

**Подані пропозиції від наукових установ до Рамкової програми ЕС  
для науки та інновацій – ГОРИЗОНТ 2020 від Національної академії  
аграрних наук України**



**Proposals for the open calls of EU Framework Programme for  
researches and innovations – HORIZON 2020 from National Academy of  
Agrarian Sciences of Ukraine**

[www.uaan.gov.ua](http://www.uaan.gov.ua)

2014/2015

**PRESIDIUM OF THE NATIONAL ACADEMY OF AGRARIAN  
SCIENCES OF UKRAINE**



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## NATIONAL ACADEMY OF AGRARIAN SCIENCES OF UKRAINE

*Scientific, methodological and coordinating center of agro-industrial complex on problems of Ukrainian agro-industrial complex development, state self-governing scientific organization, established in 1931 as All-Ukrainian Academy of Agricultural Sciences, since 1990 –Ukrainian Academy of Agrarian Sciences (UAAS), and since December 2010 — the National Academy of Agrarian Sciences of Ukraine (NAAS).*

The Academy determines the main directions of fundamental and applied researches, elaborates state and branch scientific and technical programs on important agricultural problems and water economy, food and processing industry, as well as branches which provide services for Agroindustrial Complex. It also organizes and controls these programs execution, accomplishes system supply, scientific and technical development, formation of scientific institutions network, high-qualified specialists training and realizes scientific and technical cooperation with foreign countries.

The superior self-governing body of the Academy is the General Meeting. During the period between Sessions of General Meeting the Academy work is governed by the Presidium, which is elected for 5 years.

The structure of the Academy consists of six Departments: plant growing; arable farming, irrigation and mechanization; veterinary medicine; animal science; agrarian economics and food; scientific provision and innovative activity.

NAAS Network includes 187 institutions, enterprises and other organizations; 42 research stations; 10 scientific and research centers; 1 research field; 126 state research enterprises.

The following objects of national scientific heritage operate at the Academy: Bank of genetic resources of Ukraine, which has 141,3 thousand samples of 378 varieties for food and agriculture as well as 224 samples of wood and decorative varieties, which represent 1203 samples of wild plant varieties.

Genetic resources bank with 126 thousand sperm-doses of 207 bulls of 27 cattle species, 4730 epididymal zooblasts of boars and goats, 50 sperm-doses of stallions and 250 sperm-doses of scaly carps, 275 embryos of cattle.

Animal collection of Biosphere reserve “Askania-Nova” named after F. E. Falts-Fein is represented by 4330 individuals of 116 animal species which are kept in enclosures and half-freely.

Microorganisms' strains bank for veterinary medicine (accounts more than 1400 strains) and one of the biggest collections of lepto-spores (98 strains).

Collection of 561 varieties of useful microorganisms, including 465 strains of bacteria's and 96 strains of micromycetes, on their basis were created a number of biological medicines to fight with pests, diseases, nitric and phosphoric plants nutrition improvement.

Ampelographic collection of grape varieties from more than 30 countries of the world consists of 623 samples. 87 samples passed DNA passport registration, 130 samples are registered as characteristic collection, which is on the second place in Ukraine. Collection of strains for vine making consists of 117 species, including 68 yeast strains. They are registered in the World federation of collection of varieties.

NAAS scientific institutions hold breeding activity of more than 125 main agricultural crops registered in the State Register of Plant Varieties of Ukraine.

Varieties and hybrids of NAAS occupy more than 60% of the whole planting acreage of Ukraine.

The total amount of agricultural animals of native breeding in the total number of livestock is: cattle of dairy breed – 80%; cattle of beef breed – 68%, swine – 72%, sheep – 88%;

According to government order 36 NAAS Institutions train the high qualified researchers on 59 specialties for 6 scientific branches.

Implementation of international cooperation of NAAS establishes according to the scheme of formation of joint research programs, obtaining grants, signing the cooperation agreements, memorandums and so on. The total numbers of documents contracting scientific cooperation with academies and institutions 136, from over 50 countries: the Czech Republic, France, Poland, Lithuania, Hungary, Moldova, Belarus, China, Egypt, Iran, Brazil, Argentina, USA, Canada, Japan, etc. The primary means for implementing cooperation contract is a practice to illustrate its success is the quantitative index, annual stacking of 70 - 100 contracts worth about 4 million USD and extension of more than 150 transactions in the amount of 2 - 2.5 millions, including annual royalty – 1 - 1.5 million USD and 20 - 25 grants with a total value - about 7 million USD.

***The strategic priorities of NAAS of Ukraine for 2015-2020:***

1. Building relationships with relevant institutions in Ukraine and abroad initiating relationships on scientific researches and their commercial incarnations.
2. Promotion of agribusiness development and commercialization of finished scientific research-and-development activities, particularly technologies.
3. Participation in creating a favorable regulatory environment to restore areas of irrigated lands, in particular by introducing the concept of single irrigation tracts for land, a clear legislative strengthening property rights and the use of irrigation systems.
4. Active involvement of NAAS experts in providing legislative regulation and practical implementation of financial instruments on agricultural markets.
5. Development of the concept of reforming Ukraine agricultural science based on an innovative model to improve its efficiency by providing, in particular, the preservation of public funding of basic research and research in the field of environment protection, quality and safety of life and optimization of funding applied research, privatization and liquidation of inefficient enterprises and institutions of NAAS.
6. Promoting the advancement of domestic producers of agricultural and food products to foreign markets, including their participation in international exhibitions.
7. Initiate drafting and signing intergovernmental agreement “On cooperation of European countries and Ukraine in the field of adaptive farming and organic production of agricultural products and biological material”.
8. To initiate the approval of the Parliament of Ukraine for draft Law of Ukraine's accession to the International Agreement on Plant Genetic Resources for Food and Agriculture.
9. To implement energy-saving and environmentally safety technologies in animal production, form information base breeding value of farm animals of different species.
10. Development and implementation of joint cross-border programme for monitoring emergent and economically important infectious animal diseases, introduce a system of controlling the quality and safety of agricultural products in accordance with EU requirements and international standards, unified regulatory framework on biosafety issues and biological protection.

***We are looking forward for cooperation!***

## **General information about programme Horizon 2020**

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness.

Seen as a means to drive economic growth and create jobs, Horizon 2020 has the political backing of Europe's leaders and the Members of the European Parliament. They agreed that research is an investment in our future and so put it at the heart of the EU's blueprint for smart, sustainable and inclusive growth and jobs.

By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

Horizon 2020 is open to everyone, with a simple structure that reduces red tape and time so participants can focus on what is really important. This approach makes sure new projects get off the ground quickly – and achieve results faster.

The EU Framework Programme for Research and Innovation will be complemented by further measures to complete and further develop the European Research Area. These measures will aim at breaking down barriers to create a genuine single market for knowledge, research and innovation.

### **Work Programme components**

Funding opportunities under Horizon 2020 are set out in multiannual work programmes, which cover the large majority of support available. The work programmes are prepared by the European Commission within the framework provided by the Horizon 2020 legislation and through a strategic programming process integrating EU policy objectives in the priority setting.

The preparation of work programmes involves the consultation of stakeholders. For this purpose 19 Horizon 2020 Advisory Groups have been set up as consultative bodies representing the broad constituency of stakeholders ranging from industry and research to representatives of civil society. Additional open and targeted consultation activities aim to obtain further views and contributions, including from the Enterprise Policy Group, European Innovation Partnerships and European Technology Platforms. For more detailed information see programme sections.

The main Horizon 2020 work programme comprises 18 thematic sections and the general annexes describing general rules such as standard admissibility conditions and eligibility criteria, types of action, selection and award criteria, etc. Each thematic section is self-contained, and describes the overall objectives, the respective calls for proposals, and the topics within each call.

The Horizon 2020 work programme is complemented by the separate work programmes for the European Research Council, Euratom, the Joint Research Centre and the Strategic Innovation Agenda for the European Institute of Innovation and technology (EIT).

### **Excellent Science**

Activities under this Pillar aim to reinforce and extend the excellence of the Union's science base and to consolidate the European Research Area in order to make the Union's research and innovation system more competitive on a global scale.

The Excellent Science pillar has main four specific objectives:

1. The European Research Council (ERC) will provide attractive and flexible funding to enable talented and creative individual researchers and their teams to pursue the most promising avenues at the frontier of science, on the basis of Union-wide competition.

2. Future and emerging technologies will support collaborative research in order to extend Europe's capacity for advanced and paradigm-changing innovation. They will foster scientific collaboration across disciplines on radically new, high-risk ideas and accelerate development of the most promising emerging areas of science and technology as well as the Union-wide structuring of the corresponding scientific communities.

3. Marie Skłodowska-Curie Actions will provide excellent and innovative research training as well as attractive career and knowledge-exchange opportunities through cross-border and cross-sector mobility of researchers to best prepare them to face current and future societal challenges.

4. Research infrastructure (including e-infrastructures) will develop European research infrastructure for 2020 and beyond, foster their innovation potential and human capital, and complement this with the related Union policy and international cooperation.

Together, these objectives form a powerful and balanced set of activities which, in concert with activities at national and regional levels, span the breadth of Europe's needs regarding advanced science and technology. Bringing them together in a single programme will enable them to operate with greater coherence, in a rationalised, simplified and more focused way, while maintaining the continuity which is vital to sustain their effectiveness.

The activities are inherently forward-looking, building skills in the long term, focusing on the next generation of science, technology, researchers and innovations and providing support for emerging talent from across the whole of the Union and associated countries, as well as worldwide. In view of their science-driven nature and largely 'bottom-up', investigator-driven funding arrangements, the European scientific community will play a strong role in determining the avenues of research followed under the programme.

### **Industrial Leadership**

This pillar aims to speed up development of the technologies and innovations that will underpin tomorrow's businesses and help innovative European SMEs to grow into world-leading companies.

It consists of three specific objectives:

- "Leadership in enabling and industrial technologies" will provide dedicated support for research, development and demonstration and, where appropriate, for standardisation and certification, on information and communications technology (ICT), nanotechnology, advanced materials, biotechnology, advanced manufacturing and processing and space. Emphasis will be placed on interactions and convergence across and between the different technologies and their relations to societal challenges. User needs will be taken into account in all these fields.

- "Access to risk finance" will aim to overcome deficits in the availability of debt and equity finance for R&D and innovation-driven companies and projects at all stages of development. Together with the equity instrument of the Programme for the Competitiveness of Enterprises and small and medium-sized enterprises (COSME) (2014-2020) it will support the development of Union-level venture capital.

- "Innovation in SMEs" will provide SME-tailored support to stimulate all forms of innovation in SMEs, targeting those with the potential to grow and internationalise across the single market and beyond.

The goal is to make Europe a more attractive location to invest in research and innovation (including eco-innovation), by promoting activities where businesses set the agenda. It will provide major investment in key industrial technologies, maximise the growth potential of European companies by providing them with adequate levels of finance and help innovative SMEs to grow into world-leading companies.



## Societal Challenges

Horizon 2020 reflects the policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere.

A challenge-based approach will bring together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities. This will cover activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake. It will include establishing links with the activities of the European Innovation Partnerships ([EIP](#)).

Funding will focus on the following challenges:

- Health, demographic change and wellbeing;
- Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the Bioeconomy;
- Secure, clean and efficient energy;
- Smart, green and integrated transport;
- Climate action, environment, resource efficiency and raw materials;
- Europe in a changing world - inclusive, innovative and reflective societies;
- Secure societies - protecting freedom and security of Europe and its citizens.

### Information sources:

HORIZON 2020 – [http://ec.europa.eu/research/horizon2020/index\\_en.cfm?pg=h2020](http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=h2020)

CORDIS – Information Service EU for Research and Development  
[http://cordis.europa.eu/home\\_en.html](http://cordis.europa.eu/home_en.html)

Participant Portal – <http://ec.europa.eu/research/participants/portal/>

NIP/Ukraine – [www.fp7-ncp.kiev.ua](http://www.fp7-ncp.kiev.ua)

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## Proposals of NAAS Institutions

### Department of Agriculture, Irrigation and Mechanization proposals for the open calls of EU Framework Programme for researches and innovations – HORIZON 2020

#### I. National Scientific Center «Institute for Soil Science and Agrochemistry Research named after O.N. Sokolovsky» (NSC ISSAR)

##### 1. FARMERS AGRO ASSISTANT

*Call SFS-02b-2015: Assessing soil-improving cropping systems*

Project proposal envisages the creation of an innovative information management complex for management of agricultural plants nutrition in various production conditions. Farmers Agro Assistant complex includes:

- remote assessment system for soil inhomogeneity on moisture supply and condition of the plants with the use of space data and unmanned aerial monitoring data;
- diagnostic system of plants mineral nutrition with express methods for detection of macro and microelements deficiency;
- land management optimization system to reduce erosion and soil nutrients losses, as well as parcelling of large areas for accurate fertilizer application by diagnostic data;
- information and analytical support system for accumulation and initial processing of data on soil cover condition, land management, climate, yield and other data;
- system for optimal usage of agricultural wastes for the maintenance and restoration of soil fertility, especially in organic production conditions;
- system of environmental and economic optimization of farmers management to maximize the profitability of production and to reduce risk of environmental pollution and soil degradation.

The project envisages integration of the latest tools and techniques for precision farming (advanced automation, remote sensing, geographic information technology), modern methods of soil and plant diagnostics, erosion protection of agricultural landscapes, etc.

Depending on local conditions (climate, relief, soils), cultivated land (up to 50 ha, 50-500 ha, 500 ha) and farm specialization (traditional or organic) it is envisaged the development of different variants of information management complex.

Expected results of the proposed project may become the basis for solving the main strategic objectives on the intensification of European agriculture:

- improved management of external nutrient application;
- improved management of external water application;
- optimization and efficiency growth of nutrient and water usage at the farm level to improve both productivity and quality;
- reduced soil erosion and improved quality and structure of the soil;
- prevention of the agricultural landscapes degradation and reducing of the anthropogenic pressure on the environment in agricultural production;
- improving the competitiveness of European farmers due to reducing production costs.

**Project coordinators:** Prof. Mykola Miroshnychenko [ecosoil@meta.ua](mailto:ecosoil@meta.ua); Dr. Arkadiy Levin [alevin@ukr.net](mailto:alevin@ukr.net)

##### 2. SIMPLIFIED SOIL TESTS AND MONITORING FOR ORGANIC FARMING

*Call SFS-02b-2015: Assessing soil-improving cropping systems*



Project proposal is aimed at ensuring efficient management of soil quality in the organic farming in sector of small and medium farmers. Representatives of this segment are dominated among organic producers, but as a rule, do not have enough resources for detailed monitoring of soil condition and expensive technologies of soil fertility management (especially in Eastern Europe). It does not allow to achieve high stability of land use, reduces the positive impact of organic production on the health of the soil and creates risk of developing certain degradation processes.

It is planned to create a flexible system of simplified qualitative and quantitative tests for the rapid diagnosis of physical, chemical and biological condition of the soil, as well as to prepare a manual with recommendations for the use of soil conditioners and fertilizers. In addition, to demonstrate the project results and share best practices in quality management of soil organic agriculture it is proposed to establish a special training and consulting center.

The result of the project is to raise productivity, product quality and stability of yield in organic farming systems by improving the practice of soil economic use in the sector of small and medium farmers.

**Project coordinators:** Prof. Mykola Miroshnychenko [ecosoil@meta.ua](mailto:ecosoil@meta.ua); Dr. Arkadiy Levin [alevin@ukr.net](mailto:alevin@ukr.net)

### 3. PROTECTIVE IMPACT OF CONCENTRATOR-PLANTS ON ACCUMULATION OF HEAVY METALS IN CROPS

***Call SFS-02b-2015: Assessing soil-improving cropping systems***

Certain species of wild plants are known for their ability to accumulate significant amounts of Cd, Pb, Zn, Cu, Ni and other heavy metals, in their organism, without significant damage to themselves. In areas of natural geochemical anomalies, these concentrator-plants (CPs) protect less resistant species from excessive accumulation of heavy metals. Taking up this metallic loading on themselves, CPs perform a great protective function in ecosystems.

Our piece of work assumes a goal to use this effect to create an artificial biological community that would help protecting crops from excessive accumulation of heavy metals under conditions of environmental contamination. Complex cultivation of agricultural crops and CPs enables growing up agricultural products with acceptable safety characteristics in areas contaminated with heavy metals. This method of bioremediation is promising to involve agricultural production in close vicinity to urban areas which, due to soil contamination indices, are considered as out-of-condition. Such an approach does not conflict with other (physical, chemical, biological etc.) detoxification and pollution- localization measures, and can be used either separately or in combination with other approaches, with such items as:

- Control of soil contamination with toxic compounds and heavy metals;
- Protection of biodiversity and wildlife.

#### *a. green manure as a source of microelement nutrition for crops*

Green manure (GM) is an important factor in regulation of mineral nutrition for crops, especially in organic farming conditions. GM of different plant species varies both in accumulation-ability for proper micro-elements (ME), and in tempos of organic matter mineralization in soil, due to an essential difference in their chemical compositions. As a result, green cropped mass of different plants is characterized by different composition and speed of nutrient's release, including micro-elements as well.

Determination of promising plants species, in terms of their efficient quality as a green fertilizer (the source of micro-elements), is proposed. Of a certain scientific and practical interest is a velocity of floral residuals' transformations in soil that defines speed of nutrients' release, and time needed for their availability to the follow-on plant-link of cropping-rotation.

Results of these studies shall help nominating a list of prospective crops and various combinations hereof to be of maximal effect as a green bulk manure capable to meet the crops'

demand for micro-elements. Release of micro-elements in the process of GM decomposition is expected to coincide in time with critical phases of crops development, i.e., when plants are especially responsive to ME nutrition.

Special-purpose studies with various plant species, in different soil & climate conditions shall be implemented to determine an extent of MEs concentrations availability in plant residues during critical phases of main crop development.

Project

*b. improvement of anti-erosion management for agricultural land*

In the process of agricultural activity occurs unintentional violation of the conditions in which steady erosion processes of natural land cover are taken place. Nature tends to compensate for the loss of stability through the complexity of the relief through erosion and differentiation runoff. For effectively soil protection from water erosion it is necessary to predict the intensity of the manifestations of this non-equilibrium process. Accurate prediction of soil flushing is impossible due to objective reasons. More realistic is approach, aimed at minimizing of water erosion risk for a specific field by optimizing the methods of agricultural activity based on relief and properties of the Earth's surface.

The project envisages the development of management technology of erosion control measures that could through detailed account of the relief and the properties of the Earth's surface identify and map the lands erosion risk, select appropriate and most cost-effective methods and techniques to protect them from water erosion at the level of detail specific agricultural fields (soil protection occupancy of crop rotations; the choice of optimal processing directions, as well as orchards and vineyards; spatial optimization of specific agricultural methods of soil conservation and other methods). Main technological project solutions are protected by patents of Ukraine.

In the future, with wide practical use of project results it should be expected a significant reduction of the water erosion risk of soil cover for agricultural lands with difficult terrain.

**Project coordinators:** Prof. Mykola Miroshnychenko [ecosoil@meta.ua](mailto:ecosoil@meta.ua); Dr. Arkadiy Levin [alevin@ukr.net](mailto:alevin@ukr.net)

#### 4. PROTECTIVE IMPACT OF CONCENTRATOR-PLANTS (CPS) ON ACCUMULATION OF HEAVY METALS IN CROPS

***Call SC5-07-2015: More effective ecosystem restoration in the EU***

Certain species of wild plants are known for their ability to accumulate significant amounts of Cd, Pb, Zn, Cu, Ni and other heavy metals, in their organism, without significant damage to themselves. In areas of natural geochemical anomalies, these CPs protect less resistant species from excessive accumulation of heavy metals. Taking up this metallic loading on themselves, CPs perform a great protective function in ecosystems.

Our piece of work assumes a goal to use this effect to create an artificial biological community that would help to protect crops from excessive accumulation of heavy metals under conditions of environmental contamination.

Complex cultivation of agricultural crops and CPs enables growing up agricultural products with acceptable safety characteristics in areas contaminated with heavy metals. This method of bioremediation is promising to involve agricultural production in close vicinity to urban areas which, due to soil contamination indices, are considered as out-of-condition. Such an approach does not conflict with other (physical, chemical, biological etc.) detoxification and pollution- localization measures, and can be used either separately or in combination with other approaches with such items as:

- Control of soil contamination with toxic compounds and heavy metals;
- Protection of biodiversity and wildlife.

**Project coordinators: Prof. Mykola Miroshnychenko [ecosoil@meta.ua](mailto:ecosoil@meta.ua); Dr. Arkadiy Levin [alevin@ukr.net](mailto:alevin@ukr.net)**

## **5. IMPROVEMENT OF ANTI-EROSION MANAGEMENT FOR AGRICULTURAL LAND**

***Call SC5-07-2015: More effective ecosystem restoration in the EU***

In the process of agricultural activity occurs unintentional violation of the conditions in which steady erosion processes of natural land cover are taken place. Nature tends to compensate for the loss of stability through the complexity of the relief through erosion and differentiation runoff. For effectively soil protection from water erosion it is necessary to predict the intensity of the manifestations of this non-equilibrium process. Accurate prediction of soil flushing is impossible due to objective reasons. More realistic is approach, aimed at minimizing of water erosion risk for a specific field by optimizing the methods of agricultural activity based on relief and properties of the Earth's surface.

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## **II. Institute for Agroecology and Environmental Management**

### **1. PHYTO TECHNOLOGIES FOR MANAGEMENT OF RADIONUCLIDE AND PESTICIDE CONTAMINATED SOIL IN UKRAINE**

***Call SFS-02b-2015: Assessing soil-improving cropping systems***

A set of innovative, plant-based natural remediation technologies that preserve soil fertility, will be developed for clean-up of soils contaminated with both organic pollution and radioactive elements. This will be evaluated in laboratory and field conditions. The test site in the Korosten Zhytomir region, Ukraine, will be characterized and indigenous plants with hyper accumulating properties for the radionuclide and organic pollutants will be identified. Their phytoextraction potential as well as the usability of other hyper accumulators will be tested along with possibility of using chemical remediation on polymeric sorbents as one of the alternative method in a process. Arbuscular mycorrhizal fungi from the rhizosphere of such plants will be isolated and characterized. Mechanisms involved in mycorrhizae mediated plant uptake will be studied and the potential of rhizosphere management to increase phytoextraction efficiency will be evaluated. New knowledge will be disseminated to local authorities, stakeholders and the international scientific community.

**Project coordinator: Lidiya Moklyachuk, Dr. of Agrarian Sciences, e-mail: [moklyachuk@ukr.net](mailto:moklyachuk@ukr.net)**

## 2. DEVELOPMENT OF METHODS FOR AGROLANDSCAPES TRANSFORMATION AND DESERTIFICATION MONITORING IN SEMI-NATURAL EROSIIVE AGROLANDSCAPES USING REMOTE SENSING DATA FROM SPACE

*Call SFS-02b-2015: Assessing soil-improving cropping systems*

**The main idea of the project:** scientific substantiation and development of environmentally sustainable agrolandscape structure and identification of potential risks of soil degradation and desertification by using space remote sensing data and GIS technologies.

The project will be focused on agrolandscapes ecological assessment methods development, agricultural technologies and land use best practice realization, land and water recourses and biodiversity protection. Special attention will be paid to solving the problem of erosion and land degradation, the impact of soil and water for agricultural products. Desertification processes and climate change impact on agroecosystems will be studied as well. The models and scenarios of economically efficient agricultural production will be proposed by reducing the use of local industrial resources, including biomass and waste usage for bioenergy and nitrogen fixation legumes, plant biological protection, optimal crop rotation, use of green and other organic fertilizers. As a result the technogenic stress on the ecosystem will be reduces and high quality products will be provided.

*Scientific & Technical Objectives of Project:*

- Development of agrolandscapes transformation monitoring universal method and technology based on the remote sensing data in conditions of private ownership of land, land lease relations and free market, including control of land degradation, desertification processes, agrobiodiversity in semi-natural erosive landscapes with complex relief.
- Research and development of best practice in land use management and agricultural technologies to investigate the optimal agrobiodevirsity, erosion processes minimization and environment protection.
- Development of general principles of creation the environmentally sustainable agrolandscapes, land use systems and agricultural technologies in terms of land lease relations and high risk of erosion processes.
- Intensifying of agrobiological potential (nitrogzen fixation, phosphorus mobilization, phytosanitary condition of crops and soil).
- Water management regime in erosion-hazardous agricultural landscapes by reducing water losses with surface runoff.

*Subjects:*

- Development of agrolandscapes state assessment methods and their agrobiodeversity level determination in different types of agricultural production, the ratio of farming and natural ecosystems determination by using modern space remote sensing data to form the environmentally sustainable agrolandscapes structure, land use systems and agricultural technologies;
- Identification of potential risks of soil degradation (water & wind erosion, crop rotation disturbance);
- Research and development of the best practice in land use management and agricultural technologies, water and bioresources rational usage, and creation of closed cycles nutrients and bioenergy from biomass and waste.
- Intensifying the use of biological nitrogen and phosphorus mobilization by the use of highly efficient biological agents, including plant protection, optimal crop rotation, soil conservation technologies, green manure and other organic fertilizers.

*Expected impact*

- It purport to study and implement a more environmentally friendly systems of land use and agricultural technologies to prevent land degradation, optimal biodiversity parameters obtainment (acreage structure, crop rotation, natural lands, water resources), mitigating the risk of crisis occurrence and impact in agricultural landscapes.

- The best practices of regional farming, restoration of degraded soils and natural lands as well as realization of biodiversity positive effects in agroecosystems will be offered. The proposed recommendations will be approved in particular farms within the zonal features.

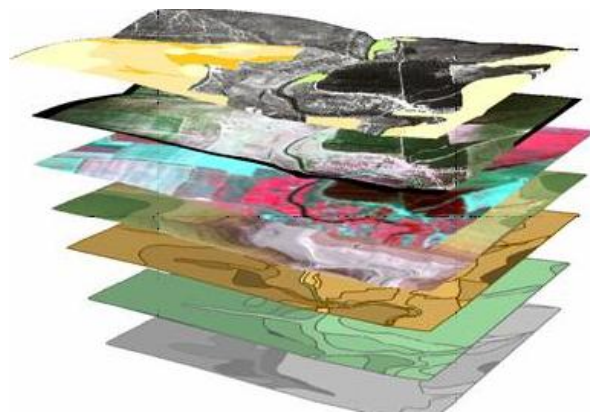
- The results will contribute to the science-based decision making in the formation of sustainable land use systems and agricultural landscapes, the introduction of resource- and energy-saving agricultural technologies, land consolidation, increasing areas of ecological redundancy, so as degraded soils restoring and reduction of chemical and anthropogenic impact on ecosystems, degraded lands conservation, adaptation to climate change.

- The results of the project will be used for demonstration and information dissemination among relevant target groups, including farmers, politicians, consulting services, and local authorities.

Illustrations:



*Soil degradation*



*Spatial analysis*

*Field and beneficiaries:*

1. Farmers
2. Local/regional authorities (policy-makers, development programme managers)

#### **INNOVATIVE APPROACHES**

As a result the following will be proposed:

1. Models of mixed low-carbon energy-saving agro-ecosystems
2. Energy- and resource-saving agricultural technologies
3. Agricultural technologies and land- and water use best practice
4. Monitoring methods of agroresources, desertification processes and critical phenomena using remote sensing data and GIS technologies.

5. Agricultural technologies, providing high quality products and feed

The proposed model of agro-ecosystems and agricultural technologies will be tested in specific farms in different soil and climatic conditions.

**Project coordinator: Oleksandr Tarariko, academician of National Academy of Agrarian Sciences of Ukraine, email: [tarariko@ukr.net](mailto:tarariko@ukr.net)**

### **3. BALANCED RURAL AREAS DEVELOPMENT IN CONTEXT OF EUROINTEGRATION PROCESSES**

**Call ISIB-03-2015: Unlocking the growth potential of rural areas through enhanced governance and social innovation**

Under the proposed theme, these tasks will be made:

- the international experience of rural areas sustainable development will be studied;
- the criteria and indicators of social, economic and ecologically safe development of rural areas will be defined;



- the influence of socioeconomic factors on the agro-ecological soil condition, the quality of plant products and potable water in various soil-climatic conditions of Ukraine will be investigated;

- the ecological risks of rural areas sustainable development in order to prevent potential negative consequences for the environment and the rural areas population health will be established.

**Project coordinator: Palapa Nadiya, Dr. of Agrarian Sciences, e-mail: [palapa.60@mail.ru](mailto:palapa.60@mail.ru)**

### **III. Institute of Water Problems and Land Reclamation**

#### **1. DEVELOPMENT OF WATER SUPPLY SYSTEMS BASED ON ENERGY-SAVING TECHNOLOGIES**

***WATER-5c-2015. Development of water supply and sanitation technology, systems and tools, and/or methodologies***

Sustainable providing all consumers with the desired amount of water of proper quality under the required head ensuring the lowest capital and operating costs is of great importance for the society development.

To solve this problem it is necessary to meet the following challenges:

-to analyze quantitative and qualitative values of water resources in different regions of Ukraine and trends of their changes in time and space;

-to offer resource-saving technologies for water abstraction, purification and distribution in view of such ideas:

a) to sort the water supplied to the consumers out for technical and drinking needs, taking into account the requirements of being industrial water cheap and drinking one of a high quality (in accordance with the European standards);

b) to use closed systems of water use in agricultural enterprises with minimal water abstraction from natural water sources and using biotechnology for wastewater treatment which can provide biogas and fertilizers for crops;

c) to develop the technologies of decentralized systems of group agricultural water-supplies enabling to get cheap industrial water being deep advanced treated to the drinking water standards in the areas of consumption;

d) to develop a method of optimizing joint structures operation in water supply and distribution systems to minimize the specific energy consumption for water supply to consumers.

**Project coordinator: Petro Khoruzhy Dr. of Engineering, e-mail: [petro1939@bigmir.net](mailto:petro1939@bigmir.net)**

#### **2. OPTIMISATION OF SEWAGE TREATMENT IN UKRAINIAN VILLAGES IN DEPENDANCE OF LANDSCAPE CHARACTERISTICS, NAMELY SOIL TYPES, LANDUSE AND RECEIVING WATERS, BASED ON GIS MODELLING**

***WATER-1b-2015. Demonstration/pilot activities***

In most Ukrainian villages waste water canalization is missing causing additional pressure on land and water resources. To minimize such pressures different sewage treatment variants can be considered and their efficiency assessed. Besides technical standards landscape characteristics like soil types, land use and distance to water bodies should be taken into account to reduce negative impacts. For related specific questions modern GIS techniques can provide various kinds of decision supporting information and show consequences of different treatment types on a larger scale.

**Project coordinator: Michael Hoffmann Dr. rer. nat., e-mail: [mi-hoffmann@gmx.net](mailto:mi-hoffmann@gmx.net)**



### 3. PREVENTION OF EMERGENCY SITUATIONS BY USING ADVANCED AND OPTIMIZED MONITORING NETWORK FOR THE QUALITATIVE AND QUANTITATIVE STATUS OF SURFACE WATERS IN UKRAINE

#### ***WATER-4b-2015. Water management solutions for agricultural sector, thematic networks***

Spatial and time organization of surface water monitoring must meet certain criteria to obtain representative data on the quality state of water bodies, namely:

- existence of observation points in the detected referential areas of each river basin to evaluate an anthropogenic load;
- distance-finding between the observation points;
- observation points network should cover potential contamination sources of surface water as trade and municipal return wastewaters discharge, diffuse sources, mouth parts of large tributaries;
- location of the observation points enables to evaluate the impact of withdrawals of water from water bodies for sanitary needs on water quality depending on their water content;
- determination of false or abnormally high or low values of measurements at observation points;
- statistical treatment of raw data to determine the trends of water quality parameters at each observation point;
- observation points for surface water quality should be adjusted by the basin principle and take into account basin and sub-basin boundaries;
- possibility of applying a reduced program of observations on the quality of surface water without significant loss of its representativeness.

Specifying the emergency results and identifying the trends of water quality and quantity parameters of water bodies must be performed by using a computer information database of the surface water monitoring system of Ukraine and applied GIS. An additional condition for the efficient optimization of the surface water monitoring system is extending the list of pollutants determined according to EU Directives.

***Project coordinator: Sergiy Shevchuk Ph.D. in Engineering Science, e-mail: [sergey.shevchuk@ukr.net](mailto:sergey.shevchuk@ukr.net)***

### 4. SCIENTIFIC SUBSTANTIATION OF WATER INDUSTRY OF UKRAINE FUNCTIONING IN TERMS OF WATER SCARCITY

#### ***DRS-01-2015. Potential of current and new measures and technologies to respond to extreme weather and climate events***

The project was launched to create effective mechanisms for optimization the river runoff distribution (including transboundary) between parties of water economy system to reduce the effects of water lack and guaranteed water supply of population, sectors of the economy and to improve the ecological state of rivers.

The project takes into account all documents developed by the EU in relation to integrated water resources management and its adaptation in crisis emergencies. This is directly related to the solution of the main problem - functioning of water economy system in terms of years with water lack. A tool for solving these problems is the plan of integrated water resources management in Ukraine and transboundary river basins, which are an integral part of measures to reduce or mitigate the effects of water lack. This is preceded by preparation for water lack, such as: developing a plan of fight against water lack, changes in reservoir operation rules (cascade reservoirs), prioritization of water users, reducing intake for individual water users, planning in case of emergency.

The project is solved through the implementation of guidelines on fair redistribution of water resources (including transboundary rivers) between water users during water lack period or a series of water lack years and drafting rules of runoff redistribution between the parties water

complex based on the models of climate change, water content of rivers, water scenarios and hypotheses of socio-economic development and political structure of the state.

Key measures to improve the sustainability of the of water economy system are: reducing demand for water, improving technology and practice of efficient water use, increasing the level of resource availability of surface and ground water, fight water losses in sectors of the economy, the economic and fiscal policies, technological mechanisms of rational water resources redistribution between water users.

**Project coordinator: Arkadiy Kordum Ph.D. in Geographical Science, e-mail: [julia.danilenko@ukr.net](mailto:julia.danilenko@ukr.net)**

## 5. POTENTIAL OF EXISTING AND NEW MEASURES AND TECHNOLOGIES TO PROTECT AGAINST THE HARMFUL EFFECTS OF SURFACE AND GROUND WATERS

***DRS-01-2015. Potential of current and new measures and technologies to respond to extreme weather and climate events***

The aim of the research is to create an innovative product-the scientifically-based and systematized using technical and economic criteria of the potential of existing and new measures and protection technologies against the harmful effects of surface and ground waters.

The specific problem of the proposal: a harmful effect on the human life, industrial and natural systems of surface and ground waters.

The harmful effect of water is the result of extreme weather, climate event and accidents on water objects. The harmful effect of water consists of the harmful effect of surface water (flooding) and the harmful effects of ground water (ground water level rise above the permissible). The problem of the harmful effects of water relates to the problem of risk management of emergency situations, which can be solved in two ways.

According to the first trend risks management measures are implemented by the operational control and emergency response to the extraordinary situations in order to reduce the negative consequences (loss) of an emergency.

According to the second trend preventive engineering measures are implemented to protect against harmful effects of water, in order to prevent the harmful effects of water and its negative consequences (loss of emergency) and to create conditions for the safe of the population.

A list of basic researches on the development of preventive measures and technologies of protection against the water's harmful effects includes activities and technologies of forecasting of water's harmful effects, operational monitoring, warning and emergency response to the accidents on water objects, technologies and measures of preventive protection against the harmful effects of surface and ground waters, which includes the following:

- structural and functional analysis of measures of preventive protection areas from the harmful effects of ground and surface water;
- measures of protection against the harmful effects of surface waters on the basis of increasing capacity of river channels;
  - coating for fixing river beds, the technology of their construction and operating regimes;
- measures of protection against the harmful effects of surface waters on the basis of the drainage of flood flow in flood-control pool;
- the reservoirs for flood protection on the mountain rivers, the technology of their construction and calculation of optimal modes of filling and emptying;
- the reservoirs for flood protection on lowland rivers, the technology of their construction and calculation of optimal modes of filling and emptying;
- measures of areas protection from the harmful effects of ground waters based on acceleration of the ground waters disposal out of the territory;

- the construction of drainage to protect rural areas and settlements from the harmful effects of ground waters;
- the construction technology of drainage-protection systems;
- new advanced construction technology of deep horizontal drainage;
- the grout cutoff curtain and diaphragm to protect the territories and settlements against harmful effects of ground waters of natural and man-made type;
- the construction technologies of grout cutoff curtains and diaphragms;
- the method of basis's deformation for optimization by economic criteria of designed-technological solutions deep horizontal drainage;
- combined drainage-cutoff systems for comprehensive protection of rural areas and settlements from the harmful effects of ground waters;
- the method of basis's bifurcation and its use at the stage of choosing optimal design decisions drainage-cutoff systems of protection against the harmful effects of ground waters;
- cost-effectiveness technique for project solutions on protection systems against the harmful effects of surface and ground waters;
- procedure for determining the priority of investments in protect measures against the harmful effects of surface and ground waters.

New technical solutions that will be given in the project are patentable or protected by patents. By the category of research project implementers have more than 50 technical solutions protected by patents in Ukraine.

***Project coordinator: Vyacheslav Petrochenko Ph.D. in Engineering Science,***  
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## 6. DEVELOPMENT OF TOOLS FOR THE ADAPTATION OF BUILDING STANDARDS AND DESIGN METHODOLOGY FOR PROTECTION STRUCTURES IN THE AREAS PRONE TO FLOODS.

***DRS-13-2015. Demonstration activity on tools for adapting building and infrastructure standards and design methodologies in vulnerable locations in the case of natural or man-originated catastrophes***

The aim of the research is to establish a scientific and innovative adaptation mechanism of building standards and design methodology of engineering infrastructure protection of areas which are vulnerable to prone to floods.

Every year frequency and destructive effect of floods increase in the world. Also enlarge the value of annual losses from floods - economic, environmental and social. To prevent damage from floods in river basins, preventive flood protection is carrying out. For flood protection of buildings, utilities, agricultural land, private farms and forest resources constructs the engineering infrastructure. Due to the fact that the living conditions of people and economic activity in flood hazard of areas have their own characteristics, needs to develop adaptation tools of construction standards for buildings located in flood hazard area and flood protection infrastructure.

First of all there is a need to adapt the parameters of engineering infrastructure to the conditions of its operation. Are being developed and proposed adapted to conditions of the flood risks methods of parametric calculations for the main flood protection facilities: coast-protection covering rivers; dam with diaphragm wall; flood-control reservoirs.

Adaptation of building standards shall be based on both the technical properties of flood protection infrastructure and economic needs of their application.

Construction of flood protection infrastructure is not attractive for private investors because they can't get income directly from this. Therefore, the construction of flood protection infrastructure is carried out mainly at the expense of the state budget. In order to the most effective use of the budget there is a need to create and the practical use of the most advanced

methodology for developing infrastructure projects for flood protection and management of these projects. The methodology consists of three stages of infrastructure projects development for flood protection and management of these projects.

At the first stage with results of flood situations over the years carried out flood hazard basis forecasting for the future. Basis of flood hazard are estimated with two indicators- hydrological and economic. The hydrological basis flood hazard is determined by the magnitude of the excess consumptions of flood flow relative to the consumption of water flow in the river in the low-flow period. The economic basis of flood hazard is defined in monetary units by the average value of economic, environmental and social damage from flooding the area that should be protected by infrastructure. At the second stage are determined the most competitive engineering flood protection infrastructures of a certain territory. For this purpose, provides engineering and mathematical methods: "method of basic branch"; "method of basic tree "; "method of bifurcation basis".

At the third stage is carried out integrated project management of local flood protection which was developed at the second stage. Integrated project management is carried out to determine the priority of investments in projects that have the highest individual potency indexes and provide high efficiency of integrated flood protection in the whole region within one or more states. Priority investments are determined by the value of the profit investments ratio. Under the new methodology of the profit investments ratio is determined by the results of the new procedure of each project differentiated economic analysis.

Implementation of research for this content are proposed:

1. Adaptation of methods of parametric calculations and construction standards for infrastructure protection against floods, which includes:

- basis flood protection of areas and the main alternatives to its achievement;
- methodology of the resistance of coast protecting constructions to the harmful influence of flood flow calculation and the choice of the type and constructive parameters of coast protection;
- methodology of calculation of protection embankment with an diaphragm wall;
- methodology of calculation of structural parameters and modes of operation of flood control reservoirs of various types;
- the difference between the facilities of flood protection and production by their functional features and principles of their investments;
- adaptation of building standards with the technically-economic substantiation of infrastructure projects;
- adaptation of building standards with a determination of the degree of reliability, class effects (liability) and the category of complexity of hydraulic facilities which are related to infrastructure of areas flood protection.

2. Methodology of design of engineering protection infrastructure for areas which are sensitive to flood flow, that includes:

- methodology of calculating the economic, environmental and social damage from floods;
- methodology of forecasting of hydrological indicators of flood situations that may occur in the next calculation period of infrastructure that protect areas from flooding functioning;
- methodology of potential losses from floods and the expected benefits of the use of engineering infrastructure that protect areas from flooding forecasting;
- new engineering and mathematical methods for determination of the optimal project solutions in a complex areas protection systems;
- methodology of differentiated technically-economic analysis of projects for protective infrastructure construction;
- scientific fundamentals of integrated project's management for flood protection of regions within one or more states;

- an example of scientific substantiation of project for integrated flood protection in the river basins of the region.

New technical solutions that will be presented in the project are patentable. Some of them have already been protected by patents of Ukraine.

**Project coordinator: Vyacheslav Petrochenko Ph.D. in Engineering Science,**  
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## 7. NEW COMPOSITE MATERIALS TO IMPROVE OPERATIONAL RELIABILITY, DURABILITY AND ENVIRONMENTAL SAFETY OF CONCRETE COMPONENTS OF HYDRAULIC STRUCTURES

**NMP-19-2015. *Materials for severe operating conditions, including added-value functionalities***

Concrete-steel constructions of hydro technical engineering structures of water management and reclamation complex of Ukraine, in the process of the long-term operation in complicated conditions of aggressive environment and insufficient funding suffered great damages and urgently need a repair works. Particularly relevant is the operative removal of local structural damages in monolithic and section concrete structures, cracks of different widths disclosure, softening of zones and areas with high porosity, defects of constructions butt joints, and liquidation of active water leaks.

Traditional techniques for water management and reclamation complex facilities repair are based on the use of cement-sand mortars. However, low physical and mechanical properties of these solutions, low adhesion, insufficient corrosion resistance, low frost do not meet the requirements for efficient repair of tracks operating in difficult conditions.

The project involves the development of new effective composite materials using complex of additives with high physical and mechanical characteristics and technologies of their usage for concrete and reinforced concrete hydraulic structures restoration.

Of particular importance is the creation of reparations composite materials system for specific operations conditions, which should complexly solve all the problems of the rehabilitation and reconstruction of buildings, ranging from emergency liquidation of active leaks in the construction, and finishing by the restoration of surfaces construction, their geometry and aesthetic appearance.

Major technological designs solutions are protected by patents of Ukraine.

In the future, with wide practical application of the project is expected to increase the durability of hydraulic structures, reducing capital investment in the reconstruction, increasing of repair period, filtration losses reducing and improvement of the ecologically-ameliorative status of the adjacent area.

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## 8. ENERGY EFFICIENT SOIL FUNCTIONING AS THE BASIS OF SUSTAINABLE ENVIRONMENTALLY SAFE AGRICULTURE

**SFS-02b-2015. *Assessing soil-improving cropping systems***

Current models of the crop production process are not taking into account dynamic of soil's system heterogeneous component's stabilization in the daily cycle, although this is the basis of plant's growth physiological cycle. Considering the kinetic energy balance as a component of soil, which is a fundamental principle of energy of different soil processes and source of self-regulation of soil properties, will allow managing soil fertility not only through capacity factor, but to regulate intensity factor, namely the availability of components for plants nutrition.

From the synergetic point of view, the soil is considered as a dissipative stream type system. From the level of transformation in soil external flows of energy and matter (dissipation level) depends the dynamic of soil system components stabilization. Therefore, this project is aimed at more efficient use of agro-climatic potential through increasing energetic efficiency of the soil functioning, especially to increase recycling of energy by plants. According to an active kinetic environment as a key concept for the synergy – soil, essential requirement is the presence of a distributed energy source or a substance rich in energy. In distinction from the widespread stereotype that the energy of soil defines only by possibility of organic matter to produce energy, were investigated the mechanism of distributed energy sources as compressed in soil's pores air, that reacts on the changes in temperature, atmospheric pressure and water saturation. The thermodynamic approach allowed establishing dynamic's patterns of thermodynamic state of the soil system, subordinated processes of redistribution of pore solution and zoning in space of matter with a phase transitions that occurs in a three-dimensional soil matrix relatively to structural macroporousness.

The availability of such subordinated processes actually defines them as homeostatic processes through which is going creation of fundamental and structural properties of the soil environment. The intensity of subordinate processes that characterized by the amplitude and period, determines the kinetic part of the energy balance of the soil, and in fact is the most important criterion for evaluating of the farming systems influence on the evolution of soil properties and fertility restoration.

New theoretical principles of estimation and management of properties using energy as "ecological currency" is a promising trend of forecasting changes in soil properties, including under conditions of climate change, development of control measures methods and operative fertility management and increasing of efficient use of the territory agro-climatic potential.

The synergies between three-dimensional structure of the soil matrix and energetically efficient (dissipative) functioning of soil determines fundamental geo-membrane soil properties in the process of their continuous self-regulation and, accordingly, provides new opportunities for management of environmental conditions of the agricultural landscapes main components-water, air and living matter.

**Project coordinator: Sergiy Kolomiets Ph.D. in Agricultural Science,**  
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## 9. BIOENERGY AGRO-ECOSYSTEMS AS A BASIS FOR SUSTAINABLE AGRICULTURAL PRODUCTION IN VIEW OF CLIMATE CHANGE AND ENERGY SHORTAGE

### ***SFS-02b-2015. Assessing soil-improving cropping systems***

The project proposal is aimed at providing of expanded reproduction of soil fertility and reduction of desertification, food safety, reducing of greenhouses gas emissions, energy independence, taking into account soil and climatic conditions and provides:

- Implementation of agro-resource potential of farm with simultaneous production of 0,8-1,0 thous.m<sup>3</sup>/ha methane, 1 and more tons/ha of organic animal production, organic crop production -1 tons/ha of sugar, 0.2 - 0.3 tons / ha of oil and so on;
- Carbon sequestration up to 10 tons/ha;
- Exclusion outside the boundaries of an agro-ecosystem only constituents of air: C, B, H, N as part of carbohydrates, fats, proteins, and hydrocarbons with annual savings of up to 400 kg/ha of fertilizers;
- Adoption to the principles of organic farming and manufacturing for creation of closed macro and micronutrients cycle, systematic sanitation of the whole biomass and use of crop rotation factor;
- Improvement of the environmental state by optimization of agricultural landscapes structure, reduction of land degradation and minimization of agrochemicals usage;



- Accomplishment of absolute energy independence of agriculture and rural areas;
- Reduction of the production cost up to 2 times due to agrochemicals, industrial energy and transportation costs;

- Providing of gross income within 10 thousand dollars per hectare.

**Project coordinator: Ludmyla Datsko Ph.D. in Agricultural Science,**

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#### 10. DEVELOPING A COMPREHENSIVE STRATEGY FOR SURFACE WATER QUALITY CONTROL IN THE WESTERN BUG RIVER BASIN

**SC5-07-2015. More effective ecosystem restoration in the EU**

Participate to assess the surface waters current quality (qualitative and quantitative characteristics) and the influence of some anthropogenic factors (drainage reclamation and drained lands agricultural use, discharges of coal mining, municipal and industrial) on it, and climatic and other environmental factors. With that primary condition is to develop a common methodology for surface waters quality estimation. Execution of the task should be based on a detailed examination and determination of pollution sources, gathering, processing and compilation of all observational data for the most extended period from the Polish and Ukrainian sides. This will not only reliably allow to assess current environmental situation in the basin of the Western Bug, but also to develop an integrated strategy for managing the quality of surface water.

**Project coordinator: Olena Sydorenko Ph.D. in Agricultural Science,**

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#### 11. SUSTAINABLE WATER MANAGEMENT IN THE TRANSBOUNDARY AREAS.

**SC5-07-2015. More effective ecosystem restoration in the EU**

The aim of the project is an evaluation of the water resources state on a transboundary protected areas of Fund (Shatsky NNP, "Pripyat - Stokhid") in conditions of growing anthropogenic pressure on them based on the information base of ecologically-reclamation monitoring. The project is aimed at conservation, restoration and sustainable use of typical and unique natural Polissya's ecosystems that are of environmental, scientific, aesthetic, recreational and sanitary importance; raising of environmental awareness. Based on the results of the researches to develop a plan of action within the sustainable management of the conservation of aquatic ecosystems in anthropogenic loadings conditions; Raise the public awareness on the economic impact and conservation of wetlands by environmental and educational activities.

**Project coordinator: Olena Sydorenko Ph.D. in Agricultural Science,**

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#### 12. EFFICIENT MANAGEMENT OF WATER AND LAND RESOURCES AS A BASIS FOR RESTORATION AND SUSTAINABLE ECOSYSTEMS FUNCTIONING ON IRRIGATED LANDS

**SC5-07-2015. More effective ecosystem restoration in the EU**

**Task.** Irrigation as a form of intensive agriculture leads to the impoverishment of ecosystems, primarily due to the destruction of forest plantations. In Ukraine, for example, its area has decreased to 0.4%, which is unacceptable. The lack of belts causes the high surface air temperatures, unproductive expenditure of irrigation and atmospheric moisture on physical evaporation, which together reduce the water resources potential of rural areas and causes gradual degradation of the initial ecosystems.

**Scope.** Irrigated land is conceptually belonging to the coherent ecosystems type, which are relevant scientific and applied problems related to biodiversity and ecosystem measures.

The authors of the proposal have experience and certain research results for irrigated land ecotypes, ameliorative role of belts and lands moisture.

**Expected effect.** In the medium term, its improved design of irrigation systems adapted its particular elements to long-term vegetation density and configuration its will provide a more effective ecosystem restoration, increase yields, decrease of specific water and energy consumption, promote rural development and sustainability its to climate changes.

**Project coordinator:** *Yuriy Mykhailov Dr. in Engineering Science,*

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### 13. INNOVATIVE TECHNOLOGIES FOR THE EFFICIENT USE OF IRRIGATED LAND OF HUMID ZONE IN VIEW OF NATURAL AND CLIMATIC CONDITIONS CHANGES

#### **SFS-05-2015. Strategies for crop productivity, stability and quality**

Land reclamation in the humid zone of Ukraine is an important aspect of sustainable and efficient agricultural production, an integral part of creating a reliable food base for livestock development and a source of raw materials for food industry. Drained lands have also a significant energy potential that can be realized by growing energy crops to produce bioenergy (biogas and liquid fuels). The efficiency of their use influences largely on the economic, environmental and social sustainability of the Polissya region of Ukraine.

However, over the past decades, the changes in natural and climatic conditions of the humid zone of Ukraine are observed, which significantly affect the efficiency of drained land use. In particular, there is an increase in the temperature regime of air and soil, decrease in rainfall during the growing season and a significant depletion of water content in small river basins.

To use effectively agro-resource and energy potential of the drained lands under the conditions of mentioned changes it is necessary to optimize the structure of land use on the basis of innovative environmentally safe technology and regional models of sustainable food and bioenergy production and adaptive-landscape farming systems.

In its turn, this requires to create and implement advanced modular double-acting irrigation systems with independent control of water regime in drained soils and a guaranteed water supply in reclaimed areas.

**Project coordinator:** *Galyna Voropay Ph.D. in Engineering Science,*

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### 14. MANAGING CROP PRODUCTIVITY AND QUALITY ON THE BASIS OF ENERGY EFFICIENCY AND ECOLOGICAL SAFETY OF PRODUCTION WHEN USING DRIP IRRIGATION

#### **SFS-05-2015. Strategies for crop productivity, stability and quality**

Aggravation of the food crisis and increasing shortage of water resources in the world are the main factors of the irrigation area increasing in the XXI century. Among the well-known methods of irrigation, drip irrigation is the most advanced and efficient between the technologies of the perennial and tillage crops cultivation.

In the model small-plots based experiments we found that namely by drip irrigation is forming minimum unit costs of resources for a one unit of production, established the ability of yields levels control, management of production quality parameters maintaining the ecological balance of the environment.

However, these preliminary results need to be tested through large-scale production experiments. Elements of drip irrigation technologies which need an improvement, clarification or adaptation to the specific soil and climatic conditions are:

- systems of fertilization (fertigation) in part of improvement of calculations methods of fertilizers dose applying according to the intended crop yield;
- drip irrigation regimes management in the section of methods of total water consumption calculation improvement;
- protection systems in the section of chemicalization techniques substantiation (introduction of PPA with irrigation water);
- determination of products quality formation principles according to fertigation and irrigation regimes;
- Determination of basic principles of ground water regimes formation depending on the rates of fertilization and irrigation.

Obtained results will be the basis for the development of management algorithms of crops yield and quality on the basis of energy conservation and environmental safety of production in conditions of drip irrigation.

**Project coordinator: Andriy Shatkovsky Ph.D. in Agricultural Science,**  
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## 15. OPTIMIZATION OF RESOURCE EFFICIENCY CHAINS FOR SUSTAINABLE FOOD PRODUCTION AND RURAL DEVELOPMENT

### ***SFS-08-2014-1. Resource-efficient eco-innovative food production and processing***

The project will focus on the issue how to provide sustainable food production and rural development under limitation of energy resources and how to reach high ecological standards for food quality, water and land management. A number of innovations will be developed and checked on few pilot areas in two regions of Ukraine that will be different in terms of nature resources and agriculture practice. The participation of small, medium and big agriculture enterprises as well as local rural communities that look for benefits from agribusiness activities are foreseen in the project. The developed innovations will relate to the management of three types of resources efficiency chains that will be integrated within one business planning process for sustainable food production and rural development:

1) water resource management starting from water management for crop growing via modernization of irrigation infrastructure or agri-technologies for saving soil moisture till recycling water management in the food processing sector and reconsidering of “virtual water” transfer via food selling on local, regional and global market;

2) land management starting from land development and land consolidation in different scales (field, crop rotations, rural areas) and land productivity maintaining by protection of soils from degradation via more eco-friendly crop growing technologies;

3) chain of energy resources management and recycling within innovative agribusiness models that use and produce energy from many alternative sources (sun, soils, crops, water, manure, wastes etc.).

Finally an algorithm on inter resource efficiency management chain will be developed as well as cross scale scenarios of food transfer checked from economical, environmental and social point of view as well as possible climate changes.

The innovations for integrated management of resource efficiency chains will be developed by organizing a strong communication within “a golden triangle” that joins research expertise, business capacities and policy instruments. The innovative modeling and agri-monitoring technologies (RS, GIS, remote controls) will be used for business planning and then for demonstration of final synergy results of resource efficiency, environment and social sustainability. The information system with digital mapping of economical and environment

indicators will be developed for assessment of business plans and follow up implementation activities. The following outcomes are planned after the project implementation:

- Information system for integrated management of resources efficiency on farm level;
- Guideline on organization and management of resource efficiency chains on the rural territories;
- Participatory method for development of food trade scenarios taking into account resource efficiency.

**Project coordinator: Olga Zhovtonog Dr. in Agricultural Science,**  
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#### 16. HARMONIZATION OF PRODUCTIVE AND ALL-BIOSPHERIC FUNCTIONS OF DRAINED PEAT LANDS OF UKRAINE

***WATER-2b-2015. Integrated approaches to food security, low-carbon energy, sustainable water management and climate change mitigation***

During the extensive development of reclamation works in Ukraine for 60-80-ies of the past century the subsequent environmental effects of drying peat lands were not considered.

In modern conditions of the threat of planetary climate system violation the greenhouse gas emissions from drained peat lands are a source of danger due to the disruption of the carbon cycle.

The project is supposed to develop:

- proportions of drained and native wetlands by a balance carbon sequestration;
- fundamental structures of cascading environmentally safe reclamation systems using peat lands;
- agricultural landscapes structures on reclaimed land by their heterogeneity indices, that optimizes the energy-mass transfer of the surface air and provides the increase of biodiversity in ecotones network and stabilization of quality and quantity of water resources.

It is expected to developed some normative documents on environmental damage to the major components of drained agricultural landscapes-soil, water, atmosphere and wild life, which is suppose to be a basis for state policy formation on harmonization of productive and biospheric functions of the hydromorphic landscapes of the Polissya (forest zone) of Ukraine against the background of preservation of social significance of reclaimed lands and food security providing.

**Project coordinator: Sergiy Kolomiets Ph.D. in Agricultural Science,**  
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### **IV. Institute for Agriculture of Carpathian Region**

#### 1. COLLECTION, STUDY AND CONSERVATION OF GENETIC RESOURCES OF PERENNIAL LEGUMES AND GRASSES

***SFS-7-2014/2015. Genetic resources and agricultural diversity for food security, productivity and resilience***

**PROJECT TYPE** Project expeditions, field studies and scientific works

During the previous century, the problem of collection and conservation of plant genetic resources became not only scientific, but also ecological, which affects on interests of the people of most countries in the world. Genetic resources (wild growing population) of perennial grasses need to gather, learn and save. Varieties and breeding material should be investigated in different climatic conditions in order to identify their plasticity, hardiness.

With the aim of preserving the genetic diversity of natural meadows should be a collection of local ecotypes from different parts of the distribution. An important objective of our

investigation is the introduction - attraction to the collection of new samples of plant genetic resources, which are created in Ukraine and foreign countries, and also reintroduction - re-attracting valuable samples, which for various reasons were lost. The enrichment of the collections of the gene pool is a precondition for their effective use in breeding, scientific, educational and other programs. This direction of work is required for form more perfect composition of collections, that will optimize the volume and structure, therefore more efficient to carry out the preservation and introduction of the gene pool.

Key words: collection, study, legumes, grasses, conservation

In the course of performing this work assumes:

- to visit the cherished territory, where there are perennial herbs
- to exchange information about the environmental situation in the partner countries, and also ecological impact on the environment of natural resources
- to collect, to study and to preserve(method of preservation of natural resources – ex situ) wild growing biotypes as valuable source material for different directions of selection:
  - creating a database for the exchange of information with other countries;
  - registration of best varietal samples in plant genetic bank.

Research will be conducted at a high level with the use of modern techniques. The authors of the project have perennial experience in the field of breedingof perennial grasses and legumes, as evidenced by entry in the State register of plant varieties of Ukraine 12 varieties of herbs, and a number of scientific articles.

**Project coordinator: Baystruk-Hlodan L., Ph.D. of Agrarian Science, phone: +380677417290**

## **V. Institute for Agricultural Microbiology and Agro-industrial Manufacture**

### **1. PROJECT TO DEVELOP AN ESSENTIALLY NEW METHODOLOGY FOR ESTIMATION OF ECOLOGICALLY ACCEPTABLE DOSES OF NITRIC FERTILIZERS IN AGRICULTURAL PRODUCTION**

***Call SFS-02b-2015. Assessing soil-improving cropping systems***

Existing ways of calculation of necessary doses of mineral fertilizers orientates, basically, on the carrying out NPK with the planned crop, taking into account preliminary soil diagnostics and coefficients of fertilizers use. However, if we take into account, that coefficients of fertilizers usage by cultural plants is extremely low (nitrogen - no more than 50 %; phosphorus - about 20 % and potassium - 25-60 % depending on a type of soil), we shall come to the conclusion, that its large part is wittingly planned on pollution of environment. It is especially urgent for mineral nitrogen.

Criterion of selection of optimum in ecological sense of understanding of doses of nitric fertilizers can be intensity of process of associative nitrogen-fixation. As the process of the nitrogen-fixation is rational from the energetic point of view (it will not pass in soil, where there is a surplus of nitrogen, in connection with the mineral nitrogen is energetically more favourable, than the fixation of atmospheric N<sub>2</sub>), occurs an opportunity, having studied with gazhromatographic methods efficiency of nitrogen-fixation in a root zone of plants in various soil fertilities, and having compared with parameters of control variant (without entering fertilizers) to estimate a degree of influence of mineral nitrogen on activity of nitrogen-fixation of microorganisms. In those variants, where the efficiency of nitrogen-fixation is above control parameters, the doses of mineral nitrogen will be ecologically optimal; if the efficiency of N<sub>2</sub>-fixation is at the level of the control, these will be ecologically allowable, and in case of decrease of intensity of process, the doses of mineral nitrogen will be surplus.

Having studied conformities to nature laws of proceeding of the N<sub>2</sub>-fixation in agroecosystems, typical for the soil-climatic zone, it is possible to develop practical recommendations on ecologically optimal application of mineral nitrogen.

In case ecologically accepted doses of mineral nitrogen are too small for the economically profitable agricultural crops, the limit of ecologically accepted doses can be increased, initiating plants growth by using the microbial preparations, micro elements, growth stimulators, and other physiologically active substances. This way cultivated plants have higher biomass, which “dilutes” the concentrated compounds of nitrogen in the mass of plants. Besides, the usage of the microbial preparations and growth stimulators in the agricultural growth technologies contributes to the growing rates of mineral fertilizers due to the growth of the root system of a plant, as well as through an increasing ability of the roots to absorb and through the activation of the plants’ ferment system.

The results of researches can be used for the development of systems and strategies of fertilizers of agricultural cultures. Considering the growing requirements for environmental protection the necessity of realization of these researches are doubtless and the received results will be of a great value.

Introduction of a new methodology of calculation of nitric fertilizer of cultural plants into the production can harmonize the requirement to mineral nutrition of plants with the specifications of environmental protection.

**Project coordinator: Prof. Dr. Vitaliy Volkogon (Ukraine) ( [rifam@ukrpost.ua](mailto:rifam@ukrpost.ua) )**

## 2. PROJECT TO EXPLORE THE FEATURES OF USAGE OF HELPFUL SOIL MICROORGANISMS IN AGRICULTURE TO REDUCE CHEMICAL PRESSURE ON AGROECOSYSTEMS AND OBTAIN ADDITIONAL CROP PRODUCTION

### ***Call SFS-02b-2015. Assessing soil-improving cropping systems***

Soil microorganisms being a certain ecological niche in the soil and the root zone of plants, are in close relationship with these and influence significantly the development of crops.

Today, the possibility of introduction of different types of beneficial microorganisms in the root zone legumes, cereals, vegetables and other crops by inoculation seeds before sowing is being considered in many countries. This technique facilitates more intensive plant growth and increases production. In addition, improvement of the crops nutrition supplies may reduce the dose of fertilizer (eg, nitrogen).

At the same time, the efficiency of valuable soil microorganisms can be affected by various factors, both biotic and abiotic. In particular, to increase the functional and growth activity as well as the efficiency of the nitrogenfixing bacteria is possible through a simultaneous usage of different types of microorganisms. For example, according to our data the combination of bacteria *Bradyrhizobium japonicum* and *Azospirillum brasilense* is very perspective.

For the efficient combination of microorganisms we are planning to identify and verify the species selection and the optimum ratio of bacterial components, to implement quality control and quality of the number of microorganisms introduced the basic type, to select of the optimum ratio of components of culture media for the cultivation of mixed cultures, and to explore their impact on plant growth and development.

The growth and functional activity of microorganisms depends on the availability of trace elements: zinc, manganese, sodium, molybdenum, copper, vanadium, nickel, cobalt. The role of these elements is determined as following: they are part of major cellular metabolites, and participate in the implementation of vital functions of organism. Analysis of the simultaneous use of trace elements and mineral soil microorganisms will improve their performance.

Research results will help to develop new environmentally friendly bio preparations and provide recommendations for their usage in agriculture.

**Project coordinator: Dr, PhD Kozar Serhiy F. (Ukraine) ( [ismav@online.ua](mailto:ismav@online.ua) )**



### 3. EMISSION OF N<sub>2</sub>O AND CO<sub>2</sub> FROM AGRICULTURAL SOILS WITH DIFFERENT FERTILIZATION SYSTEMS

***Call SFS-02b-2015. Assessing soil-improving cropping systems***

The project proposal will help to optimize the system of fertilizers in agricultural production and to determine the necessary from an environmental point of view optimum of the dose of nitrogen fertilizers for different crops.

An important diagnostic indicator of agrocenoses is the intensity of emission of greenhouse gases (especially N<sub>2</sub>O). Gaseous loss of nitrogen from fertilizers is mainly associated with the processes of nitrification and denitrification carried out in the soil with the participation of microorganisms. Integral indicator of soil respiration, processes of mineralization of organic substance and soil dehumification at different levels of nitrogen support is CO<sub>2</sub>. Monitoring of emissions of these greenhouse gases will reduce their accumulation in the atmosphere.

This project will result in the selection of optimal systems of fertilizers, based on the yield of agricultural crops and optimization of the processes of mineralization-synthesis of soil organic substance.

***Project coordinator: Prof. Dr. Volkogon Vitaliy (Ukraine) ( [rifam@ukrpost.ua](mailto:rifam@ukrpost.ua) )***

### 4. THE COMPOSTING TECHNOLOGIES OF BIRD DROPPINGS INVOLVING MICROORGANISMS WITH USEFUL AGRONOMIC PROPERTIES

***Call SFS-02b-2015: Assessing soil-improving cropping systems***

The following project is aimed at the development of the effective composting technologies for organic substances in order to receive agronomically valuable microorganisms' compost-holders. Thus, composts will have qualitative agrochemical characteristics and at the same time will serve as certain microbial preparations for the improvement of crop production process (or, otherwise, for the optimization destruction of by-products production in the field).

The project results in the improvement of the quality of derived from bird droppings composts, as well as, in the increasing of crop productivity through the usage of this very fertilizers in the technologies of crop production.

***Project coordinator: Prof. Dr. Volkogon Vitaliy (Ukraine) ( [rifam@ukrpost.ua](mailto:rifam@ukrpost.ua) )***

### 5. EFFICIENCY OF COMBINED USE OF PROBIOTIC BACTERIA STRAINS WITH ENZYME PREPARATIONS FOR PRESERVING GRAIN ROLLED CEREAL

***Call SFS-01c-2015. Assessing sustainability of terrestrial livestock production***

Save grown crop nutrients through the use of new technology and production techniques — one of the most effective ways to reduce the cost of feed and feed intake, and hence the cost of livestock production.

Recently, widespread cheap ways to store wet grain feed, which have several practical advantages. In particular, this technology is rolled grain preservation using biological preservatives, which allows improving taste of food, improving its nutritional value.

When spontaneous canning rolled grain especially low humidity anaerobic conditions are created only after 1–2 days, and so quickly appear favorable conditions for the growth and development of fungi, yeast, putrefactive bacteria. Usually fodder grain, they develop more active than in the silo. Therefore, the use of preservatives has become mandatory in the reception rolled grain harvesting.

Environmentally friendly production and use, technological process of conservation, efficiency and relatively low cost — all of which points to benefits of widespread biological preservatives.

It is known that in fodder grain contained in large quantities is difficult to digest complex carbohydrates (cellulose, hemicellulose, starch, etc.) that are not available for fermentation lactic acid bacteria.

Application of biological preservatives in combination with enzyme preparations will ensure probiotic bacteria with nutrients. Enzyme hydrolysis of complex carbohydrates into simpler monosaccharides accelerates bacterial fermentation of raw materials and improve the nutritional value of the finished feed, which has a positive effect on feed conversion, productivity and safety of livestock numbers.

**Project coordinator:** *Dr, PhD Kravchenko Natalia (Ukraine)* ( [iggardsil@mail.ru](mailto:iggardsil@mail.ru) )

## **VI. National Scientific Centre "Institute for Agricultural Engineering and Electrification"**

### **1. DEVELOPMENT OF THE TECHNICAL AND TECHNOLOGICAL BASIS FOR HEATING OF THE RURAL AREAS USING SOLID BIOFUELS OF THE LOCAL PRODUCTION.**

The share of biofuels in global energy balance does not exceed 2% (55 million ton), but in 2050 its share is going to be more than 27%. Economically sustainable potential of the biomass without damage to soil and soil fertility is about 27 million ton per year. Using garden wastes for the purpose of heating allows saving about 14-16 billion cubic meters of natural gas per year. The main advantage is studying progressive technologies with minimum energy consumption, implementation of European specifications to ecological protection of environment, expansion in the number of newest developments, increasing technical level of equipment.

The main scientific and innovative problems: to develop organizational and technological basis (infrastructure) for effective heating of rural areas in modern conditions; develop technological regulations and technical means for the production of the main types of solid biofuels - granules directly at the place of storage of plant materials and their use; undertake studies to ensure the effectiveness of the proposed system of heating in rural areas in the model economy.

#### Expected results:

1. Project of technological process, working drawings and prototype of mobile aggregate for the production of solid biofuels in the conditions of rural areas.
2. Publication of articles, patents for invention, an international workshop;
3. Reducing the cost of fuel for heating is 2.3 - 2.6 times;
4. Expected economic gain is 29.38 thousand USD per month from one machine; payback period of the project implementation - 1 - 3 years

**Project coordinator:** *Subota S.V.- research worker; e-mail: [tstimesy@ukr.net](mailto:tstimesy@ukr.net)*

### **2. DEVELOPMENT OF MOBILE POWER EQUIPMENT FOR AGRICULTURAL PURPOSES ON THE BASIS OF TRACTOR HTZ - 2511-04 WITH ELECTRIC MOTOR DRIVE.**

Most European countries use imported diesel. At the same time for the basic technological operations in the plant growing field, its cost is more than 20% of products prime cost. The role of electrical energy received from different sources, in particular renewable energy sources is increasing over the world. Correlation of energy consumption using diesel motor and electric

motor drive for soil cultivation is more than 4:1. Considering the capacity of JSC Kharkov Tractor Plant, and also progressive development of an electrical power industry, there are conditions for the solution of technical tasks and implementation in production of tractors with the electric motor drive.

**Main scientific and innovative objectives:** to determine potential technical and operational indicators of work of an electrotractor in case of accomplishment of various technological transactions; to prove rational structure and parameters of an electrotractor; to conduct researches and to determine energy, ecological and cost efficiency of an electrotractor; to develop offers on serial release of an electrotractor based on the HTZ tractor - 2511-04.

**The expected results:**

1. The experimental sample of the energy resources for electric (adapter) accumulator drive.
2. Test reports, patents for inventions, the published articles.
3. Reduction of costs of energy in case of accomplishment of the main technological transactions in agricultural production – by 3-4 times.
4. Lack of environmental pollution and improvement of working conditions of the tractor operator in view of lack of noise and vibrations.

**Project coordinator:** *Melnyk R.V. – PhD; e-mail: [roma\\_meln@mail.ru](mailto:roma_meln@mail.ru)*

### 3. DEVELOPMENT OF AUTOMATIC CONVEYOR-BASED MILKING SYSTEM

It is possible to implement and use fully benefits of modern loose housing technologies of content with automatic management systems engineering procedure of a farm, considerably to raise a labor productivity, effectively to conduct selection work and to arrange fast centralized deliveries of high-quality commodity milk for the overworking entities only in the conditions of large-scale dairy and commodity farms (600-1000 heads).

The production technology of a difficult element of conveyor milking system most technically – the ring conveyor is fulfilled in Ukraine . It is necessary to robotize only process of putting on of milking glasses, and process of milking and removal of the device will happen automatically using earlier developed milking post with a physiological and adaptive operating mode.

**Main scientific and innovative objectives:** modeling of process of work of milking systems with the different level of automation of engineering procedure; development of schemes of nodes and technological fragments of automatic milking system conveyor-based; development of design documentation on production of automatic milking system conveyor-based; reasons for parameters and operating modes of the unified physiologically safe milking machines; production of prototypes of nodes and technological fragments of automatic milking system conveyor-based and their researches under production conditions; carrying out actions for implementation of results of researches (exhibiting at exhibitions, presentation for potential consumers).

**The expected results:**

1. Prototypes of nodes and technological fragments of automatic milking system conveyor-based.
2. Test reports, patents for inventions, the published articles.
3. Reduction of diseases of mastitis by 2,5-4 times, increase of productivity of cows for 5-9%, increase of fat content of milk for 0,05-0,15%.

4. Implementation of results of researches will allow to reduce work costs during machine milking of cows to 80%.

**Project coordinator: Tkach V.V.**

#### 4. DEVELOPMENT OF WORKFLOW AUTOMATION ELEMENTS IN GROWING AND HARVESTING CORN AND SOYBEAN USING MINIMUM TILLAGE TECHNOLOGY.

In search of energy saving tillage technology world science and practice has gone from heavy plow tillage to zero. That means that the soil before planting does not mechanically processed, and sowing is in raw ground (No-Till). Comparing to conventional technology, the usage of minimum tillage technology would reduce fuel consumption up to 70%. Thus, it will have the best environmental perspectives.

Growing crops such as corn and soybeans, minimum tillage technologies associated with increased complexity and driving MTA field at the surface of a large vegetable crop residues precursor. This factor complicates visual inspection by operators at the surface of the field of foreign bodies, stones, metal objects, and other. Therefore, one of the most important issue is to develop a system in order to protect tillage, sowing and harvesting machinery from destruction.

**Main research and innovation tasks are:** modeling new principles for up-to-date devices for complex protection of agricultural machinery working from a foreign search and dangerous objects; development of elements of control and working bodies of machines using GPS navigation systems.

**Expected results:**

1. Prototypes of the device protecting workers from foreign objects and controls and management direction of motion and working bodies of machines.
2. Minutes of research and testing, patents, published articles.
3. Implementation of research results will reduce fuel consumption up to 70%, reduce to 30% of the amount of fertilization compared with traditional technologies, and reduce labor costs and increase service life of equipment.

**Project coordinator: Kuzmych A.**

## VII. Institute for Irrigated Agriculture

### 1. INNOVATIVE SYSTEMS OF AGRICULTURE ON THE IRRIGATED EARTHS IN ECONOMIES WITH DIFFERENT SPECIALIZATION OF PRODUCTION

**1. Entry.** The socio-economic processes of development of agrarian meliorative potential in the South of Ukraine stimulated building of the irrigation systems for watering of lands, as one of basic factors of intensification of agriculture in districts with the insufficient and unsteady moistening.

**1.1 State of the use of the irrigated earths.** The use of all area of the irrigated lands in the South region provided a production 29% grain, fruit and vegetable products – 87, technical crops – 26, fodder crops – 63, rise – 100 % to the general production volume, and the productivity of the irrigated hectare was in 2,0-2,5 times more high by comparison to unirrigated. In Ukraine and in foreign countries it is set with the developed irrigation, that from realization of plant-grower products commodity producers get a 40-50% money, due to growth of production of goods from irrigation, without regard to that the irrigated lands occupy from 2,0 to 16,5 % from the area of plough-land.

**1.2 Results.** On the whole the use of the irrigated lands on a prospect it is necessary to bind the reconstructions of the irrigation systems to the dynamics. It will enable to grow the enough body of raw material for work of processing enterprises and forage for providing of stock-raising industry. On the whole experimentally grounded introduction of five systems of agriculture on the irrigated lands in accordance with specialization of economies, which was formed and has a prospect of subsequent development.

**2. Description of innovative products.** Modern agricultural production need increase of the productivity of agrophytocenozises on the irrigated lands, due to the improvement of technologies of growing of agricultural crops which provide the recreation of fertility of the reclaimed soils. The complex decision of agronomical, economic and ecological problems is development of technologies of growing of corn on grain, soy, vegetable crops and long-term herbages, on seed at the use of the systems mikroirrigation and tiny irrigation. As a result of implementation of the put tasks it is possible to perfect the technological projects of growing of agricultural crops in the crop-rotations of different specialization. Considerable part of questions from this direction of researches was worked out on the systems of irrigation of different constructions of domestic and foreign production watering machines the scientists of scientific establishments of Ukraine, near and distant foreignness. That touches the systems of mikroirrigation and tiny irrigation such results in Ukraine not enough and experimental information is got in Israel and other countries of the world conducted in quite another soil-climatic conditions and duplication of the technologies developed there in our terms results in worsening of ecological situation in agrocenosis especially at growing of vegetable crops and potato. It is therefore necessary leadthrough of experimental researches of that to take into account the reclamative state of soils and territories where the wide use of these systems of agriculture is possible.

**2.1 Conclusions.** In strategic plan modern conception of the use of the irrigated lands is needed on market principles, what would foresee specialization directed on the production of food and feed grain, soybeans, green-stuffs and fruit, with the purpose of improvement of the food providing of population of Ukraine and going into oversea markets. There must be the conducted reconstruction and improvement of existent water-economies complexes on its basis.

## 2. SEED-BREEDING OF NEW HIGHLY TECHNOLOGICAL VARIETIES OF TOMATO OF INDUSTRIAL TYPE FOR CONDITIONS OF SOUTH OF UKRAINE

### 1. Description of innovative products

**1.1 Compressed description of sorts.** The innovative products of project are seed of new highly technological varieties of tomato of industrial type of selection of Institute of the Irrigated Agriculture of NAAS: «Naddnipryanskiy 1»; «Kimmeriec»; «Sarmat»; «Inguleckiy». Sorts are adapted to natural soil-climatic conditions of the South of Ukraine.

Advantages of products are: industrial direction of the use; universal setting (a consumption is in a fresh kind, there is the whole fruit's canning, processing, on tomato products), all sorts - intensive type, sensible to the high level agrotechnics, irrigations; there are the potential productivity on irrigation of 75-85 t/ha; suitable for combine harvesting.

**1.2 Competitiveness.** The new varieties of tomato are exceeded by existing in Ukraine analogues after the productivity, marketability, biochemical indexes of garden-stuffs (by content in the garden-stuffs of dry solvent, sugar, ascorbic acid), have the best taste qualities (saccharine-acid an index is more high 7). The offered product (seed of tomato) is more cheap by comparison to foreign analogues (in 2013 years price of 1 kg of seeds was below on 300-400 UAH) at equivalent high-quality indexes.

### 2. Description of innovative project.

A project answers priority direction, to certain Law of Ukraine «On priority directions of innovative activity in Ukraine», item 8, p.5 highly «Technological development of agriculture and processing industry». Adjusting of the system of seed-breeding of new varieties of tomato

of industrial type will be given by possibility to satisfy the requirements of producers of tomato products (farms, private sector) in high-quality seed. Realization of project will promote to the decision of problems of a particular branch character – development of vegetable-growing in South of Ukraine, to adjusting of the system of seed-breeding of sorts of tomato of domestic selection with the purpose of substituting for the imported seed at the Ukrainian market by the high-quality competitive seed of domestic sorts, adapted to soil-climatic conditions of the South of Ukraine.

**2.1 The Basic production indexes:** 1 year; is an area of the seeds sowing 50 hectares; general production volume – 2500 tonnes garden-stuffs; amount of products (seed of tomato new varieties) – 2500 kg; a cost of products is 2 million Uah at a price 800 UAH/t.

**2.2 Sources and terms of financing:** At implementation of this suggestion does Institute of the Irrigated Agriculture of NAAS gives: seeds of tomato of high reproductions of own sorts; line for the selection of seeds; scientifically-methodical and expertly consultation's providing and accompaniment of production processes by the scientists of Institute.

**2.3 Market of sale.** Producers of tomato products of economies of all patterns of ownership (farms, private sector).

**2.4 Form of realization.** Realization in Ukraine of innovative product (seeds of tomatoes) is foreseen as to good, and also realization of right on the use of objects of intellectual property (sorts of tomato) on contractual principles (license contracts).



## **Department of Plant Growing proposals for the open calls of EU Framework Programme for research and innovation – HORIZON 2020**

### **I. Plant Breeding and Genetics Institute – National Center of Seed and Cultivar Investigation**

#### **1. DEVELOPMENT OF BIOCHEMICAL METHODS FOR CONTROL OF CEREAL CROPS RESISTANCE TO BIOTIC AND ABIOTIC STRESS FACTORS WITH THE PURPOSE OF APPLICATION IN THE PLANT BREEDING FOR SELECTION OF VARIETIES WITH HIGHPRODUCTIVITY, STABILITY AND QUALITY**

***Call SFS-05-2015. Sustainable Food Security«Strategies for crop productivity, stability and quality***

The issue of plant resistance to unfavorable environment is one of the most urgent problem in the modern plant breeding due to worsening the global ecological situation and climatic changes that brings about the necessity to search the genotypes of agricultural plants with the maximal adaptive characteristics. The problem of food safety requires a study of biochemical mechanisms of agricultural crops resistance to phytodiseases, particularly to *Fusarium* spp. *Fusarium* fungi produce mycotoxins, most of which are high toxic, cancerogenic, mutagenic and teratogenic. Local and extensive epiphytoses which occur annually and periodically lead to deterioration of food, feed and technological qualities of products.

Breeding of resistant to phytodiseases and abiotic stress varieties is the most economically sound and ecologically safe solution of such problems. Developing such varieties it is important to know the mechanisms of the formation of plant biochemical resistance to biotic and abiotic stresses, to possess effective, express methods of prediction and selection of resistant genotypes of agricultural crops.

The project offers new methods for selection of resistant to *Fusarium*, *Alternaria* infection and to drought, heat shock cereal crops (wheat, barley, maize) genotypes using biochemical parameters (changes in the trypsin inhibitors, lectin, phenylalanine ammonia-lyase activity in the seed, embryo, seedlings, adult plants when they are infected with pathogens, under water deficiency, hypo-hyperthermia and combined action of stress factors and the influence of resistance inducers (salicylic and jasmonic acids, lectins) and the development of methods of mycotoxins control in grain and plants of cereals. The methods enable a plant breeder to analyze a great quantity of genotypes in the early stages of breeding in the maximal short terms.

***Project coordinator: Molodchenkova O.O., Dr. Sc. (Biology) E-mail: [sgi-uaan@ukr.net](mailto:sgi-uaan@ukr.net)***

#### **2. MOLECULAR BIOTECHNOLOGY FOR EVALUATION AND UTILIZATION OF GENETIC RESOURCES OF CEREAL AND LEGUMINOUS CROPS OF UKRAINE**

***Call SFS-07b-2015. Sustainable Food Security “Management and sustainable use of genetic resources”***

European countries are in need of safe, high-quality, useful food and feed. Cereal (wheat, barley, maize etc.) and leguminous (soybean, kidney bean, chickpea etc.) crops play an important role in the human and animal diet and are the most important crops for European agriculture. The existing resources of germplasm and breeding methods is not sufficient for understanding the mechanisms that underlie the important processes to dramatically improve the productivity, resistance, sustainability and quality, to minimize environmental impact. Significant advances in crop yield need a wide range of modern methods and approaches of

genomics. This strategy is a complex and large-scale, and can be effective only under the condition of cooperation between the countries.

The project is aimed at the development of the molecular markers systems and biotechnology to achieve the key objectives of the 21st century' breeding: to improve the quality and functionality of crops, plant adaptation to new conditions, resistance to abiotic (climatic) effects and diseases.

The breeding programs that use classical methods to introduce genes from elite lines into local varieties, or the introduction of genes by means of transgenesis require volumetric phenotypic selection and evaluation for the conversion of breeding lines in the variety. The development of low-cost and high-performance biotechnologies based on molecular markers will allow for the support of the conventional breeding techniques by Marker Assisted Selection for the evaluation of genetic resources of cereal and leguminous crops, sampling the entries with target genes that are important for the breeder, "pyramiding" genes. This approach will reduce the costs (including temporary) to develop a variety and will increase the breeding efficiency.

**Project coordinator:** Volkova N., Dr. Sc. (Biology), **E-mail:** [sgi-uaan@ukr.net](mailto:sgi-uaan@ukr.net)

## **II. Institute of Plant Protection**

### **1. STOP RESISTANCE**

***Call for proposal title: Sustainable Food Security***

The system for the rational use of insecticides that provides for reducing the number of resistant populations of main pests of agricultural crops.

The solution of this problem improves the protection tactics for agrocenoses and includes:

- overcoming resistance, an important element of which is the timely recognition of the sensitivity changes of natural populations of phytophages to insecticides depending on their biological characteristics and pesticide load;
- establishing possible group or other form of resistance to insecticides of different chemical classes;
- development of disposable methods for monitoring the sensitivity to insecticides in pests;
- enhancement of research aimed at studying the mechanisms of resistance formation;
- development of mapping of agricultural land areas with the estimation of the degree of threat from the resistant pest populations using modern information technologies;
- obtaining and use of insecticide-resistant populations of entomophages.

Scientific research and implementation of the proposed project will form the basis for solving the problems of resistance of the main phytophages in the European agriculture.

The created anti- resistance system will allow predicting and controlling the development of pest resistance to insecticides with the optimal combination of a number of techniques and technologies that reduce the chemical load on agrocenoses. Due to this the natural mechanisms of self-regulation in agrobiocenoses will be preserved, the risk of accumulation of toxic substances in the environment and in products decreases (the price in the market under these conditions is much higher), a significant basis is laid for the harvest next year, the agroecological environmental conditions are improved.

The project proposal for connection: we are looking for an experienced coordinator to help to create a consortium to establish fruitful cooperation.

We hope that our project (a request for cooperation) will be integrated into a large research project with the aim of solving the above problem or will serve a basis for preparation of the project proposal in general.

*Project coordinators: Sergey Retman Dr of Agricultural Sciences, e-mail: [plant\\_prot@ukr.net](mailto:plant_prot@ukr.net); Olga Vlasova Ph.D. in Agriculture, e-mail: [toxicology\\_pest@mail.ru](mailto:toxicology_pest@mail.ru)*

### III. Institute of Vegetable and Melon Growing

#### 1. DEVELOP FOR ORGANIC VEGETABLE PRODUCTION METHOD OF GROWING CROPS BY INTERCROPPING

*Call SFS-05-2015: Strategies for crop productivity, stability and quality*

**The purpose of the project.** Develop for organic vegetable growing universal multifunctional growth method based on the intercropping method.

**The task of research.**

1. Develop a methodology for the selection of allelopathic compatible plants (vegetable and groundcover) for intercropping.
2. Justify the method of cultivation and crop bio-rotation based on the intercropping.
3. Provide a guaranteed expanded reproduction of soil fertility.

**Brief description of the project.** Development and introduction of organic vegetable production method of growing crops by intercropping ensure the creation of conditions for self-regulation and self-maintenance of the agroecosystem. Intercropping (polyculture) - a system of growing two or more species of plants on the same area, ie, in one plant community. On small (household) areas where the majority of manufacturing operations for growing vegetable plants is carried out manually, such communities are easily created and are functioning effectively. In an industrial scale for the application of technical means needed a different approach.

Our preliminary studies designed "micro strip way" placing plants (patent of Ukraine for useful model № 25113), in which are formed on the area of equal multiples of the base tractor tracks, tinned and tinned strip cultivation in not grassing strips of vegetable crops. Crop rotation in bio-rotations to perform periodic change of these bands (patent of Ukraine for useful model № 32543). Mulching the soil surface in no grassing bands (which houses vegetables) crop residues or polymeric materials guaranteed to provide the expanded reproduction of soil fertility (patent of Ukraine for useful model № 44455). Consistent application of low-cost environmentally friendly activities contributes to effective protection of vegetable plants from weeds (patent of Ukraine for useful model № 44456).

**Expected results.** As a result of the proposed project will be the basis for solving scientific cultivation of vegetable crops on organic technology.

*Project coordinator: O.Vitanov, Dr. of Agricultural Sciences, e-mail: [ovoch.iob@gmail.com](mailto:ovoch.iob@gmail.com)*

#### 2. TO INVESTIGATE THE GENETIC DIVERSITY OF TOMATO, SWEET PEPPER, EGGPLANT OBTAINED FROM INTRASPECIFIC AND INTERSPECIFIC HYBRIDIZATION AND IDENTIFY SOURCES OF HIGH BIOCHEMICAL EVIDENCE OF FETAL TO USE IN HETEROSIS BREEDING

*Call SFS-05-2015: Strategies for crop productivity, stability and quality*

**The purpose of the project.** Study of the gene pool *Lycopersicon esculentum* Mill., *Capsicum annuum* L, *Solanum melongena* L. and allocation of sources of high content of chemical components (dry soluble substances, sugars, titrated acid, ascorbic acid,  $\beta$ -carotene, lycopene, anthocyanins) with high yield, marketability and transportability of the fruit for later use in the creation of new varieties and hybrids. The task of research. Chemical analysis of tomato fruit on the content of soluble dry matter sugars titrated acids, ascorbic acid,  $\beta$ -carotene, lycopene, anthocyanin. Study collection and selection material for complex traits yield and fruit

quality; selection of sources for chemical fruit quality parameters. Hybridization and recruiting to establish donor properties of the sources of economic traits.

**The task of research.** Chemical analysis of tomato fruit on the content of soluble dry matter sugars titrated acids, ascorbic acid,  $\beta$ -carotene, lycopene, anthocyanin. Study collection and selection material for complex traits yield and fruit quality; selection of sources for chemical fruit quality parameters. Hybridization and recruiting to establish donor properties of the sources of economic traits.

**Brief description of the project.** The growing shortage of genetic diversity, and consequently decrease adaptability of modern varieties and hybrids, their vulnerability to biotic, abiotic and anthropogenic stresses require the development of fundamentally new varieties and hybrids with more severe genetic divergency using wild species of crop varieties and mutant forms. Search and introduction of new genetic breeding programs as a source, especially mutant origin, allows to optimize and speed up the breeding process, increase its effectiveness, get new varieties and hybrids with characteristics of high quality marketable products. Improving the quality of the fruit provides multi-perspectives for industrial use and is one of the priorities of modern breeding. At deserves high priority breeding and genetic improvement of fruit on a model containing main biologically valuable components through the use of mutant genes. Since our studies have shown the possibility of increasing the soluble dry matter in tomato to 6,5-7,0% to 4,3-4,6% sugars, ascorbic acid 30-35 mg%,  $\beta$ -carotene to 2,5-2 9 mg% lycopene to 9-12 mg%, and the shape of anthocyanin color of the fruit.

**Expected results.** Sources and major donors of commercial signs, especially signs of quality and marketability of the fruits of tomato, sweet pepper and eggplant. This will create a special genetic collections, primarily on the basis of fruit quality, keeping quality and color genes of the fetus determined their suitability for breeding programs to improve the quality characteristics of the fruit. The selected source will be involved in the selection process for new varieties and heterotic hybrids. The project will allow more efficient use of genetic resources of both countries and enrich the genetic potential of *Solanaceous* plants.

**Project coordinator:** Maksym Gyrin, Ph.D. of Agricultural Sciences, phone: +380997215280, e-mail: [ovoch.iob@gmail.com](mailto:ovoch.iob@gmail.com)

### 3. GETTING OUT OF THE GENE POOL OF CROP OF THE CUCURBITACEAE FAMILY OF GENOTYPES WITH HIGH CONTENT OF BIOLOGICALLY VALUABLE COMPONENTS IN FRUITS AND SUITABLE FOR INTENSIVE AND ORGANIC FARMING SYSTEMS

**Call SFS-05-2015: Strategies for crop productivity, stability and quality**

**The purpose of the project.** Study of the genetic diversity of the gene pool of watermelon, melon, pumpkin, zucchini, squash and allocation of sources of high chemical (dry matter content, sugars, ascorbic acid,  $\beta$ -carotene, folic acid, pectin, nit-vehicles and heavy metals, mg / kg less MPC) and technology (high marketability, storability and transportability of fruits, their resistance to cracking and overmaturity) characteristics of the fetus for subsequent use in the creation of new varieties and hybrids for intensive and organic farming systems.

**The task of research.**

1. Differentiation of the gene pool (collector and breeding material) on a range of valuable features of the mating and breeding selection, genetic selection of quality sources.
2. Biochemical analysis of fruits on the content - of dry matter, sugars, vitamin C, folic acid,  $\beta$ -carotene, pectin and nitrates.
3. Allocation of quality sources and bring them in the selection process.
4. Determination of the suitability of the collections received in intensive and organic farming systems.

In work leading breeding and genetic centers in the world there is a tendency to ensuring the competitiveness of new varieties and hybrids of vegetable plants is by improving the quality and expanding

the use of commodity products require updating and refinement of the genetic diversity of long cucurbits in the direction of improving the quality of the fruits of modern varieties and hybrids. Search and implementation in breeding programs of new genetic sources of high chemical attributes of the fetus to optimize and speed up the breeding process, increase its efficiency, to obtain new varieties and hybrids with drug prevention, sacrificial and dietary properties, the most important line of pumpkin and melon plants.

**Brief description of the project.** Compete with foreign breeding - seed companies can only create their own genetic sources economically - valuable traits. Creating on the genetic basis of collection of samples of genotypes for various purposes extends the product range, improve product quality. So relevant today for cultures of the Cucurbitaceae family is the increase in the fruit content of valuable substances such as dry solute, sugars, vitamin C, which is defined as the quality of production and its therapeutic properties. In severe environmental conditions, where people are in contact with the heavy, including radioactive metals and various toxins, increases significantly the need for environmentally friendly, cheap foods with a high content of pectin, carotene, dietary fiber. Pectin substances capable of binding and excrete heavy metal ions, including Radioactive as well as various toxins and promote fruit storage for a long time.

**Expected results.** This will create the culture collection of the Cucurbitaceae family, watermelon, cucumber, squash, melon, pumpkin with a high content of valuable biological substances in the fruit with a view to their use in breeding work on the creation of varieties and heterotic hybrids, as well as determine their suitability for intensive and organic farming systems. Creating genetic collection on quality indicators of fetal and suitability as to intensity and Organic production systems allow as soon as possible to create a given model F1 hybrids are in demand in the consumer market.

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#### **IV. Plant Production Institute named after V. Yuriev**

##### **1. IMPROVING OF MAIZE (*ZEAMAYS*) AND SPRING WHEAT (*T. AESTIVUM* L.) STARCH QUALITY BY USING MUTATION TECHNIQS**

The question of starch quality improving is very crucial for several crops. It relates to the fact, that the starches with different contents of amylose (waxy starch, or amylose-free in one hand and high-amylose starch in other hand) has a wide range of application and is in great demand in food industry, pharmaceutical, paper and film producing and so on. This mainly refers to the grain corn. As for wheat, the waxy wheat is absolutely new product for Ukraine. The waxy flour is the best row material for the production of biscuits and cakes, morning cereals and granola. Thanks to its special properties, these products can help to remove radionuclide and toxic substances, which is especially important for Ukraine, taking into account the Chernobyl tragedy.

By using a mutation technic we have created the new maize and spring wheat mutant lines. This scientific work was done under International Atomic Energy Agency funds (TC Project No 15483).

Our new mutant line is different from the initial line by the color of grain, uniformity of morphological characters and high content of oleic acid. All of them are highly desirable for practical breeding of maize in Ukraine and not only. This new mutant line will be registered in National center of plant resources in Ukraine and in mutant data base in IAEA. The total concentration of tocopheroles in the seeds of mutant lines BK-36/2.1 – 100 Gr White and BK-36/2.1 – 100 Gr Yellow is greater than in initial line on 0,53 mg/% and 0,75 mg/% respectively. These lines are the nice initial material for the practical breeding of maize hybrids with the high level of tocopheroles in oil. The total concentration of tocopherols in mutant line BK-69/2.1 – 100 Gr improved is higher than in initial line BK-69 control on 2,27 mg%, Based on our



experimental data, after the mutagen influence the tocopherols content in mutant line BK-69/3 – 100 Gr improved super trumps substance in control line almost four times.

- What can be done within a new project: we have a very promising plant material (maize and spring wheat) for successful creation of absolutely new for Ukraine types of maize (*Zea Mays*) and spring wheat (*T. aestivum* L.) with a altered amyloze/amylopectine composition in starch.

- Publications: part of our investigations, concerning the maize starch granules, was published as a chapter in the book “Mutagenesis: exploring novel genes and pathways” (DOI 10.3920/978-90-8686-787-5\_12). Chapter 12 – Influence of gamma radiation on maize (*Zea mays*) starch granules morphology. P. 239 – 249.

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## **V. Institute of Horticulture**

### **1. BIOTECHNOLOGY OBTAIN OF RECUPERATION, GENETICALLY HOMOGENEOUS AND VIRUS-FREE PLANTING MATERIAL OF BERRY CULTURES SFS-2015-2. Sustainable Food Security**

Using healed planting material it's one of the preconditions for high performance berry crops.

Developments over the last years in the field of plant biotechnology revealed the significant potential of cell technologies for plant propagation. Biotechnological methods allow healing elite varieties of berry cultures to increase their rate of reproduction, obtain genetically homogeneous, quality of planting material, speed up the selection process. Also method of microclonal propagation provides an opportunity detect a wide range of patterns and morphogenesis of plant resistance to diseases.

In view of this problem-solving accurate diagnosis and prevention of infectious diseases of the perspective berry crops, development methodology improvement, clonal micropropagation and genotyping of elite varieties are opens wide prospects and opportunities for implementation in Ukraine gardening on a virus-free basis.

In work is scheduled to perform the following tasks:

- Selection of donor plants and optimization of the process of obtaining aseptic plant material of perspective varieties of the fruit crops family for their introduction to culture in vitro.

- Selection of culture media components and testing process microclonal reproduction of perspective varieties of the berry crops such families as: Rosaceae Juss., Grossulariaceae DC., Ericaceae Juss. under in vitro conditions.

- Conducting of multilocus DNA profiling of the perspective grades of strawberries, raspberries, blackberries and currants for the use of molecular genetic SSR-PCR markers and development of DNA-passports of the elite varieties of strawberries, raspberries, blackberries and currants.

- Study characteristics in somaclonal variability of the perspective grades berry crops, that arise in the process of reproduction by the method of indirect morphogenesis by using molecular genetic markers.

- Study the specificity forming of the tissue barriers in system of sustainability berry crops Rosaceae Juss., Grossulariaceae DC., Ericaceae Juss.rod. Rosaceae against pathogens and study the characteristics of the synthesis of secondary metabolites in tissues of berry crops during their recovery.

- Perform design and synthesis of primers test systems used in the diagnosis and identification of viruses strawberries, raspberries, blackberries and currants.



- Testing technology adaptation regenerants recovered plants to the open ground and creating experimental research plantations berry crops on virus-free basis.

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\*- National University of Life and Environmental Sciences of Ukraine

\*\* - Institute of horticulture (NAAS of Ukraine)

# **Department of Animal Science proposals for the open calls of EU Framework Programme for research and innovation – HORIZON 2020**

## **I. Institute of Fisheries**

### **1. CONTROL OF INFECTIOUS DISEASES IN AQUACULTURE**

Diminishing impact of fish diseases is an important issue in sustaining and developing an economic aquaculture industry. Chemotherapeutants are currently used to treat bacterial and parasite infections in fish and have become an integral part of modern aquaculture, but their use is restricted by different European Agency. The recognition of farming ponds as valued ecosystems further argues against pharmacological interventions and strongly in favour of sustainable approaches, i.e. genetic selection for increased resistance to disease. Genetic selection will therefore be a potential and sustainable approach to disease control in semi-intensive fish pond farming.

Indirect breeding is based upon markers potentially associated with an improved health status. To date, the number of potential markers for disease resistance in fish are rapidly increasing. Further, recent data indicate a clear potential for the use of immunologically important genes (like MHC, for instance) as quantitative trait loci for disease resistance in Atlantic salmon.

The aim is to screen known polymorphic genes of immunological importance in the innate immune system of carp for use as markers in future marker-assisted selection programmes for increased resistance to disease

It is vitally important to realise that (i) the carp is being used as it is an excellent model of a modern bony fish, (ii) host institution have worked with this species and have experience with it and access to it, and (iii) the results of the research effort are perfectly adaptable to other fish species in the European aquaculture and fisheries.

#### *Experimental approach*

1. Selected breeding lines of common carp have been already reproduced and their offspring is grown in the laboratory to evaluate disease resistance. Infections with the parasite are routinely maintained by syringe passage of known numbers of parasites. Parasitaemia will be determined in blood samples taken weekly from infected fish.

2. Serology will comprise the determination of natural antibody levels using enzyme-linked immunosorbent assays (ELISA) by spectrophotometric analysis of plasma samples from (un)infected carp.

3. Backcrosses between parasite-susceptible (low survival rate) and parasite-resistant (high survival rate) carp lines will be made, selecting individuals expressing different alleles. The offspring will be typed for survival rate, disease resistance, immune polymorphisms.

#### *Scientific questions*

1 Can correlations be established between carp lines with a record of high or low survival (cq. high or low resistance to pathogen) and immune polymorphisms for genes of immunological importance?

2 Can correlations be established between carp lines with a record of high or low survival (cq. high or low resistance to pathogen ) and innate differences in their levels of natural antibodies?

3 Can the immune polymorphisms for genes of immunological importance unequivocally be correlated with the above-studied innate differences in immune responsiveness?

Experiments are designed to answer these questions and will lead to a better understanding of the importance of genetic differences in immune responsiveness for survival rate and/or disease resistance. The final goal of the project is to get insight into the potential of

immune polymorphisms for use as markers in future marker-assisted selection programmes for increased fish resistance to disease.

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## 2. BIODIVERSITY OF THE NATIVE BLACK SEA STURGEONS POPULATIONS

Sturgeon fish (Acipenseridae) - valuable and promising objects of world aquaculture producers that are delicious and expensive as fish products. Despite the commercial and ecological importance, information on the genetic status of sturgeon and their diversity in the Black Sea poorly studied. At the present intensive anthropogenic pressure on natural ecosystems, understanding of the genetic diversity of sturgeon is the main basis of development plans for the conservation and management structure of natural populations and the stocks recovery.

The project proposal involves the study of intraspecific genetic diversity of populations of wild species of sturgeons: Russian sturgeon (*Acipenser gueldenstaedtii*), stellate sturgeon (*Acipenser stellatus*), beluga (*Huso huso*), sterlet (*Acipenser ruthenus*), and the North American exotic species in Ukraine - paddlefish (*Polyodon spathula*). Conducting such research is expected to conduct species identification, implementation of genetic certification, tracking paths poaching trade, carrying combining pairs and formation of heterogeneous uterine herds using microsatellite and mitochondrial DNA markers.

These results are further planned to be used for monitoring the genetic processes in the sturgeons populations, reducing pressure of the anthropogenic factors on the natural populations, developing a set of measures to improve the efficiency of selective breeding, optimization work on artificial reproduction of sturgeons through rational use of certified herds with preservation and control of genetic structure and species biodiversity in nature.

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## 3. GENETIC CONTROL OF POPULATIONS OF VALUABLE FISH SPECIES

**SFS-11b-2015: Consolidating the environmental sustainability of European aquaculture**

**The basis of project** is position that the most effective uses of populations of valuable fish species is impossible without genetic control of specificity formation of the genetic structure for obtaining consolidated groups of individuals with specific breed economically valuable characteristics.

Ukraine is one of the European countries that occupy a leading position with aquaculture production. To date, due to the sharp decline in natural fish resources and growing needs of humanity in foods of animal origin is an important to preserve genetic diversity of different species of fish. Solving of this problem is possible only with help of rational fish farming, based on a harmonious combination of ensuring human quality clean food while saving the genetic fund of various species of fish. In future it will provide the more prosperous living of fish populations.

**The goal of the project** is to develop the scientific approaches for effective uses of modern methods of genetic monitoring of valuable fish species of Ukraine using molecular genetic markers and cytogenetic control. Application of molecular genetic and cytogenetic studies of fishes in aquaculture will help to save the most valuable specimens for selection of breeding pairs in artificial reproduction. The main investigation will be performed in the

direction of evaluation of the molecular genetic polymorphism markers of some valuable fish species such as salmon and sturgeons and identification of their individual, intra-species and species differences. There will be developed ways of preservation genetic biodiversity.

**Expected results.** According to proposed project for population-genetic control and further correction of population-genetic structure of valuable fish species will be chosen the most informative molecular genetic and cytogenetic markers. Ultimately, it will allow to reduce the time of population-genetic adaptation of fishes to various environmental conditions and will improve the efficiency of aquaculture. Analysis of genetic variability of valuable fish species will help to select of the most optimal methods of fishes reproduction and selection.

Control of homozygosity and polymorphism level of populations will be used for expanding the range of population and species variability, phylogenetic study and analysis of genetic similarity of valuable fish species.

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#### 4. CYTOGENETIC CONTROL OF ENVIRONMENTAL SUSTAINABILITY OF VALUABLE FISH SPECIES

##### ***SFS-11b-2015: Consolidating the environmental sustainability of European aquaculture***

The main direction of aquaculture in inland water bodies of Ukraine is pond fisheries as the main reserve for further raising of production amounts. Today in Ukraine is increased the intensity of salmon (rainbow trout, brook trout and European grayling) cultivations. Among new objects of fisheries in fresh-water aquaculture is paddlefish (*Polyodon spathula*). It is the specimen of acipenseriformes which was introduced from North America. Specimens of pond aquaculture are characterized by the different phenotypic and genotypic peculiarities, growth rate, fecundity, search ability, cold resistance, resistance to infectious diseases. Consequently, in pond and river fisheries are necessary complex knowledge of variability of populations genetic structure, level of somatic and generative mutagenesis, resistance to infectious diseases for creating of high-productive brodstock of fish and effective breeding work.

During the vegetative period in inland water bodies are collected physical, chemical and biological mutagens which induce in fish the occurrence of different types of mutations (gene, chromosomal, genomic). As far as increase the influence of environmental genotoxins onto the chromosomal apparatus of fish is very necessity to analyse the level of mutations for estimation of physiological state and make the forecast of viability, fruitfulness. It is not universal method for detection of all types of aberrations in fishes. But cytogenetic methods are most sensitive and reliable for detection of mutagenic effects of genotoxic agents *in vivo*.

That is why cytogenetic control of fish chromosomal apparatus, presence of structural changers (aberrations) and quantitative damages of karyotype is necessary for genetic examination of breeding resources of fish. Now there are many are not investigated questions in native fisheries such as: karyotype specificity of different species of fish, somatic and generative mutagenesis, that slow down development of this sphere of the national economy. Today are not investigated mechanisms of such translocations, homological pairs of autosomes and sex chromosome pairs. For detail analysis of kariotype variability at fishes, character of chromosomal translocations are not enough to use classical methods of kariotyping. It is necessary to use of molecular-cytogenetic methods such as fluorescence *in situ* hybridization (FISH) with different DNA probes.

**The purpose of investigations** is to study the cytogenetic variability of valuable fish species (salmons and sturgeons) using the micronucleus assay to monitor aquatic pollution displaying mutagenic features and karyotyping for creating of high-productive brodstock of fish and effective breeding work.

To attain this goal is necessary to perform series of investigations such as:

- to research specificity of normal karyotype of valuable fish species (rainbow trout, brook trout, European grayling and paddlefish);
- to analysis the level of quantitative and structural chromosomal polymorphism of investigated fishes;
- to identify homological pairs of autosomes and sex chromosome pairs in investigated species of fish;
- to study level of chromosomal and genomic mutations in lymphocytes and erythrocytes of peripheral blood and find out the species specificity of somatic mutagenesis.

**Expected results.** Knowledge of kariotype variability of valuable fish species, character of chromosomal translocations, identification of autosomes homological pairs and sex chromosomes will help as to carry out the selection of fishes effective for creation of brodstocks. Cytogenetic analysis of paddlefish will give us the possibility to perform comparative analysis of paddlefish brodstockes of Ukrainian aquaculture with North American aborigines and European individuals and if necessary, to perform correlation breeding conditions.

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## 5. HYDROACOUSTIC FISH FAUNA SURVEY OF THE DNIEPER RESERVOIRS

### ***SFS-11b-2015: Consolidating the environmental sustainability of European aquaculture***

Estimation of commercial fish abundance and ichthyomass, as well as rare and endangered species, is carried out at fixed points (1-3 points on the reservoir). The local nature of these studies, in some cases reduces the representativeness of the data on the evaluated characteristics (especially at the population level). Taking into account the imperfect system of yield inventory and prevalence of uncontrolled fishing, the accuracy of such estimates provide only the definition of the total allowable catch, but is not suitable for management decision making and the formation of long-term fisheries policy on inland waters.

All this necessitates the introduction of new methods to assess the size, abundance and distribution of fish fauna that would meet the following requirements:

1. Possibility of undertime ichthyological survey.
2. Coverage of the entire area of the reservoir.
3. Sufficient precision of the estimates.
4. Minimal impact on the fish fauna.

Taking into account the constraints that has an active fishing, the best method for assessing the state of the fish fauna of the Dnieper reservoirs (as well as reservoirs of the Dniester and Southern Bug) are evaluating hydroacoustic surveys with parallel selection of the ichthyological material on individual biological characteristics of the netting catches. To implement this scheme are relevant water crafts and support staff.

A significant obstacle to the widespread introduction of hydroacoustic surveys in fisheries research practices in inland waters of Ukraine is the lack of modern echo-sounders with technical

specifications that are sufficient to survey large water areas in terms of fish migration activity, and consequently lack of qualified professionals who know how to handle them.

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## **II. Institute of Animal Breeding and Genetics named after M. Zubets**

### **1. NANOMATERIALS TO OPTIMIZE TECHNOLOGY OF CRYOCONSERVATION OF FARM ANIMAL'S GENETIC RESOURCES**

***Call SFS-07b-2015. Management and sustainable use of genetic resources***

The current problem of endangered species preserving due to environmental degradation on Earth, has increased the focus on the functioning of banks of genetic resources. Ukraine is a member of the European Regional Focal Point for Animal Genetic Resources at the FAO (ERFP) and operates under the international program "Cryoweb", which adapts to the conditions of Ukraine, and also updates the national database of the European Farm Animal Biodiversity Information System (EFABIS). For program purposes of preservation of the gene pool of farm animals at the cellular level necessary to improve technology of cryoconservation. Relevance of the project is to create new bioactive nanomaterials that will complement standard cryomedium for boar spermatozoa (ejaculate, epididymal – removed from the testes). The project involves the use of environmentally safe nanomaterials synthesized from silica and biomolecules. Physical and chemical properties of nanomaterials that will improve the viability of boar spermatozoa in terms of their cryoconservation will be studied. The methods of producing biologically valuable pig embryos in vitro will be improved through the use of cryoconserved sperm with nanomaterials. Improved technology will be used for preservation of cryoconserved semen of genetic valuable boars in genetic programs of preserve of the gene pool of farm animals.

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### **3. EVALUATION OF GENE POOLS OF BREEDING LIVESTOCK RESOURCES OF ABORIGINE AND ENDANGERED BREEDS CATTLE THROUGH THE USE OF MODERN MOLECULAR GENETIC APPROACHES**

***Call SFS-07b-2015. Management and sustainable use of genetic resources***

The processes of transformation in agricultural production quickly cover most components of the livestock industry in a market economy. Especially noticeable transformation occurring in breeding livestock resources so intensification selection process based on the preferred use of the most competitive specialized species that are able to demonstrate a high level of productivity and provide a cost-effective livestock production. Rapid change of breed composition in Ukraine animal husbandry makes the problem of preserving the gene pool of local breeds and populations that are not able to compete in terms of productivity with specialized breeding resources. In particular this applies to domestic local breeds and leads to a narrowing of the natural diversity of animals and loss of genes and gene complexes characteristic them. At the same time these breeds are characterized by high levels of resistance, adaptability to adverse environmental factors, they have a strong constitution, higher reproductive ability and a number of other valuable qualities.

Researching of aborigine breeds gene pools of is important for the combination of alleles of quantitative and qualitative characteristics (productivity, resistance to disease, stress) that can later be used in breeding. Search and analysis of the most informative molecular genetic methods for evaluation of genetic structure of cattle different breeds is important in genetic monitoring system Ukraine animal husbandry, preserving their gene pool. Such researching has both theoretical and practical importance in determining of the genetic status of the breeds, evaluating of the effectiveness of various methods of breeding and selection.



Aim of project is the improvement methods of breeding animals evaluation by the use of DNA markers that will increase output of calves and identify animal carriers of hereditary disease with autosomal recessive inheritance, improve the milk and meat productivity of cattle on the base of animal selection for quantitative traits of loci, cytogenetic studies of variability in different species of farm animals.

System of genetic monitoring of local breeds on the basis of analysis of the characteristics of genetic structure for STR-markers will be worked out as a result of the theme. It will be some contribution to solving the global problem of biodiversity in accordance with the "Convention on Biological Diversity". This researching will provide definitive characterization of gene pools at the population and at the individual level. This will give the opportunity to make genetic certification of animals and create a database of existing gene pool material and identify ways to further effective use.

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#### 4. DEVELOPMENT OF A SYSTEM OF REQUIREMENTS FOR THE PRODUCTION OF ORGANIC

***Call SFS-05-2015: Strategies for crop productivity, stability and quality***

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## 5. ASSESSMENT OF GENETIC DIVERSITY AND GENE POOL CONSERVATION OF THE LOCAL HORSE BREEDS

### *Call SFS-07b-2015: Management and sustainable use of genetic resources*

The rapid increase in population on earth and rising resource consumption leads to disruption of the ecological balance of the biosphere by narrowing the genetic diversity of natural ecosystems. The need for large amounts of food leads to a gradual reduction in the number of farm animals, including horses. Of particular concern are local and numerically small breed, raised in certain climatic conditions and are not particularly attractive in terms of large-scale agricultural production. The main threat to reduce their genetic diversity caused by the use of more productive breeds, crosses unsystematic, lack of clear selection strategy and adequate support from the state, the requirements of the modern market. On the territory of several European countries, including Ukraine, one of the local indigenous breeds of horses are Hutsul, which has a number of features that distinguish it from other species. Despite the great popularity of this breed of horses in several countries due to the reduction of its size, acquires particular relevance monitoring and conservation of genetic diversity.

The project involves the development of monitoring system and conservation of genetic diversity of indigenous local breeds of horses, including Hutsul, in vivo and in vitro by:

- Genetic identification of individuals using modern genetic markers;
- Assessment of the genetic structure and effective population size;
- Assessment of the genetic unity and diversity of species;
- Determination of animal carriers of genetic diversity;
- Analysis methods for selection and breeding work with local aboriginal species;
- The creation of genetic material cryobank of breed and effective use of biodiversity;
- Establishing international cooperation in conservation of genetic diversity of countries

where the native bred horses as local Hutsul breed;

- Promoting the breed among private owners and government agencies.

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# **Veterinary Medicine Department proposals for the open calls of EU Framework Programme for research and innovation – HORIZON 2020**

## **I. National Scientific Center “Institute of Experimental and Clinical Veterinary Medicine”**

### **1. NATIONAL NORMATIVE BASIS HARMONIZATION FOR BIOSAFETY AND BIOSECURITY TO EU REQUIREMENTS**

**Introduction:** Current Ukrainian legislation, which is aligned to future CDF’s work and EDPs caused diseases management, pertinent to animal health encompasses three main areas: 1) instructions for outbreak response, 2) requirements and guidelines for diagnostics and/or prophylaxis, and 3) standards for management of new equipment. Much of this legislation is outdated and requires modification, especially because of diagnostics and surveillance basis improvement using biosafety regulations and novel molecular based pathogen detection techniques. This is particularly true when considering the rate at which diagnostic techniques, safety measures, and reporting systems are evolving in the international arena, which has resulted in a schism between current and preferred practices in Ukraine, including practices associated with laboratory diagnostics and biological safety and security (BS&S), especially concerning EDPs-caused diseases.

**Justification of the project:** NSC “IECVM” is the leading establishment in veterinary sciences and reference activities in veterinary medicine. Our center is responsible for pathogens maintenance and its using for veterinary drugs elaboration and its validation in accordance with the National and International rules. Reference activities of NSC “IECVM” include 6 scientific centres of expertise (for avian diseases, cattle diseases, TBC, parasitology, prionic infections, feed-stuff quality and safety) and Reference laboratory for avian influenza and Newcastle disease.

NSC ‘IECVM’ has microorganism strains’ collection, which will get the status of National Honority. Now about 700 strains of microorganisms are stored and used for scientific researches and production of over 80 diagnostic and vaccine preparations. Stored pathogens include different bacterial, viral, fungal species, also the emergency diseases agents: NDVs, HPAIV, LPAIV, Brucellas, B.anthraxis, Salmonellas, Mycobacteria, etc.

**Aim of the study.** To implement World-wide and to elaborate own standards, techniques and SOPs for animal viruses storage and management, reference substandards development for highly dangerous diseases and toxins in Ukraine

#### **Tasks of the study:**

To create the regulation for reference laboratories duties and responsibilities, harmonized with OIE rules.

To implement its critical points and aspects in NSC IECVM centers for reference expertise

To harmonize international standards for animal diseases diagnostics and control for Ukrainian normative basis

To elaborate and finalize diagnostics techniques and SOPs in the frames of EU and Ukrainian veterinary law

To establish the practical workshop for field diagnostics veterinarians for elaborated standard implementation

**Expected results.** The European standards for selected agent control, biosafety and biosecurity will be implemented in Ukraine.

***Project coordinator: Prof. Borys T. Stegnyy, Director of NSC IECVM, e-mail: admin@vet.kharkov.ua, +380577072044, fax +380577041090***

## 2. IMPLEMENTATION OF THE STANDARDS FOR MOLECULAR CHARACTERIZATION OF EMERGENCY ANIMAL DISEASES AGENTS, ISOLATED IN UKRAINE IN DIFFERENT PERIODS

**Introduction:** The emergent animal diseases caused by viruses are strongly related to possible viral associations. They could be presented by multiple agents belonged to RNA- and DNA-contained viruses. The specific control measures of the diseases are aligned to notification of the sero- and genotypical profile of the pathogens. Determination of these parameters requires implementation of the modern diagnostics and laboratory typing techniques, widely implemented all over the World. The most distributed agents in the World, described and typed in the EU countries are highly pathogenic avian influenza, velogenic Newcastle disease virus, PRRS virus and PCV-2.

**Justification of the project:** Implementation of the European standards for rapid indication and identification of the agents of highly pathogenic avian influenza, velogenic Newcastle disease virus, PRRS virus and PCV-2 will provide Ukraine, as the potential member of EU, with equal with EU and effective methodology for detection and typing of the agents of the emergent animal diseases. This will supply the protection of EU from the introduction of the selected agents by the transboundary way from Russia and Belorussia.

**Aim of the study and methodology.** This study aims to determine biotypes and genotypes of selected infectious causative agents of animal diseases. The list of viral species will include agents of highly pathogenic avian influenza, velogenic Newcastle disease virus, PRRS virus and PCV-2, allocated in Ukraine since establishment of the profile laboratories. Molecular study of the selected animal pathogens, isolated in our state and stored in our institute will be done in order to improve the detection, treatment, prevention, and control measures and systems for these pathogens and infections, caused by them. The specific variable loci will be selected and amplified by routine PCR. Collected products will be purified and used for the direct sequencing of NDV F0 and NP genes, represented the pathotype of virus, HA and NA genes (partial) for HPAI viruses of H5 serotype. Also the genes of ORF 5, 7 for RRSSV and ORF-1, ORF-2 for PCV-2 isolates will be sequenced. The sequencing data will be used for the phylogenetic analysis of viruses. It will show pathotypes circulation in different years and it correlation with vaccines use effect. Analyzed data will support the recognition of viral source from the position of its reservoir, geographical progeny etc. Collected information will improve the level of fundamental researches in veterinary sciences, especially in molecular epidemiology and forecasting of animal diseases, caused by especially dangerous pathogens. The results will be added to the surveillance study for selected diseases.

### **Tasks of the study:**

1. Determine the pathotype and genotype characteristics for highly pathogenic animal viruses and brucellae, allocated in the outbreaks locations of Newcastle disease, HPAI, PRRS and PCVI in Ukraine.
2. Molecular epidemiology study for selected infections in Ukraine.
3. Describe the risk factors for viruses introduction in the state.
4. To improve molecular diagnostics and epidemiology study systems.

**Expected results.** The European standards for selected agent caused diseases molecular diagnostics will be implemented. The risks for selected agents transboundary introduction for Ukraine and EU-counties will be described. The molecular epidemiology parameters of the selected diseases will be studied.

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### 3. DISEASE BASELINES OF RUMINANT DISEASES (BT, SBV, IBR, BVDV)

**Introduction:** Bluetongue, Schmallenberg disease, infectious bovine rhinotracheitis, bovine viral diarrhea are the most distributed and hazardous emergence and economically significant diseases of ruminants all over the world. Economical threats, caused by these viral infections, stimulate great losses and decrease of cattle and sheep farming profitability not only in affected countries. Both diseases have panzootic potential. The main reservoirs of causative agents of these diseases are wild animals, and animals, imported from countries with non-clear or problem status. These animals can be virus keepers without demonstration of clinical signs and lesions, but present potential threat for susceptible species. Therefore, study of these diseases distribution in wild-life and farming animals and its status comparison is the main aim for researches, related for creation of effective control and preventive and forecasting measures.

#### **Justification of the project:**

This study will be devoted to collection of clinical specimens in wild and domestic ruminants. Ukraine is situated with bordering with Russia and European countries affected with BT.

Threats of ruminant diseases distribution can be effectively studied with screening near bordering territories on the East and West of countries, and also in port-situation places (Odessa). These areas can be covered with field expeditions of NSC IECVM research teams and due potential collaboration with territorial veterinary services and Center field offices in the regions.

About 1000-3000 samples will be collected in field conditions from wild species of ruminants and farming animals. Representative selections will be formed from the point of view of possible relations with affected and potentially affected countries and imported animals from these places. Collected samples, presented in this collection will include feces, blood, clinical material of other kinds collected in accordance with OIE requirements in case of tissues and carcasses collection. Sampling will be done in active migration period of wild ruminants and spring-summer formation of domestic ruminants of surround areas. Its screening will be done by PCR-assay (conventional and real-time) for BTV, SBV, IBRV, BVDV and ELISA-techniques. Seroprevalence and PCR-screening positive samples will be used for more deep study by virus isolation and its typing with classical virological techniques, in accordance with OIE-WHO requirements. Isolated agents will be certified and its variability potential will be studied and characterized. Places, isolation was successful in, will be studied more wide, with sampling and testing not only animal origin specimens, but environmental factors assessment.

**Aim of the study.** To implement World-wide standards for ruminants' viral diseases surveillance and diagnostics, techniques and SOPs for animal viruses detection, and to study the diseases baselines in Ukraine

#### **Tasks of the study:**

5. Analysis of surveillance data for bluetongue, SBV, IBR, BVD seroprevalence and distribution in Ukrainian territory, ways and population density in areas of viral spread potential risk.
6. Implementation of OIE-WHO-recommended screening protocols for ruminant emergent diseases monitoring and development of in-house protocols for their detection.
7. Performance of domestic and wild ruminants monitoring for virus-keepers determination.
8. Isolation and characterization of strains of ruminants' viruses, circulating in wild and domestic animals.
9. Analysis of collected information, database creation, formulation of novel control and forecasting principals for ruminant emergence and economically significant diseases.
10. To perform training for ruminant emergence and economically significant diseases diagnostics using molecular techniques

#### **Expected results.**

Collected ruminant viral diseases surveillance data will be analyzed and summarized for surveillance schemes preparation, elaboration of effective preventive and forecasting means for ruminants viruses. Specific PCR techniques for agents detection will be elaborated, validated and implemented for practical use for active surveillance.

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## **II. Institute of Veterinary Medicine**

### **1. DEVELOPMENT ELISA FOR SEROLOGICAL DIAGNOSTICS OF THE RUMINANTS' BLUETONGUE**

***SFS-12-2014. Assessing the health risks of combined human exposure to multiple food-related toxic substances***

Bluetongue, or catarrhal fever, is a viral infectious disease of wild and domestic ruminants transmitted by *Culicoides* blood-sucking insects. It was first observed in the 19<sup>th</sup> century in South African sheep, but during the 20<sup>th</sup> century it spread rapidly over tropical and subtropical regions, occupying geographic range between 40° of north latitude and 35° of south latitude. Within the last years, due to the global warming, bluetongue distribution area has expanded till 50° of north latitude and was documented in East Europe.

Due to the high mortality from the infection, Bluetongue was included to “A” list by International Office of Epizootics (OIE) as potentially dangerous infection having economical effect. It presupposes constant monitoring of the infection spread, particularly when transporting animals for international trade. Early detection of infected animals and their eradication can considerably decrease disease consequences by reducing viral load and limiting disease distribution through export of potentially infected animals. The latter situation is a serious problem, because the course of disease can be without any clinical signs up to 100 days.

Serologic diagnostics methods are usually used for control and monitoring of Bluetongue distribution, as the virus-specific antibodies are formed in 7 – 14 days after contamination and usually exist for a long time. Two main serological methods for Bluetongue diagnostics recommended by OIE are agar gel immunodiffusion (AGID) and Enzyme-linked immunosorbent assay (ELISA).

Project proposal is aimed to developing an ELISA for serological diagnostic of Bluetongue with the use of virus-specific Bluetongue antigen VP7, produced from transgenic tobacco plant (*Nicotiana tabacum*) and evaluating its diagnostic potential by performing a validation analysis with reference samples of experimentally infected sheep serum.

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### **2. DEVELOPMENT AND INTRODUCTION OF NEW METHODOLOGICAL APPROACHES TO THE DEFINITION OF BACTERIAL TOXINS IN PORK**

***SFS-12-2014. Assessing the health risks of combined human exposure to multiple food-related toxic substances***

In the framework of Ukraine of food safety control designed for their quality. To include this control and evaluation of food products for veterinary terms, namely, organoleptic, microbiological, histological and pathological.

An important element in the diet of the population of Ukraine is the production of pig



production. It is important to control the presence of bacterial toxins in pork, including pathogens such as *Clostridium perfringens*, *Salmonella* spp., *Listeria monocytogenes*.

The main objective is to identify at all stages of processing products (pork) toxins of clostridia and *Salmonella* as the most dangerous to human health.

This project aims to develop a methodology for the above toxins of bacteria in pork producers. To solve the problem is planned to obtain pure proteins of bacterial toxins, get monoclonal antibodies to them and develop on the basis of their test systems for the determination of toxins, to show its efficiency (sensitivity and specificity) on the model of pork production; develop and implement regulatory documentation in this development procedure of veterinary-sanitary evaluation of products.

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# **Department of Scientific Providing of Innovative Development proposals for the open calls of EU Framework Programme for research and innovation – HORIZON 2020**

## **I. Institute of Oilseed Crops**

### **1. INCREASE IN PRODUCTIVITY OF OILSEED CROPS BY OPTIMIZING LAND USE TO UNLEASH THE POTENTIAL OF MODERN VARIETIES AND HYBRIDS** ***Call SFS-02b-2015. Assessing soil-improving cropping systems***

At the present stage agriculture focuses on the organic farming that is environmentally friendly and doesn't utilize GMOs, agrochemicals, fertilizers. This leads to the activation of natural biological processes in soil, restoring the balance of nutrients. Living organisms also normalize and humus increases leading to increasing crop yields.

The development of organic farming is a nationwide problem. The transition to ecological agriculture is essential for Ukraine. This will facilitate the development of production of environmentally friendly products, health improvement and will enable Ukraine to fill a adequate niche in the production and marketing of its produce in the European and world markets.

Purpose of the study is to develop and implement new methods and technologies of oilseed crops cultivation that will increase fertility and nutrient soil activity, obtain biologically valuable and environmentally safe produce through determining the best precursor for achieving genetic potential of oilseed crops, establish the impact of tillage methods on its water-physical properties, determine the effect of sideration, soil mulching, use of bacterial fertilizers and biological products to restore balance of nutrients and activation of natural biological processes in the soil, increase crop yields, determine economic and bioenergetic efficiency.

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### **2. THE SOIL SEPARATOR MODULE FOR CULTIVATED CROPS SEEDER** ***Call SFS-02b-2015. Assessing soil-improving cropping systems***

The layered distribution of soil aggregates by size in carrying the preseeding cultivation and providing no damage for waterproof aggregates raise the efficiency for the initial phase of the crops growth and improve the conditions for accumulation and preservation of humus in the soil. At the same time, other problems are being solved, such as fighting against the wind erosion by locating large soil aggregates in the upper soil layer and the environment friendly production of agricultural products due to the mechanical weeds removal in the cultivating layer, which is an alternative to chemical methods of the treatment against the weeds. To solve the technological problem the design of the soil separator module for the cultivated crops seeder, which consists of the rod coulter, smooth and rod rollers, two rod reels, was developed and its constructive and technological parameters have been substantiated. Due to the application of the developed module in the preseeding soil cultivation for crops in the sunflower production process, it becomes possible to increase the yield up to 5.9% and to reduce the amount of granular mineral fertilizers down to 3.5% compared with the hinged cultivator KH-3.8.

Advantage of the machine over existing domestic and foreign analogues

The developed soil separator module for cultivated crops seeder provides a high separation level up to 80% compared with existing analogues, which allows getting a seeding layer of soil with aggregates diameter 0.25-5 mm. The module design eliminates the clogging of

the space between rods in wet soils and the soil spillage in overdried soils, which significantly increases its productivity and reduces energy consumption.

By placing the development to the production, its design has to be improved by automating the separation process based on the adaptation to climatic conditions and technological tasks for the combined seeder of cultivated crops.

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## **II. State Agricultural Experimental Station of Zakarpatia**

**1. STUDY THE PECULIARITIES OF THE MICROELEMENTS NUTRITION OF THE AGRICULTURAL CROPS ON THE BASIC SOIL TYPES OF TRANSCARPATHIA AND ELABORATE THE MEASURES OF ITS MANAGEMENT TAKING INTO ACCOUNT THE ECOLOGICAL FACTORS**

***Call SFS-02b-2015. Assessing soil-improving cropping systems***

The rational usage of the land potential and soil multifunctionality preservation is an actual question and in the conditions of the Carpathian region the actuality of the problem is being conditioned by both –the unique nature and the biogenetic meaning of the natural territorial complexes.

By the physical-chemical soil characteristics Carpathian region presents an independent geochemical province, that's why the aim of the project is to study the regulative functions, buffer peculiarities of the Carpathian brown soil, their microelements state and persistence to the anthropogenic loads, and it represents an important theoretical and practical value for the soil science.

Within the framework of the scientific-research work it is planned to elaborate the theoretical bases of the microelements state in the system of soil-plant, to study the peculiarities and mechanism of the nutrition elements regulation, acid-basic regime of the different soil types. It's being foreseen to elaborate the system of microelements nutrition optimization for the basic agricultural crops. With the aim to find out the antagonistic and synergic cooperation there will be conducted the diagnostics of the microelements nutrition. We are going to use the data on the soil fertility and yield value indicators, and on the quality of the crops made on the long-term stationary researches, which are being established in the lowlands and mountainous areas of Transcarpathia. With the help of the statistic modeling method it is being planned to elaborate the productive and ecological measurement of the anthropogenic loads for the different soil types.

**Project coordinator: Choma Z.Z., PhD, e-mail: [insbakta@ukr.net](mailto:insbakta@ukr.net)**

**2. IMPROVE THE COMPLEX OF THE MEASURES ON PRESERVATION AND RESTORATION OF THE SOIL PRODUCTIVITY, ITS PRODUCTIVE AND ECOLOGICAL FUNCTIONS IN THE MOUNTAINOUS CARPATHIAN ZONE**

***Call SC5-07-2015. More effective ecosystem restoration in the EU***

The aim of investigation is to elaborate the elements of the ecologically safe directions of the creation of the soil protective arable-farming systems model, which is based on the concrete natural and climate and household-economic conditions of the mountainous zone of the Ukrainian Carpathians, and which would give the possibility to provide the necessary level of the soil protection from the water erosion, rational, scientifically-grounded usage of the land resources, the expected level of their productivity and ecological balance in the region.

Project aims:

- To improve the household mechanism of the usage and exploitation of the land resources;

- To raise the effectiveness of the AIC enterprises work;
- To preserve and raise the soil productivity and to improve other useful soil qualities;
- To protect the agricultural lands from the overgrowth of the bushes and underwood;
- Temporary conservation of the degraded agricultural lands;
- Ecologization of the mountainous arable farming.

As the result of the conducted researches there will be elaborated an arable farming model for the mountainous Carpathian zone, which will provide the necessary level of the ecosystems productivity, and protection of the soil from the water erosion, there will also be given recommendations on the adaptation of the existing technologies of the arable crops growing corresponding to the conditions of the soil preventive arable farming.

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### 3. INVESTIGATION OF THE ADAPTATION POTENTIAL OF GRAPE VARIETIES OF NATIVE AND FOREIGN BREEDING IN TERMS OF TRANSCARPATHIA

The aim of the research is to investigate and single out the new for the Transcarpathian conditions grapes varieties and improve the existing assortment of the districted varieties under the indicators of productivity and quality with the aim of their further spread and cultivation in the region. Special attention will be given to the table varieties of early and medium ripening periods, as the assortment of the latter in the region is rather limited and it doesn't satisfy the actual demand of the population on this production.

In consequence of the study of the new grapes varieties in the agroclimatic conditions of the region there will be chosen the best due to the complex indicators (steadiness to abiotic and biotic environmental factors, quality, productivity, ripening period, usage direction) varieties with the aim of their implementation into the production in Transcarpathia and there will also be done work on the improvement of the already existing genetic fund of the grapes plantations in the region.

**Project coordinator: Ljubka O.S., Candidate of Agricultural Sciences, e-mail: [insbakta@ukr.net](mailto:insbakta@ukr.net)**

### 4. TO ELABORATE THE ECOLOGICALLY SAFE TECHNOLOGIES OF THE GRAINCROPS GROWING IN CORRESPONDENCE TO THE ZONAL SPECIALIZATION OF THE CARPATHIAN REGION.

Constant appearance in the industrial horticulture of Ukraine of the new introduced varieties of the domestic and foreign breeding with the undefined adaptivity and its variability depending on the growing conditions needs its precise study for the usage in the ecologically safe horticultural technologies. Agroclimatic conditions of the Carpathian region contribute to its full realization of the potential biological peculiarities and competitiveness. Choosing the optimal fast ripening slow growing graft of the fruit crops provides fast gaining of the invested money and considerable income from the plantations. The usage of the biological sort potential of sustaining power and immune system to the basic diseases and pests gives the opportunity to grow ecologically clean and safe production and in maximum escape from the environmental pollution. Huge land massifs and side hills of Khust, Tyachiv and part of Uzhhorod districts of the pre-mountainous zone of Transcarpathia are not being used or being used under the less effective technologies in the time when they more fully correspond by the majority of their natural and climatic characteristics to the demands of growing the raw - and ecologically safe gardens on the basis of the immune varieties usage. On the other side a considerable amount of

the mineral springs and health treatment resorts of the given region demand a special attention to the environmental preservation.

The aim of the project is to study and single out the most adapted to the region's conditions and enduring to the diseases varieties and fruit crops grafts, to evaluate their availability for the usage in the modern highly intensive, ecologically safe technologies of the industrial and amateur horticulture.

The result of the researches is the creation of the new ecologically safe technologies of the horticulture growing in correspondence with the zonal specialization of the Carpathian region on the basis of the highly productive immune varieties of different origin usage.

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## 5. TO ASSESS THE COMPLEX OF THE HOUSEHOLD-BIOLOGICAL PECULIARITIES OF THE RARE AND VANISHING FRUIT AND NUT-BEARING CROPS VARIETIES IN THE TRANSCARPATHIAN COLLECTIONS AND TO SINGLE OUT THE VALUABLE SAMPLES FOR THE EFFECTIVE USAGE IN THE BREEDING PROCESS.

In Transcarpathia there had been preserved the separate, aborigines varieties of apple, pear, plum and nut trees, which are adapted to the complex soil-climatic conditions of the region. They obtain such positive features as enduring to the diseases, frost resistance, late blooming, heavy crops of trees and fruits quality. Local varieties are of great value for the horticulture, and can widely be used in a breeding process, and as well in the ecologically safe fruit production without the usage of the pesticides. The given products are important for the dietary, children, and health resort nourishment.

The aim of the elaboration is to single out the vanishing, rare and local fruit and nut-bearing varieties of Transcarpathia, to create collections and their effective usage in the horticulture, to study their basic biological and valuable household definitions and to add them to the National Bank of the genetic resources of horticultural crops of Ukraine.

In consequence of the project implementation there is going to be created the genetic fund of the fruit and nut bearing crops of various origins, which have a reduced spreading area, valuable characteristics of which are able to be used in the breeding process and in the creation of the ecologically safe fruit growing technologies.

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## 6. TO FORM THE SOURCES AND BREEDING MATERIAL OF THE LOW-SPREAD VEGETABLE AND GREEN CROPS WITH THE HIGH USEFUL MATTERS CONTENT FOR THE CREATION OF THE NEW VARIETIES UNDER THE GLOBAL CLIMATE CHANGING CONDITIONS

Combining the soil and climate conditions, which under the cardinal climate changes had been lately made unsuitable for the cultivated plants of the peculiar climate zone, it often leads to a considerable yields reduction and quality characteristics earlier than the heavy crops plant varieties are being created. That's why for today the most important task is to select and study the starting material of the low spread vegetable and green crops as to the regularity of valuable household characteristics changes, and quality characteristics changes under the influence of the global climate changes. On the basis of the material study, the aim of the project is to form the sources of the valuable household characteristics and the breeding material with the high useful matters content and high adaptive qualities to the growing conditions.

As a consequence of the project fulfillment, there are going to be created the varieties of the low spread and green crops with the high useful matters content and valuable household

characteristics in the conditions of the soil –climate factors changes and there will be elaborated the measures of the complex preservation of the mentioned above characteristics and qualities under the creation of the perspective heavy yield varieties with the high adaptive qualities in the present conditions.

**Project coordinator: Kormosh S.M., Candidate of Agricultural Sciences,**  
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7. TO CREATE THE SOURCES, VARIETIES AND HYBRIDS OF THE ESSENTIAL OILS, AROMATIC AND MEDICINAL PLANTS WITH THE HIGH ADAPTIVE POTENTIAL TO THE CLIMATE CHANGES CONDITIONS OF THE CARPATHIAN REGION.

Essential oils, aromatic and medicinal plants are low spread in the Carpathian region. And they are also low spread in Ukraine as a whole. Thus, these plants are multifunctional and can enrich the genetic fund of the valuable household and rare plants and they might widen their growing zone. However, the mentioned above plants are being studied a little. That's why the aim of our project is to study and determine the regularities of the genetic gaining of the valuable household features of the essential oils, aromatic and medicinal plants, and also to form the breeding material for the creation of the new varieties considering the environmental factors changes.

Following the results of the project, we are going to single out the sources of the valuable household characteristics for their implementation into the breeding process when creating a heavy yield and adaptive varieties of the essential oils, aromatic and medicinal plants.

**Project coordinator: Kormosh S.M., Candidate of Agricultural Sciences,**  
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8. CREATION OF THE SUITABLE INSTITUTIONAL CONDITIONS FOR THE RURAL ENTREPRENEURSHIP CONDUCTING (REGULATIVE AND COMPETITIVE POLICY, GROCERY SAFETY, LIBERALIZATION OF THE GOODS ACCESS TO THE MARKETS AND PRODUCTION FACTORS) AND PROVIDING THE DEVELOPMENT OF THE SOCIAL COMPONENT IN THE STATE POLICY FORMING.

The development of the rural entrepreneurship is a pledge of creation of the possibilities for the society needs satisfaction. The significance of the enterprise depends on the set of factors, the most decisive of which are the institutional ones. Such a factor is the aspect of the investigation, meaning the creation of the institutional conditions for the rural entrepreneurship functioning through the adoption of the corresponding legal acts and providing the development of the social component in the state policy formation.

The aim of the project is to mark out the general area and define the stages of solving the problems both – in the scientific-theoretical and practical plans, it means to characterize the actual functional measures of the entrepreneurship as a social phenomenon and a means of the satisfaction of the society needs, to form the considerable seeing as to the rural entrepreneurship, to analyze the stage of the institutional providing for the rural business activity in Transcarpathian region. To accomplish analysis of the agrarian production effectiveness in the joint ventures. To investigate the investment activity of the enterprises with the 100% part capital participation.

Following the results of the project it is being planned to work out the recommendations as to the creation of the profitable investment conditions of rural business conducting and to mark the ways for assurance of the development of the state social policy in the country. To accomplish the theoretical grounds of the necessity of the new normative documents adoption which concerns the social policy in the rural areas.

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