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მეცნიერებათა აკადემია

GEORGIAN ACADEMY OF  
AGRICULTURAL SCIENCES

# International Scientific Conference „AGRICULTURAL MECHANIZATION AND TECHNOLOGY IN EUROPE AND PERSPECTIVES“

MAY 27-28, 2022, TBILISI, GEORGIA



# ABSTRACTS

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**International Scientific Conference “Agricultural Mechanization and Technology in Europe and Perspectives”, was organized by Union of European Academies for Science Applied to Agriculture, Food and Nature - UEAA and the Georgian Academy of Agricultural Sciences – GAAS (Tbilisi, Georgia).**

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## **Brief Information about History of Mechanization and Nowadays**

### **Situation in Georgia**

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President of Union of European Academies for Science Applied to Agriculture, Food and Nature (UEAA)

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**Abstract.** The importance of holding an international scientific conference in the conditions of independent Georgia is especially great. Application of modern machine technologies will contribute to raising prestige of Georgian agricultural products in the international arena in the process of entering and establishing on European markets, and it is also vital for the country's economy.

Georgia's complex agricultural mechanization system was, and it still mainly relies on imported machines and tractors which are either directly implemented in the system or are used after their adjustment to zonal conditions, depending on the technological features of crop maintenance.



### **Interaction between the French Academy of Agriculture and the Union of European Academies for Sciences applied to Agriculture, Food and Nature (UEAA)**

**Michel Thibier** - Professor, Past President of the UEAA - Académie d'Agriculture de France, Paris, France

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**Abstract.** The **Union of European Academies for Sciences applied to Agriculture, Food and Nature** (UEAA) was created in October 2000 by 14 National Academies, both from European Union members and from countries external to it, all committed to the advancement of science in Europe.

The **French Academy of Agriculture** was with the Italian Academy of Georgofili a founder of UEAA 22 years ago.

The French Academy of Agriculture, established in 1761 by the King Louis XV, is committed to inform the French Government and the public opinion of progresses in all aspects of agricultural sciences. "*A passion for knowledge, a passion for transmission*", words that are inscribed in the French Academy of Agriculture motto to translate the wealth of skills and knowledge of its members. A regular public session meeting is being held every Wednesday afternoon, in the premises of the Academy and which is also recorded and available to the public by internet on [www.academie-agriculture.fr](http://www.academie-agriculture.fr)

Regarding the UEAA, the European Academies at creation have indicated among their main objectives *to foster comparative studies on a European scale regarding the development and dissemination of knowledge and the innovation and sustainable development of agriculture, land use*

*and food supply*.. There are now 31 members from countries within the E U and also external to it which gives a comparative advantage to the UEAA. The President and the Vice President are elected. The current President is Professor Guram Aleksidze from Georgia and the Vice President from Slovakia is Professor Elena Horska.

Thanks to the commitment and the dynamism of the President Aleksidze and of the Steering Committee members, UEAA has recently been proactive to the E U Commission regarding the E U Forestry strategy and also on the issue of Gene Editing. By the same token, UEAA has set up a new "Best Abstract" scientific competition opened to all UEAA members and also now publishes a monthly Newsletter.

The UEAA has many comparative advantages having under the same hat more than 30 European Academies of Agriculture with hundreds of high-level scientists and Academicians ready to give wise recommendations to the politicians involved in management of Agriculture, particularly in the context of research and innovation which are critical for the future of the European Agriculture industry in such a global world as ours.



## **Smart Farming Industry in Agriculture: Latvian Case**

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**Abstract.** New cycle and digitization of the industry, creation and introduction of new technologies are affecting the whole society, and it also raises new demands for the workforce who must be equipped with proper knowledge to respond to current challenges. The introduction of new technologies increases productivity, but today it does not develop at the same level in European countries and can not cope with the common challenge - ensure sustainable development of the environment and climate. Precision farming based on advanced technologies and artificial intelligence is the basis for increasing productivity and protecting the environment. Farms with an area of more than 500 hectares get the desired result within a short period of time, but this also depends on the type of crop they produce.

Large Latvian farms, which use "smart technologies" based on accurate data, run the farm effectively and make sensible decisions. For example, a soil nitrogen sensor is easily attached to a tractor and can control the nitrogen delivery dose and select a suitable strategy.



## **CURRENT STATE AND TRENDS OF MODERN AGRITECHNOLOGIES USING IN UKRAINE**

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**Andrei Gutorov** – Professor, Academician-Secretary of Agrarian Economy Department  
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**Abstract.** The article deals with the agriculture of Ukraine: main characteristics, features of Ukrainian agriculture, place of Ukraine in the world rating of agricultural and food exporters in 2020/2021, prospective lines of high-agritechnology development, main receipt ways of modern technologies on the Ukrainian market, high-impact synergy of crop growing technologies developed by national scientific center «institute of agricultural engineering and electrification», innovative

technologies and technical means for drop irrigation developed by the institute of water problems and melioration of NAAS and main risks of application modern agrotechnologies in Ukraine, 2022.

Ukraine has a significant potential for production of high quality agricultural products and its increase using modern agricultural technologies. Widening prospects of high-agritechnology usage depends on time and implement of cessation of hostilities, possibility of sponsorship of postwar economy. In modern conditions, the role of promising research and development of innovations is growing, which allows to increase production based on sustainable development. Successful development of modern agricultural technologies will be facilitated by the expansion of international scientific relations, the use of proven developments and experience.



## **ENERGY SELF-SUFFICIENCY OF FARMS**

**René Autellet** - Professor, French Academy of Agriculture, Paris, France

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**Abstract.** Taking the example of France, the author shows how public policies have placed all agricultural production in total dependence on an energy supply not only of fossil origin, but also from outside Europe.

Alternative solutions exist however, they have appeared, in an ephemeral way, according to the various oil crises. These same responses have been hailed by great innovation awards at specialized trade fairs, although without experiencing a commercial launch.

Following the awareness of the direct impact of carbon dioxide emissions of fossil origin on climate change, the decarbonization of practices is gradually turning self-evident through recent announcements from manufacturers.

Hydrogen, methane, vegetable oils, bio or synthetic fuels, green electricity could constitute an energy mix, compatible with the necessary transition. Coherent public policies could sustain these trends.



## **AGTECH COMPETENCE:**

### **URGENT NEEDS AND POSSIBLE PATHWAYS**

**Kerstin Niblaeus**, Doctor, Royal Swedish Academy of Agriculture and Forestry

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**Per Frankelius**, Associate professor, Linköping University and Chairman of the KSLA

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**Abstract.** The world faces huge challenges regarding food needs in relation to food supply. Some estimate that we need 60% more food in 2050 than today. The expanding food needs are not only connected with the population growth, but as much with changing food habits in Asia and elsewhere. Because agricultural production is vital for food production, many challenges must be handled by developing agricultural tools and methods.

This article takes off from a discussion about the challenges agriculture faces, like threatened biodiversity, sealing of arable land, climate change, lack of manpower and spreading of animal diseases. Then is discussed three pathways: evolution, imitation, and innovation. The main argument that is put forward in the speech, then, is that innovation is the best way forward. The main part of

the speech therefore is about agtech innovation, with focus on technology. Some present innovations are presented. Among the examples are field robotics, fossil-free farms, connected animals and AI-based field analysis.

The article ends with a discussion about competence development in relation to the mentioned challenges – based on the KSLA report from the Technology committee.



## **Potential of Smart Farming Technologies in the Czech Republic**

**František Kumhála** - Czech Academy of Agricultural Sciences, Department of Agricultural Engineering, Energy and Construction  
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**Abstract.** Intensive agriculture is facing a number of serious environmental problems worldwide. Average weight, power or agricultural machinery performance increased several times, as well as the maximum tire load. Each year, at least than 86% of soil appears under the wheels of agricultural machinery using classic ploughing technology. In the headlands, soil degradation, mainly due to technogenic compaction, is already beginning to manifest. In CR, more than half of agricultural land is at risk of erosion (large fields, growing wide-ranging crops like maize, mostly for biogas plants). Possible solution: using state-of-the-art technique and technology – Smart Farming. The idea of smart (precision) farming was born in the US in the 1980s with yield mapping. A commonly used technology is the navigation of machines via GPS with RTK correction (accuracy to centimetres). Controlled Traffic Farming technologies also have great potential. The implementation of ISOBUS technology seems inevitable. Interesting data can be obtained by monitoring the work of agricultural machinery and remote sensing. The use of agricultural robots also seems inevitable.



## **DEVELOPMENT OF SMALL SMART DATA LOGGER ROBOTS EMBEDDED IN IOT SYSTEM FOR CROP PRODUCTION**

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**Abstract.** The original idea for the research project came from Wang et al.'s 2019 article. In the development of a small smart robot described herein, a 360-degree rotating camera collects the data and sends images and videos to a telephone or computer terminal. In this paper the sensing possibilities have been significantly expanded upon. With the help of an RGB camera and a set of sensors mounted on a robot, it is possible to detect diseases, lesions, pathogenic syndromes, as well as soil-plant micro-climate, and by leaf sampling other characteristics of plants can be measured to enhance databases using a neural network.





## THE CURRENT STATE AND TRENDS OF AGRI-ENGINEERING STUDIES IN GEORGIA

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**Abstract.** The article analyzes the main results of agri-engineering studies in Georgia, taking into account the world trends; proceeding from the distinctness of the agriculture of the country the main directions of the fundamental and integrated applied studies in the branch of mechanization are defined. The attention is paid to the branches of the mechanics and mathematical sciences, which application significantly raises the scientific level of agri-engineering studies. The measures for stabilization of the engineering sphere of the agricultural sector and development of agriculture on the way of technological and technical innovation are defined.



### Selection of Rational Machinery Technologies for Small Farms in Adjara Region

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**Abstracts.** The article discusses the current condition in small farms in the mountaineous regions of Adjara and the ways of its further development. Nowadays, an important part of agricultural products in Adjara region is produced in small farms.

The necessary calculation methods are applied for the proper selection of rational energy means, based on the distribution of plots according to the needs of the family food, and the limits for the use of traction means required in small farms that are set based on the plot size.



### Drive of the Electrified Bridge Unit for Farms

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**Gela Javakhishvili**<sup>2</sup> – Dr., Professor, Georgian Technical University, Tbilisi, Georgia

**Abstract.** The design of a motorized bridge unit moving along guide rails across a vineyard nursery is described. The unit's power supply is from a centralized 3-phase AC circuit through a cable running along the rails and wound on a drum. Maximal power consumption is 15 kW. Two working speeds are available for operations in the nursery including soil treatment, planting of seedlings, application of fertilizers, hilling, inter-row hoeing, spraying, sprinkling, pruning and extraction of seedlings. A procedure is proposed for calculating the drive motor operating conditions for longitudinal movement of the unit. Based on a semi graphical method, elements of the drive circuit are calculated for 5 selected cases. In each case the static and dynamic stability have to be verified. The results of a dynamic stability check are given for one case.



## Tea Plantation Rehabilitation Vehicles

**Nugzar Ebanoidze** - Doctor of technical sciences, Professor, LEPL Scientific- Research Center of Agriculture, Tbilisi, Georgia.  
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**Abstract.** The article discusses the current state of the tea production field in Georgia and the measures needed for its development, including the main ones: rehabilitation of declining plantations, cultivation of new ones which will give abundant harvest, development and introduction of modern technologies and introduction of new technical means in production.

The article describes the rehabilitation machines for degraded tea plantations developed by the Agricultural Engineering Research Service of Agricultural Research Center in 2018-2021: complex tea machines, tea pruning machines with self-propelled chassis and moto-block base, created in Belarus. Also, a high-clearance tractor BL-1200 is designed, which will be imported and tested in Georgia in the 4th quarter of this year.



## Technological Scheme of Tea Bushes Flatly Trimming Machine

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**Marita Macharashvili**

**Tengiz Tsartsidze**

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**Abstract.** The article discusses different types of machines for pruning and shaping of tea bushes. In Georgia, arch-shaped tea machines are mainly used. Current practice has shown that in real operating conditions the operation of this type of machines is complicated, as they have a number of disadvantages, such as: Construction complexity of pruning machines, cost of details and joints, a low durability due to exposure to relatively high friction forces and reactive moments, high costs of fuel and labor resources, and a frequent need of current and capital repairs.

The article provides argumentation about advantage of pruning tea bushes flat, parallel to the soil surface. Accordingly, the kinematic and technological scheme of the flat pruning machine has been developed. The article describes the principle of operation of individual units of the machine and their advantages over arc-shaped welding machines. It performs four operations simultaneously: surface pruning of tea bushes, shredding of the cut mass, inter-row tillage, and application of mineral fertilizers. The model of this machine has been tested and a recommendation is made to use a flat grinder in a complex machine.



## DIAGNOSTICS OF RESIDUAL STRESSES IN SPUTED AND FLUSHED COATINGS

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**Abstract.** One of the most urgent problems of ensuring the quality and reliability of remanufactured and hardened machine parts is the diagnosis of residual stresses. First of all, this is due to the use of technical measuring instruments that allow you to quickly obtain the required amount of information. This work is devoted to the solution of this problem, in which surface residual stresses in metal coatings deposited by plasma methods during the restoration and hardening of machine parts are experimentally diagnosed. It was found that the stress diagram is non-equilibrium and shifted towards compression. Small stresses  $\sigma_M = 15-20$  MPa were recorded on the run-out of the stress diagram



## Irrigation infrastructure planning and management

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**Abstract.** The viability and yield of the plant depends on the correct use of these factors. Most of the listed activities: relative improvement of soil and air moisture by irrigation or drainage, flushing of saline soils, control of mechanical impact on water-soil, leveling the soil surface (shrinkage), uprooting, etc. are related to the issues of water resources regulation, and their implementation necessarily requires maintenance of rather complex technical systems (irrigation and drainage network with its structures, etc.) and knowledge of management systems for their operation.

**Key words:** Agriculture; Agriculture crop; Management. Water resources, optimization, irrigation; Irrigation water.



## Hazelnut calibrator based on electromagnetic vibration drive of reciprocating motion

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**Abstract.** The paper discusses the development of hazelnut production and export opportunities of Georgia; Innovative hazelnut calibration method, our own constant current magnetic reversible-forward motion electromagnetic hazelnut calibrating machine with the ability to change the number of fractions and adjust the productivity; The trajectory of the hazelnut movement on the surface of the screen and the scheme of forces acting on it; Analysis of the optimal technological parameters obtained as a result of the study of the working modes of the hazelnut calibrator.



## **Features of the development of theoretical concepts for calculating the reliability of agricultural machinery**

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**Giorgi Kutelia** - PhD, Specialist of the Scientific Center of the Ministry of Environment Protection and Agricultural of Georgia Tbilisi, Georgia,

**Abstract.** As you know, traditional methods of calculating machines for reliability are used for those objects that operate under stationary conditions. Such methods are not acceptable for agricultural machines, because of that their parts work in difficult conditions - they are constantly exposed to alternating dynamic loads, abrasive particles in the processed environment, high humidity and inclination of the relief. All these factors negatively affect reliability and cause failures of agricultural machinery.

The theoretical foundations for calculating the reliability of agricultural machines have been developed, which differ from the traditional classical methods used in radio electronics, aviation and mechanical engineering in that they take into account their work in special soil-climatic and dynamic conditions, the corresponding structural and logical schemes have been drawn up, as well as differential transition equations into various states according to Markov processes, as well as an original technique for studying single and complex indicators of operational reliability, their calculation for wear resistance to obtain the corresponding probabilistic and statistical models.



## **Innovative combined unit for mulching soil on the basis of a Motoblock**

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**Vladimer Miruashvili** - Ph.D., Employee of the Georgian Agricultural Research Center, Agro-engineering section, chief specialist

**Abstract:** The article deals with the designs of technical means of small mechanization that are used in Georgia, namely agricultural machinery installed on motoblocks, the scale and advantages of their use in comparison with powerful equipment, and on the basis of a patent (No AP 2020 15395) a completely new combined machine for motoblock is proposed, which is currently in demand in the conditions of development of modern technologies for growing crops on the market. In particular, on small plots and greenhouse farms. The article offers a constructive description of the mentioned combined unit and the principles of its operation.



## **Machinery and equipment for the rehabilitation of abandoned agricultural land**

**Zaza Makharoblidze - Dr, Revaz Phartskhaladze - Dr, Vladimer Margvelashvili, Sergo Sharashenidze, Aleksandre Shermazanashvili, R. Dvali, Institute of Machine Mechanics, Tbilisi, Georgia,**  
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**Abstract:** The article presents machine technology and a system of machines for the rehabilitation of abandoned agricultural land. An ecological soil protection technology has been developed that involves cutting, grinding plant mass and introducing it into the soil in the form of mulch for further use as a bio-fertilizer. For deep tillage, a working body of a rotary type was developed, the dynamic parameters of which were determined from the allowable limits of soil deformation. The kinematic scheme and the principle of operation of the machine for the ridge formation have been developed. For land rehabilitation, a vegetation shredder, a plant root system shredder in the soil and a ridge forming machine have been developed.



## **Machine technologies and economic evaluation of cultivation of blueberry**

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**Roman Margalitadze – Doctor of technics, Batumi Shota Rustaveli State University, Batumi, Georgia.**

**Abstract.** The paper presents the national economic importance of blueberry, one of the representatives of berries, the process of its formation as an agricultural sector, biology, machinery technologies of production, cultivation peculiarities, and comparative economic indicators of cultivation on traditional and plastic mulch, also machine technologies for the cultivation and production of blueberry.



## **Innovative Technical Device for Pruning Tea Bush**

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**Abstract.** The article presents results of development of an innovative technical means of small-scale mechanization and the technological process of pruning a tea bush. The technical device consists of a pruning seissors connected to the walk-behind tractor system. When using technical means labor productivity is increased significantly, the quality of tea is improved.



## **MODERN TECHNOLOGIES OF MECHANIZED FEEDING OF SILKWORM CATERPILLARS**

**Elgudja Shapakidze** -Academician of Georgian Academy of Agricultural Sciences, Doctor of Technical Sciences, Professor, Tbilisi, Georgia,  
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**Abstract.** For the restoration and development of sericulture in Georgia, it is necessary to introduce modern resource-saving technologies of tundo-intensive technological processes of sericulture and especially in the process of feeding silkworm caterpillars. In Georgia, the Research Institute of Sericulture developed three versions of mechanized installations for feeding silkworm caterpillars **UVSH-1**, **UVSH-2** and **UVSH-3**. The most interesting is the installation of **UVSH-3**, which automatically performs the following operations: distribution of feed, change of litter and aeration of caterpillars when moving feeding areas. To date, farms can be recommended a new technology for feeding silkworm caterpillars using mechanized installations **UVSH-3**.



## **Minimal soil processing machine technology for small farms**

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**Merab Kvartskhava** – Dr., Ministry of Justice of Georgia, LEPL "House of Justice", Martvili, Georgia

**Abstract.** The article discusses the resource-saving modern machinery of soil processing, discusses a constructive scheme of a combined resource-saving soil processing machine that allows deep loosening of the soil and performing a machine operation for the decomposition of the belt, as a result of which the soil is prepared to sow agricultural crops.



## EVALUATION OF FACTORS AFFECTING CHARACTERISTICS OF HIGH-TEMPERATURE SPRAYING AND STRENGTH OF COATING AND BASE ADHERENCE

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**Abstract.** At present, the method of plasma spraying of refractory metals and chemical compounds is widely used in various branches of technology. This is explained by the fact that plasma coatings make it possible to create surfaces of parts with desired physical and mechanical properties: improved erosion and corrosion resistance, increased wear resistance, and high resistance to thermal and dynamic influences.

However, these advantages may lose their exclusive significance if plasma coatings have low adhesion and, as a result, change (or lose) the specified physical and mechanical properties during operation. To eliminate this disadvantage, the protected surface, before coating, is prepared by shot blasting with abrasive chips with a particle size of 0.9-1.2 mm or a sublayer is applied to it. This improves the adhesion of the coating to the substrate through mechanical and chemical interaction.



## Theories and experimental study of the Causes of losses during crop harvesting

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**Abstract.** The article discusses studies of the causes of biological and mechanical losses during the crop harvesting, quantity of biological and mechanical losses are determined under the performed studies and the reasons while machine harvesting of different crops.



## Moisture-retaining, erosion-proof, soil compactor profilator

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**Abstract.** Under the influence of water and wind erosion, soil fertility is significantly reduced and, consequently, the yield of agricultural crops are damage, as well as the environment. The main cause of erosion is the location of arable lands on the slopes and plowing

of the soil by overturning the clod. According to scientific data, 46% of the total area in Georgia is eroded and this process is growing steadily. Recommendations and technical remedies for erosion reduction proposed by the researchers are discussed in the article. In order to reduce erosion and ensure soil moisture retention in irrigated areas on slopes, a complete soil compaction construction is proposed - a soil compaction profile on which special bolts are placed. A device which is fixed to the tractor when working and making rolls, produces some small pits in the soil. Atmospheric precipitation, is accumulated in these small pits and goes deeply into the soil, creating a supply of moisture. After saturating with moisture, the pits are filled with water forming a kind of reservoir from which water is gradually supplied to the plant's root system. Thus, on the one hand, the erosion process is substantially reduced, while on the other hand, the incoming sediment remains in the soil and feeds the plant. The number of those pits created by the experimental sample is 60,000, and the reservation of moisture is up to 650-700 tons per hectare. Testing of the machine have shown positive results. Its use after optimization of working bodies is planned not only for annual crops, but also for perennials and pastures.

