p>Online Oral Session 2: Interdisciplinary Aspects of Organic Production</p>	
	<p>Evgenia Rakhimova, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Institute of Agricultural Economics and Rural Development, Pushkin, St. Petersburg, Russia.</p> <p>Lecture Title: Organic Beef Production in Russia: Overview of Development Opportunities.</p> <p>Abstract: The growing demand for high-quality organic beef both in the world and in Russia opens up great opportunities for the development of this industry. A number of domestic and foreign scientists are studying the issue of organic beef production, who note the constant growth of the organic sector. The purpose of this study is to identify opportunities and prospects for the production of organic beef in Russia. The monographic method, analysis and synthesis, and a systematic approach were used. An analysis of Russian producers of organic beef, its processed products and organic feed for cattle led to the conclusion that the main ones are concentrated in the Central Federal District, while Russia has a large unrealized potential for the production of these types of products and the use of existing experience will speed up the process of involvement in organic production in other regions of the country. The SWOT analysis showed that, in general, the development of organic beef production in Russia faces some difficulties that require an integrated approach and cooperation between the state, scientists, producers and consumers. Only in this way can the sustainable and successful development of this promising industry be ensured.</p>
	<p>Dmitry Komlach, Zheshko A.A., Lensky A.V, RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Results of the development of an algorithm for digitalization of economic accounting and planning in agricultural production using the example of the cultivation of grain crops.</p> <p>Abstract: The article presents the results of developing an algorithm for digitalization of economic accounting and planning in agricultural production using the example of cultivating grain crops, which is a basic component of the information and computing system for organizing mechanized work, the concept and main software modules of which are being developed as part of research conducted with the support of the Belarusian Republican Foundation for Basic Research (agreement with BRFFR No. T23MN-004 dated 05/02/2023).</p>
	<p>Petr Akmarov, Olga Knyazeva, Dmitry Kondratiev, Udmurt State Agrarian University, Izhevsk, Russia.</p> <p>Mircharip Gazetdinov, Kazan State Agrarian University, Kazan, Republic of Tatarstan, Izhevsk, Russia.</p> <p>Lecture Title: Econometric Method for Assessing the Level of Digitalization of Regional Agriculture.</p> <p>Abstract: The development of digital transformation processes in agriculture is uneven, and the existing methods for assessing the level of digitalization of business do not take into account industry characteristics, and therefore are not accurate and not objective. The article proposes a new approach to the integrated assessment of digitalization of agricultural business, which is based on an econometric model. In this model, a comprehensive assessment of digital transformation is determined for each specific type of digital technology according to its role in increasing production. The study shows that today the most important and essential technologies for increasing agricultural production are technologies using geoinformation systems, the Internet of Things and industrial robots. The authors propose to evaluate the contribution</p>

	<p>of each technology to the integrated digitalization index by the degree of influence of this technology on the result of production based on correlation and regression analysis. The role of an individual technology in the integral index is determined by its weight, proportional to the regression coefficient in the model of the influence of digital technologies on production efficiency. The proposed methodology can be used to assess the level of digitalization of agriculture in the region and in a separate organization.</p>
	<p>Khapsat Dibirova, Natalya Osipova, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Institute of Agricultural Economics and Rural Development, Pushkin, St. Petersburg, Russia.</p> <p>Lecture Title: Increasing the Investment Activity of Organic Producers in Russia.</p> <p>Abstract: The article considers the urgent problem of stimulating investments in organic agriculture in order to increase production efficiency and sustainable development of the industry. Organic agriculture is an important sector of the economy that contributes to the preservation of the environment, ensuring food security and improving product quality. The authors of the article analyze the main problems hindering the investment activity of organic producers and propose effective ways and mechanisms to encourage investment in this sector. Financial instruments, government support, certification mechanisms and marketing strategies that help to involve investments in organic agriculture are considered. In conclusion, the article concludes that increasing the investment activity of organic producers is a necessary condition for the development of organic agriculture. The study reveals the importance of investments in organic production for the industry's growth, promoting innovation and increasing competitiveness in global markets. The results of the study can be used to develop strategies and programs to develop the investment activity of organic producers, contributing to the sustainable and effective development of this sector of agriculture. The investment lines of the leaders of organic agricultural production in Russia were studied.</p>
	<p>Natalia Nikonova, Aleksey Nikonov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Institute of Agricultural Economics and Rural Development, Pushkin, St. Petersburg, Russia.</p> <p>Lecture Title: Pricing Strategy in the Activities of Organic Producers.</p> <p>Abstract: The growth in the supply of organic products increases the urgency of the problem of its constant sale at attractive prices for consumers. Therefore, the purpose of the study was to analyze price strategies and tasks for their improvement to ensure a stable position of producers in the market of organic goods. A system-targeted approach, methods of comparative and factor analysis of pricing, as well as statistical information processing were used. The modern economic conditions and the reasons for price changes in the organic market are investigated from the standpoint of their acceptability and possible consequences for the economic situation, the types of price strategies of commodity producers are shown. The factors of the formation of the price structure, their quantitative parameters and the possibility of price positioning of producers to obtain the desired income are analyzed. An assessment of the features of the pricing strategies of organic producers implemented in practice and the necessary measures to optimize pricing has been carried out. Strategic decisions taken by representatives of small and large businesses during the implementation of pricing policy are considered. It is concluded that it is necessary to strengthen public-private partnerships to ensure the sustainable development of organic production.</p>



Zinaida Kotova, Tatiana Danilova, North-West Centre of Interdisciplinary Researches of Problems of Food Maintenance –structural division of the St. Petersburg Federal Research Center of the Russian Academy of Sciences, Pushkin, St. Petersburg, Russia.

Leonid Danilov, All-Russian Research Institute of Plant Protection, Pushkin, St. Petersburg, Russia.

Lecture Title: Biological Protection of *Solanum tuberosum* L from Pathogens Using Symbiotic Bacteria *Xenorhabdus bovienii* Entomopathogenic Nematodes.

Abstract: The results of studies conducted in 2022-2023 on the use of symbiotic bacteria *Xenorhabdus bovienii* entomopathogenic nematodes (f. Steinernematidae) against pathogens of potato tubers (*Streptomyces scabies*., *Rhizoctonia solani*) in the conditions of the European North of Russia as a method of biological protection of potatoes are presented. Immunological assessment of tubers after harvesting showed not only a decrease in the spread of *R. solani* and *S. scabies* by 52-64% and 14-52% compared to the control, but also their development to 33-83% and 14-52%, respectively. The most effective option is double treatment with an aqueous suspension of live cultures of symbiotic bacteria *X. bovienii* (EPN-1), in which the degree of development of disease symptoms on tubers decreased to 3% compared to the control (21%). The biological effectiveness of using EPN-1 for scab was 27-39%, for rhizoctonia – 29-31%. The yield of potato tubers depended on the frequency of treatments and amounted to 23.53-27.78 t/ha according to the experimental options. It was greatest with double treatment of vegetative plants with EPN-2, higher than the control by 16%, respectively. Thus, significant potential for the use of biologically active secondary metabolites of *Xenorhabdus* sp. has been identified as biological means of protecting potato tubers from pathogens.



Maria Kuznetsova, All-Russian Research Institute of Phytopathology, Bolshie Vyazemy, Moscow region, Russia.

Lecture Title: Use of Biological and Chemical Fungicides and Biostimulators for Potato Protection Against Early and Late Blights.

Abstract: Ecological risks and health concerns associated with the use of chemical pesticides encourage application of biopesticides in the integrated pest control. We compared the biological and economical efficiency of a commercial contact fungicide Manfil (a.i. mancozeb) and a complex Agat-25K biopreparation (both either solo, or combined with the ExelGrow biostimulator) against the late (LB) and early (EB) blights of potato. Field experiments were arranged on three potato cultivars (Arizona, Vektor, and Aluett) differing in their resistance to these diseases. The leaf blight development was contributed by LB (Arizona), LB+EB (Vektor), and EB (Aluett). Agat-25K delayed the LB development under epiphytotic conditions on susceptible cv. Arizona (biological efficiency 39%), though was inferior to Manfil (62%). Compared to the control, the yield increase for the Agat-25K and Manfil variants was 158 and 254 centner/ha, respectively, and the tuber marketability increased by 28 and 13%, respectively. For moderately resistant and resistant cultivars (Vektor and Aluett), Agat-25K provided the highest yield increase compared to Manfil (191 vs. 167 and 45 vs. 14 centner/ha, respectively); the tuber marketability increased by 15 and 18%, respectively. For cv. Aluett, Agat-25K also showed a more significant EB suppression than Manfil (96 vs. 83%, respectively). The ExelGrow application together with the studied preparations additionally improved the biological efficiency of protection, yield, and marketability of potato. Thus, Agat-25K can be recommended for use on moderately resistant cultivars under sporadic LB epiphytotic as well as for the EB control.



Irina Mikheeva, Institute of Soil Science and Agrochemistry, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia.

Lecture Title: Information and Digital Methods for Assessing Soil Transformation of Agroecosystems under Anthropogenic Influence and Climate Change.

Abstract: The introduced information characteristics are a more reliable means of assessing differences in the severity of soil properties than their average values and statistical characteristics of variation. A digital information assessment of changes in chestnut soils and southern chernozems under the influence of arable use and the climate warming trend in the last third of the twentieth century in the south of Western Siberia was performed.



Victoria Bardina, Alexander, Gerasimov, Tamara Bardina, 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, St. Petersburg, Russia.

Lecture Title: Study of the Use of Organic Additives to Improve the Fertile Properties of Soil after Sifting.

Abstract: The possibility of using the soil passed through a sifter to transform it into a fertile layer on disturbed areas is considered. These soils may be contaminated with various toxic substances. Joint use of chemical-analytical methods and biotest systems with the test-cultures from different systematic groups allows for increasing the reliability of studies to assess the quality of soil. So, the degree of its ecotoxicity was determined and the soil hazard class was set. This approach to soil quality assessment can be recommended for environmental quality control purposes. In the laboratory vegetation experiment the possibility for restoring the soil ecological properties after screening and the possibility of increasing its fertility with promising ameliorants like manure, biohumus and peat were considered. The experiment has accounted for plant biomass of lawn grasses that serves as an integral indicator of vegetation productivity in assessing the physiological state of plants. The possibility of using the increase in soil fertility at the generating of a fertile layer in the areas of disturbed lands was set. The results of this research can be used in the development of technical specifications for the production of nutritious soil.



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




Svetlana Maksimova, Scientific and Practical Center of the National Academy of Sciences of Belarus for Bioresources, Minsk, Belarus.

Viktar Lemeshevsky, International Sakharov Environmental Institute of Belarusian State University, Minsk, Belarus; All-Russian Research Institute of Physiology, Biochemistry and Nutrition of Animals – Branch of the Federal Research Center for Animal Husbandry named after Academy Member L.K. Ernst, Borovsk, Russia.

Lecture Title: Utilization and Recycling of Agricultural Waste with the Help of Biological Objects.



Abstract: Currently, the poultry industry is showing an intensive development trend, which has led to a high concentration of poultry manure. Due to imperfect disposal methods and the lack of processing technology, handling poultry manure is difficult. If measures are not taken to dispose of feces effectively and promptly, large amounts of feces can accumulate near poultry farms, causing potential harm to the environment and human health. To study the effects of earthworm rearing using different bird droppings as base material on the survival, growth and development of earthworms, this paper uses bird droppings with different fermentation periods as experimental factors to conduct earthworm survival and chicken and duck droppings analysis. and goose manure during different periods of fermentation. An acute toxicity test was carried out, based on which the possibility of using cattle manure and crop

	<p>waste as a breeding substrate was tested. Experimental results show that chicken manure (depending on the fermentation period) is suitable for earthworm colonization and can serve as a substrate when adding cow manure and other crop wastes. At the same time, 100% fermented goose and duck manure can also be used as a substrate for earthworm breeding. And through the vermicomposting process, an efficient and long-lasting organic fertilizer (bio humus) is obtained.</p>
 	<p>Anna Ukolova, Denis Bykov, Russian State Agrarian University – Moscow Timiryazev Agricultural Academy, Moscow, Russia.</p> <p>Lecture Title: Clustering of Household Plots Using Self-Organizing Maps.</p> <p>Abstract: The paper considers a methodology for typing household plots at a settlement in the Astrakhan region of the Russian Federation, implemented through cluster analysis based on the Self-Organizing Maps (SOM). In the result, 3 clusters were formed: a small cluster of 125 large households (C1), a small cluster of 370 medium-size households (C2) and a large cluster of 1879 small households (C3), the silhouette coefficient was 0.56. Using the SOM map graph, the 3 largest households assigned to cluster C1 were identified. The specialization of cluster C1 is primarily livestock-raising and consists in cattle breeding (the share is 78.9%), this cluster is also distinguished by the presence of 100% of the settlement's pastures (all pastures belong to the households of this cluster), the breeding of 98% of goats, 91.7% sheep. The specialization of cluster C2 for breeding dairy cattle has been set (the share of livestock was 43.9% of the total household plot's livestock of the settlement). Cluster C3 is distinguished by a large area of perennial crops (the share is 79.4%), specialization in breeding pigs (the share in the settlement is 76.6%) and poultry (72.9%).</p>
	<p>Pritam Bhutada, VNMKV, Parbhani, India.</p> <p>Lecture Title: Study on nutrient management in upland rice intercropping system in rainfed region of Maharashtra.</p> <p>Abstract: Irrigated flooded rice monocropping systems have been demonstrated to be harmful to biodiversity and the environment, as freshwater is becoming increasingly scarce. These systems require the use of agrochemicals and have a water footprint that is 2-3 times larger than that of upland crops. For environmental reasons, this means that upland rice should be prioritized. Consequently, intercropping has long been recognized as a sort of biological insurance against dangers and anomalous rainfall behavior in arid regions. Using the largest amount of soil, water, nutrients, and sunlight possible, it increases cropping intensity, yield, and profitability. By improving the physical properties of the soil, enhancing its fertility, and reducing runoff, intercropping legumes with grains not only boosts overall productivity and revenue but also preserves moisture. Legumes, such as green gram, have a short lifespan and could be used as an intercrop with upland rice in environments that receive rain. Through intercropping, the current study intends to diversify upland rice and improve and stabilize the productivity of rainfed uplands. With this aspect a field experiment was conducted at the Upland Rice Research Farm of Vasantrao Naik Marathwada Krushi Vidhyapeeth, Parbhani during kharif season of 2018-2020 to evaluate the performance of intercropping with upland rice under rainfed condition of Maharashtra region. The treatments consisted of 5 nutrient management treatment in main plot and in sub plot 5 intercropping combinations of rice with soybean and green gram with different plant populations and replicated thrice in spilt plot design. The result of pooled mean indicated that highest rice grain yield, soybean and rice equivalent yield was observed with 75 % RDF + 5 t FYM/ha and it was found to be significantly superior over rest of the treatments. Highest rice grain yield was observed with sole crop, however, highest intercrop seed yield and rice equivalent yield was recorded with rice + soybean (3:2) intercropping system followed by Rice + Black gram (3:2 in replacement series) in rainfed areas of Maharashtra region.</p>

Oral Session 3: Digitalization and Organic Animal Husbandry: Poultry Farming, Dairy Production and Aquaculture



Roman Nekrasov, Evgenia Tuaeve, Magomed Chabaev, Nadezhda Bogoluybova, L.K. Ernst Federal Research Center for Animal Husbandry, Dubrovitsy, Moscow region, Russia.

Lecture Title: Use of *Hermetia Illucens* Larvae Fat in Calves' Feeding

Abstract: Insects are good sources of lipids and fatty acids that can be utilized in animal feed. In an experiment on calves of the dairy period of rearing the efficiency of fat utilization obtained from *Hermetia illucens* larvae (F-Hil) was studied. Animals of the control group were fed a balanced ration accepted in the farm in terms of energy and nutrients, while the experimental group was fed 10 g of F-Hil in addition to the basic ration daily individually in the morning feeding with milk. Feeding fat already in the first month of the tests resulted in an increase in ADG by 24.4% ($p < 0.001$), and in the second month – by 20.3% ($p < 0.003$), respectively, compared with the control. The average increase in ADG over the 2-month experiment period was 22.0% ($p < 0.001$) in the experimental group. Analysis of clinical and biochemical blood parameters of experimental calves at the end of the experiment did not reveal significant differences in the values of indicators between the groups. Calculation of economic efficiency showed that feeding F-Hil to heifers during the dairy period of rearing is justified and provides a profit.



Vladimir Surovtsev, Yulia Nikulina, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Institute of Agricultural Economics and Rural Development, Pushkin, St. Petersburg, Russia.

Alexandra Zaytseva, Sergey Kuleshov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences, St. Petersburg, Russia.

Lecture Title: Evaluation Model for Digital Technology Efficiency: the Example of Intelligent Digital Video Monitoring of Early Disease Diagnosis and Physiological Cows' Condition.

Abstract: The paper analyzes the effectiveness of intelligent video monitoring system (IVMS) of early diagnosis of diseases and the physiological state of cows by the developed model. The research method is modeling the assessment of the economic efficiency of innovative solutions for managing complex production processes for exercising variant calculations. The possibilities of digital intelligent systems of video monitoring and herd management at solving problems of qualitative improvement of cows' health control, early diagnostics of common diseases, increase of herd reproduction indicators are considered. Approaches to improving the methods of calculating the main efficiency indicators in dairy cattle breeding according to the tasks of expanded herd reproduction, reducing losses caused by the sale of young high-yielding cows at the height of lactation, and increasing the volume of breeding sales are proposed. The developed model allows for taking into account the aggregate effectiveness and economic efficiency of dairy cattle when implementing capital-intensive intelligent digital technologies. The model has been tested for variant calculations of performance indicators in the implementation of technological solutions that increase objectivity of economic efficiency evaluations of intelligent digital technologies for herd monitoring, the payback period at their design and implementation stage.





Konstantin Ostrenko, Anastasia Ovcharova, Nadezhda Belova, Ivan Kutysin, Kirill Koltsov, All-Russian Research Institute of Physiology, Biochemistry and Nutrition of Animals – Branch of the L.K. Ernst Federal Research Center for Animal Husbandry, VNIIFBiP, Borovsk, Russia.

Vyacheslav Rastashansky, Normopharm – Skolkovo, Skolkovo Innovation Center, Moscow, Russia.

Natalia Nevkrytaya, FSBSI “Research Institute of Agriculture of Crimea”, Simferopol, Republic of Crimea, Russia.

Lecture Title: The Effect of an Emulsion Based on Coriander (*Coriándrum Sátivum*) and Fennel (*Foenículum Vulgáre*) on the Expression of Genes Forming the Immune Status of Dairy Calves.

Abstract: In the early period of ontogenesis, the entire digestive system is formed, especially the mucous membrane lining the entire surface of the hollow organs of the digestive system and representing a large contact surface for food and various antigens. The purpose of this research was to study the effect of a feed additive based on a mixture of essential oils of coriander and fennel on the immune status of calves during the milk-feeding period. The results of the study showed that the expression level of the proinflammatory cytokines IL6 and IL8, used to destroy antigens, was higher in the experimental group. Decreased expression of SIRT3 in the control group is reduced, which is the main factor associated with low metabolic activity, including the accumulation of lipid droplets inside the cell, which contributes to a decrease in energy supply and survival of the body. In the experimental groups, an increase in the expression of the SIRT3 gene reflects factors of increased productivity and nonspecific resistance of dairy calves. The data obtained may indicate that when using a feed additive based on essential oils, it has a pronounced immunostimulating effect, contributes to an increase in the nonspecific resistance of calves.



Elena Yildirim, Larisa Ilina, BIOTROF+ Ltd; Federal State Budgetary Educational Institution of Higher Education “St. Petersburg State Agrarian University”, Pushkin, St Petersburg, Russia.

Georgi Laptev, Daria Tyurina, Valentina Filippova, Andrei Dubrovin, Natalia Novikova, Kseniya Kalitkina, Ekaterina Ponomareva, Alisa Dubrovina, Irina Klyuchnikova, Natalya Patyukova, BIOTROF+ Ltd, Pushkin, St Petersburg, Russia.

Ogulgerek Djepbarova, Federal State Budgetary Educational Institution of Higher Education “St. Petersburg State Agrarian University”, Pushkin, St Petersburg, Russia.

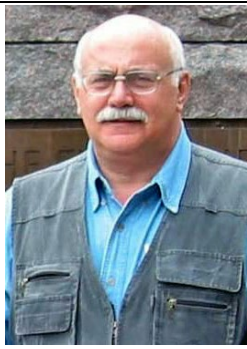
Darren Griffin, School of Biosciences, University of Kent, Canterbury, Kent, UK.

Michael Romanov, School of Biosciences, University of Kent, Canterbury, Kent, UK; L.K. Ernst Federal Research Center for Animal Husbandry, Podolsk, Russia.

Lecture Title: The Search for Sources of Enterobacteria and Clostridia Endotoxins in Russian Dairy Farms: Possible Transfer of Endotoxins through the Feed-Cow-Milk Chain.

Abstract: Here, samples to identify bacterial endotoxins were collected from two commercial dairy farms in Leningrad Oblast: farm A (samples of feces and milk were taken) and farm (where samples were taken from the feeding table, milk and rumen chyme). The study comprised four groups (A1, A2, B1, B2) where 1 was the control and 2 the test group. A1 were healthy, A2 showed signs of pathologies of the limb joints, B1 received the basic diet (BD) and B2 were fed this, plus the feed additive AntiKlos. Using PCR, samples were examined for the presence of genes for Shiga toxins (stx1A, stx2B), intimin (eae) and enterohemolysin (ehxA) produced by enterobacteria; for alpha (cpa1), beta (cpb) and epsilon toxin (etx) produced by *Clostridium perfringens*, plus binary toxin (cdtB), toxin A (tcdA) and

	<p>toxin B (tcdB) produced by <i>Cl. difficile</i>. In the test Group A2, one animal out of six studied (16.7%) had the intimin (<i>eae</i>) and enterohemolysin (<i>ehxA</i>) genes produced by enterobacteria that were not found in the control A1. The epsilon toxin gene (<i>etx</i>) was the most common and present in 100% of the examined fecal samples from both farms and 100% of milk samples from farm A.</p>
 	<p>Anastasia Ovcharova, Konstantin Ostrenko, Andrey Gavrikov, All-Russian Research Institute of Physiology, Biochemistry and Nutrition of Animals – Branch of the L.K. Ernst Federal Research Center for Animal Husbandry, VNIIFBiP, Borovsk, Russia.</p> <p>Lecture Title: The Effect of <i>Lactobacillus Reuteri</i> Probiotic Strains on Productivity and Basic Physiological Parameters of Laying Hens.</p> <p>Abstract: Probiotics have a positive effect on a digestive tract, immune system, and metabolic processes in poultry organisms. Probiotics have a pronounced antagonistic effect against the opportunistic pathogenic flora of the gastrointestinal tract. The purpose of this work was to study the effect of probiotic lactobacilli on egg producing ability of laying hens, on indicators of nonspecific resistance and the composition of the microflora of the gastrointestinal tract. Two strains of <i>L. reuteri</i> were used in the diet of laying hens of the Hysex-Brown cross. As a result, an increase in poultry egg production by 6.6% relative to the control group was found, and the yield of egg mass in the experimental group was 21.2 kg higher than in the control. There was a significant increase in phagocytic and bactericidal activity of blood serum by 7.2% and 10.4%, respectively, The content of lysozyme in the serum of poultry in the experimental group was 1.2% higher than the control. The use of probiotic lactobacilli in the diet of laying hens led to an increase in the number of bifidobacteria by an order of magnitude and a decrease in the number of escherichia, salmonella and clostridium in the intestinal contents birds.</p>
	<p>Victar Lemeshevsky, International Sakharov Environmental Institute of Belarusian State University, Minsk, Belarus; All-Russian Research Institute of Physiology, Biochemistry and Nutrition of Animals – Branch of the Federal Research Center for Animal Husbandry named after Academy Member L.K. Ernst, Borovsk, Russia.</p> <p>Lecture Title: Provision of substrates for energy processes in bulls at different levels of metabolizable protein</p> <p>Abstract: Animal productivity and product quality depend on the composition of the final products of feed digestion in the gastrointestinal tract, which, when entering the body tissues, are used as substrates for tissue enzymes that form a certain direction of metabolic processes. Purpose of the study: to study the features of the use of substrates in energy metabolism at different levels and ratios of nitrogen-containing substances in the diet of Kholmogory bulls. Materials and methods. The research was carried out on 4 bulls of the Kholmogory breed using the latin square method at the age of 7-8 months and the initial live weight of the bulls was 147.3 kg. The animals received 4 different levels of metabolizable protein in their diet: 7.80; 8.06; 8.40 and 8.60 g/MJ of metabolizable energy. At the end of each monthly period of the experiment, before feeding and 3 hours after it, the indicators of gas-energy exchange were studied using the mask method and the quantitative contribution of the main groups of substrates to energy metabolism (to the amount of heat production). Results. The effectiveness of using substrates in energy metabolism was assessed based on the results of studying the influence of different levels of metabolizable protein in the diet of Kholmogory bulls during the growing period. The effective use of metabolizable energy and amino acids for live weight gain has been established at a level of metabolizable protein in the diet of 8.2 g/MJ of metabolizable energy. A decrease in the contribution of metabolizable energy and amino acids to the increase in production was shown at a metabolizable protein value of 8.5 g/MJ of metabolizable energy.</p>



Vitaly Javakhia, Federal State Budgetary Scientific Establishment the All-Russian Scientific Research Institute of a Phytopathology (VNIIF), Bolshie Vyazemy, Moscow region, Russia.

Lecture Title: Antiviral and antifungal protective activity of a cold-shock protein from *Bacillus thuringiensis*.

Abstract: The Internet of Things (IoT) is revolutionizing agriculture, empowering farmers with real-time information crucial for efficient crop management. By utilizing IoT applications, farmers gain insights into weather conditions, soil quality, wind speed, humidity, and temperature. This knowledge allows them to plan and optimize crop cultivation, reducing losses from diseases. IoT-based agriculture applications act as constant companions, aiding farmers in every stage of their activities. In India, where agriculture contributes 17% to the economy, IoT plays a pivotal role in achieving food grain production targets. With a goal of 298.3 million tonnes for the fiscal year 2020-21, a 2.5% increase from the previous year, IoT-based agriculture applications are indispensable for empowering farmers and enhancing the overall economy. The agricultural Internet of Things (Ag-IoT) paradigm goes beyond field monitoring, incorporating underground soil sensing, farm machinery, and sensor-guided irrigation systems. This integrated approach connects growers, agronomists, crop consultants, and advisors in a complex social network. The aim is to promote sustainable and profitable agricultural products by leveraging IoT research and innovations. In precision agriculture, an IoT technology research and innovation roadmap is presented, emphasizing the importance of integrated technology research and education. The paper addresses challenges and highlights effective IoT-based communication and sensing approaches to enhance precision agriculture. As climate change, land degradation, and resource limitations challenge global food demand, modern agricultural systems turn to IoT to improve productivity and resource efficiency. A comprehensive review explores the use of IoT platforms, wireless sensor networks, remote sensing, cloud computing, and big data analytics in digital agriculture. The discussion emphasizes the necessity of interoperability for efficient data transfer and communication among devices. The surge in global population necessitates a shift towards smart agriculture practices, utilizing IoT and data analytics (DA). As wireless sensor networks evolve into IoT-driven systems, the integration of technologies such as radio frequency identification, cloud computing, and middleware systems becomes crucial. This paradigm shift enhances operational efficiency and productivity in agriculture. The IoT ecosystem, combined with data analytics, enables smart agriculture, addressing challenges and unlocking opportunities. The paper identifies benefits and challenges, categorizing future trends into technological innovations, application scenarios, and business and marketability. As the world embraces smart agriculture, the synergy of IoT and data analytics emerges as a transformative force in ensuring food security amidst growing global challenge.



Nadezhda Bogolyubova, L.K. Ernst Federal Research Center for Animal Husbandry, Dubrovitsy, Moscow region, Russia.

Lecture Title: The use of melanin in the nutrition of broilers to preserve the health of birds and obtain high-quality poultry products.

Abstract: The purpose of this work was to conduct comprehensive studies on the effect of the antioxidant adaptogen melanin on the biochemical and antioxidant status of poultry, the expression of genes of enzymes involved in antioxidant protection and the development of the immune response, the chemical composition, antioxidant, technological properties of muscle tissue and fatty acid composition of the adipose tissue of broiler chickens of the domestic cross "Smena-9. The studies were conducted in the conditions of the Ernst Federal Research Center for Animal Husbandry on broiler chickens (n=42, 50% of chickens and 50% of roosters in each group). From 7 to 45 days, water-soluble melanin was added to the main diet of poultry in the experimental group, at a

dose of 1.42 mg / kg of live weight (LM) of poultry. At the age of 26 days, there was a significant decrease in glucose levels in the blood of chickens treated with melanin (by 14.58% at $p < 0.05$), an increase in Ca/P ratio ($p < 0.05$), a decrease in phosphorus levels (by 11.94% at $p < 0.05$), magnesium (by 13.04% at $p < 0.05$), an increase in chloride levels (by 1.05% at $p < 0.05$). At 45 days of age, glucose levels in the blood of poultry of the experimental group decreased by 13.81% ($p < 0.05$), cholesterol by 20.57% ($p < 0.001$), calcium by 7.41% ($p < 0.001$), phosphorus by 9.27% ($p < 0.01$), magnesium by 17.61% ($p < 0.001$), chlorides by 7.79% ($p < 0.001$). The antioxidant properties of melanin were most pronounced in the middle and at the final stage of fattening. When melanin was fed in the blood of broilers at 26 days of age, an increase in the level of TAWSA by 9.5% ($p < 0.05$) and SOD activity by 14.7% ($p < 0.05$) was observed compared with the control. At 45 days of age, the use of melanin led to a significant increase in the total antioxidant status (TAS) by 11.9% ($p < 0.05$). The study of the relative expression of AOS genes and immunity confirms the data obtained. The addition of melanin to the diet contributed to an increase in the content of antioxidants in meat in the breast by 18.75% ($p < 0.0001$), in the thigh by 5.6%, reduced glutathione by 20.25%, glutathione peroxidase by 10.43%, catalase 17.35% in the breast compared with the control. The inclusion of melanin in broiler diets helps to increase the moisture content in muscles and enrich meat with antioxidants. The average daily increase over the entire period of the experiment in the experimental group was 67.16 g versus 66.74 g in the control, which confirms the beneficial effect of melanin on the bird's body. The results obtained open up new prospects for the use of melanin in the diets of broiler chickens, especially during the period of exposure to stresses of various etiologies.

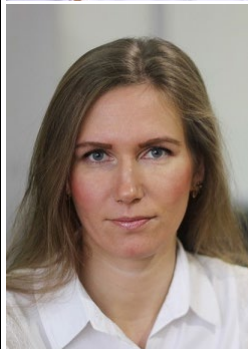


Georgi Laptev, Daria Tyurina, Elena Gorfunkel, Valentina Filippova, Andrei Dubrovin, Alisa Dubrovina, Natalia Novikova, Veronika Melikidi, Ekaterina Ponomareva, Vasiliy Zaikin, Irina Klyuchnikova, BIOTROF+ Ltd, Pushkin, St Petersburg, Russia.

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

Darren Griffin, School of Biosciences, University of Kent, Canterbury, Kent, UK.

Michael Romanov, School of Biosciences, University of Kent, Canterbury, Kent, UK; L.K. Ernst Federal Research Center for Animal Husbandry, Podolsk, Russia.



Lecture Title: Effects of Glyphosate and Antibiotics on the Expression of Genes Related to Performance, Antioxidant Protection and Histological Barrier in the Cecum of Broilers

Abstract: In conditions of intensive poultry farming, significant amounts of xenobiotics enter the bird's body. To investigate this, four groups of Ross 308 broiler chickens were formed: 1, control group fed the basic diet (BD); 2, experimental group fed BD supplemented with glyphosate; 3, experimental group fed BD along with combination of glyphosate and two antibiotics, enrofloxacin and colistin methanesulfonate. Analysis of the expression of genes for performance (IGF1, IGF2, MYOG, MYOZ2, SLC2A1, SLC2A2, SLC5A1, MSTN and TGFB1), antioxidant defense (CAT, SOD1, PRDX6 and HMOX1) and histological barrier function (MUC2, OCLN and CLDN1) in cecal tissues of birds were carried out using quantitative RT-PCR using a DTlight thermal cycler (DNA-Technology, Russia) and the SsoAdvanced™ Universal SYBR® Green Supermix kit (Bio-Rad, USA). The results showed that glyphosate alone (Group 2) inhibited the expression of a number of genes associated with productivity (IGF1, IGF2, SLC5A1, and MSTN) up to 4.1 times as compared with Group 1 ($p < 0.05$). In Groups 2 and 3, there was a decrease in almost all cases in the mRNA production of the MUC2, OCLN and CLDN1 genes in intestinal tissues from 1.3 to 2.2 times as compared to the control ($p < 0.05$).



Georgi Laptev, Daria Tyurina, Elena Gorfunkel, Veronika Melikidi, Andrei Dubrovin, Ekaterina Ponomareva, Vasiliy Zaikin, Irina Klyuchnikova, Alisa Dubrovina, BIOTROF+ Ltd, Pushkin, St Petersburg, Russia.

Valentina Filippova, Elena Yildirim, Larisa Ilina, Kseniya Kalitkina, BIOTROF+ Ltd; Federal State Budgetary Educational Institution of Higher Education “St. Petersburg State Agrarian University”, Pushkin, St Petersburg, Russia.

Ogulgerek Jepbarova, Federal State Budgetary Educational Institution of Higher Education “St. Petersburg State Agrarian University”, Pushkin, St Petersburg, Russia.

Jie Zhu, Zhejiang A and F University, Lin’an District, Zhejiang, China.

Lecture Title: The Influence of Glyphosate in Combination with Antibiotics on the Microbial Community of Broiler’s Cecum According to Whole Genome Sequencing

Abstract: To evaluate the effects of antibiotics and glyphosate, an experiment was conducted on 260 broilers. Four experimental groups were formed: I – control group, which received the basic diet (BD), II experimental group – BD with the addition of glyphosate; III experimental – OR with the addition of glyphosate and veterinary antibiotics enrofloxacin and colistin methanesulfonate; IV experimental – OR with the addition of glyphosate and ammonium maduramicin. Glyphosate and antibiotics combined with a herbicide altered the microbial community in broiler’s cecum. Genome-wide analysis made it possible to estimate the increase in the proportion of eukaryotic microorganisms and viruses under the influence of antibiotics. In the group of prokaryotic microorganisms, under the influence of glyphosate and antibiotics, significant changes were noted associated with a decrease in the proportion of bacteria, such as *Faecalibacterium* sp., *Lawsonibacter* sp., *Lachnospirillum* sp. and *Subdoligranulum* sp., capable of producing butyrate and other short-chain fatty acids. These results indicate the negative impact of glyphosate in combination with antibiotics on the health and productivity of poultry, since these acids have a wide range of positive properties, for example, bacteriostatic, anti-inflammatory and proliferative effects.



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

Lecture Title: Automatic Determination of Sturgeon Size Using Deep Learning Technologies.

Abstract: Fish resources play a crucial role in Russia's economy, especially given its extensive coastline, vast water areas, and rich marine and freshwater resources. Addressing the decline and restoration of fish populations, a consequence of farming practices, illegal fishing, and environmental catastrophes, stands as a critical issue in today's world. In Russia in recent years, there has been active construction and development of fish farms, fisheries and biological laboratories, partly due to economic difficulties. One of the most valuable fish species is sturgeon, which requires special conditions of confinement compared to, for example, catfish. Production personnel monitor compliance with the conditions and observe the growth and activity of these fish. This paper analyzes the different existing methods of weighing fish in production facilities. Nowadays, there is a trend towards digitization of production and implementation of cyber physical systems to improve the efficiency of production. Visual inspection, complemented by neural network analysis, is emerging as a valuable approach for addressing the challenge of fish weight estimation. The study suggests a viable technique for automatically measuring sturgeon sizes at various developmental phases using YoLo9 and highlights potential areas for future research.





Evgeniy Ivashko, Karelian Research Centre Russian Academy of Sciences, Petrozavodsk, Republic of Karelia, Russia.

Lecture Title: Mathematical model of a cage fish farm.

Abstract: Global aquaculture production is at a record high, and the sector will play an increasingly important role in the provision of food and nutrition in the future. In order to ensure its sustainable development, reduce risks, and improve manageability, the development of precision aquaculture methods is required, in particular mathematical models describing production processes at fish farms. This paper presents a mathematical model of fish cultivation on a cage farm with restrictions on the total volume of biomass, surface and volume density of fish. The model could be used to calculate and model the basic fish farm production parameters or to construct a production plan. The model is based on the use of feeding tables when calculating the growth of fish, but it could be easily adapted to the use of other growth models. The proposed mathematical model is implemented to automate calculations with Excel, and to construct the production plan, calculate the required feed volumes, and to produce warnings about possible exceeding planting densities. Examples of numerical modeling in the case of rainbow trout cultivation are presented. Also, with some simplifications, the model can be used in RAS.



Marina Solovey, Alexey Snytnikov, Aleksandr Tristanov, Pavel Chernyshkov, Kaliningrad State Technical University, Kaliningrad, Russia.

Lecture Title: Forecasting the SAM Index Value Using Fourier Series and Neural Networks.

Abstract: Modern science refers to krill as a strategic resource of the 21st century, because it is valuable for its biological composition (lysine, valine, leucine and isoleucine, threonine, phenylalanine, methionine). The lipids of Antarctic krill contain many unsaturated fatty acids, phospholipids, and sterols. Krill can be successfully used for organic products intended for human consumption. To predict the presence of krill in fishing zones the Southern Annular Mode (SAM) index will be used. The article presents the results of forecasting the SAM index using tools such as a recurrent neural network and Fourier series-based model. The experiments revealed that these forecasting methods unfortunately had a high percentage of error, suggesting the impracticality of this approach. However, the task of forecasting the SAM index remains highly relevant and requires the search for new solutions. Russia plans to start krill fishing at the end of 2023, with a specially designed vessel for operations in the Antarctic region. The annual krill catch is projected to reach 450 thousand tons. To achieve these goals, scientifically grounded forecasting mechanisms for indicators directly or indirectly indicating the presence of krill biomass in planned fishing areas need to be developed.

Online Oral Session 4: Digital Technologies and Robotics in Crop and Livestock Production






Artem Popov, Ivan Blekanov, Olga Mitrofanova, Saint Petersburg State University, St. Petersburg, Russia.

Mikhail Arkhipov, North-West Centre of Interdisciplinary Researches of Problems of Food Maintenance – structural division of the St. Petersburg Federal Research Center of the Russian Academy of Sciences, Pushkin, St. Petersburg, Russia.

Lecture Title: Improving the Quality of X-Ray Images of Seeds in Smart Farming Using Deep Learning.

Abstract: This work is devoted to the problem of food security and seed quality assessment in the task of automation and optimization of technological decision-making processes in agriculture. In particular, the application of neural network methods to improve the image resolution of X-ray images of seeds to increase the accuracy of their subsequent analysis is considered. The authors proposed a procedure for collecting, processing and

	<p>augmenting a training set of X-ray images of grain crop seeds. Five neural network models of super-resolution, such as SRCNN, EDSR, SRGAN, ESRGAN and SwinIR, were implemented, trained and adapted to the specifics of the subject area (quality seed), and experiments were conducted to fine-tune them. The experiment showed that the ESRGAN model has the best values of objective metrics (PSNR = 28.83 and SSIM = 0.80). The paper also shows examples of generated images, which can later be used to solve the problem of detecting the seed quality and classifying types of defects from X-ray images. The resulting solution, in addition to improving the resolution of X-ray analysis of grain crop seeds, will reduce the sensitivity of operators of specialized stations to X-ray radiation when creating and processing images.</p>
	<p>Azarenko V.V., Presidium of the National Academy of Sciences of Belarus, Minsk, Republic of Belarus. Goldyban V.V., Kurilovich M.I., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. Antipovich N.A., Republican Scientific and Practical Center of Neurology and Neurosurgery, Minsk, Republic of Belarus. Lecture Title: Determination of internal defects in potato tubers using nuclear magnetic resonance and computed tomography methods. Abstract: The results of experimental studies of determining internal defects of potato tubers using nuclear magnetic resonance (NMR) and computed tomography (CT) are presented. The methodology for conducting experimental studies and the operating parameters of NMR and CT are described. The work demonstrates the value of NMR and CT for a detailed, non-invasive method for identifying hidden defects in potato tubers on automatic grading machines.</p>
	<p>Anton Yurin, RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. Lecture Title: Development of screen forms for the control program of the technical vision system for optical fruit sorting. Abstract: This article presents the rationale for the control algorithm of a technical vision system for optical sorting of fruits of the LSP-4 technological line for sorting and packing apples.</p>
	<p>Marina Astapova, Anton Saveliev, Artem Ryabinov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences, St. Petersburg, Russia. Lecture Title: Application of Unmanned Aerial Vehicles for Precise Spraying of Chemicals in Agronomic Operations: A Case Study of Potato Desiccation. Abstract: The article deals with the investigation of unmanned aerial vehicles (UAVs) application for optimizing the dispersion of chemical agents in agriculture. The research encompasses a methodology for planning flight missions with the selection of optimal parameters based on the task at hand, exercising practical experiments on potato desiccation using UAVs for the efficient distribution of active substances. The optimal parameters like maximum linear speed of 5 m/s, distance between adjacent straight passes of 3 m, UAV height above the ground of 3 m, and pump power of 40%, have proven their efficiency, allowing for high-quality desiccation with minimal resource expenditure. The active substance used to prepare the working solution was Diquat desiccant with a concentration of 150 g/l. The experimental results demonstrate the effectiveness of potato desiccation with</p>



UAVs, along with an increase in efficiency and a reduction in chemical consumption during potato haulm treatment. The study contributes to the development of automated chemical treatment methods for agricultural lands using UAVs, showcasing their effectiveness and economic benefits. The article addresses researchers engaged in agriculture and precision farming, as well as professionals interested in the application of new technologies to agrotechnical processes.



Mikhail Tatur, Maksim Buren, Belarusian State University of Informatics and Radioelectronics, Minsk, Belarus.

Sergey Bushuk, State Scientific and Production Association "Optics, Optoelectronics and Laser Technology", Minsk, Belarus.

Adalat Pashayev, Elkhan Sabziev, Institute of Control Systems, Baku city, Azerbaijan.

Minglei Fu, College of Information Engineering, Zhejiang University of Technology, Hangzhou, China.

Lecture Title: Local Positioning of Agricultural Mobile Robot Based on Vision System.



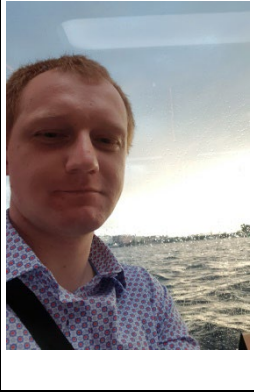


Abstract: Determining coordinates is an important component task for developing a control algorithm for mobile agricultural robots. At the moment, this problem is solved by using global positioning satellite systems. However, satellite connection is not effective forever and everywhere. Then for agricultural land processing the navigation systems with local positioning could be applied. One of such systems is the visual positioning system based on landmarks. For a long time, its implementation was hampered by the imperfection of systems for recognizing objects in images. Good to say that now neural networks perform computer vision tasks successfully. The purpose of this research was to develop and verify a mathematical model for a positioning system based on optical data of terrain images with beacons. As a result, mathematical formulas were constructed to determine the position of the robot in a rectangular coordinate system, and their verification was performed. The general requirements for the optical system were also worked out and experiments were carried out on real equipment. Ultimately, the performance of the proposed algorithm was proven by exercising an experiment using a real robot with a camera installed on it.



Kantemir Bzhikhatlov, Federal State Budgetary Institution Federal Scientific Center "Kabardino-Balkarian Scientific Center of the Russian Academy of Sciences", Nalchik, Russia.

Lecture Title: Methods for building ontologies to ensure coordinated behavior of autonomous intellectual systems in agriculture.

Abstract: Ontologies are the main tool for representing domain knowledge. The need to use ontologies to ensure consistent behavior of autonomous intelligent systems in agriculture is determined by the need to create semantic interactivity of agricultural systems and decision support systems, in which automatic knowledge inference occurs based on semantic processing of data from a sensor network. The purpose of the study is to develop methods for constructing ontologies to ensure consistent behavior of autonomous intelligent systems in agriculture. The paper presents the architecture of an intelligent control system for a heterogeneous human-machine team, consisting of an autonomous robot for active plant protection and an unmanned aerial vehicle (UAV) for monitoring the condition of the garden from the air. A multiagent architecture for constructing ontologies has been developed to ensure consistent behavior of a human-machine team. In particular, a multiagent architecture for constructing an ontology when a robot detects a new object is presented, as well as a scheme for exchanging

	<p>knowledge between team members. The results obtained can be used in the development of decision support systems, in which automatic knowledge inference occurs based on semantic processing of data from a sensor network.</p>
	<p>Andrey Perepechaev, Pylo I.S., Koleshko S.P., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. Lecture Title: Experimental studies of a mock-up sample of a device for forming the density of a flax press with a self-propelled baler PLC-1. Abstract: The article presents certain results of using a device to regulate the speed of the bale chamber depending on the initial state of the flax sliver, and also provides a comparison with the basic design of the baler.</p>
	<p>Olga Mitrofanova, Evgenii Mitrofanov, Vladimir Bure, Alexander Molin, Agrophysical Research Institute, Saint Petersburg, Russia. Ivan Blekanov, Saint Petersburg State University, Saint Petersburg, Russia. Lecture Title: Approach for Long-term Forecasting of Frosts and Droughts in Smart Agriculture. Abstract: Due to the trend of a global increase in average daily temperatures and the occurrence of extreme weather events, the task of long-term forecasting of agrometeorological risks is becoming increasingly actual. The work considers frost and drought as the main meteorological risks. In each individual case, based on a preliminary analysis of the initial information, researchers select the most effective method; there is no comprehensive methods comparison. In this regard, the goal of the work was to formulate the concept of a unified intelligent system for long-term forecasting of drought and frost. The proposed approach involves generating traditional, well-studied models for each source dataset in real time and selecting the most accurate result. For the computational experiment, three datasets were prepared: Datasets 1 and 2 for the period 01.02.2005-26.02.2024 with minimum daily temperatures and average humidity, respectively; Dataset 3 is a part of Dataset 1 for the period 01.07.2023-26.02.2024. The results showed that different methods turn out to be the most accurate for different source data: for Dataset 1 – SNaive method, for Dataset 2 - ARMA and SNaive, for Dataset 3 – SES and FIT_ARIMA. This confirms the validity of the proposed approach.</p>
	<p>Anton Yurin, Ignatchik A.A., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. Lecture Title: Design and Working Process of the Unit for Mechanical Removal of the Crown of Berry Bushes AUK-1. Abstract: The article raises the problem of reducing the productivity of plantings of berry bushes due to excessive thickening of bushes, and provides a brief overview of existing technical means for pruning the crowns of berry bushes. A solution to this problem is proposed as one of the directions for increasing the volume of sales of berry products.</p>
	<p>Anton Yurin, RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. Lecture Title: Development of a computer vision system control program for optical fruit sorting (APPLECTL). Abstract: This article presents the rationale for the technical vision system control program for optical sorting of fruits of the LSP-4 technological line for sorting and packing apples and provides a description of its main components.</p>
	<p>Anton Yurin, RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus. Lecture Title: Development of a computer vision system control program for optical fruit sorting (APPLECTL). Abstract: This article presents the rationale for the technical vision system control program for optical sorting of fruits of the LSP-4 technological line for sorting and packing apples and provides a description of its main components.</p>



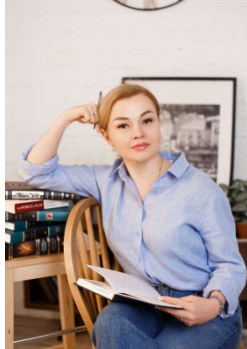
Larisa Zelenina, Dep. of Higher and Applied Mathematics, Northern (Arctic) Federal University named after M.V. Lomonosov, Arkhangelsk; Dep. of Business Informatics, North-West Institute of Management (NWIM) of Russian Presidential Academy of National Economy and Public Administration, St. Petersburg, Russia.

Lyudmila Khaimina, Ekaterina Demenkova, Maksim Demenkov, Eugeni Khaimin, Dep. of Information Systems and Information Security, Northern Arctic Federal University named after M.V. Lomonosov, Arkhangelsk, Russia.

Inga Zashikhina, Department of Philosophy and Sociology, Northern (Arctic) Federal University named after M.V. Lomonosov, Arkhangelsk, Russia.

Lecture Title: Research of Reindeer Migration Routes Based on Tracking Technologies.

Abstract: Reindeer herding practices take place in vast remote areas. Modern technologies make it easier to coordinate reindeer herders' work, track and manage their herds, maintain pasture quality and migratory routes. Herd tracking solutions for real-time monitoring record and share field information from the grazing areas with other reindeer herders and organizations. The development of monitoring systems will assist in dealing with the problem of deer population declines and extinction of wildlife species, contributing to the economic outcomes. Mathematical methods and data analysis allow for studying spatio-temporal interactions and reindeer movement to prevent habitat degradation. In the last decades technology use for reindeer husbandry has been a potent research area for scholars. There is a diverse volume of open-access scholarly papers devoted to various aspects of modern methods of reindeer tracing and migration routes management. Such a vast information bulk needs processing and analyzing for its further use. This paper aims at collecting thought-provoking research data on the highlighted topic and scrutinizing its implications. An overview of existing research on the issue of reindeer migration tracking is fulfilled. The research will be helpful for further study in the area of reindeer herding with the use of technology.



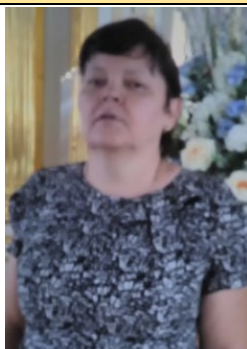
Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., Nikonchuk V.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.

Lecture Title: Study and analysis of microclimate formation parameters in livestock facilities.

Abstract: Developing a favorable microclimate in livestock facilities is one of the main terms for maintaining the health of animals and increasing their productivity. The economic efficiency of livestock farming depends on the conditions for rational keeping of animals, that are largely determined by the optimal microclimate at the premises. No matter how high breeding and breeding qualities animals possess, without developing a favorable microclimate for them, they are not able to keep their health and demonstrate their potential productive abilities, determined by their genetic potential.



Oral Session 5: Economic and Legal Aspects of Organic Production



Elena Semenova, Federal Research Center of Agrarian Economy and Social Development of Rural Areas – All Russian Research Institute of Agricultural Economics, Moscow, Russia

Lecture Title: Agricultural Production Technologies with Special Quality.

Abstract: The global trends influence the development of the organic products market in Russia. The purpose of the study is to identify technological features, achievements and problems in the development of production of products with special qualities. The article analyzes the production of organic products, products with improved characteristics, kosher and halal products, products from wild raw materials. The use of products with special quality in human nutrition leads to a qualitative change in nutrition due to the expansion of dietary diversity and natural products. The regulatory requirements for manufacturing, storage and implementation technology are compared. The development of organic production is shown, characterized by an increase in the number of certified producers and the number of regions producing organic products and the low specific gravity of sown areas under agricultural technologies of organic production. It was concluded that industrial technologies of food processing reduce the quality of products, especially ultra-processed food, which negates all efforts to produce products with special quality. The way out of this situation is priority for purchases in specialized organic stores, bringing agricultural producers to consumers of finished processed organic products, home cooking.



Tamara Makarova, Veranika Saskevich, Iryna Kuzmich, Department of Environmental and Agrarian Law, Faculty of Law, Belarusian State University, Minsk, Republic of Belarus.

Lecture Title: Legal Support for the Development of Organic Production in the Republic of Belarus.

Abstract: The ways to reduce the rural economy harmful impact on the environment and to contribute to solving problems related to climate change, food security, etc. are the popularization, promotion and support of organic agriculture. Belarus has established the legal framework for the production, storage, transportation and sale of organic products, the national procedure of voluntary certification of organic products and processes of their production and related requirements for the use of the mark "Organic Product". The research goal is to assess the legal support for the development of organic production in the Republic of Belarus. The article provides an analytical review of the provisions of legal acts, documents of state forecasting and state planning. The authors substantiate the need to highlight the environmental component of the activities for the organic production and to consolidate the corresponding principle in the Law "On the production and circulation of organic products". The feasibility of creating a more effective legal mechanism for state support for organic producers is justified, and it is also proposed to strategize the development of Belarusian organic agriculture in the context of the formation of a common market for organic products in the Eurasian Economic Union.





Valentina Kundius, Altai State Agrarian University, Barnaul, Russia.

Petsukh Nina, Federal State Budgetary Institution "Rosselhoztcenter" in the Altai Territory, FGBU "Rosselhoztcenter", Barnaul, Russia.

Lecture Title: Efficiency of Organic Production.

Abstract: The article presents the results of scientific research of the possibilities and efficiency of organic production. The transition to organic agriculture is determined by the negative consequences of global intensification for the environment, natural resources, public health. The effectiveness of the production of organic products is considered from the point of a socio-eco-economic approach. It is proved that the production of organic products in the regions improves the quality and standard of living of



	<p>the population; the concept of an economic model is presented in which the development of organic production takes place that contributes to increasing the economic efficiency of agriculture. The results of re-research in economic indicators and components of production efficiency of organic agricultural products, including the use of agrobiotechnologies, are presented in the Altai Territory and other regions of Russia. The relevant conclusions are drawn about the prospects for the development of organic agriculture with the aim of increasing socio – ecological and economic effects. The necessity of developing digitalization of the organic products market, organic products market, state support of farms.</p>
	<p>Azhgirevich A.N., Iovik L.N., Polesie Agrarian-Ecological Institute of the National Academy of Sciences of Belarus, Brest, Republic of Belarus. Lecture Title: Analysis of the state of organic production in the Republic of Belarus. Abstract: The article contains information about certified producers of organic products in the Republic of Belarus as of the first quarter of 2024, assesses the state of the market and prospects for its development.</p>
	<p>Valeria Chesnokova, Ural State Economic University, Ekaterinburg, Russia. Lecture Title: Forming a methodology for the artificial intelligence application at agro-industrial enterprises. Abstract: Artificial intelligence (AI) possess an enormous potential to improve production processes and increase the efficiency of agribusinesses. However, to successfully implement this potential, it is necessary to develop a methodology for applying AI to the agricultural industry. At the first step of developing a methodology specific tasks that can be automated using AI are to be identified. For example, the above mentioned tasks could cover the problems of predicting yields, optimizing the use of resources (e.g., fertilizers and water), monitoring product quality, etc. Then, it will be required to select suitable methods and machine learning algorithms to solve these tasks. It is also important to account for the specifics of the agricultural industry, including seasonal fluctuations, variability of weather and natural conditions, as well as the characteristics of production processes; as well as to arrange for a data collection and analysis system that will provide reliable information for training AI models. Accounting for various data sources, like agricultural machinery and equipment, sensors in the fields, weather stations, and other is highly important. Finally, it is necessary to test and implement the developed AI models at agro-industrial enterprises in order to evaluate their effectiveness, adapt them to the specific needs of enterprises, and train staff to work with new technologies. In general, the development of a methodology for the use of artificial intelligence at agro-industrial enterprises requires an integrated approach and close interaction of specialists in machine learning, agriculture and information technology. It is important to remember to train staff and support the project at all stages in order to successfully implement and use artificial intelligence at agricultural enterprises.</p>



Alexander Soltsev, Peoples' Friendship University of Russia named after Patrice Lumumba, Moscow, Russia.

Lecture Title: Issues of the use of pesticides in agriculture and the protection of human rights in accordance with international law.

Abstract:



Maria Gurieva, ANO "MODERN FARM", Moscow, Russia.

Lecture Title: Organic farming, ethical farming and terroir products as the basis for development of life quality.

Abstract: Most of Russia is comprised of rural territories. The population of rural areas is 36.9 million people (as per 2022). Peculiarities. In Russia, this is the climate and heterogeneity of rural territories occupying two-thirds of the country's area. 75% of the Russian population live in areas with harsh climatic conditions. Only 5.5 million square kilometers of Russia are classified as effective territory. During the Soviet period, agricultural complexes used to be placed with no account for natural features, often in the areas unfavorable from the climatic and demographic aspects. The delayed effect could be seen even now; some farms of the kind become economically ineffective, lose workers and reduce the area of farmland, negatively affecting the landscape. The interests of the population remain behind the scenes - including a competitive business environment, and work with indigenous products, and the development of culture - everything that in the long term span improves the living standard, slows down the outflow of the population from the villages and attracts tourists. The relation between the type of agricultural production and the quality of life becomes most visible in the landscape: agricultural holdings have endless monotonous fields or megafarms, where mainly inexpensive and tasteless products are produced. Unlike large injections into agricultural holdings, the URST model is based on many small investments. The population is becoming more interested in rural life.







Elina Zakirova, Ural State Economic University, Ekaterinburg, Russia.

Lecture Title: Practical application of the methodology forming the sustainable financial development of agricultural enterprises based on optimization of financing sources.

Abstract: Forming sustainable development of agricultural enterprises based on optimizing sources of financing is an important task that requires an integrated approach and the application of methodology to achieve the goals. Practical methodology is considered that can be used for this purpose: 1. Analysis of the financial state of the enterprise: The first step will include an analysis of the financial state of the enterprise. It is necessary to determine the current sources of financing, expenses, income, debts, liabilities and other financial indicators. 2. Identification of optimization opportunities: Next, opportunities for optimizing sources of financing should be identified. This may include a search for new sources of financing, renegotiating the terms of existing loans, optimizing costs, improving working capital management, etc. 3. Development of a strategy for sustainable development. Based on the analysis and optimization of sources of financing, it is necessary to develop a strategy for the sustainable development of the enterprise. This strategy should include specific steps and activities to achieve financial sustainability and improve financial performance. 4. Implementation of changes and monitoring results. After developing a strategy, it is necessary to implement changes in the operation of the enterprise. This may include negotiations with

	<p>creditors, attracting new investors, reorganizing the financial structure and other activities. It is important to monitor the results and adjust the strategy if necessary. 5. Personnel training. Special attention should be paid to the training of company's employees. It is important that all employees understand the sustainable development strategy, their role in its implementation and know how to work with new financial instruments. 6. Evaluation and monitoring. Once changes have been implemented, effectiveness evaluation and results monitoring should be carried out. This will help you evaluate the effectiveness of your sustainability strategy and make adjustments if necessary. Using the above methodology and adapting it to the specific conditions of the enterprise, it might be possible to effectively optimize sources of financing, improve the financial condition of the enterprise and ensure its sustainable development in the long term span.</p>
	<p>Pratyush Kumari Rath, Digambar Perke, Dheeraj Pathrikar, Department of Agricultural Economics, COA, VNMKV, Parbhani, Maharashtra, India. Buddhabhushan Wankhade, Department of Soil Science and Agricultural Chemistry, COA, VNMKV, Parbhani, Maharashtra, India. Lecture Title: Ag-IoT: Empowering Sustainable and Economic Organic Agriculture. Abstract: In India, where agriculture plays a major part in the economy, the integration of the Internet of Things (IoT) has completely transformed crop management. By giving farmers real-time data on weather, soil quality, and environmental factors, they can now make more informed decisions, leading to reduced losses due to disease and increased productivity. The use of IoT technology extends beyond field monitoring to include underground soil sensing, machinery management, and sensor-based irrigation systems, creating a comprehensive support network. This network connects farmers, experts, and advisors, promoting sustainable and profitable farming techniques. With challenges like climate change and resource limitations becoming more prevalent, modern agriculture increasingly relies on technology to boost efficiency and output. The article explores the role of various platforms, sensor networks, satellite imagery, cloud computing, and big data analysis in digital agriculture. These technologies facilitate data exchange and communication between devices, streamlining operations. The integration of technology and data analysis emerges as a crucial force in farming, helping farmers overcome obstacles and identify new opportunities amidst global food security concerns.</p>
	<p>Sangram S. Wandhekar, Kshirsagar R.B., Agarkar B.S., Department of Food engineering, College of Food Technology, VNMKV, Parbhani, Maharashtra, India. Aboli R. Bhatlawande, Ghatage P.U., Department of Food Chemistry and Nutrition, College of Food Technology, VNMKV, Parbhani, Maharashtra, India. Gopal U. Shinde, NAHEP-CAAST, DFSRDA, VNMKV, Parbhani, Maharashtra, India. Lecture Title: Insights on Digitalizing the Supply Chain for Sustainable Organic Food Products. Abstract: The digital transformation of supply chains is revolutionizing the way organic food products are sourced, produced and distributed, with a strong focus on sustainability digitalization in supply chain management. It is elucidating its concept, benefits and the technologies driving this transformation. Environmental concerns, a desire for natural and sustainable food options, and health consciousness are some of the reasons behind the increase in demand for organic food. Digitization like IoT to block chain, artificial intelligence to big data analytics are reshaping how organic food products are managed and traced throughout in the supply chain. Digitalized supply chain operations, distribution and process integration are all positively</p>

	<p>and significantly correlated with business sustainability and profitability. Integration of digitalization into organic food supply chains presents challenges but also showcases successful case studies and opportunities for improvement. The impacts of digitalizing these supply chains are far-reaching, affecting the environment, society, economy and consumer behaviors. This paper serves as a valuable resource for industry players seeking to navigate and leverage the evolving intersection of digitalization and sustainability in organic food products and its supply chains.</p>
 	<p>Elena Nikiforova, St. Petersburg State Economic University, St. Petersburg, Russia. Marina Ermolina, St. Petersburg State University, St. Petersburg, Russia. Lecture Title: Improving the legal framework for digitalisation of the agro-industrial complex as a condition for ensuring Russia's national security. Abstract: The article substantiates the need to ensure digitalization in the agro-industrial complex of the Russian Federation. The authors note that in light of global trends, there emerges an urgent need to introduce an economic development model that can ensure the gradual growth of the Russian economy, based on the internal factors of the state's competitiveness. Based on the analysis of regulations and other acts, as well as other sources, the authors draw their own conclusions. The work emphasizes the need to develop and adopt strategic planning acts, which should be aimed at the digitalization of agriculture and reflect the goals, objectives, directions and policy mechanisms in this area.</p>
	<p>Anna Osetrova, Volgograd Institute of Management – RANEPa, Volgograd, Russia. Lecture Title: Rural territories as an object of urban development. Abstract: The author proceeds from the thesis that modern urban planning legislation does not contain a definition for “rural territories”. In the scientific legal literature, rural territories are generally defined as terrain used for agricultural purposes beyond large cities with its natural conditions and infrastructure, rural population, as well as various elements of material culture and production resources. According to the author, this approach does not contradict the OECD methodology and foreign approaches developed in world legal practice, also many domestic economists who consider issues related to the system of rural development agree on this approach. The conceptual apparatus of such definitions as “rural territories”, “rural areas” in the Strategy for Sustainable Development of Rural Territories of the Russian Federation for the period up to 2030 requires a more precise scientific justification. There exists a need for a legal typology of rural territories, scientifically based criteria for identifying rural agglomerations and a unified approach to managing their development.</p>
	<p>Tavrykina O.M., Gromadskaya E.I., Republican Unitary Enterprise “Central Research Institute for Integrated Use of Water Resources”, Minsk, Republic of Belarus. Semenenko L.V., Kochik E.N., National Research University “Institute of Applied Physical Problems named after A.N. Sevchenko” Belarusian State University, Minsk, Republic of Belarus. Lecture Title: Development of the information and analytical system “Water Protection Zones” as a basis for digital transformation in the field of surface water protection. Abstract: Information and analytical system of the IAS “Water Protection</p>

Zones” has been developed, containing spatial and attribute data on the Republic surface water bodies, water protection zones and coastal strips for them, with the ability to obtain and provide information for monitoring and analyzing activities within the boundaries of water protection zones and coastal strips.

Online Oral Session 6: Interdisciplinary Aspects of Organic Production



Anahit Manvelyan, Astghik Pepoyan, Liana Grigoryan, Department of Food Safety and Biotechnology, Armenian National Agrarian University; International Association for Human and Animals Health Improvement, Yerevan, Armenia.

Michael Chikindas, Health Promoting Naturals Laboratory, School of Environmental and Biological Sciences, Rutgers State University, New Brunswick, USA.

Lecture Title: Fishery in Armenia and Aqua-Probiotics

Abstract: The development of probiotics for commercial use in aquaculture is an interdisciplinary process that requires basic and applied research, full-scale testing, and economic evaluation. Armenia has historical opportunities for developing the probiotic therapies in the country. On the other hand, interest in the development of fish farming has also increased in Armenia in recent years. This study relates the validation of receiving targeted aqua-probiotics for aquatic organisms and the development of fisheries in Armenia. To understand the market situation and the opinions of experts, a series of questions and suggested answers were prepared by us for the structured interviews. This qualitative research method includes asking open-ended questions and gathering data on the fisheries and fish feed. Demonstrated that fisheries/aquaculture have significant development potential in Armenia, and for Armenia, receiving and offering probiotics is important both for the conservation of aquatic animals, especially fish species, and for agriculture and the economy as a whole. Methods for selecting probiotic bacteria to use in aquaculture may include the following steps: i) collection of source information; ii) receiving prospective probiotics; iii) screening of prospective probiotics; iv) assessment of pathogenicity and test for survival, and v) in vivo assessment.



Alina Guzeva, Artem Lapenkov, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), Institute of Limnology of the Russian Academy of Sciences, St. Petersburg, Russia.

Lecture Title: Seasonal Dynamics and Vertical Distribution of Phosphorus in Sediments under Trout Cage Farms in Lake Ladoga.

Abstract: This study focuses on the seasonal dynamics and vertical distribution of phosphorus in the sediments of trout cage farms in Lake Ladoga, Russia. With the burgeoning development of aquaculture, assessing the environmental impact of this practice is crucial. The fieldwork was conducted at two farms, where sediment cores were collected for layer-by-layer laboratory analyses. Chemical parameters such as the Red/Ox potential (Eh), phosphorus content (organic and inorganic forms), and organic matter percentage were measured to understand their influence on geochemical behavior of phosphorus. The findings revealed increases in organic matter and phosphorus content during the active feeding periods. Inorganic compounds of phosphorus, primarily from fish feed, was the predominant form of the element entering the sediments. It was shown that reducing conditions exist in the sediments under the studied cages. Thus, anoxic Red/Ox environment can contribute to phosphorus release into the water column from polluted sediments. At the reference sampling sites, no accumulation of organic wastes and phosphorus was observed, which suggests a local spatial impact of fish farming on sediment quality. The results obtained are important for developing sediment monitoring strategies to mitigate the environmental footprint of trout farming in Lake Ladoga.



Tuyen Tran, Bien Duong, Quyen Vu, Van Le, Le Quy Don Technical University (LQDTU), Ha Noi, Viet Nam.

Oksana Glibko, Andrey Ronzhin, St. Petersburg Federal Research Center of the Russian Academy of Sciences (SPC RAS), St. Petersburg, Russia.

Lecture Title: Methods and Technical Means of Nonintrusive Assessment of Fish Biomass and Robotic Maintenance of Cage Aquaculture.

Abstract: Smart aquaculture applies smart production methods to eliminate existing shortcomings in traditional aquaculture. The combination of technology and the art of smart aquaculture completely changes the way of managing and processing food and seafood production where artificial intelligence, IoT and automation systems are applied effectively. From water quality management to livestock health monitoring, automated fish feeding and harvesting systems, these technologies are changing the traditional landscape of the industry, creating new growth opportunities and helping to build a sustainable environment. In smart aquaculture, the main processes are evaluation of fish biomass and size regularly to check fish growth, evaluation of the efficiency of farming operations, calculation of appropriate feed amounts, and calculation of oxygen consumption, antibiotic dose, grading time and optimal harvest time. This article presents automatic and effective solutions for fish size assessment methods based on computer vision and linear models to estimate fish weight, allowing you to determine fish mass by size. Machine learning models combined with computer vision helps to make the fish counting process faster and more efficient. From there, it becomes easier to estimate fish biomass without directly affecting the fish and causing no physical impact and stress.



Alexander Bekarev, Karelian Research Centre Russian Academy of Sciences, Petrozavodsk, Republic of Karelia, Russia.

Lecture Title: Aquaculture human resources in Russia: the regional dimension.

Abstract: Aquaculture in Russia demonstrates rapid growth both in production volumes and number of fish farms. The further growth should be supported by involvement more and more qualified personnel having knowledge and skills on the modern production tools and processes. In this paper we perform quantitative analysis of the labour market. We analyze availability of yearly number of graduates of higher and secondary levels of education for aquaculture enterprises. We also study the geographical distribution of new human in correspondence to the geographical distribution of fish farms. The results show great lack of new aquaculture educated personnel; this problem could harm the further industry development. The same time, the number of regions with developed aquaculture has not enough local educational organizations to perform fishfarmers trainings. The results of this study could be used to perform modernization of the aquaculture educational system to support further industry rapid development.



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

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

Gopal U. Shinde, Principal Investigator, NAHEP, World-Bank Project Centre and Govt. of India and Associate Professor of Mechanical Engineering, FMPE, CAET, VNMKV, Parbhani, India.

Lecture Title: Organic Farming in the Era of Artificial Intelligence: Towards Sustainable Agriculture and Environmental Resilience.

Abstract: This in-depth analysis presents organic farming as a crucial pathway to achieving sustainable agricultural practices in the face of contemporary environmental challenges. It underscores organic farming's role



in environmental conservation, non-renewable resource preservation, and the delivery of quality food products. The paper juxtaposes organic and conventional farming, highlighting the former's advantages in improving soil health, enhancing bio-diversity, and combating climate change effects. Central to this discourse is the exploration of cutting-edge technologies and methodologies in organic farming, including the utilization of biochar, biofertilizers, and digital innovations. A significant focus is placed on the integration of Artificial Intelligence (AI) in organic agriculture, showcasing its potential to transform practices through predictive analytics, precision farming, crop monitoring, and sustainable water management. This investigation extends to the regulatory land-scape of organic farming, with a detailed review of standards and regulations within the European Union, India, and on a global scale, emphasizing the critical role of certification and labeling in ensuring food safety and consumer confidence. By examining organic farming's principles, challenges, and the latest trends, particularly the emergence of AI-driven solutions, the paper advocates for a strategic shift towards sustainable, technologically advanced, and environmentally responsible agricultural systems.



Amardeep Singh Sandhu, Mehak Rai Sethi, University School of Law and Legal Studies, Guru Gobind Singh Indraprastha University, Delhi, India.

Lecture Title: A Critical Analysis of the Interaction Between Biotechnology and Intellectual Property Law in India.

Abstract: Biotechnology's evolution has catalysed numerous technological breakthroughs across diverse sectors such as healthcare, agriculture, and environmental sciences. This advancement has been paralleled by the increasing complexity of the Intellectual Property Right (IPR) landscape, particularly in the realm of patent law, which grapples with the intricate innovations in biotechnology. The research critically analyzes the trajectory of patent law in light of emerging biotechnologies, focusing on the nuanced intricacies within the Indian legal framework. The landmark Novartis AG v. Union of India case in India has foregrounded discussions on the patentability of pharmaceuticals and the consequential impact on public health. This study delves into the legal ramifications of emerging biotechnologies on patent law and IPRs within the Indian context, examining issues of patent eligibility, the incentivization of innovation through patents, and the inherent limitations in the biotechnological domain. Furthermore, it delves into the ethical and social dimensions engendered by biotechnological advancements and their patentability, with particular attention to India's unique challenges. This research advocates for the adaptation of the legal framework in India to accommodate emerging biotechnologies while ensuring the safeguarding of public interests. It underscores the necessity for a balanced approach that fosters innovation while upholding public welfare within the patent law regime, especially concerning biotechnological innovations. In conclusion, this study offers an exhaustive analysis of the challenges and prospects engendered by emerging biotechnologies for the trajectory of patent law and IPRs in India. Through its contextual examination of the Indian milieu, this research contributes to a nuanced comprehension of the multifaceted legal and ethical conundrums at the intersection of biotechnology and patent law.



Prasad Gangakhedkar, Hemant W. Deshpande, Department of Food Microbiology and Safety, College of Food Technology, VNMKV, Parbhani, India.

Rahul Eknath Kamble, Vidhya Baban Wadmare, Department of Food Chemistry and Nutrition, College of Food Technology,

Vaibhav Jadhav, Department of Food Engineering, College of Food Technology, VNMKV, Parbhani, India.

Gopal U. Shinde, Principal Investigator, NAHEP, World-Bank Project Centre and Govt. of India and Associate Professor of Mechanical Engineering, FMPE, CAET, VNMKV, Parbhani, India.

Lecture Title: From Farm to Fork: Digital Evolution of Food Industry through AI and other Digital Technologies.

Abstract: All industries will eventually face the challenge of digitalization, to which businesses must respond in order to stay competitive. Even though e-commerce only accounts for 2% of revenues in the food business, significant investments in digital initiatives are presently concentrated on this sector. Therefore, it's possible to argue that digitization is only now beginning to impact the food business. Next, developments in Industry 4.0-era analytical methods for evaluating food quality. Growing digitization and automation of food analysis employing the most cutting-edge technology in the food business are characteristics of food quality and safety. Due to the growing demand for food products that are healthier and more nutritious, governments, experts, and consumers have recently focused a great deal of emphasis on food quality. Food quality is now assessed using a variety of laborious, damaging methods that have poor analytical performance, which highlights the pressing need to create new analytical methods. Food safety is essential to our survival and well-being. The intricacy and sophistication of today's food systems necessitate upholding the strictest food safety regulations and employing modern technologies in order to protect consumers from foodborne illness.



Pritam Bhutada, VNMKV, Parbhani, India.

Lecture Title: Response of Sorghum Crop Towards Organic Manure under Climate Change.

Abstract: Agriculture is mainly under rain-fed conditions in Maharashtra State as the rainfall is very uncertain and temperature is increasingly high which is a major challenge and detrimental to crop growth and development. Therefore, climate risk management in agriculture (rainfed and residual moisture) is among the most important pillars of food security and resilience of agro-ecosystems. The objective of this study was to address residual farming system with selection of drought tolerant crop and proper production technology. In Maharashtra sorghum is major crop in rainfed areas of rabi season. Sorghum crop is main source of food, fodder and fuel till today. Small holding farmers use to sow sorghum crop on residual moisture with less input. This leads to focus and formulate experiment on effect of different organic manures on growth and yield of sorghum crop. A farm experiment was conducted at Agronomy farm of Sorghum Research Station, Vasantnaik Marathwada Krushi Vidhyapeeth, Parbhani during year 2022 in rabi season. The field experiments followed a randomized complete block design with three replications and seven treatments combination. Reveals significant impacts of organic nutrition treatments on rabi sorghum grain production. Biofertilizers though improved rabi sorghum mean grain and stover production by 22.23% and 18.73%, respectively over control. Further ZBNF treatment has 19.79% and 24.75% higher grain and stover yields than treatment biofertilizer alone. Both the manures (FYM and vermicompost) with near identical impacts on crop performance proved superiority to biofertilizers for both grain and stover. Integration of manure with biofertilizers has brought numerical superiority in production of both grain

	<p>and stover as compared to manures alone. Study shows that Sorghum crop gives positive response towards organic manure.</p>
	<p>S.U. Pawar, Sneha Bhise, Apeksha Thombre, and Bhagwan Asewar, VNMKV, Parbhani, Maharashtra, India. Lecture Title: Organic and Inorganic Weed Management Practices in Soybean under Different Land Configurations. Abstract: Presented research work was conducted in monsoon season during 2022-23 for three different land soil bed preparations (Land configurations). The study aims to investigate influence of microclimate and weed management approaches on soybean growth and productivity. The experimentation was in split plot technique with main plot treatments comprised of three land configurations (Two row broad bed furrow, four row broad bed furrow, flat bed) and four different techniques to control weeds (PE Sulfentrazone 28% + Clomazone 30% WP 350+375 g.a.i./ha, PoE Fomesafen 12% + Quizalofop ethyl 3% w/w SC @180+45 g.a.i./ha, weedy check and mechanical weeding) in sub plot replicated three times. The results indicated that growing soybean on BBF of four rows (L2) and two row BBF (L1) was productive as well as profitable and found efficient in storing more soil moisture and maintaining canopy temperature over sowing soybean on flat. The lowest weed population of both monocot and broad leaf weeds as well as more soybean seed yield was observed in mechanical weeding and PoE Fomesafen 12% + Quizalofop ethyl 3% w/w SC @ 180+45 g.a.i./ha.</p>
 	<p>Monica Shinde, DSM'S IITM, Jintur Road, Parbhani, Maharashtra, India. Kavita Suryawanshi, D.Y. Patil Institute of MCA and Management, Dr. D.Y. Patil Educational Complex, Sector 29, Pimpri-Chinchwad, Maharashtra, India. Kanchan Kakade, E&TC Department, Jawaharlal Nehru Engineering College, MGM Campus N-6, CIDCO, Chhatrapati Sambhajanagar, Maharashtra, India. V.A. More, E&TC Department, Jawaharlal Nehru Engineering College, MGM Campus N-6, CIDCO, Chhatrapati Sambhajanagar, Maharashtra, India. Lecture Title: Digital Maize Crop Guardian: Automated Identification of Fall Armyworm Infestation using Computer Vision. Abstract: Fall armyworm (FAW) infestation poses a significant threat to maize cultivation worldwide, leading to substantial yield losses. Timely identification of FAW presence is crucial for implementing effective management strategies to mitigate its impact. This study explores the use of computer vision techniques to automatically detect FAW infestation in maize crops by analyzing visually observable patterns indicative of FAW damage amidst various biotic and abiotic stresses. Leveraging deep convolutional neural networks (DCNNs) and transfer learning, an algorithm is proposed to identify FAW-infected areas in maize fields. The algorithm exhibits high accuracy rates, achieving 98.47% training accuracy and 93.47% validation accuracy. Evaluation on actual clear FAW images yields an average classification accuracy of 82%, with 70.8% accuracy on augmented images and 32.1% accuracy on false positives. By analyzing images and identifying affected spots, our proposed algorithm serves as a digital guardian for maize crops, aiding in timely intervention and management strategies thereby aiding in the preservation of maize yields and ensuring food security.</p>



Kalbande Vishal Dashrathrao, VNMKV, Parbhani, Maharashtra, India.

Lecture Title: Grafting robot technology – a review.

Abstract:



Sushant R. Bhalerao, O.D. Kakade, S.V. Muley, and D.V. Samindre, NAHEP-CAAST, DFSRDA-VNMKV Centre, VNMKV, Parbhani, India.

Francisco Rovira-Mas, Universitat Politecnica de Valencia, Agricultural Robotics Laboratory, 46022 Valencia, Spain.

Indra Mani, B.V. Asewar, VNMKV, Parbhani, India.

Lecture Title: Deep Learning for Pink Bollworm Detection and Management in Organic Cotton Farming Practices.

Abstract: Deep learning for the organic cotton pest detection and management using Agri-Bot has introduced a new practice of pest detection and pest management. The robotic pest detection for pink bollworm with its characterization carried in Yolo v8 software by trained model. A mean Average Precision (mAP) value observed as 67.1%. The peripherals such as Intel Real-Sense camera, Data Storage System (DSS) mounted on Agri-Bot for field experiment and the health condition monitoring system is developed for organic cotton production. The accuracy and performance of the model for Rasi variety was decreasing at 70cm height from 87.50% when speed varies from 1 to 3.6 km/hr. Whereas for Bt-cotton species at 50 cm height and 1 km/hr speed exhibits a model accuracy up to 78.12%, and for PDKV variety at a range 50 to 70 cm shows 65% to 54% respectively. Additionally, the study delves into agricultural machinery's operational parameters, showcasing diverse theoretical capacities ranging from 0.067 to 0.2412 hectares per hr at speeds of 1, 2.5, and 3.6 km/h. Actual machine performance capacities varies from 0.058 to 0.177 ha/hr, with average accuracy range between 74% to 81%. This DL model can more trained for high accuracy level management of overall crop health condition monitoring.











Zheshko A.A., Lensky A.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.






Lecture Title: Software module for calculating technical and economic indicators of agricultural chemicalization machines.

Abstract: The article presents the results of the development of a software module for calculating the technical and economic indicators of agricultural chemicalization machines. The software module is designed to calculate operating parameters of the main and auxiliary units for applying fertilizers and plant protection chemicals. The development of the software module was executed within the research done with the support of the Belarusian Republican Foundation for Basic Research (agreement with the BRFFR No. T23MN-004 dated 05/02/2023).

Oral Session 7: Digital Technologies and Robotics in Crop and Livestock Production

	<p>Dmitry Komlach, Evgeniy Zhilich, Rogalskaya Yu.N., Nikonchuk V.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Research on improving the domestic herd management system.</p> <p>Abstract: The article provides a general description of the systems used in the Republic for identifying and measuring the economic and biological parameters of dairy herds. The results of testing the IKFS “MAISTAR” system for identifying and monitoring the physiological state of animals, developed by the Republican Unitary Enterprise “NPC NAS of Belarus for Agricultural Mechanization” together with the domestic manufacturer of equipment for dairy farms LLC “Polyester Agro” are presented. A comparative analysis of the functionality and performance characteristics of the tested system with a foreign analogue was carried out.</p>
	<p>Evgeniy Zhilich, Rogalskaya Yu.N., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Research and development of a milking equipment positioning system for robotic milking technology.</p> <p>Abstract: Based on the done research, the availability of imported milking equipment on dairy farms of the Republic of Belarus, as well as the need for import substitution, there is a need to develop domestic robotic milking systems. One of the important elements of this development is the positioning system, responsible for the functionality of the milking manipulator.</p>
	<p>Nikolay Bakach, Andrey Perepechaev, Volodkevich V.I., Shakh A.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Scientific support for the creation of promising mechanization tools for agricultural production based on the implementation of a system of promising machines.</p> <p>Abstract: The article examines the scientific support for the creation of promising mechanization tools for agricultural production in the Republic of Belarus.</p>
	<p>Evgeniy Zhilich, Rogalskaya Yu.N., Nikonchuk V.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Principles of development of robotic milking systems.</p> <p>Abstract: The article discusses the technological principles of the development of robotic milking systems. A mistake in analyzing the effectiveness of using robotic systems is their assessment from the point of view of saving labor costs, especially in enterprises where they are trying to replace unskilled and poorly motivated personnel with robots. However, through the use of robotic systems, it is impossible to reduce the overall wage bill, since the operation of such systems requires specialists with a much higher level of qualifications and a corresponding level of remuneration. Therefore, when developing your own concept for the development of robotic milking, it is necessary to take the simplest, inexpensive, universal solutions that can be used within the framework of any technological concept and equipment configuration with a high level of unification, interchangeability, maintainability and operational stability.</p>

	<p>Evgeniy Zhilich, Getsman S.A., Rogalskaya Yu.N., Nikonchuk V.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Teat detection method for developing robotic milking systems.</p> <p>Abstract: The udder teat detection method consists of a number of image processing and analysis steps, which together form an overall teat detection algorithm. The time of positioning of milking equipment directly depends on the correctly selected detection method, algorithm for analyzing and processing the incoming image stream, which in the future can negatively affect the entire milking process.</p>
	<p>Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., Nikonchuk V.V., Ekelchik O.L., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: On the issue of intensifying the mixing process in the preparation of mixed feed and feed mixtures.</p> <p>Abstract: The successful development of the livestock industry is possible only on the basis of a developed and strong feed base, in the creation of which the feed industry plays an important role. One of the stages in the production of mixed feed and feed mixtures is the process of mixing the main components to achieve the greatest homogeneity of the prepared feed mixture. During the research, a design of a feed mixer was proposed, which facilitates faster preparation of feed, without compromising the uniformity of the feed mixture.</p>
	<p>Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., Nikonchuk V.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Set of equipment for the production of easily digestible feed for cattle of various sex and age groups KOBK-1.5.</p> <p>Abstract: The feed industry is called upon to fulfill one of the important national economic tasks, namely to increase the productivity of livestock farming, the rapid development of which is necessary to meet the growing needs of the population for basic food products and light industry for raw materials. The successful development of livestock farming is possible on the basis of a developed and strong feed base, in the creation of which the feed industry plays a major role. It is designed to supply livestock farms with highly nutritious feed containing all the substances necessary for animals, such as proteins, carbohydrates, fats, minerals and vitamins.</p>
	<p>Evgeniy Zhilich, Tsalko S.A., Rogalskaya Yu.N., Nikonchuk V.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Analysis of mobile technical equipment for preparing feed for feeding and distribution.</p> <p>Abstract: The productivity of production and the volume of livestock products directly depend on the level and quality of animal feeding, as well as the balance of diets, taking into account the nutritional value of feed for various groups of animals. Therefore, analysis of progressive and promising trends in mobile technical means for distributing concentrated, liquid and combined feed requires study.</p>

	<p>Anton Yurin, Viktorovich V.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: The Relevance of the Development of a Wide-Spread Sprinkler System for the Natural Production Conditions of the Republic of Belarus.</p> <p>Abstract: This article outlines the state of the land reclamation industry and describes the relevance of the development of wide-spread irrigation machines for the conditions of Belarus.</p>
	<p>Dmitry Komlach, Vorobey A.S., Tyurin A.N., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: An electronic analyzing device for setting design parameters and operating modes of lines for pre-realization preparation of potatoes.</p> <p>Abstract: The article determines the maximum loads for compression of a potato tuber, for peeling, and for peel rupture, which formed the basis for the development of an electronic analyzing device for determining the occurrence of dangerous zones of mechanical damage in serial lines for pre-sale preparation of potatoes.</p>
	<p>Zheshko A.A., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Prospects for the development of robotic technical means for applying fertilizers and chemical plant protection products.</p> <p>Abstract: The article analyzes the development of technical means for applying fertilizers and discusses the prospects for the development of robotic technical means.</p>
	<p>Zheshko A.A., Lensky A.V., Volodkevich V.I., Shah A.V., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Digitalization of the process of forming the structure of the fleet of mobile forage harvesters.</p> <p>Abstract: The results of designing an application for the automated formation of the structure of a fleet of mobile forage harvesting machines are presented.</p>
	<p>Azarenko V.V., Presidium of the National Academy of Sciences of Belarus, Minsk, Republic of Belarus.</p> <p>Zheshko A.A., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.</p> <p>Lecture Title: Analysis of digital tools for studying the properties of solid mineral fertilizers and other bulk materials.</p> <p>Abstract: The article presents the results of an analysis of digital tools for studying the properties of solid mineral fertilizers and other bulk materials, which are of particular importance for computer modeling of agricultural chemicalization machines.</p>



Dmitry Komlach, Goldyban V.V., Selivanova V.P., RUE SPC of the NAS of Belarus for Agricultural Mechanization, Minsk, Republic of Belarus.

Lecture Title: Requirements for autonomous mobile units for applying plant protection products.

Abstract: The article presents a list of requirements for autonomous mobile units for applying plant protection products. The developed list of requirements is based on regulatory documentation in the field of agricultural mechanization and can be used in the design of autonomous mobile units for agricultural needs.



Alexander Fokin, Natalya Zakharova, Rashid Kurbanov, All-Union Research Institute of Agricultural Mechanization, Moscow, Russia.

Lecture Title: Methodology for determination of agrotechnological and physical-mechanical parameters of soil using UAV.

Abstract: This report outlines recommendations for determining agrotechnological and physical-mechanical parameters of soil using UAV. A list of selected soil parameters is given in order to optimize the determination of agrotechnological and physical-mechanical soil parameters. The proposed recommendations represent a significant step forward in the field of agrotechnological research. They are based on the use of unmanned aerial vehicles, which significantly expands the possibilities of collecting data on soil and its characteristics. This is essential for the effective implementation of digital technologies in agriculture.

Format of the Conference

The conference is held in a hybrid format: on site of RUE SPC of the NAS of Belarus for Agricultural Mechanization (Knorina Str. 1, Minsk, Republic of Belarus) and in the format of videoconference. A single link to the video conference for the opening ceremony, plenary sessions, oral sessions, closing ceremony for participants and listeners: <https://us06web.zoom.us/j/87926743169?pwd=Y1RWWGtua1JtWEgyZEZob3ZUNlp4UT09>; connection to Oral sessions is carried out in the Halls in accordance with the names of the sessions.

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

Contacts

E-mail: conf@spcras.ru

Web: <http://adop.nw.ru/>

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