Review of the activities of the Lithuanian Research Centre for Agriculture and Forestry

ANNUAL REPORT FOR 2017

2017 MAJOR FACTS

The Lithuanian Research Centre for Agriculture and Forestry (hereinafter the Centre):

- employed a total staff of 582, including 183 researchers and 399 other employees; had 45 doctoral students;
- carried out 27 international, 60 national research projects, funded by the Research Council of Lithuania, Ministry of Agriculture, Ministry of Environment and undertook over 100 outsourcing work projects for national and foreign economic entities;
- launched 6 high-level R&D (SMART) projects and 1 project of high-level researchers' group;
- implemented 6 long-term institutional research programs;
- published 82 scientific publications in the journals, indexed in the "Clarivate Analytics Web of Science" (hereinafter CA WoS) database, 5 chapters of books published by international publishers, over 35 scientific publications in peer-reviewed periodical journals;
- arranged 3 international and 7 national conferences, more than 20 seminars and field days;
- 4 researchers started postdoctoral internships.
- 4 of the Centre's crop varieties were included in the National Plant Variety List and in the EU Common Catalogue of Agricultural Plant and Vegetable Varieties.

CONTENT

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FOREWORD

The year 2017 is the eighth year of the joint activities of Lithuanian Research Centre for Agriculture and Forestry after reorganization and merger of three research institutions. During this period, the institution operated in the context of reforms in the science and studies system and faced major challenges caused by the meteorological conditions. Despite the various challenges, this past year 2017 was active and productive for the Centre.

First of all, we should rejoice over the increasingly improving research results. Compared with the year 2016, the number of both national and international projects has increased. We should be particularly pleased with the abundance of high-level R&D (SMART) projects won – as many as 6 agreements have been signed and the projects of the "Horizon 2020" have been launched. In addition, the past year was extremely productive: the Centre's researchers published 82 research publications in the international scientific journals, including those with a citation index of seven.

Like every year, the Centre's breeders have released and launched on the market new productive crop varieties tested and approved at the international variety testing centres. In 2017, the National List of Plant Varieties was supplemented by 4 varieties. A total of 141 of the Centre's varieties are included in the National List. These varieties are cultivated not only in Lithuania but also in Finland, the USA and other countries.

Seeking to raise a new generation of scientists, increasingly more attention is being paid to the PhD students and young researchers. The PhD studies provided by the Centre are attractive to foreign citizens. As a result, we have PhD students from Nigeria, Syria and Ukraine.

The Centre is involved not only in the conduct of research but also in the experimental development, as well as in the provision of services to national and foreign economic entities. It is gratifying that fertilizer and pesticide manufacturing companies, commercial seed sales companies and many other national and international economic entities commission research services from the Centre.

In 2017, the Centre's researchers and PhD students were actively involved in the in-service training in short-term and long-term internships in the science and studies institutions in the USA, Sweden, Denmark, Germany, Poland and Romania, where they gained new knowledge and experience, familiarized themselves with research of international level, and established collaborative contacts.

To maintain and develop scientific contacts, it is equally important for the Centre to organize conferences. In 2017, three significant international scientific conferences were arranged, which attracted researchers from all over the world. It is noteworthy, that the exhibition of agricultural technologies "Agrovizija" was arranged for the 11th time. It received special attention from Lithuanian and foreign business entities. Thus, the relations established at the events help to expand the Centre's research and experimental development activities and to find new customers and partners.

In 2018, we will focus even more on productive and collaborative work.

Director Zenonas Dabkevičius

1. MISSION

The Centre's mission is to conduct basic and applied research relevant to science, national economic development, social and environmental needs, rational and sustainable use of land, forest and natural resources and high quality production in compliance with the envisaged major directions of the scientific activities; to elaborate research and development activities in the fields of agriculture, horticulture, forestry, ecology and related sciences; to generate new scientific knowledge, systemize it and disseminate to the public; to foster balanced and sustainable agricultural, forestry and rural development.

2. RESEARCH FIELDS

The key research priorities:

- to carry out long-term basic and applied research, experimental development activities pertinent to the national economy, accrue and disseminate scientific expertise necessary for rational and sustainable use of land, forest and environmental resources and high quality production;
- to ensure international level of scientific competence in agricultural and forest sciences and to work with business, government and members of the public, to render methodological and expert advice, in co-operation with higher education institutions to train scientists, to help them develop specialists in formal and informal training and education.

Strategic objective is to conduct R&D in the fields of agriculture and forestry, as well as related fields of biology, biophysics, ecology and environmental studies, botany and zoology.

3. HUMAN RESOURCES

3.1. Research Board

The Research Board is the supreme body of the Centre's government. It is comprised of 15 members. The term of service of the Board is 5 years.

The Board sets the key directions for the research activities, approves the long-term activity plan submitted by the director, reports on the annual activities, monitors qualifying analysis of the Centre's activities, sets forth qualification requirements for the research and other staff, as well as procedures for their performance assessment and employment, approves various documents, performs other activities envisaged in the Centre's regulations.

Members of the Research Board

Dr. Virginijus Feiza	Head of Soil and Crop Management Department, Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry, Chairman of Research Board
Dr. Audrius Sasnauskas	Director of Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry, Deputy Chairman of Research Board
Dr. Marius Aleinikovas	Director of Institute of Forestry, Lithuanian Research Centre for Agriculture and Forestry, Deputy Chairman of Research Board
Dr. Sigitas Lazauskas	Head of Department of Plant Nutrition and Agroecology, Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry, Secretary of Research Board
Dr. Gintaras Brazauskas	Director of Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry
Prof. Dr. habil. Vidmantas Stanys	Head of Orchard Plants Genetics and Biotechnology Department, Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry
Dr. Zita Duchovskienė	Head of Strategical Planning and Scientific Research Unit, Department of Economics, Ministry of Agriculture of the Republic of Lithuania
Prof. Dr. habil. Pavelas Duchovskis	Head Researcher of Plant Physiology Department, Institute of Horticulture, Lithuanian Research Centre for Agriculture and Forestry
Rimantas Krasuckis	Director of the Department of Agricultural Production and Food Industry, Ministry of Agriculture of the Republic of Lithuania
Dr. Virgilijus Mikšys	Deputy Director for Research of Institute of Forestry, Lithuanian Research Centre for Agriculture and Forestry
Dr. Rimantas Prūsaitis	Director of the Directorate General of State Forests
Assoc. Prof. Dr. Steponas Raudonius	Head of Studies Department, Aleksandras Stulginskis University
Dr. Vidas Stakėnas	Head of Ecology Department, Institute of Forestry, Lithuanian Research Centre for Agriculture and Forestry
Prof. Dr. habil. Gediminas Staugaitis	Director of Agrochemical Research Laboratory, Lithuanian Research Centre for Agriculture and Forestry
Prof. Dr. habil. Rimantas Velička	Director of Experimental Station, Aleksandras Stulginskis University

3.2 Personnel

The Centre employed a total staff of 582, of which specialists and other personnel accounted for 36 %, research staff – 32 %, laboratory assistants and technicians – 22 %, administration – 10 % (Figure 1).

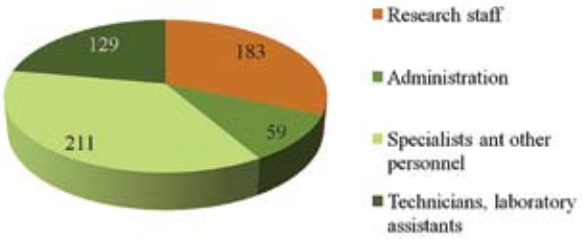


Figure 1. Personnel of the Centre

The research staff includes 36 % of senior researchers, 26 % of junior researchers, 23 % of researchers, and 15 % chief researchers (Figure 2).

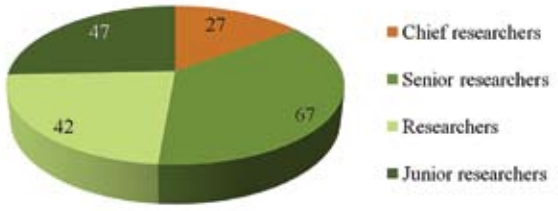


Figure 2. Research staff

In 2017, the Centre had a total of 45 PhD students doing research in the fields of agronomy, forestry, ecology and environmental sciences, and biochemistry. Most of them are based at the Institute of Agriculture (Figure 3).

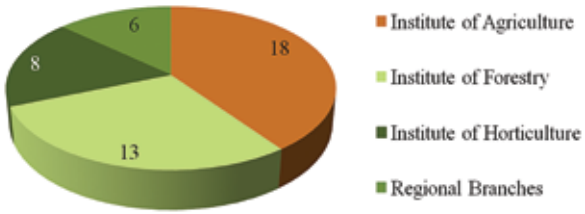


Figure 3. Number of PhD students in branches

4. DOCTORAL STUDIES

Researchers in the fields of agronomy, forestry, and environmental sciences had already been trained for several decades before the merger of the institutes. Since the establishment of the Centre, this tradition has been continued. Based on the order of LR Minister of Education and Science, in 2011 the Centre was newly granted the right for doctoral studies in 4 science fields:

- **Agronomy** jointly with Aleksandras Stulginskis University,
- **Forestry** jointly with Aleksandras Stulginskis University,
- **Ecology and Environmental Science** jointly with Vytautas Magnus and Aleksandras Stulginskis University,
- **Biochemistry** jointly with Vytautas Magnus and Lithuanian University of Health Sciences and Nencki Experimental Biology Institute (Poland).

The four-year PhD programs provided by the Centre conform with the problematics of the contemporary agriculture and forestry, the latest methods are used in research, studies and research are led by experienced scientists.

4.1. Students enrolled in the PhD programmes in 2017 and research topics

Agricultural Sciences, Agronomy (01 A)

1. **Modupe Olufemi Doyeni**. "The influence of digestate fertilization on the biomass productivity and quality of energy crops and on the composition of soil microorganizms", supervisor Dr. Vita Tilvikienė.
2. **Asta Bylaitė**. "Effect of light on the development of the Botrytis spp. and formation of lettuce (*Lactuca sativa* L.) antioxidant potential", supervisor Dr. Aušra Brazaitytė, scientific advisor Dr. Alma Valiuškaitė.
3. **Viktorija Gecaitė**. "Study on increase of spatial crop diversity in organic agrosystem", supervisor Dr. Aušra Arlauskienė, scientific advisor Dr. Žydrė Kadžiulienė.
4. **Linas Jurgutis**. "The effect of industry-derived organic matter on soil properties", supervisor Dr. Alvyra Šlepetienė.
5. **Kristina Laužikė**. "Optimization of apple tree biological potential using technological tools", supervisor Dr. Giedrė Samuolienė, scientific advisor Dr. Nobertas Uselis.
6. **Lina Šernaitė**. "Adaptation of plant extracts for biological control of strawberry (*Fragaria ananassa* Duch.) pests", supervisor Dr. Alma Valiuškaitė, scientific advisors: Prof. Dr. Pranas Viškelis, Dr. Edita Dambrauskienė.
7. **Tomas Žukaitis**. "The influence of different intensity tillage on sustainability of organic carbon in clay loam *Cambisol*", supervisor Dr. Inga Liaudanskienė, scientific advisor Dr. Aleksandras Velykis.
8. **Armina Morkeliūnė**. "Genetic diversity of *Colletotrichum* spp., harmfulness and control of strawberry anthracnose", supervisor Dr. Alma Valiuškaitė.
9. **Mohammad Almogdad**. "Insect pest species diversity, severity and control in faba bean crop (*Vicia faba* Linn.)", supervisor Dr. Roma Semaškienė.

Agricultural Sciences, Forestry (04 AB)

Lina Beniušienė. "The influence of initial stand density and pre-commercial thinning on the conifer tree stem quality", supervisor Assoc. Prof. Dr. Edmundas Petrauskas.

Biomedical Sciences, Ecology and Environmental Science (03B)

Dovilė Gustienė. "Peculiarities of reforestation in clear cuttings of Scots pine stands on nutrient poor sites", supervisor Dr. Iveta Varnagirytė-Kabašinskienė.

4.2. Doctoral theses defended in 2017

Agricultural Sciences, Agronomy (01 A)

1. **Akvilė Jonavičienė**. "Causal agents of seedling blight (*Fusarium* spp., *Microdochium* spp.) and snow mould (*Microdochium*spp.) – their occurrence and damage in cereals", supervisor Dr. Roma Semaškienė, scientific advisor Dr. Skaidrė Supronienė.
2. **Andrius Aleliūnas**. "Identification of functional markers for freezing tolerance in perennial ryegrass (*Lolium perenne* L.)", supervisor Dr. Gintaras Brazauskas.
3. **Ilona Kerienė**. "Mycotoxins and their relationship with phenolic compounds in buckwheat grain", supervisor Dr. Audronė Mankevičienė, scientific advisors: Prof. Dr. habil. Audrius Maruška, Dr. Bronislava Butkutė.
4. **Agnė Veršulienė**. "Long-term changes of the soil properties in different agroecosystems and their complex influence on agrocenosis", supervisor Dr. Virginijus Feiza, scientific supervisor Dr. Dalia Feizienė.
5. **Monika Vilkienė**. "The assessment of soil organic carbon stock accumulation in soil by employing bio-indicators", supervisor Prof. Dr. habil. Zenonas Dabkevičius, scientific supervisor Prof. Dr. Dalia Ambrazaitienė.

Agricultural Sciences, Forestry (04 AB)

1. **Valda Gudynaitė-Franckevičienė**. "Eco-gentic plasticity and adaptation of poplar hybrids and clones to Lithuanian natural conditions to be used in plantation forestry", supervisor Prof. Dr. Alfas Pliūra.
2. **Julija Konstantinavičienė**. "Factors of development of willow energy plantations in Lithuania", supervisor Dr. Vidas Stakėnas.

Biomedical Sciences, Ecology and Environmental Science (03B)

Dovilė Čiuldienė. "Soil sustainability in the forest stands of alien species, supervisor Dr. Kęstutis Armolaitis.

Physical Sciences, Biochemistry (04 P)

Inga Tamošiūnė. "Endophytic bacteria population structure of domestic apple and interaction with apple cells and shoots *in vitro*", supervisor Dr. Danas Baniulis, scientific advisors: Prof. Dr. habil. Vida Mildažienė, Prof. Dr. habil. Vidmantas Stanys.

5. SCIENTIFIC RESEARCH AND EXPERIMENTAL DEVELOPMENT

5.1. Scientific output

The year 2017 was very productive: a total of 82 scientific articles were published in the journals indexed in CA WoS database, the highest citation index – 7.33. A monograph "Citrusai" written by Dr. G. Stanienė and Prof. Dr. habil. V. Stanys is worth a mention. In 2017, over 100 popular science articles were written. The main scientific publications of the Centre are presented in Figure 4.

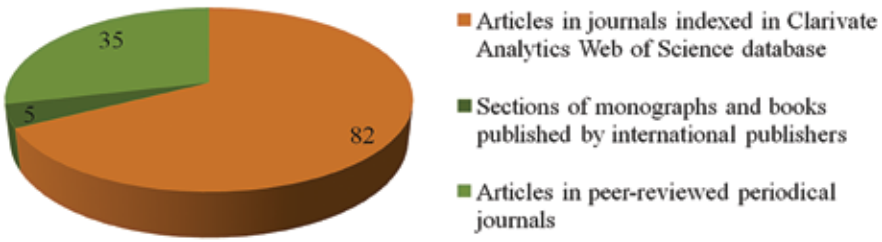


Figure 4. Main scientific output

5.2. Long-term research programmes, 2017–2021

The Centre has launched six long-term research and development programmes.

"Biopotential and quality of plants for multifunctional use"
Leader Dr. Žydrė Kadžiulienė

The development of the bio-economy concept is focussed on the most innovative and diversified use of plant-derived raw materials. It is therefore important to gain deeper insights into the qualitative parameters of plant biomass production technologies in order to obtain as valuable as possible products. The **aim of the programme** is to develop and sophisticate the scientific foundations of the crop production, necessary for a stable, sustainable and competitive agricultural development under the changing market and climate conditions, for various farming systems, to develop innovative agronomic practices of cultivation technologies enabling preservation of sustainable soil and healthy environment and contributing to the development of the bio-economy. In 2017, the second cycle of the programme commenced, which will continue until 2021. Some of the activities are ongoing, others have been started. Research into the effects of the diversification of crop rotations, fertilization intensity on crop productivity and on the quality of heavy loam *Cambisol* has been summed-up as well as the findings on the impacts of sewage sludge on the productivity of energy crops and on the changes in the properties of acid soils, and the data on awnless bromegrass and reed canarygrass cultivation for biofuel using sewage sludge compost as a fertilizer. The influence of decapitation and amino acids on the development of potato micro-clones and micro-tubers differing in duration of ontogenesis has been established, the resistance of silky bentgrass to the herbicides of IPU and sulfonylurea group has been assessed. The results of the programme topics are being published in various scientific publications and presented at scientific events.

Research on the peculiarities of crop yield formation as influenced by different cropping systems

"Sustainable forestry and global changes"
Leader Dr. Virgilijus Mikšys

Forests occupy about one third of the country's area. Lithuanian forests and the forest sector have undergone a number of global / regional changes in recent years, including climate change, the transition to market economy relations, the emergence of private forests. Forestry must be developed in compliance with the principles of sustainable development, i.e. meet the economic, social and ecological needs of society. The **aim of the program** is to obtain and systematize the new scientific knowledge necessary for the development of sustainable forest management in the context of global natural, economic and social changes and to prepare recommendations for applying this knowledge in practice. The key research objectives are:

1) evaluation of the impact of the current global changes on sustainability of forest ecosystems and its affecting factors;
2) determination the possibilities of forest tree populations and individual genotypes breeding, adaptation and use of innovative biotechnologies for formation of valuable genetic resources;
3) detection of regularities of the impact of negative biotic disturbances on forest ecosystems and establishment of protection methods for reducing damage;
4) development of forest growing and formation techniques for achieving higher productivity and preserving the ecological and environmental functions of forests;
5) investigation of the economic and social changes in sustainable forest development and sustainable use of forest resources.

Evaluation of pine seedlings treated with *Hylonox* repellent in Jurbarkas Forest Enterprise

"Harmful organisms in agro- and forest ecosystems"
Leader Dr. Roma Semaškienė

The aim of the programme is to investigate the peculiarities of behaviour of dominant and newly-emerging pests in the agro-forest ecosystems and to develop the scientific basis for managing their destructive effects in a manner that maintains economic benefits without compromising environmental and human safety, biodiversity conservation.

To achieve the objective of the programme, the following three tasks have been set:

1) to study the crop-destroying phytopathogens and phytophagous populations and to determine the peculiarities of their behaviour (interaction between host plants and pathogens or pests and the environment, factors affecting the spread of harmful organisms and outbreaks) in various agro-forest ecosystems of Lithuania;
2) to investigate and assess the occurrence of pathogenic and toxic fungi, pest insects in arable, garden and orchard crops and the abundance and spread of soil microbiota as influenced by natural and anthropogenic factors;
3) to examine and evaluate the effect of harmful organisms on crop productivity and quality and to identify measures for their prevention and control.

The program implementation encompasses research within the framework of 4 thematic topics. A total of 13 research studies were done in 2017, 3 scientific publications were published in the journals indexed in CA WoS database. The research findings were presented in international and national conferences and published in the conference proceedings. Seven recommendations for users (farmers, advisers and other stakeholders) were prepared. In 2017, three PhD students defended dissertations, 4 PhD students are actively involved in the research activities.

Analysis of disease incidence on seeds, carried out by the technicians Regina Pikšrienė and Svetlana Kišonienė

"Horticulture: agrobiological foundations and technologies"
Leader Dr. Giedrė Samuolienė

The research in horticulture is carried out in various aspects – fundamental and applied – in Lithuania. Developing the principles of horticulture, in order to ensure the safe and competitive production, taking into account changing climatic and market conditions, it is important to develop and improve ecological, integrated and intensive horticultural technologies; to carry out the breeding, physiological, genetic and biochemical aspects. In order to achieve competitive horticultural production, which would be important for growers and manufacturers the special attention is paid to yield, diversity of horticultural products, chemical composition and technological properties. It is necessary to develop and optimize storage processes, which would allow us to keep natural biochemical composition.

The purpose of the programme is to create scientific basics for the development of modern horticulture in changing climatic and economic conditions; ensuring qualitative, safe and competitive production for the local market and export.

Results of 2017: 3 sections of monographs and books published by international publishers, 16 articles in the journals indexed in CA WoS database, 31 peer-reviewed publications, 8 recommendations, etc.

Research results are presented in the annual scientific conference

"Productivity and sustainability of agricultural and forest soils"

Leader Dr. Virginijus Feiza

EC Directive (COM(2006) 232) sets out common principles for Soil Thematic Strategy to protect soils across the EU. The document sets forth that the EU Member State will be in a position to decide how best to protect soil and how to use it in a sustainable way on their own territory.

The goal of the programme is to evaluate soil fertility potential in agricultural and forest ecosystems, to identify the factors which affect their degradation and to choose the measures to maintain soil sustainability, to optimize carbon cycle in the soil, to reduce greenhouse gas emission and plant nutrient losses from the soil in different regions of the country.

The research is focused on three basic directions:

1) productivity improvement and reduction of degradation processes in the soils of morainic and limnoglacial origin;
2) rational use of natural soil resources, organic and mineral materials of local origin;
3) evaluation of productivity potential of agricultural and forest soils.

In 2017, the participants of the programme published 10 articles in the journals indexed in CA WoS database, 4 papers are under review, 16 popular articles were published in national press, participated in national / international conferences with 19 oral and 13 poster presentations.

Soil profile

"Genetic determination of the traits of agricultural and forest plants, development of modern cultivars"

Leaders Prof. Dr. habil. Vidmantas Stanys, Assoc. Prof. Dr. Vytautas Ruzgas

Agronomic and forest plants can provide economic revenue only if competitive lines, varieties or populations are being used. Natural and agricultural ecosystems are in perpetual fluctuations because of various environmental factors, such as climate change, hydrological regime, pest and pathogen infestation. New techniques and products are constantly being developed for the plant cultivation; quality parameters for the plant production are constantly changing in the processing industry. Therefore the genotypes and population structures of agricultural and forest plants have to be continuously improved and adapted to meet the current economic and environmental needs.

The objective of the program is to identify molecular markers for abiotic and biotic stress resistance, plant productivity and quality parameters; to create new breeding material for the development of new commercially successful plant varieties; to identify genotypes of forest plants beneficial for the development of the national economy.

Departments of Cereal and Grass breeding, Laboratory of Genetics and Physiology of Institute of Agriculture, Department of Orchard Plant Genetics and Biotechnology of Institute of Horticulture, Department of Forest Genetics and Tree Breeding of Institute of Forestry carried out the programme during 2017. Genetic factors governing plant phenotype and stress response were investigated; new breeding material superior in productivity and quality was created and new varieties were developed. Phenotypic plasticity of Norway spruce half-sib families was estimated in the 1983 series of field trials.

Results of 2017: monographs, books, textbooks and their sections published by international publishers – 1, articles in the journals indexed in CA WoS database – 9, articles in other scientific journals – 16, presentations at international scientific conferences – 24. New breeding lines – 98, new varieties submitted for registration – 7.

Wood hardness measurements in spruce plantations

5.3. Projects

In 2017, there were carried out 27 international, 60 national projects, supported by Lithuania's Research Council, Ministries of Agriculture and Environment, and more than 100 orders commissioned by the national and foreign economic entities (Table 1). The projects are presented in the appendixes.

Table 1. Projects implemented by the Centre in 2017

	Interna-tional	Research Council of Lithuania	Ministries of Lithuania	With national economic entities	With foreign economic entities	Total
Institute of Forestry	11	6	10	5	–	**32**
Institute of Horticulture	4	12	4	30	8	**58**
Institute of Agriculture	11	8	18	17	41	**95**
Regional Branches	1	–	2	29	1	**33**
Total:	**27**	**26**	**34**	**81**	**50**	**218**

5.3.1. Projects started in 2017

Projects funded by the Lithuanian Research Council

Projects of researchers' teams

1. "Biogeography and spread of local and invasive tree pathogens: focus on climate, tree species and intensity of forest management". Project leader Dr. Audrius Menkis. 2017–2020.
2. "GrowGene – Genome-wide functional analysis of perennial ryegrass for improved growth under water limiting conditions". Project leader Dr. Kristina Jonavičienė. 2017–2020.
3. "Dynamic light spectrum and intensity modelling and photoresponse in different vegetable morphogenesis stages". Project leader Dr. Giedrė Samuolienė. 2017–2020.
4. "Improvement of apple fruit quality by application of innovative horticultural technologies". Project leader Dr. Darius Kviklys. 2017–2020.
5. "Involvement of oxidative stress in molecular mechanism of seed response to cold plasma treatment". Project leader Dr. Danas Baniulis. 2017–2019.

High level R&D projects (SMART)

1. "Development of wood modifying eco-friendly technology for higher value products". Project leader Dr. Marius Aleinikovas. 2017–2021.
2. "Closed plant cultivation system for production of raw materials for peptide nanoengineering applications". Project leader Dr. Danas Baniulis. 2017–2021.
3. "UV-A lighting strategies for controlled environment horticulture: upgrade to sustainable, high-value production". Project leader Dr. Akvilė Viršilė. 2017–2021.
4. "Quality diagnostics of biogas production by-product (digestate) for innovative use as a biofertilizer". Project leader Dr. Alvyra Šlepetienė. 2017–2021.
5. "Development of winter wheat varieties for amylose-free starch and vital gluten processing". Project leader Dr. Gintaras Brazauskas. 2017–2021.
6. "Enhancement of the multifunctional properties of legumes in feed and food value chains" (SmartLegume). Project leader Dr. Žydrė Kadžiulienė. 2017–2021.

Grant for high-level researchers' group project

"Insights into future forests: challenges of climate change and diseases, and possible measures for saving biodiversity and ecosystem functioning". Project leader Dr. Audrius Menkis. 2017–2021.

Implementation of Postdoctoral internships in Lithuania

1. "The resistance of different Scots pine (*Pinus sylvestris* L.) genotypes against root rot (*Heterobasidion annosum* (Fr.) Bref.)". Post-doc Dr. Adas Marčiulynas. Research supervisor Dr. Virgilijus Baliuckas. 2017–2019.
2. "The metabolic response of summer rape (*Brassica napus* L.) to negative effects of climate change". Post-doc Dr. Austra Dikšaitytė. Research supervisor Dr. Akvilė Viršilė. 2017–2019.
3. "The impact of light quantity and quality parameters on changes of the *Fragaria* x *ananassa* pathogens bioecological properties". Post-doc Dr. Neringa Rasiukevičiūtė. Research supervisor Dr. Aušra Brazaitytė. 2017–2019.
4. "Assessment of different perennial herbaceous plant species as potential feedstocks for conversion into bioenergy products". Post-doc Dr. Kristina Amalevičiūtė-Volungė. Research supervisor Dr. Bronislava Butkutė. 2017–2019.

Projects funded by the Ministry of Agriculture of the Republic of Lithuania

The agriculture, food and fisheries research and development projects

1. "Evaluation of the most harmful seed borne diseases of cereals and fodder legume crops, and the establishment of their thresholds in certified cereal and fodder plant seed". Project leader Dr. Roma Semaškienė. 2017–2019.
2. "Assessment of the potential of carbon sequestration in agriculture". Project leader Dr. Žydrė Kadžiulienė. 2017–2019.
3. "Evaluation of cereal varieties susceptibility for integrated pest management (IPM)". Project leader Dr. Jūratė Ramanauskienė. 2017–2019.
4. "The use of digestate for the fertilization of agricultural crops". Project leader Dr. Vita Tilvikienė. 2017–2019.
5. "The inventory of greenhouse gas emissions in crop production". Project leaders Dr. Jūratė Aleinikovienė (ASU), Dr. Vita Tilvikienė. 2017–2019.
6. "Analysis of epidemiological and laboratory research of ASF (African swine fever), prognosis of disease transmission, risk analysis and disease management strategy in wildlife and pig farming localities in the Republic of Lithuania". Project leader Dr. Olgirda Belova. 2017–2019.
7. "The nurture facilities of Stelmuze's progeny clones *in vitro* culture". Project leader Dr. Sigutė Kuusienė. 2017–2018.
8. "The dynamics of grain contamination with mould fungi as influenced by climate, grain storage facilities and conditions" Project leader Dr. Audronė Mankevičienė. 2017–2018.
9. "Optimization of horticultural plants' mineral nutrition using biostimulants of natural origin". Project leader Dr. Ona Bundinienė. 2017–2018.
10. "Scientific research of risk factors of plant origin products produced in Lithuania and preparation of methodological recommendations". Project leader Prof. Dr. Pranas Viškelis. 2017–2018.

Support for the beekeeping sector in Lithuania

1. "Evaluation of proteins of pollen extracted from honey and collected by hand and plant preference by bees". Project leader Dr. Kristina Jonavičienė. 2017.
2. "Development and assessment of *Apis mellifera carnica* lines and their beneficial properties adapted to Lithuania's honey flow". Project leader Dr. Violeta Čeksterytė. 2017.
3. "Investigation of the efficacy of *Apivar* and *MAQs* preparations against *Varroa destructor* and their effects on bee colonies". Project leader Dr. Violeta Čeksterytė. 2017.

Support for projects of the measure "Knowledge transfer and information activities" (Program for the Lithuanian rural development 2014–2020)

1. "Quality and risk assessment of conserved forages aimed at ensuring high feeding-value forage and well-being for dairy cattle". Project leader Dr. Audronė Mankevičienė. 2017–2020.
2. "Crop rotation diversification and agro-technology optimization for the restoration of biodiversity and agro-ecosystem functions". Project leader Dr. Lina Šarūnaitė. 2017–2020.

Support for international research and technology development projects

"IT-solutions for user friendly IPM-tools in management of leaf spot diseases in cereals". Project leader Dr. Antanas Ronis. 2017–2019.

EIP activity group project (Program for the Lithuanian rural development 2014–2020)

The "Innovation gateway" centre for knowledge gathering and transfer, development and demonstration of agricultural technologies". Project leaders Rimtautas Petraitis (LAAS), Dr. Roma Semaškienė. 2017–2019.

Applied research projects funded by the Ministry of Environment of the Republic of Lithuania and its subordinate state institutions

1. "Sustainable forests for the future society". Project leader Dr. Marius Aleinikovas". 2017–2019.
2. "Selection of Scots pine genotypes resistant to root rot". Project leader Dr. Virgilijus Baliuckas. 2017–2019.
3. "Maintenance and renewal of national genetic resources field collections". Project leader Dr. Virgilijus Baliuckas. 2017.
4. "The services for level II forest monitoring". Project leader Dr. Vidas Stakėnas. Customer – State Forest Service. 2017.
5. "Identification of the old Lithuanian orchard plant varieties growing in Samogitia and Central Lithuania, investigation of their phytosanitary state and their propagation". Project leader Prof. Dr. habil. Vidmantas Stanys. Customer – Plant Gene Bank. 2017.

5.3.2. Projects completed in 2017

Projects funded by the Lithuanian Research Council

Projects of the national research programme "Sustainability of agro-, forest and water ecosystems"

"Anthropogenic influence on vegetation as component of Lithuania river ecosystem stability". Partners: LAMMC (Dr. Laisvūnė Duchovskienė) together with VMU, VU. Project leader Prof. Dr. habil. Donatas Žvingila (VU). 2015–2017.

Biological and genetic diversity of water ecosystems, their stability are adversely affected by anthropogenic activities. Changes occur in the proportion of components comprising communities; alien species spread has significant effect on ecosystem stability. Analyses and forecast of adverse long-term consequences on water ecosystems and evidence-based recommendations for managers are cardinal tasks for worldwide scientists working in the field of ecology, biology and agriculture. To date, there has been no comprehensive data concerning outcomes of extensive use of resources on stability of separate ecosystem elements, pathways and mechanisms of this phenomenon. **The aim of the project** was to evaluate the influence of anthropogenic factors on stability of vegetation as the core component of water ecosystems. During the implementation of the project, recreation activity, streamway modification and incoming chemical pollution effects were

Wild cucumber (*Echinocystis lobata*) affected by *Cucumber mosaic virus* (CMV) and non-defective cucumber leaves

analysed employing parameters of genetic diversity, genetic structure of populations and ecological adaptation of plant species representing the main aquatic niche. Evaluation of genetic diversity, together with other biological parameters, including description of species composition, morphophysiological, phenological characteristics, potential for phytoremediation, pest and disease registration was carried out.

The main results of the Institute of Horticulture's project part: diseases and viruses in the invasive plant wild cucumber Echinocystis lobata (Michx) (*Cucurbitaceae*) were detected and compared with the viruses and diseases detected in the cucumber (*Cucumis sativus* L.) plants. Diseases of wild cucumber *Echinocystis lobata* (Michx) were investigated in different habitats. *Cladosporium* and *Alternaria* predominated on wild cucumber, also *Fusarium* genus fungus was often found. But *Cucumber Mosaic Virus* (CMV) was detected only in cucumber plants grown from seeds in a garden crop rotation.

Wild cucumber in a natural environment near the village of Babtai, where samples were collected for the detection of diseases and viruses

Projects funded by the Ministry of Agriculture of the Republic of Lithuania

The agriculture, food and fisheries research and development projects

1. **"Selection of lupine cultivars suitable for cultivation under Lithuania's climate conditions"**. Project leader Dr. Zita Maknickienė. 2015–2017.

The aim of the research was to develop new technologies for the production of lupine, suitable for use in the organic production farms, to select and recommend the most suitable cultivars for the production of lupines in the organic production system.

During the research years, meteorological conditions were very different in terms of rainfall, temperature regime and soil moisture. The analysis of meteorological conditions in recent years has shown that there is a lack of heat and moisture during plant emergence period, which has a negative effect on the germination of crops in the field conditions.

Studies have shown that the anthracnose causative agent in the lupine seed remains viable for 3 years. The pathogen needs an average daily temperature of 18–24 °C for development and sparse rainfall lasting for three days. We recommend sowing lupine seed stored for 3 years.

Investigations showed the effect of bio-preparations on the yield of lupine seeds. The most suitable bio-preparations for fertilizing lupine through leaves gave a yield increase of 0.25–1.15 t ha^{-1}.

Investigations showed that the meteorological conditions, morphological-biological characteristics of the varieties, the growth rate, the plant height, the leaf area and density of the crop, influenced the ability of lupine plants to suppress weeds. The most suitable seeding rate was found to be 1.4 million seeds per hectare when sown as a sole crop.

Lupine crop

Flowering lupine

A new, economical technology for the production of lupine for organic farms is presented. In mixtures with spring cereals, lupine seeding rate is 1.05 million viable seeds and of spring wheat 3.0 million seeds per ha. The number of weeds in lupine and spring wheat mixture decreased by 1.5 times and weed mass by 1.6 times compared with lupine grown as a sole crop. The yield of the lupine and spring wheat mixture varied from 2.35 to 3.05 t ha^{-1} and was by 9.1–37.4 % higher than the seed yield of lupine grown as a sole crop.

The research identified low-alkaloid lupine varieties suitable for organic farming systems No1672, No1710, 'VB Antaniai', 'Boregini', 'Sonate' and 'Boruta'.

The study showed that the following lupine varieties are not susceptible to viruses: 'VB Vilniai', 'Borlu', 'Sonate', and 'Boruta'.

2. **"Cultivation technologies of soy"**.
Project leader Dr. Žydrė Kadžiulienė. 2015–2017.

The benefits of soybeans are unquestionable. They are excellent food for humans, complete forage for livestock and valuable raw material for industry. Nevertheless, there are very few soy growers in Lithuania, and its cultivation has been little investigated compared with other crops. **The aim of the project** was to assess the effects of different soy varieties, grown using organic production technologies in the stands with different row spacings, on the seed yield.

The research was done at Institute of Agriculture, Lithuanian Research Centre for Agriculture and Forestry in the organic crop rotation on a light loam *Cambisol*. The data averaged over the three experimental years suggest that the soy cultivar 'Merlin' produced the highest seed yield when sown using the seed inoculated with nitrogen-fixing bacteria at an earlier date (middle of May) with 25 cm row spacings. The seed yield was 20 % higher compared with that of the crop sown 2 weeks later, and the seed inoculation gave a yield increase of 24 %. The seed yield of soy grown with narrower row spacings was 12 % higher than that of the soy crops grown with wide 50 cm row spacings; however, mechanical loosening of 25 cm-wide row spacings is complicated. Due to the abundance of weeds, it is difficult to dispense with inter-row loosening, therefore one should choose soy growing with wider row spacings. The growing season of soy is approximately 140 days and lasts until the middle of October. As a result, soy cultivation in organic farms is risky due to the rainy weather, which usually occurs during the harvesting season.

Organic farms should choose soy varieties characterised by as early maturity as possible. Based on the results obtained in the current project as well as those obtained by other researchers, preliminary technology for organic production of soy has been developed. The findings of the project are being disseminated in scientific conferences and in various publications.

Organically grown soy crop

3. **"Winter wheat crop stand formation for good overwinter survival and yield".**
Project leader Dr. Sigitas Lazauskas. 2015–2017.

Winter wheat in Lithuania benefits from climate change: milder winters, longer growth period enables farmers to produce highly productive crop stands, however, requires adaptation of growing of technologies. **The aim of the project** was to modify recommendations on sowing date and autumn fertilisation in winter wheat, and consequently to improve winter survival and increase productivity of this crop. In 2015–2016 and 2016–2017 three-factor field experiments were conducted at the Institute of Agriculture in Dotnuva. Effects of variety, sowing date and autumn fertilization on crop stand formation and yield were studied. Statistical analyses indicated significant effects of variety and sowing date on traits of plant development and process of yield formation. However, effects of autumn fertilization and different interactions of factors were not so evident.

Development of plants during autumn depended mostly on the sowing date – winter wheat sown in middle of September produced a few tillers before winter, while, sown at the end of September –beginning of October had only main shoot. Winters

Although the spring arrived late in 2017, even the late sown winter wheat formed a productive crop

were mild and wheat plants survived cold season well in all treatments. In spring on average 7–9 plants from 10 were alive and ready to produce grain; however, crop stands were in different conditions. In 2017, plants started to produce tillers only at the end of March – beginning of April; however, under cool and long spring the plants were able to produce more than 450 ears per m^2 and grain yield above 9 t ha^{-1}, even in late sowing plots. According to two years' results, longer season variety 'Kena' produced higher grain yield than shorter season variety 'Famulus'. In both years, plants sown in the middle of September started to produce tillers in the autumn and were in adequate condition to survive winter. Response of winter wheat, grown after peas, to small doze of nitrogen fertilizers applied before sowing was low.

Support for the beekeeping sector in Lithuania

1. **"Evaluation of proteins of pollen extracted from honey and collected by hand and plant preference by bees"**. Project leader Dr. Kristina Jonavičienė. 2017.

The aim of the study was 1) to identify proteins / peptides contained in honey, depending on the honey origin; 2) to evaluate the composition of pollen proteins / peptides collected by hand and compare them with proteins/peptides of pollen extracted from honey.

Pollen collected by hand from cherries (*Cerasus),* wild cherry (*Prunus avium*), white clover (*Trifolium repens*), willow (*Salix caprea*), winter rape (*Brassica napus*), lime-tree (*Tilia cordata*) to identify main proteins and pollen, extracted from willow, winter rape, lime, white clover monofloral honey were used to evaluate proteins specific to the monofloral honey. The pollen proteins extracted from honey and the ones collected by hand were blasted against *SwissProt* plant database and classified according to their function. The pollen proteins extracted from honey as well as collected directly from plants are involved in numerous cell–based processes. The model developed enables identification of monofloral honey according to the specific proteins and peptides of known plants pollen.

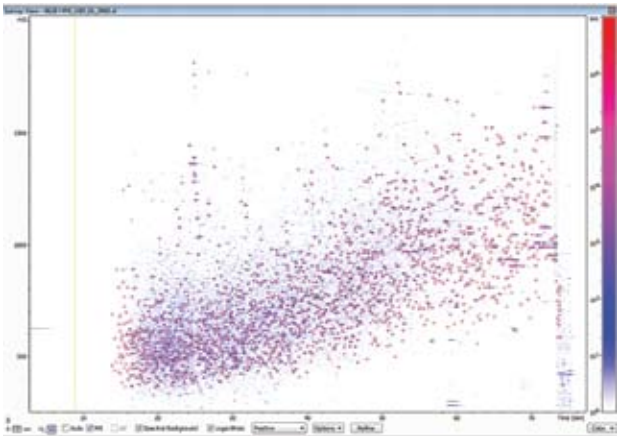
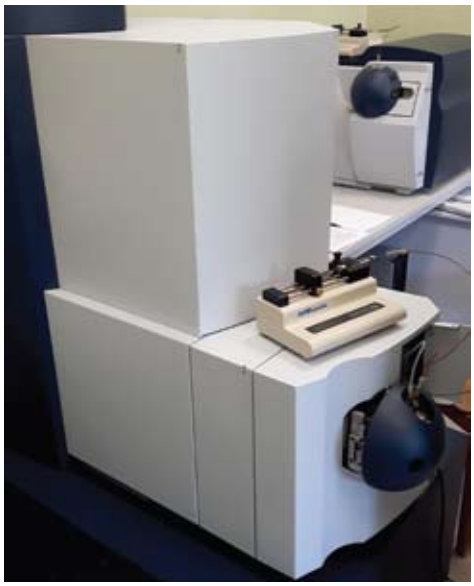


Figure 5. Peptide mapping in the pollen of oilseed rape honey



Maxis QTOF high resolution mass spectrometers

2. **"Development and assessment of *Apis mellifera carnica* lines and their beneficial properties adapted to Lithuania's honey flow conditions"**. Project leader Dr. Violeta Čeksterytė. 2017.

The aim of the project was to develop a new *Apis mellifera carnica* bee ecotype, acclimated to Lithuania's honey flow, characterised by high productivity and meeting the modern requirements of beekeepers.

Apis mellifera carnica is a universal race. A targeted breeding of this bee race can result in the desired bee characteristics tailored to the specific location, climate, plants, and hives and produce disease resistant bees.

The long-term objective is to achieve that *Apis mellifera carnica* in Lithuania will eventually become native bees capable of perfectly exploiting all honey flows, exhibiting good over-winter survival and overall performance. The short-term objective is by applying interlinear hybridization to preserve the available *Apis mellifera carnica* lines with the best development and vitality/vigour indicators.

In 2017, a total of 96 *Apis mellifera carnica* bee colonies were assessed for morphological, biological

and productivity characteristics. All the tested colonies were found to conform to the *Apis mellifera canica* standard. The colonies showed particularly good overwinter survival in the winter of 2016–2017. The lowest food consumption 9.31 kg was recorded for the colonies of L3-Cslov line. The spring of 2017 was very changeable with abrupt short thaws alternated several times with long-lasting spells of cold. The bee colonies developed slowly and unevenly. In the spring, the L1 – Cvig, L3 – Cslov bee colonies were stronger. They had more brood. More spring honey was produced by the colonies of L1 – Cvig and L5 – Ctrojc lines – on average 39.13 kg per colony. Ten bee colonies swarmed, most of them (4) were of L3-Cslov line. The colonies maintained cleanliness in nests. Aggressiveness was minimal.

In 2017, 65 bee colonies were assessed for hygienic behaviour. It was found that 48 colonies did not have this property and 8 colonies with very high hygienic behaviour (80–100 % cleaned cells). The colonies exhibiting high hygienic behaviour were used for rearing bee queens. Parental colonies were formed from them and transferred to Pervalka isolation, bee mating division.

Analysis of the four-year data on the viruses and causal agents of *Nosema apis* and *Nosema ceranae* showed that in 2016 there were significant reductions in the number of colonies infected with viruses and nosema causal agents; however, in 2017, viruses were detected in all bee samples tested, while no nosema causal agents were detected.

Assessment of bee colonies

Determination of hygienic behaviour of bees

3. **"The efficacy of *Apivar* and *MAQs* acaricides against *Varroa destructor* mites and their effects on bee colonies"**. Project leader Dr. Violeta Čeksterytė. 2017.

An acaricide "Apivar" is a product manufactured by a French company "Veto-pharma". It is a contact formamide acaricide. Its active ingredient is amitrase, its concentration per strip is 3.33 %. Its mode of action is neurotoxic, which leads to mite paralysis. The efficacy of the product reaches 99 %, and no mite resistance to this product has been observed over 15 years of its application. The developed resistance of most parasitic *Varroa destructor* mites to most standard synthetic acaricides has been observed worldwide, including Lithuania. Therefore, it is very important to perform annual monitoring for the efficacy of the pyrethroid acaricide "Apivar" in the laboratory and field trials. The efficacy of this product was started to be tested in 2016 at the Institute of Agriculture.

The overall laboratory efficacy of the "Apivar" studied for the second year was 98.75 %. The efficacy of "Apivar" in the bee colony without brood was 98.63 % and in the bee colonies with brood it was 97.93 %. About 1.5–2 % of mites still remained unaffected by the product and therefore an additional treatment with oxalic acid is needed when brood is no longer there.

Mite control in bee colonies using *MAQs* strips

The Canadian company "NOD Apiary Product Ltd" produces "MAQs" strips containing formic acid (68.2 g) intended for quick extermination of *Varroa destructor* in hives. The formic acid is released from the product via fumigation or evaporation, and by acting on mites present on adult bees it kills mite nymphs in caked brood cells and in this way restricts the entry of viruses to young developing bees. The mode of action of formic acid is still not fully understood.

The "MAQs" were tested at the Institute of Agriculture in 2015–2016 and showed a very high level of efficacy. However, the side effect of this preparation on bees was also revealed – within the first days after the administration of the treatment there was found a significant increase in the number of dead bees, the death of brood and part of the bee queens, as well as the decrease in the strength of the families.

In 2017, the efficacy of "MAQs" in bee colonies without brood was 91.30 %, in the colonies with brood it was 81.18 %. The incidence of *Varroa destructor* mites varied considerably among the colonies in different sites. It was observed that not all families tolerated treatment with "MAQs" in the same way. It was noted that bees severely infested with mites and injured ones, as well as bee queens older than 2–3 years were more likely to be killed by the product.

Support for international research and technology development projects

"Fertility building management measures in organic cropping systems" (FertilCrop). Project leader Dr. Žydrė Kadžiulienė. 2015–2017.

While implementing the current project, the team of researchers from Lithuanian Research Centre for Agriculture and Forestry focussed on the objective of gaining new knowledge about the productivity of crops in response to the enrichment of soils, differing in fertility, with nitrogen from legumes, cereals and organic fertilizers under the conditions of organic cropping. In the national part of the project, a major emphasis was placed on the research into "The impacts of biological and organic fertilizer nitrogen on the productivity and quality of spring cereals under the conditions of organic cropping" and "Plant-derived organic fertilizers for soil productivity and viability enhancement in organic agro-systems". In terms of productivity, organic matter cycling, NPK flows, we estimated different crop rotation sequences and sequences in which legumes in the main crops were replaced by undersown legumes, pelleted cattle manure or their combinations. The highest productivity was obtained in the crop rotation sequence having used undersown perennial grasses together with pelleted cattle manure or having used the latter twice in the crop rotation sequence. The nitrogen content in the yield of cereals grown for three years in the crop rotation sequence can be offset by the mass of undersown red clover in combination with pelleted cattle manure or mass of red clover grown without a cover crop. Assessment of plant-derived organic fertilizers showed that their effects on crop yield were ambiguous. The highest yield increase of spring wheat was provided by the organic fertilizer with a narrow C:N ratio – incorporated biomass of undersown red clover. The grain yield of wheat was also increased by the pelleted cattle manure, red clover and straw compost. The aforementioned organic materials are characterised by different accumulation of nutrients (NPK) and decomposition rate (C:N); therefore appropriate use of their combination increases crop productivity and improves soil fertility. In order to maintain and increase soil fertility in organic crop production farms, it is recommended to offset the amount of nutrients accumulated in the crop rotation sequences by a wide range of local soil improvement measures.

The influence of biologically fixed nitrogen and organic fertilizer nitrogen on spring wheat productivity and quality in the organic cropping system

Effect of white clover mass incorporated in the autumn on spring barley yield formation

Projects funded by the Ministry of Environment of the Republic of Lithuania and its subordinate state institutions

1. **The contract on the purchase of services on "Preparation of the maximum density norms of wild boars in the different regions of Lithuania"**.
   Project leader Dr. Olgirda Belova. 2016–2017.

The aim of the project was to determine the maximum density norms of wild boars population. Its surveillance is the responsive strategy preventing spread of contagious diseases, determining wild boar role in disease transmission and its timely suppression, by that minimizing damage caused to forests and agricultural crops. The maximum density norms were ascertained considering valid legal acts,

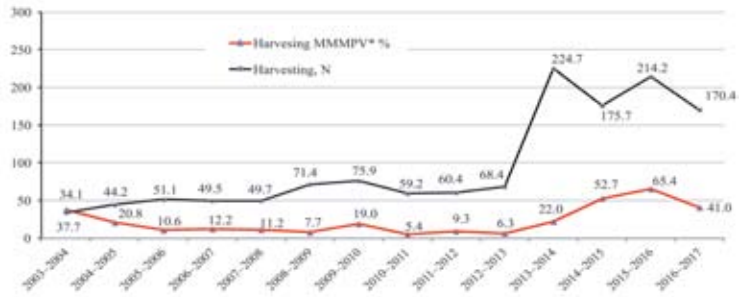


Figure 6. Wild boar dynamics in science and training hunting plot unit (MMMPV) and in the country

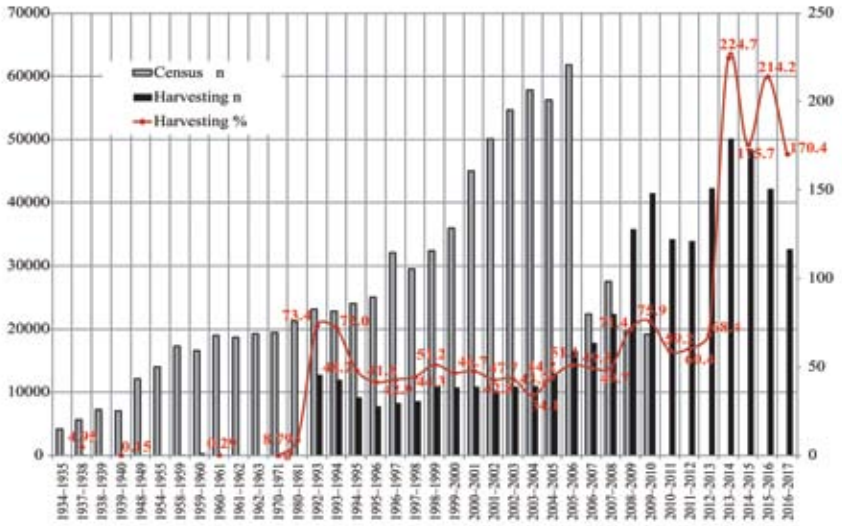


Figure 7. Multiannual change of wild boar abundance and population control

Consequences of burrowing activity of wild boars' herd

Young boars feeding according to today's requirements (veterinary requirements as prevention of African swine fever)

suitability of natural regions for wild boars, changes in the long-term number, and key population parameters in the context of spread of contagious diseases (ASF). The maximum density norms are as follows: for pure pine forests 5 / 1000 ha in the Southern and 8 / 1000 ha in the Western Lithuania; for mixed coniferous forests 5–8 / 1000 ha in the Eastern and 8 / 1000 ha in the Central and Western Lithuania; for mixed spruce-deciduous forests 8–12 / 1000 ha; for deciduous with spruce forests 5–12 / 1000 ha, including 8 / 1000 ha in the Northern Lithuania with respect of habitat carrying capacity, potential predatory effect, indices of wild boar herds (family groups) and risk of ASF outbreaks.

The non-intensive population use acts it stimulatingly while an intensive use up to 150 % of pre-reproductive abundance allows reducing population number. Considering the average increment rate 50 %, the population use at least 100–120 % should be maintained.

2. **"Guidelines for breeding of spruce, larch, birch and black alder plantations"**.
Project leader Dr. Gintautas Urbaitis. 2015–2017.

The aim of research was to prepare guidelines of the establishment of short rotation plantations of Norway spruce, larch, birch and black alder considering national and international experience. Analysis of Latvian, Estonian and Polish outcomes on establishment of above-mentioned short rotation plantations was done. The tables on prediction of growth rate of Norway spruce, larch, birch and black alder in short rotation plantations were prepared for each species. Requirements of planting site selection, soil fertility, soil preparation, initial density of planting, locations, fertilization, maintenance, protection and thinning were prepared. Prognosis of short rotation plantations economic efficiency by tree species and cutting age was performed. Short rotation plantations of larch should be planted in Nc, Nd, Nf sites, Norway spruce – Nc, Nd, Nf and Lc, birch – Nc, Nd, Nf and Ld, black alder – Lf, Ld, and Uf. Initial density of Norway spruce and larch – 2000–2500 units ha-1, birch and black alder – 3000 units ha^{-1}. The width between rows should be approx. 4 m. In the sites Nc, Nd, Nf, Lc, Ld, Lf with "plough pan", soil should be ploughed at 25–27 cm depth. Soils with formed "plough pan" are ploughed over all area at the depth at which the compact subsoil layers will be turned on the soil surface

Larch and Norway spruce plantations should be fertilized with NPK 20-8-9 fertilizers. Fertilizer dose per tree is 2.5 g of active substance when fertilizers are spread 10–15 cm around the tree. By wood log structure and economic effect of plantations growing larch and birch cutting age should be 51 years, Norway spruce and black alder – 61 years. If plantations are cut at younger age (40 or 30 years) huge economic losses are incurred.

Birch plantations in Tauragė Forest Enterprise, in Obelynas forest district, in the Nd vegetation site, unprocessed (1) and grooved (2) growing in the soil for 5 years

3. **"The services for level II forest monitoring".**
Project leader Dr. Vidas Stakėnas. Customer – State Forest Service. 2017.

The International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests operating under the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP) was launched in 1985. This monitoring program aims to assess the impact of contaminated air and precipitation on various environmental components.

European Commission (EC, 1995) in April 29 of 1994 Resolution obliged EU countries to implement Forest monitoring (Level II) program. **The objectives of intensive monitoring** were: 1) to collect and

evaluate information on the impact of environmental pollution and other stressors on the most common (typical) forest ecosystems; 2) lead to a better understanding of the causal relationship between the condition of trees and air pollution and other stressors that could affect the condition of forest ecosystems.

In 2017, the tasks of Intensive Forest Monitoring (Level II) were carried out in accordance with the planned and successfully functioning scheme for many years, in line with the requirements and methodology of the ICP-Forests program.

In nine permanent observation plots, the following parameters were assessed: the condition and vulnerability of trees were evaluated according to the morphological parameters; air pollution, soil solution quality, amount of pollutants (deposition) and litterfall mass; intensity of ozone-induced damage and chemical foliage analysis.

According to the long-term data of the Forest monitoring (Level II) program, the average amounts of elements found under tree canopy annually (2000–2016) are as follows: 6,7 kg / ha of S; 11,3 kg / ha of N; 15,9 kg / ha of K; 5,7 kg / ha of K; 11,2 kg / ha of Cl and 5,8 kg / ha of Na. In open field, the average amounts are: 4,8 kg / ha of S; 8,4 kg / ha of N; 4,8 kg / ha of K; 7,9 kg / ha of Ca; 7,8 kg / ha of Cl and 5,9 kg / ha of Na.

Assessment of tree phenology

Wind damage (windbreak)

Consequences of wind damage

5.3.3. International projects started in 2017

"Horizon 2020" projects

1. **"Fostering sustainable legume-based farming systems and agri-feed and food chains in the EU (LEGVALUE)".**
   Coordinator in the Institute of Agriculture Dr. Žydrė Kadžiulienė. 2017–2021.

The goal of LEGVALUE is to pave the way for the development of sustainable and competitive legume-based farming systems and agrifeed and food chains in the EU. Using value chains reflecting the market diversity, and farm networks covering the diversity of legumes species, LEGVALUE will demonstrate the added value of various legumes value chains and will provide a range of solutions to improve the economic interest to use legumes. The project will provide a decision tool for farmers to choose the optimal legume species with their adapted crop management and to assess the economic and environmental benefits of legumes in the cropping systems. The project will contribute to defining the supply chains that are the most competitive to foster legume crops. LEGVALUE will provide accurate recommendations for the development of legumes in the EU, will provide scientific support for EU and national policy-makers aimed at increasing legume production, support technological innovation designed for increasing self-sufficiency with protein rich plant materials. The project consortium size is 24 participants-institutions from 10 countries. For more information, please visit *www.legvalue.eu.*

2. **"A thematic network to design the penetration path of non-food agricultural crops into European agriculture (PANACEA)"**.
   Coordinator in the Institute of Agriculture Dr. Vita Tilvikienė. 2017–2020.

Non-food crops are used to produce a wide range of bio-products and bioenergy. In spite of considerable investment in R&D and the increasing need for bio-based industries for feedstock, such crops are not widespread in the EU agriculture. **The aim of PANACEA** is to set up a thematic network to foster the effective exchange between research, industry and the farming community so that directly applicable solutions are widely disseminated and grassroots-level needs and innovative ideas thoroughly captured in order to design the penetration path of NFC into European agriculture. To achieve this goal, an inventory of long-term scientific results will be developed. Knowledge sharing on technical, economic and environmental aspects of NFC, extensive communication and networking, matching between the supply and demand sides will be facilitated by the PANACEA Platform.

The first meeting of PANACEA project participants in Brussels

"Interreg" Programme projects

"Revival of old traditional fruit, vegetable and ornament plants and their products: Heritage Gardens Tour". Coordinator in the Institute of Horticulture Dr. Darius Kviklys. 2017–2019.

There is an increasing interest in old horticultural plant cultivars and their products as natural and cultural heritage objects across Europe as well in Latvia and Lithuania. The overall **objective of the project** is to assess heritage objects of horticultural plants, identify old cultivars, increase attractiveness and accessibility of old horticultural plant collections. The main tasks are: 1) to assess most valuable heritage objects during the expeditions; 2) to identify old plant cultivars using genetic investigations; 3) to prepare technologies in order to preserve heritage sites; 4) to propagate endangered cultivars and establish collections of gene resources; 5) together with tourism associations to develop a new tourism product - Heritage garden tour aiming at awareness for preservation of natural heritage horticultural plants.

The oldest apple tree in Lithuania

The 7th Framework Programme projects

1. **FP7 ERA-NET SUMFOREST "Benchmarking sustainability performance of value chains using ToSIA, the tool for sustainability impact assessment" (BenchValue)**.
   Coordinator in the Institute of Forestry Dr. Marius Aleinikovas. 2017–2019.

Scientific studies have shown the potential of renewable wood-based materials to reduce GHG emissions in the construction sector. **The aim of the project** is to develop a versatile benchmarking method to compare between renewable and non-renewable value chains to support decision makers in policy and market environment. Further, we aim to show the usability of the benchmarking method to quantify the impacts and potentials of substituting non-renewable with renewable materials in the construction sector. The production of cross laminated timber (CLT) is rapidly growing in Lithuania. Various size CLT is used in the construction sector (holding constructions for the large buildings or as the main material for small and medium size houses). One of the largest manufacturers of CLT structures in the Baltic States is operating in Lithuania "Jures wood". The company has been manufacturing CLT beams since 1974 and production capacity has significantly increased in the last years. In total, 80 % of the production is exported

to the EU and Asia; meaning that conventional housing constructions like concrete and steel are locally preferred over CLT. This case study compares CLT structures vs conventional (non-renewable raw material) use in the construction sector in Lithuania.

2. **FP7-ERANET-2013-RTD "IT-solutions for user friendly IPM-tools in management of leaf spot diseases in cereals" (SpotIT)**.
   Coordinator in the Institute of Agriculture Dr. Antanas Ronis. 2017–2019.

The aim of SpotIT is to provide cereal farmers in the Nordic-Baltic region with better models for predicting leaf spot diseases in wheat and barley by choosing and improving user-friendly disease prediction models, made available to the farmers through locally adapted IPM tools.

Other projects

1. **Swedish Institute Baltic Sea Cooperation project "Baltic Sea Region network for sustainable wheat production (BALTICWHEAT)"**.
   Coordinator in the Institute of Agriculture Dr. Rita Armonienė. 2017–2018.

The aim of this project, funded by Swedish Institute, is to identify solutions for reducing the need for the use of fertilizers and pesticides in the wheat cultivation system. The project will identify and evaluate various alternative solutions both at the pre-breeding and at farm management levels such as: 1) increasing genetic diversity in wheat for improved nutrient use efficiency (NUE) and higher disease resistance; 2) diversifying agroecological system using mixed cropping systems and efficient crop rotations; 3) speeding up plant breeding by using next generation breeding techniques and high-throughput phenotyping; and d) evaluating management practices for fungicide resistance in wheat pathogens. The planned activities are: 1) kick-off workshop in Sweden; 2) pilot project to evaluate NUE and disease resistance in selected Baltic wheat cultivars; 3) workshop on next generation breeding techniques and high-throughput phenotyping in Finland; 4) identify relevant funding calls and prepare a joint application.

Meeting of participants of the BalticWheat project (21 participants from 7 Baltic Sea regions)

2. **Swedish Institute Baltic Sea Cooperation project "Cooperation in the Baltics on the development of strategies to foresee outbreaks of *Fusarium* damage"**.
   Coordinator in the Institute of Agriculture Dr. Skaidrė Supronienė. 2017–2018.

The aim is to disseminate information among the project partners on the problems with *Fusarium* contamination among the different partner countries and on the current status on the development of alert systems to ensure that cereal crops are not damaged by *Fusarium* or other pests that can endanger crop quality. In view of the changing climate, it is important to cooperate among neighbouring countries to prevent hampering in the increase in high quality cereal crop production in the Baltics. It is intended to perform a pilot project where experiences from the different partners are utilised. One of the important aims is also to prepare an application which will boost cooperation. It is intended to establish contacts with potential partners outside the partner group. We are considering extending the network to Russia, Estonia and Finland. The intention is to prepare an application either for the "Horizon" program or for the "Interreg" Baltic Sea.

Visit to experimental fields

5.3.4. International projects completed in 2017

The 7th Framework Programme project

P7-ERANET-CORE Organic Plus project "Fertility building management measures in organic cropping systems (FertilCrop)".
Coordinator in the Institute of Agriculture Dr. Žydrė Kadžiulienė. 2015–2017.

The objective of the project was to develop efficient and sustainable management methods that enable enhancement of crop productivity in the organic cropping systems. We were involved in the working groups of the following work packages of the "FertilCrop" Project: "Crop-weed-soil interactions in organic conservation agriculture (CA) systems", "Interactions of crop plants with soil structure and stratified soil fertility and" and "Soil and plant management by farmers and farm prototyping".

The project partners agreed to test the methodology suggested by Keuskamp et al. (2013) and to collect and compare the data on the mineralization level and decomposition rates of soil-incorporated organic matter using commercially available tea bags as standardised test kits. Field experiments were conducted in Joniškėlis on a clay loam *Endocalcary-Endohypogleyic Cambisol* and in Dotnuva on a moderately heavy loam *Endocalcari-Endohypogleyic Cambisol*. The test method proved to be simple and straightforward. The research findings suggest that organic matter decomposition rates differ between the soil types, organic matter mineralizes also during the no-growing season. The project partners from each country carried out the work "Analysis of assessment of soil fertility indicators, their determination methods and agronomic practices (data of farmers' survey)" based on which a joint methodological recommendation will be worked out. We have summarised the data of farmers' survey and submitted to the partners for further processing.

The data of our survey indicate that farmers consider enhancement of soil fertility and biodiversity as well as production of high quality products particularly important farming aspects. Most of the surveyed farmers recognize and distinguish relevant blocks of agronomic tools that affect farming quality and success: 1) crop rotation and plant residues; 2) legume crops; 3) organic fertilizers and green manure. Farmers are aware of the importance of soil fertility and prefer simple, soil quality assessment methods that do not require any special training (according to smell, colour, structure, etc.); however, they still pay insufficient attention to the identification of such methods and their application. Other collaborative / joint activities were performed whose results are expected to be published in scientific journals.

Geographical distribution of field experiments included in the *FertilCrop* project

Green or red tea used to evaluate mineralization conditions of soils

Other projects

SNS-NKJ (Nordic Joint Committee for Agricultural and Food Research-Nordic Forest Research Cooperation Committee) network "Effects of bioenergy production from forests and agriculture on ecosystems services in Nordic and Baltic landscapes".
Coordinator in the Institute of Forestry Dr. Kęstutis Armolaitis. 2016–2017.

This is a completely new network that includes the scientists working in both the forestry and agricultural sectors. **The aim** was to learn from each other's experiences regarding the effect of bioenergy production from forests and agriculture on ecosystem services in the Nordic (Denmark, Finland, Iceland, Norway, Sweden) and Baltic (Estonia, Latvia, Lithuania) countries. Although bioenergy is a major renewable energy source in the Nordic and Baltic countries, and a great deal of work has already been done on all aspects of its use, including effects on ecosystem services, there has so far been little contact between scientists working in different sectors and in some cases on different ecosystem services. The network will act to fill this gap.

Two workshops were planned:

1) An initial workshop "Effects of bioenergy production from forests and agriculture on ecosystems services in Nordic and Baltic landscapes" (4–5 March, 2016, Moss, Norway) where the researches and the state-of-the-arts were presented. Lithuania was presented by Vita Tilvikienė (presentation "Agro biomass potential in Lithuania", Institute of Agriculture) and Julija Konstantinavičienė ("The studies of willow bioenergy plantations in Lithuania", Institute of Forestry).
2) Final conference "Governing sustainability of bioenergy, biomaterial and bioproduct supply chains from forest and agricultural landscapes" will be held in 17–19 April, 2018 (Copenhagen, Denmark) (*http://ign.ku.dk/bioenergy-conf-2018*).

Meeting of project participants in Norway

5.3.5. Results of 2017 of continuous projects

1. **"EUFORGEN – The European forest genetic resources programme – V".**
   Coordinator in the Institute of Forestry Dr. Virgilijus Baliuckas. Since 2010.

EUFORGEN – European Forest Genetic Resources Programme is an international cooperation programme that started in 1994 for implementation of 1990 Strasbourg resolution – S2 Forest genetic resources. **Objectives** of the program:

1) collate, maintain and disseminate reliable information on forest genetic resources in Europe (EUFGIS – European Information System on Forest Genetic Resources (*www.eufgis.org*) has been set up to achieve this);
2) coordinate and monitor the conservation of forest genetic resources in Europe;
3) develop guidelines and analyses on topics and issues relevant for the use of forest genetic resources in Europe.

Countries participating in the EUFORGEN program (dark green on the map)

EUFORGEN also seeks to coordinate and participate in the development of strategies and policies for the conservation of European forest genetic resources. The Program Steering Committee is comprised of National Coordinators representing all member countries, Program Coordinator (Dr. Michele Bozzano) and the Secretariat. The Steering Committee evaluates and plans for EUFORGEN at annual meetings. At present, three thematic working groups have been formed and operate in the EUFORGEN, the objectives of which are formulated at the meetings of the Executive Committee, and include relevant topics for forest genetic resources. Since 2015 working groups: Working Group 1 – collecting scientific evidence to support the development of guidelines and decision support tools; Working Group 2 – decision support tool for the management of dynamic genetic conservation units; Working Group 3 – revision of indicator on genetic resources of the pan-European criteria and indicators for sustainable forest management (*http://www.euforgen.org/about-us/how-we-operate/working-groups/)*.

The Ministry of Environment of the Republic of Lithuania supports the participation of Lithuania in the activities of EUFORGEN, therefore Lithuanian scientists actively contribute and participate in the program since it started.

The summit of the 12th EUFORGEN Steering Committee took place in Amsterdam this summer. The EUFORGEN program has so far been active in the Bioversity International organization, but at the meeting of the Steering Committee national coordinators voted in favor of extending EUFORGEN's activities to the European Forestry Institute (EFI). The majority of countries have unanimously voted for this decision. So, in the near future, the EUFORGEN program will work in the composition of the European Forestry Institute. The decision is based on the EFI's activities, as they focus on the sustainable use and conservation of European forest resources, thus, the EUFORGEN program will successfully complement and contribute to the EFI's activities by providing expert knowledge of forest genetic resources.

Also at the meeting there were presented updates in the projects related to the conservation of genetic resources: GenTree (*www.gentree-h2020.eu*) and LIFEGENMON (*www.lifegenmon.si*). Subsequently, further activities of the program were discussed taking into account the most pressing problems of using and preserving forest genetic resources.

2. **"Winter wheat breeding, variety testing and marketing in Estonia".**
Project leader Assoc. Prof. Dr. Vytautas Ruzgas. Since 2000.

The main task is to develop winter wheat varieties suitable for growing under Estonian conditions.

In 2017, the winter wheat breeding program, conducted jointly with Estonian Crop Research Institute, was continued. The winter wheat lines, developed and preliminarily tested in Lithuania, are transferred to Estonian Crop Research Institute in Jogeva. The lines are selected according to winter hardiness, plant height, resistance to snow mould and grain quality. The growing conditions in Estonia are slightly different. The height of winter wheat plants is shorter in Estonia than in Lithuania. Therefore, the lines which are too tall for growing in Lithuania can be successfully grown in more northerly latitudes. The project partners exchange the winter wheat lines and breeding data. In 2017, 12 promising lines, 4 of which are under State Variety Testing in Lithuania, were transferred to Estonian Crop Research Centre for investigations. Seventeen winter wheat breeding lines, developed in Estonia, are investigated in winter wheat breeding nurseries of Institute of Agriculture.

Sowing of winter wheat breeding lines

3. **"European plant genetic resources conservation programme"**.
Coordinator in the Institute of Agriculture Assoc. Prof. Dr. Vytautas Ruzgas. Since 1998.

The main task is to collect and investigate plant genetic resources in order to ensure development of highly competitive varieties.

In 2017, the European plant genetic resources conservation program was continued. The plant genetic resources of all plant species, which are included in the institute's approved plant breeding programs were collected and investigated. A total of 180 varieties and breeding lines were tested in the nurseries of winter wheat collections. Most of these varieties, developed in West European and other countries for high-input or sustainable cropping,

can be selected for crossing programs in the future. Among the tested varieties there were detected the most promising ones to be used for the crosses in the nearest future. In the group of spring cereals there were grown and investigated 362 varieties of spring barley of which 5 varieties were transferred for long-term storage / conservation, 214 varieties and 166 breeding lines of spring wheat, among them there were found varieties with high resistance to fusarium disease and promising material for future crosses. In the oats gene resources collection, there were investigated 905 varieties. The most disease resistant material was identified. In the field pea collection, there were investigated 136 varieties, the resistance to lodging and diseases, and grain yield were determined. One variety was transferred for long-term conservation. In 2017, there was investigated a large collection of perennial grasses: 75 common sheep fescue, 100 red fescue, 80 tall fescue, 50 creeping bent, 10 meadow foxtail, 35 hard fescue, 10 yellow oat-grass varieties and lines. In the collection of forage grasses, there were collected and investigated 359 ryegrass and festulolium, 172 meadow fescue, 104 cocksfoot, 72 Kentucky blue grass varieties and breeding lines. In the nurseries of clovers, there were grown and investigated 261 varieties, and in the nurseries of lucerne 211 varieties. Thirteen most valuable varieties and lines of perennial grasses were transferred to long-term storage in the National Gene Bank.

Spring barley collection

Collection of grasses

4. **"Research on winter wheat winter hardiness and diseases"**.
Coordinator in the Institute of Agriculture Assoc. Prof. Dr. Vytautas Ruzgas. Since 1994.

The main task is to evaluate the winter hardiness and disease resistance of winter wheat and triticale varieties, developed in the mild maritime climate conditions.

In 2017, the long term project, conducted jointly by Lithuanian Institute of Agriculture and Danish Sejet plant breeding station, was continued. These investigations were begun by jointly implementing the long term project "Improvement of winter wheat breeding". Professional contacts have been continued till now. The aim of these investigations is to study and evaluate the winter wheat and triticale breeding lines and varieties, developed in mild maritime climate conditions, in Lithuania. In Denmark, winters are mild and therefore it is not possible to evaluate the winter hardiness of the developed lines. In 2017, a total of 352 lines of winter wheat and triticale from Sejet breeding programs were investigated. Nineteen lines of winter triticale were investigated in replicated yield trials. The plant breeders evaluated the testing results and decided to continue this project in 2018.

Testing of winter wheat winter hardiness – the most sensitive genotypes were killed by the cold

5. **"Research on facultative and winter wheat".**

Coordinator in the Institute of Agriculture Assoc. Prof. Dr. Vytautas Ruzgas. Since 1993.

The main task is to investigate the facultative and winter wheat, developed at distant regions and select promising genotypes for local genetic collections and submit the data to the global research network.

The research program is organized and coordinated by the International Centre for Improvement of Wheat and Maize CIMMYT. It is a global research network and wheat varieties for the investigations are collected from the USA, Western, Central and Eastern Europe, Far East countries. Institute of Agriculture has been involved in these investigations since 1993. The aim is to enlarge the germplasm we use for hybridizations programs. As a rule, breeders use the best commercial varieties for crossing programs. This means that the genetic variability is diminishing and we have the so called "genetic erosion". To avoid this phenomenon, pre-breeding programs are conducted to get genetic material including a more diverse genetic set. Lithuanian plant breeders are sending the new developed varieties to CIMMYT programs too.

In 2017, a total of 179 lines and varieties developed in distant regions and received from CIMMYT wheat improvement program were investigated at Institute of Agriculture. They were evaluated for winter hardiness, grain yield, 1000 grain weight, susceptibility to plant diseases and agronomic traits. The variety 'Ada' was used as a check variety. As a result of this program, there were developed some lines, whose pedigree included varieties form the CIMMYT project. A promising line 'Arktis / Jubilejnaja 100' was grown in the replicated yield trials. The variety 'Jubilejnaja 100' was received from the CIMMYT program. In other nurseries, there were investigated F2 – 12; F3 – 3; F5 7 lines developed using germplasm from CIMMYT. In the germplasm collection block, there were investigated 27 varieties, selected for future crosses.

Inspection of experimental plots of facultative and winter wheat

5.4. Plant breeding

The Centre conducts breeding programs for the major field crops, vegetables and pomefruits, stonefruits and berries. Four varieties of agricultural and horticultural plants were included in the National Plant Variety List and in the EU Common Catalogue of Agricultural Plant and Vegetable Varieties in 2017:

- **Pea variety 'Jūra DS'**

Breeders: Kristyna Razbadauskienė, Dr. Jūratė Sprainaitienė

The variety was developed using a conventional pedigree method, by crossing two semi-leafless varieties (Madonna x Nitouche) at the Institute of Agriculture. Testing of value for cultivation and use (VCU) of this variety was conducted during 2015–2016 by the State Plant Service under the Ministry of Agriculture in Kaunas, Pasvalis and Utena Plant Variety Testing Departments (PVTD). The test for distinctness, uniformity and stability (DUS) was performed in Poland at Plant Variety Testing Centre. The average seed yield was 5.56 t ha^{-1}. The highest yield (7.11 t ha^{-1}) was produced in 2016 in Kaunas (PVTD). The other traits were: thousand grain weight –261.8 g, duration of vegetation – 91.5 days, plant height – 90.4 cm, lodging resistance – 6.8 scores, resistance to grain shattering – 9 scores (1 is susceptible and 9 – resistant), protein content – 24.6 %, that is 6 % higher than the check variety. Also, the variety is resistant to root and leaf diseases, which is important for pea growers. 'Jūra DS' is the only one registered green pea variety in Lithuania.

Cocksfoot 'Luknė DS'

Breeders: Dr. Pavelas Tarakanovas, Dr. Juozas Kanapeckas, Dr. Vilma Kemešytė

The cocksfoot (*Dactylis glomerata* L.) cultivar was developed by the selection method from the natural ecotype collected in Kaliningrad region. In 2017, the cultivar was included in the EU Common Catalogue of Varieties of Agricultural Plant Species and in the National Plant Variety List.

It is a medium early cultivar, its vegetation period until the 1st cut is 144 days. According to the data from the plant testing stations (Plungė and Pasvalys, in 2014–2015), the plant height at the beginning of inflorescence emergence (before the first harvest) reaches 83.5 cm. During the years of testing, the plants of 'Luknė DS' produced a dry matter yield of 16.43 t ha^{-1}. The protein content at the beginning of inflorescence emergence is 12.92 %, fibre – 31.96 % of the dry matter. Leaves compose up to 46.98 %. The plants survive winter very well, recover well in spring and after cutting and are resistant to lodging (8.2 points). It is suitable for grazing and haymaking.

Reed canary grass 'Pievys DS'

Breeders: Dr. Nijolė Lemežienė, Eglė Norkevičienė

The cultivar (*Phalaris arundinacea* L.) is high-yielding. In Pasvalys and Plungė Plant Variety Testing Stations in 2014–2015, it produced an average dry matter yield of 20.4 t ha^{-1}. According to the dry matter yield data from cultivar trials at Institute of Agriculture, LAMMC in 2013–2014, the cultivar was equivalent to outstanding foreign cultivars. 'Pievys DS' is medium early to medium late, beginning of inflorescence emergence starts in the first ten-day period of June. Plants are leafy, with medium length of inflorescences, tolerant to leaf diseases, exhibit a good tillering ability and regrowth. Seeds mature in the middle of July. The seed yield is 200–400 kg ha^{-1}.

In Lithuania, *Phalaris arundinacea* L. tolerates soil of various mechanical composition and may be cultivated under conditions of minimal fertilization or even without it. The species is relatively resistant to drought because of well-developed root system, has good winter hardiness, is persistent and exhibits good weed suppression.

Tomato 'Auksiai' H

Breeder: Dr. Audrius Radzevičius

'Auksiai' H is an indeterminant type, middle early Lithuanian tomato hybrid. The first flower stalk forms above the 5th–7th leaf. Fruits are not big, round shape, orange coloured with two or three seedlings. The average fruit weight is about 30–40 g. The average number of fruits per plant reaches 106. The average yield in an unheated greenhouse is about 17 kg m^{-2}. Marketable yield is about 16.11 kg m^{-2}. Fruits are valuable in biochemical composition and have a particularly good taste and are suitable for fresh consumption and preservation. The hybrid is intended for growing in greenhouses.

5.5. Healthy and high-quality food products

The Institute of Horticulture performs not only scientific but also experimental and production activities. In the existing experimental base, consisting of orchards and gardens, greenhouses, tree nurseries and arboretum, the Institute is involved in cultivation of Lithuanian fruits and vegetables from which they produce healthy and natural products of exceptional quality. The values of the tested indicators in all the products do not exceed the maximum permitted concentration limits established by the European Union, which is confirmed by the quality certificates issued. The national quality product certificate testifies that the products comply with the national quality system's specification for agricultural and food products and gives them the right to mark them with a national product quality label KOKYBĖ / QUALITY.

In 2017, at the Christmas2Business exhibition, the LABU delicacy Christmas wreath was recognized as the "Best Christmas Business Gift".

In the exhibition "Choose a Lithuanian product" the apple, cherry and beetroot delicacy LABU was awarded the exhibition diploma.

Sales outlets:

- a trading pavilion in Babtai (Vėrupės St. 11) near the motorway;
- a shop in Kaunas, in the building of the Agrochemical research laboratory (Savanorių pr. 287);
- a warehouse of the experimental base in Babtai (Sodų St. 5);
- home delivery can be ordered at *http://www.kaimasinamus.lt/ukininkas/.192/*.

LABU delicacy was awarded the exhibition diploma

LABU delicacy – Christmas wreath was recognized as the best Christmas gift

6. RESEARCH FELLOWSHIPS

Dr. Rita Armonienė's internship in Sweden

Researcher of the Institute of Agriculture, Laboratory of Genetics and Physiology, was awarded by Swedish Institute "Visby" programme a scholarship for post-doctoral research at Swedish University of Agricultural Sciences (SLU), Department of Plant Breeding for one year (September 2016 – September 2017). The main aim of research work was to identify novel sources of Septoria tritici blotch (STB) resistance in winter wheat landrace and breeding lines.

The main tasks were: 1) to perform scoring for STB in Nordic and Baltic winter wheat genotypes in the field trials and controlled conditions; 2) to generate single nucleotide polymorphism (SNP) markers of winter wheat genotypes using genotyping by sequencing (GBS) technology; 3) to identify

Dr. Rita Armonienė with colleagues of the research group in wheat research field. Internship supervisor Dr. A. Chawade (in the middle) and Dr. F. Odilbekov

SNP markers for the scored phenotypic traits by association mapping.

Besides the main research project, Dr. Rita Armonienė was involved in other research group projects lead by her supervisor Dr. Askash Chawade. One project aim was to establish low cost high throughput phenotyping laboratory for plant imaging and analysis. During one year post-doctoral internship, she mastered many new research methodologies, gained experience of working in a big international collective, improved her English language knowledge, established contacts with researchers from SLU and other institutions.

Dr. Dianos Marčiulynienės stažuotės Švedijoje

Researcher of Institute of Forestry, Department of Forest Protection and Game Management, several times was in short term scientific missions in the Southern Swedish Forest Research Centre at the Swedish University of Agricultural Sciences.

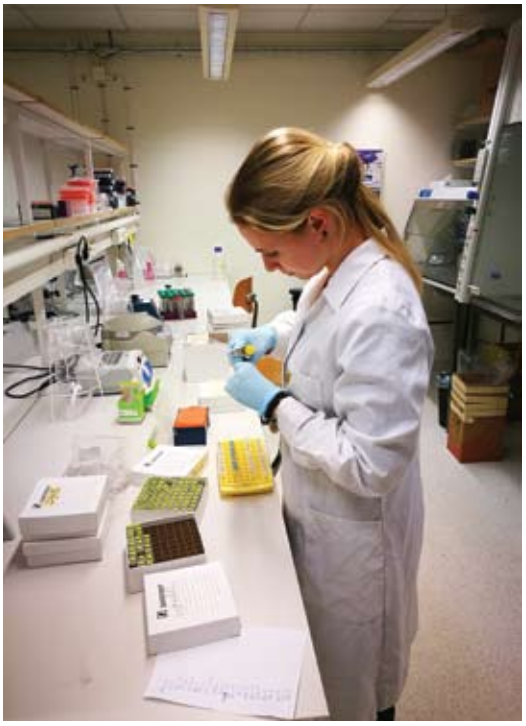
- January 16 – February 28 "Mapping the distribution and diversity of alien invasive *Phytophthora* species in forests and urban landscapes in Nordic and Baltic countries".

Forestry is one of the major economic engines of Nordic countries as well as a socio-cultural icon. However, climate change and increasing international trade of plants and plant products are presenting major challenges to the health of forests that potentially threaten the forest sector's sustainability. Over the last 200 years, the number of invasive forest pathogens introduced to Europe has increased exponentially. Referred to as "biological bulldozers", invasive, introduced phytophthora-pathogens are currently one of the most serious and challenging forest health problems in the world, affecting agricultural crops, forests, and the urban landscape.

The overall **aim of this internship** was to provide new scientific information, with high practical relevance, on the genetics, distribution and diversity of newly established *Phytophthora* spp. in Nordic and Baltic countries and their impact on biodiversity.

- April 1–14 "Diversity of foliar fungal communities in native and exotic pine (*Pinus* spp.) from arboreta: implications for alien invasive species introductions in Lithuania".

The genus *Pinus* includes some of the most ecologically and economically significant forest tree species in Northern Hemisphere, and is also commonly planted in the southern hemisphere in industrial plantations. Because of this importance, pines are the focus of considerable research including mycological work to determine fungi associated with all parts of the trees, including mutualists, pathogens and endophytes. Knowledge of the diversity and biogeographic distributions of needle inhabiting fungi, as well as the role of these organisms and factors shaping these communities



Dr. Diana Marčiulynienė in short-term internship in the Southern Swedish Forest Research Centre at the Swedish University of Agricultural Sciences

remains limited. The overall **aim of this internship** was to provide new scientific information, with high practical relevance, on the fungal species diversity of native and exotic *Pinus* species planted in arboreta in Lithuania, and their implications for invasive species introductions.

- May 15 – June 5 "Biotic threats of native and non-native pine (*Pinus* spp.) from common gardens and arboreta: implications for alien invasive species introductions".

In recent years, several pine pathogens have increased in importance, including needle diseases such as Dothistroma needle blight (*Dothistroma septosporum*), brown spot needle blight (*Lecanosticta acicola*), and *Diplodia sapinea* causing tip blight of pines; all of which are recognized alien invasive pathogens that result in extensive needle loss or shoot dieback and causing large ecological and economic losses to trees planted in forests and urban

landscapes. The introduction rates of these and other harmful ascomycete pathogens to Europe have continuously increased over the years, particularly in the Baltics. The overall **aim of this internship** was to provide new scientific information, with high practical relevance, on the fungal species diversity of native and NNT planted in common gardens and arboreta and their implications for invasive species introductions.

- November 13 – December 3 "*Citizen Science* to combat invasive forest *Phytophthora* diseases".

Over the last 15 years, the prominence of *Phytophthora* tree pathogens in Northern Europe has increased dramatically. This is believed to reflect a marked increase in the introduction and spread of invasive *Phytophthora* spp. via imported planting stock. The situation is probably not due to the global trade of plants alone, but also connected to changes in climate conditions over the last 60 years, i. e. increased mean winter temperatures, seasonal precipitation shifts from summer into winter, and a tendency for heavy rain; all factors favouring pathogen activity (infection and spread) by several species of *Phytophthora*.

In this internship, a "Citizen Science" platform was used to advance the spatial prediction of invasive forest *Phytophthoras* by providing the public with inexpensive location-based, time series data of unprecedented quantity and distribution. A key component of the "Citizen Science" platform is public education through information dissemination, seminars and training workshops.

Dr. Adas Marčiulynas' internship in Sweden

Researcher of the Institute of Forestry, Department of Forest Protection and Game Management, was on short term scientific mission in the Southern Swedish Forest Research Centre at the Swedish University of Agricultural Sciences from January 16 to February 28.

In Europe, the invasive fungal pathogen, *Hymenoscyphus fraxineus* is currently threatening the survival of common ash (*Fraxinus excelsior*). The situation with ash dieback is now critical as large populations of F. Excelsior are disappearing from our forests and the urban landscape.

In eastern USA and Canada, the emerald ash borer (EAB), *Agrilus planipennis*, has been killing all native *Fraxinus* species. Most trees succumb and die within a few years of colonization.

Besides substantial economic losses, the establishment of H. *Fraxineus* and EAB presents a new and pressing conservation challenge for the *Fraxinus* species populations as well associated organisms of those trees.

The main purpose of this internship was to use a DNA metabarcoding approach to assess fungal biota associated with congeneric *Fraxinus* planted in various locations across the globe, and specifically determine the fungal biota inhabiting congeneric species of *Fraxinus* growing under the same conditions in natural forests and in arboreta.

Dr. Adas Marčiulynas in short-term internship in the Southern Swedish Forest Research Centre at the Swedish University of Agricultural Sciences

Dr. Povilas Žemaitis' internship in Poland

Researcher of the Institute of Forestry, Department of Ecology, completed an internship during the period of March 1 – June 30. The internship was held at the Forest Research Institute (pol. *Instytut Badawczy Leśnictwa*) in Poland.

Internship results: gained knowledge about the tree species composition of the Poland, about European beech, Norway spruce, Large-leaved lime, Sycamore maple and European larch ecological preferences, climate optimum and distribution range, about listed species interspecific competition; contributed to data collection in *Białowieża Forest* long term sample plots. Gained knowledge about tree species composition changes in *Białowieża Forest.* Contributed to calculations on long-term dynamics of *Vaccinio vitis-idaeae Pinetum*, *Calamagrostis-Pinetum* and *Calamagrostis-Piceetum* associations of North-East Poland region.

Researcher did calculations on regeneration of European beech (in Poland) in dependence of stand structure and environment factors. The study cover data from 80 sample plots in four forests complex: Lasy Środkowopomorskie, Lasy Elbląsko-Żuławskie, Lasy Bieszczadzkie and Sudety Zachodnie.

Dr. Valda Araminienė's internship in Romania

Junior Researcher of Institute of Forestry, Department of Ecology, had an internship during the period of July 17 – August 24. The internship was held at the Department of Ecology in National Institute for Research and Development in Forestry, "Marin Drăcea" (Braşov, Romania). During period of internship V. Araminienė worked together with head of Ecology Department Lucian Dinca and his team.

The aim of the internship was to gain knowledge and competence about growing technologies of commercial birch stands under different climatic conditions, aiming to find out opportunities to grow the best quality timber and to reach its higher productivity. The internship aimed the following tasks: 1) to gain knowledge about practice of forest stands growing under warmer climatic conditions; 2) to investigate timber quality and productivity of birch stands growing in warmer climatic region; 3) to learn basics about commercialization of results. During field trips, tree increment cores and foliage samples were collected in four birch stands in Vad, Zarnest, Bârsa, Dobârlăului region. The samples were analysed at the laboratories of Romania Forest research institute.

She participated in theoretical and practical training on the possibilities of monitoring the use of drones in stands; familiarized with the Romanian Forest Monitoring System. The trainee visited a part of the intensive forest monitoring plots, got acquainted with the research carried out and the results obtained. V. Araminienė has gained commercial knowledge and experience from Romanian researchers and has learned how to apply this knowledge in practice.

Dr. Valda Araminienė participates in the measurement and collection of samples of birch in Romania

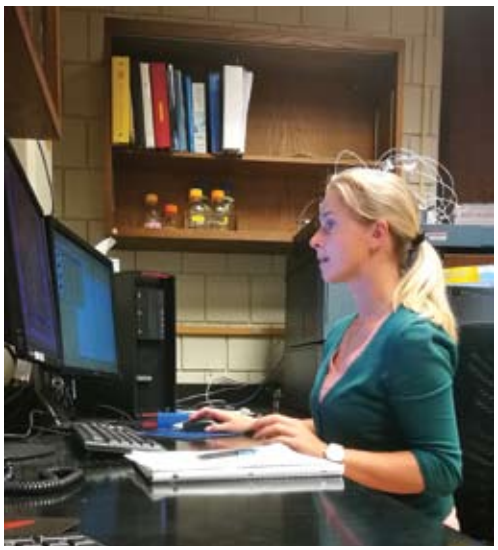
Dr. Diana Marčiulynienė's internship in the United States of America

Researcher was in short-term internship at the Ohio State University in the Department of Plant Pathology from August 1 to September 30.

Global climate change continues to lead to more frequent and intense weather extremes, including severe drought and high-temperature events, which can kill trees outright or indirectly, via reduced resistance to pathogens. For example, Austrian pine (*Pinus nigra*) is under increasing pressure from the normally non-lethal shoot blight pathogen, *Diplodia sapinea*.

Effective management responses to emerging mortality in forest environments due to climate change will only be possible if we leverage system-level understanding of tree-pathogen interactions. Currently, the molecular and physiological mechanisms that increase plant susceptibility to pathogens under climate stress remain very poorly understood, particularly for trees.

The overall **aim of this internship** was to learn unique and novel techniques on working with forest plant pathogens and get a better understanding of tree interactions with their environment (investigate metabolomic responses (soluble phenolics) in *Pinus nigra*).



Dr. Diana Marčiulynienė in short-term internship at the Ohio State University in the Department of Plant Pathology

PhD student Renaldas Žydelis' internship in Germany

PhD student of the Institute of Agriculture, Department of Plant Nutrition and Agroecology, did an internship in Germany at Jülich Interdisciplinary Research Centre from February 7 till August 6. Before the internship, R. Žydelis prepared the project "Simulation of maize yield in drought and cold conditions". The project was positively evaluated by the environmental expert commission DBU (German Environmental Foundation) and R. Žydelis was granted a scholarship for six months. During the internship, using data from field experiments carried out at the Institute of Agriculture, simulation of the formation of maize yield in different conditions of drought and cold was performed.

Two different models were used for simulation: "AquaCrop" model for simulation of various formation stages of agricultural plant yield in different wet conditions with model performance being based on water balance equation; "AgroC" model which encompasses 3 different models ("SoilCo2", "RothC", SUCROS) and is based on Richards equation.

During the internship, R. Žydelis had an opportunity to visit one of the largest and most famous interdisciplinary research centres in Europe as well as to establish valuable relationships with scientists working in the field of plant simulation and discuss the possibilities of future collaboration.

Fellows of German Environmental Fund (DBU) in 2017 (Renaldas Žydelis second from the bottom left)

PhD student Monika Toleikienė's internship in Denmark

PhD student of the Institute of Agriculture, Department of Plant Nutrition and Agroecology, attended an internship in Aarhus University on October 4 – November 9. Supervisor of internship was Assoc. Prof. Dr. Jim Rasmussen, researcher who published 53 scientific articles dealing with the use of isotope methods.

The aim of the internship was to acquire competence and practice investigating fixation of legume nitrogen, using labelled 15N isotope method. The objectives of internship were: 1) run the experiment to determine the efficiency of soybean nitrogen fixation; 2) update knowledge about labelled 15N isotope method; 3) participate in SOM course.

A new experiment was established in greenhouse conditions in pots. Factors: plant density, inoculation, sowing date. Soybean 'Merlin' from PhD experiments in Lithuania was used. ^{15}N isotopes method was used during the experiment. Observations and calculations were carried out. New knowledges about this method and obtained results were introduced. The possibility of using labelled isotopes method in Lithuanian agronomic researches was estimated. During the internship, the student attended the SOM – "Soil organic matter" course for students. In this course, PhD students from different countries presented their ongoing researches on organic matter in the soil. The latest scientific literature was reviewed and relevant issues were discussed. During the discussion, the experiments carried out under M. Toleikienė's doctoral program were discussed.

The scientist has acquired new competencies and international experience. The data of experiment will be published in an international article. After the internship, further cooperation with this institution and its scientists is planned.

Nitrogen fixation study of soy-wheat an isotope-labelled agro system (in photo PhD Student Monika Toleikienė and internship supervisor Assoc. Prof. Dr. Jim Rasmussen)

PhD student Mykola Kochiieru's internship in Poland

PhD student of Institute of Agriculture, Department of Soil and Crop Management, was in short-term scientific internship at the Institute of Agrophysics, Department of Metrology and Modelling of Agrophysical Processes, Polish Academy of Sciences at October 1–28. The internship was funded by the Polish Academy of Sciences.

The topic of the research is "Soil structure study, geometry of soil pore size and volumetric distribution of pores and visualization of 3D visual X-ray computed tomography". The purpose of the mission is to master the soil structure study in Lithuania using the *X-ray method*. Using this method, one can accurately measure not only the general soil porosity, but also the size of the individual soil pores and calculate their amount and volume.

During the visit, special computer software for soil porosity study was used: "Fiji is just image J", "Avizo", "VGstudio MAX 2.1", "Phoenix Dates Ix 2.0 reconstruction".

Mykola Kochiieru at Institute of Agrophysics in Lublin

7. DISSEMINATION OF SCIENTIFIC KNOWLEDGE

In 2017, international and national events were organized: conferences, seminars, agricultural technology exhibition "Agrovizija". Important anniversaries should be mentioned – the 90th anniversary of plant protection and the 95th anniversary of plant breeding in Lithuania. The international joint meeting "Breeding grasses and protein crops in the era of genomics" was attended by a large international scientific community. Also, scientific and popular press articles were prepared. In 2017, the citation index of the scientific journals "Žemdirbystė=Agriculture" and "Baltic Forestry" in CA WoS database increased, new informational publications were published. Cooperation agreements with Lithuanian and foreign institutions of science and studies were signed.

7.1. Scientific conferences, seminars

7.1.1. International conferences

March 1–2. The 9th **NORBARAG conference** was held in Vilnius. The conference is organized annually in different countries by the leaders of the Nordic-Baltic Action Group on Pesticide Resistance. The most urgent problems of pesticide resistance in Nordic and Baltic countries were discussed. Eighty-two participants from Denmark, Estonia, Latvia, Lithuania, Norway, Finland, Sweden, Germany, and Switzerland attended the annual event. Researchers, advisers, representatives of pesticide companies presented reports on insect pests, weeds, and pathogens resistance situation in individual countries and generally in the region. Scientists from Institute of Agriculture working in the field of plant protection are actively involved in the activities of NORBARAG – carry out joint research, prepare recommendations for pesticide resistance management strategies, work in

groups as leaders. Dr. Roma Semaškienė acted as chairperson of NORBARAG during 2011–2014. Dr. Ona Auškalnienė, who actively works on the topic of weed resistance to herbicides, has been elected team leader of NORBARAG herbicide resistance sub-group for the next two years.

June 19–20. **International conference "Plant breeding: science for agricultural development"**, devoted to the 95th anniversary of Lithuanian plant breeding, was held at Institute of Agriculture. The event attracted not only scientists but also representatives from state institutions and business. On the first day of the conference, the participants were familiarized with the history and achievements of plant breeding, participated in an outdoor workshop, where the most relevant issues of grass and cereal breeding were discussed. The second day was dedicated to scientific presentations and discussions. Scientists from Lithuania, Latvia, Estonia and Belarus presented research in the fields of agriculture, horticulture and forestry.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

September 11–14. **The fifth international joint meeting of the European Association for Research on Plant Breeding (EUCARPIA) "Breeding grasses and protein crops in the era of genomics"** was held in Vilnius, in which 156 scientists from 25 countries, including scientists from the Institute of Agriculture, presented their research. This meeting, traditionally held every two years, was focussed on two groups of plants – grasses and protein crops used in the production of forage as well as a renewable energy source for the production of biogas, biofuels and bioliquids and for recreational purposes. In addition to the traditional breeding results, much attention has been paid to the use of genetic resources in pre-breeding.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania and the Lithuanian Science Council.

7.1.2. National conferences, seminars

January 24–27. **Scientific conference "Agrarian and forestry sciences: recent research results and technological development".** The presentations were divided according to the long-term research programs implemented during 2012–2016. On the first day of the conference, the results of the programs "Productivity and sustainability of agricultural and forest soils" and "Bio-potential and quality of plants for multifunctional use" were presented. The second day was devoted to the review of long-term research on "Harmful organisms in agro-forest ecosystems" and "Genetics of agricultural and forest plants and purposeful change of genotypes". In the Institute of Forestry, major findings of the long-term program "Sustainable forestry and global change" and their potential use were discussed. On January 27, the long-term program "Horticulture and olericulture: agro-biological basics and technologies" was presented. During the four days of the conference, not only scientific presentations were made, but also the Centre's activities and future prospects were reviewed.

March 2. **Conference "Horticulture and environment: current issues and practical innovations"**, dedicated to the Earth Day was held at the Institute of Agriculture. The innovations and topicalities of horticulture, the latest ornamental plant varieties, suitable for planting both in private and public spaces were discussed. Larger garden areas, innovative gardening technologies help to nourish more people, and well-chosen ornamental plants create an aesthetic environment.

May 10. **Conference "Plant biology investigations in the fields of crop production breakthrough"** and the orchard flowering festival were held at the Institute of Horticulture. The conference was attended by representatives and students of Kaunas Technology University, Vytautas Magnus University, Aleksandras Stulginskis University, Nature Research Centre, and farmers. The speakers of the aforementioned scientific institutions introduced zero waste food technologies, phytochemical analysis methodology for crop research, and rapeseed research. Biotechnological tools for optimizing the tolerance of winter crops to cold, survival and yield were also analysed, solid-state lighting technology for plants was discussed as well as the application of pulsed electric fields to intensify anthocyanin extraction from plant material. The plant adaptive mechanisms (from the gene to the phenotype), breeding, pomological and phytopathological value of the old gardens in Lithuania were presented.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

May 25. **Conference "Plant protection: achievements and challenges"**, dedicated to the 90th anniversary of plant protection science in Lithuania, was held at Institute of Agriculture. During the event, the evolution of plant protection over a 90-year period was discussed: the major developments in plant protection science and the main achievements of scientists in this field as well as the current situation of the plant protection science in the context of climate change and pest resistance to pesticides. Director of the Institute of Agriculture Dr. Gintaras Brazauskas thanked the head of the Department of Plant Pathology and Protection Dr. Roma Semaškienė and senior research scientist of the Department of Soil and Crop Production Dr. Irena Deveikytė for the application of new and already tested plant protection methods. These scientists received notes of commendation from the Ministry of Education and Science of the Republic of Lithuania. Plant Pathology and Protection Department, Soil and Crop Production Department, Plant Protection Department of the Institute of Horticulture received notes of commendation from the Ministry of Agriculture of the Republic of Lithuania.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

July 4. **Conference "Aspects of the development of agricultural science in heavy soils of North Lithuania"**, dedicated to the 90th anniversary of Joniškėlis Experimental Station. The developments of Joniškėlis Experimental Station and research done there were presented, solutions to the problems of sustainable agriculture and soil fertility, such as decreasing microbiological activity,

organic matter, and nutrient availability to plants; deterioration of physical properties, air and water regimes, utilization of nutrients from fertilizers, and environmental pollution were discussed. The landscape of the Karst region of North Lithuania was reviewed, the chemical and mechanical activity of surface and ground water causing melting or thawing of the rock and karst classification, its ecological and practical significance were presented, intelligent decisions that bring the success of the farm through knowledge, management of economy, information and other technologies integration were dealt with.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

September 7. **Conference "Sugar beet growing: research, problems, prospects",** dedicated to the 90th anniversary of Rumokai Experimental Station. The conference participants were familiarized with the history of the station, founded on October 20, 1927, and its prospects, the latest developments in sugar beet fertilization, the influence of varieties on the yield and quality of roots, the main characteristics that determine the quality of a beet variety (root form, crown height, resistance to bolting, resistance and tolerance to diseases and pests, sugar content, and other factors). The situation in Lithuanian and EU sugar industry was discussed. With complete abolition of the regulation of the EU sugar market, we seem to have entered a new era characterised by more efficient warehousing and logistics, more exports, competition, fighting for deficit areas, and approaching consolidation of sugar production.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

October 6. **Conference "Plant introduction, dendrology and breeding in Lithuania"**, held at the Institute of Forestry. The 100th anniversary of the birth of Lithuanian forester, breeder, dendrologist Stasys Tuminauskas (1917–2010) was commemorated during the conference. The researchers highlighted the importance of introducing and crossing plants, discussed the work done on breeding and crossing plants, presented the experimental plantations, in which the introduced and hybrid woody plants are tested, and discussed the importance of such plants for science and practice. The event reviewed the research on the introduction of forest trees by S. Tuminauskas and the importance of such work.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

June 19. **Workshop "Enhancement of the components of soil organic matter and increasing their sustainability in the organic farming system"** was held at Perloja Experimental Station. Participants of the workshop were interested in microorganisms living in the soil, scientists revealed their significance for soil biological properties. Like every year, farmers were eager to see the collection of medicinal herbs.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

May 31. **Workshop** "**Development of oilseed rape cultivation and research in Lithuania: experience and prospects"**, held at Vėžaičiai Branch to commemorate the 60th birth anniversary of Dr. Stasys Bernotas. The event was attended by the representatives of the Centre, Aleksandras Stulginskis University's administration, teachers, researchers, farmers, agricultural specialists from Šilutė, Šilalė, Plungė and Klaipėda districts, members of S. Bernotas family and former colleagues. The participants reviewed the work done by the former long-term director of Vėžaičiai Branch, S. Bernotas, in the field of rapeseed research, the key stages of his life and research, and the contribution made by the scientist to the development of rapeseed technologies. In addition, the event presented the characteristics of rapeseed growing in the area of Klaipėda, new cultivation technologies, spring and oilseed winter rape diseases and pests.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

October 24. **Workshop "Innovative technologies for greenhouse vegetable-growing"** was held at the Institute of Horticulture. The event discussed the importance of the spectrum, intensity and duration of artificial lighting; what possibilities the light-emitting diode (LED) lighting provide for greenhouses; how to estimate and adjust the cumulative amount of light reaching plants; how to develop solid-state lighting strategies; the significance of lighting quality for greenhouse vegetables productivity and quality; innovations in greenhouse protection, and other relevant issues were addressed.

The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

7.2. Activities in popular science

May 19. On the **"Fascination of plants day"** the students of Kėdainiai "Šviesioji" and "Atžalynas", Krakės "Mikalojaus Katkaus" and Akademy Gymnasiums visited the Institute of Agriculture's departments of Soil and Crop Production, Plant Nutrition and Agroecology, Grass Breeding, Laboratory of Genetics and Physiology. The students received a lot of new information about the soil, plants, pests and diseases, and plant breeding and got acquainted with the research carried out by the Institute of Agriculture.

March 30–April 1. The Institute of Agriculture and the Institute of Horticulture participated in the **22nd exhibition "Ką pasėsi" / "What you sow... 2017"**. The Nemunas Valley stand displayed video material about the applied research carried out at the Institute of Agriculture and services provided to business entities; publications about the varieties of cereals, pulses and grain legumes developed by the Institute's scientists and listed in the National Plant Variety List and EU Common Agricultural Plant Variety Lists as well as about control of weeds and pests were presented. The Institute of Horticulture sold exceptional quality products: fruit, vegetable and berry delicacies produced by the IH Fruit and Vegetable Processing Simulation Open Access Centre.

June 28–30. **The exhibition of agricultural technologies "Agrovizija 2017"**, organized by the Institute of Agriculture, the Lithuanian Plant Protection Association and the Lithuanian Farmers' Union took place in Akademija, Kėdainiai district. Companies, presenting agricultural machinery, varieties of agricultural crops (winter and spring wheat, oilseed rape, barley, rye, oats, sugar beet, maize, peas, beans, perennial grasses, etc.), fertilizer innovations, organizations involved in agricultural scientific research and provision of advice participated in the exhibition.

Demonstration trials of plant protection technologies, plant varieties and fertilization were presented as well as a rich exposition of agricultural machinery. A show of sprayers and drills was arranged. Workshops and consultations on various topics were held all three days of the exhibition. Visitors were given advice by the representatives of companies on plant and machinery / technical innovations, financial solutions for farms, opportunities for publicizing activities.

The Centre's researchers presented 13 reports on plant diseases and pests, resistance of weeds to herbicides, climate change, application of legumes, changes in plant breeding, sustainable soil use, and other relevant topics. The Centre's stand exhibited the evolution of plant breeding in Lithuania and plant varieties developed from 1924 to 2016.

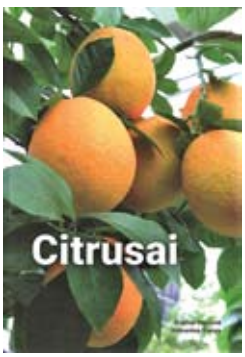
The event was supported by the Ministry of Agriculture of the Republic of Lithuania.

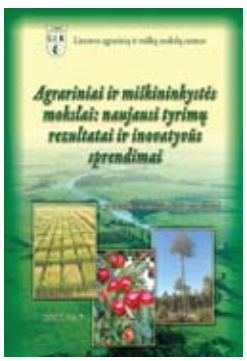
July 14. Vytautas Magnus University's Kaunas Botanical Garden hosted the **midsummer fragrance, taste and beauty event "The night of fragrances".** Live music was played at the festival, exhibitions and fairs were held, specialists from various Lithuanian educational and research institutions presented crop innovations, special varieties, and consulted on their cultivation and maintenance issues. Traditionally, the representatives of the Institute of Agriculture, who introduced the family of bean plants, participated in the event. Junior research worker K. Razbadauskienė (Cereal Breeding Department) and a research worker Eglė Norkevičienė (Grass Breeding Department) told the participants about the benefits of the cultivation of legume plants, their peculiarities, alternatives to their use and the various secrets of the world of these plants. The participants of the event were able to get acquainted with the latest varieties of semi-leafless peas 'Ieva DS' (registered in 2015) and 'Jūra DS' (registered in 2017) developed by the Institute of Agriculture's breeders.

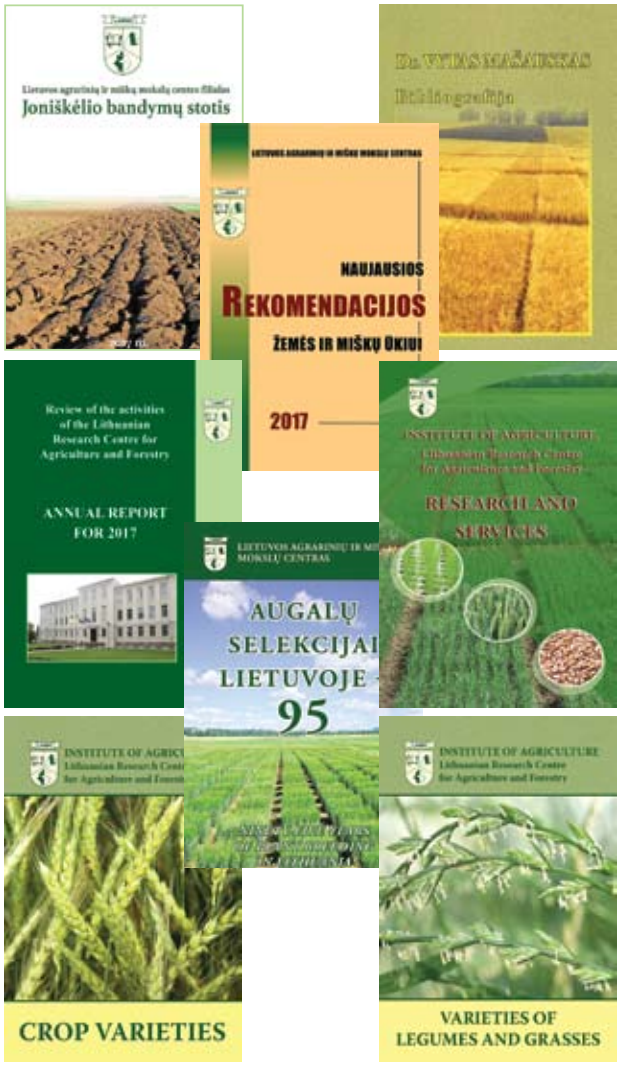
7.3. Publishing

The Centre is a co-publisher of the scientific journals "Baltic Forestry" (IF 2016 / 2017 – 0,635), "Žemdirbystė=Agriculture" (IF 2016 / 2017 – 0,644), "Sodininkystė ir daržininkystė", "Miškininkystė", "Agronomy Research". Other publications released in the year 2017:

- Gražina Stanienė, Vidmantas Stanys monograph "Citrusai" / "Citrus";
- abstracts of presentations of the scientific conference "Agrariniai ir miškininkystės mokslai: naujausi tyrimų rezultatai ir inovatyvūs sprendimai" / "Agricultural and Forestry Sciences: the Latest Research Results and Innovative Solutions";
- "Naujausios rekomendacijos žemės ir miškų ūkiui" / "The Latest Recommendations for Agriculture and Forestry";
- bibliography "Dr. Vytautas Mašauskas";
- "2016 metų veiklos ataskaita" / "Annual Report for 2016";
- publications "Javų veislės", "Pupinių ir miglinių žolių veislės", "Tyrimai ir paslaugos" / "Crop Varieties", "Varieties of Legumes and Grasses", "Research and Services";
- publication "Lietuvos agrarinių ir miškų mokslų centro filialas Joniškėlio bandymų stotis" / "Joniškėlis Experimental Station of Lithuanian Research Centre for Agriculture and Forestry";
- publication "Augalų selekcijai Lietuvoje – 95" / "Ninety-five Years of Plant Breeding in Lithuania".







7.4. Cooperation with institutions of science and studies

Every year, students from different schools and from higher education institutions of the country visit the Centre. Representatives of the Centre's laboratories present scientific research, acquaint the students with the terms and conditions of doctoral studies. In 2017, new contacts with scientific and educational institutions were established.

A cooperation agreement between the Centre and the Indian Rai University of Technology was signed. It foresees cooperation in the field of agricultural innovation and research.

A cooperation agreement between the Centre and Tyumen State University of Russia was signed. The agreement aims to establish and expand scientific contacts.

A scientific cooperation agreement with the Belarus Institute of Horticulture was signed at the Institute of Horticulture. The agreement envisages the initiation of new research on horticultural issues, participation in joint projects, exchange of scientists and doctoral students' visits, scientific information and literature.

A cooperation agreement between the Institute of Horticulture and the Lithuanian University of Health Sciences was signed. The agreement foresees the promotion of cooperation in vocational information and guidance, in-service training, scientific and student practical training activities.

A cooperation agreement between the Institute of Horticulture and Vilnius College was signed. Its aim is to promote cooperation in various fields of study and other collaboration that is beneficial to both parties.

The Institute of Agriculture signed a cooperation agreement with Kėdainiai Šviesioji Gymnasium. At the Genetics and Physiology Laboratory, the students of the gymnasium will carry out practical experiments and research under the guidance of the laboratory's researchers, will learn to prepare presentations for practical-scientific conferences and otherwise deepen the knowledge of natural science.

8. EVALUATION OF RESEARCH ACTIVITIES

Lithuanian Science Board's scholarships

The Centre's students who received the scholarships are Eglė Norkevičienė, Viktorija Vaštakaitė and Jonas Viškelis.

Awards, certificates of merit presented to doctoral students and young researchers

On March 23, awards, diplomas of contests, certificates of merit were presented to doctoral students and young researchers in Lithuanian Academy of Sciences (LAS). The LAS awards for the best project of young researchers and doctoral students were presented to Researcher Dr. Neringa Rasiukevičiūtė (Institute of Horticulture, Laboratory of Plant Protection) for work "Genetic and phenotypic diversity of *Botrytis* spp. from strawberry and onion, diseases forecasting and control", and Junior Researcher Dr. Diana Marčiulynienė (Institute of Forestry, Department of Forest Protection and Game Management) for work "Characterization of *Hymenoscyphus fraxineus* populations of different origin and susceptibility of common ash to the dieback pathogen". Among the students of higher education institutions, a doctoral student Benas Šilinskas (Institute of Forestry, Department of Forest

Resources, Economics and Policy) was awarded for his work "Norway spruce (*Picea abies*, (L) Karst.) wood modulus of elasticity and wood mechanical properties correlation analysis".

LAS certificate of merit was presented to Researcher Dr. Kristina Amalevičiūtė-Volungė (Institute of Agriculture, Chemical Research Laboratory) for work "Changes in the properties of *Pachiterric Histosol* as influed by management and renaturalization".

Dr. Diana Mačiulynienė

Dr. Kristina Amalevičiūtė-Volungė

Dr. Neringa Rasiukevičiūtė, President of the Lithuanian Academy of Sciences
Prof. Dr. Valdemaras Razumas, Mayor of the municipality of Panevėžys Rytis Mykolas Račkauskas

PhD student Benas Šilinskas, President of the Lithuanian Academy of Sciences
Prof. Dr. Valdemaras Razumas, Mayor of the municipality of Panevėžys Rytis Mykolas Račkauskas

Lithuanian Academy of Sciences' Scholarships

Centre's Researcher Dr. Neringa Rasiukevičiūtė (Institute of Horticulture, Laboratory of Plant Protection) for work "The antifungal activity of essential oils for the vegetable pathogenic fungi" and Researcher Dr. Andrius Aleliūnas (Institute of Agriculture, Laboratory of Genetics and Physiology) for work "Homozygous inbred lines induction in perennial ryegrass" on September 19 were awarded certificates of young scientists' scholarships in the field of agricultural sciences from the Lithuanian Academy of Sciences.

Dr. Neringa Rasiukevičiūtė, President of the Lithuanian Academy of Sciences
Prof. Dr. Valdemaras Razumas

Dr. Andrius Aleliūnas, President of the Lithuanian Academy of Sciences
Prof. Dr. Valdemaras Razumas

Other awards

On June 8 a festival honouring the laureates, the ten most deserving agronomists over the one hundred years (1918–2017), of the competition arranged by the editorial office of the newspaper "Ūkininko patarėjas" / "Farmer's Advisor" and Aleksandras Stulginskis University on the occasion of one hundredth anniversary of the restoration of Lithuania's Statehood was held at Stulginskis University. Prof. Dr. habil. Zenonas Dabkevičius, the Centre's director, was among the ten most prominent agronomists of the century.

On July 14 Aleksandras Stulginskis University hosted the 31st Congress of Lithuanian Agronomists' Union, dedicated to the Day of Agronomists. Last year, the 16th of July was proclaimed as the state memorable Day of Agronomists. During the event, the most prominent agronomists of the country were honoured. The titles of Honorary Member or the Prominent Agronomist of Lithuania were conferred. Among the awarded was Prof. Dr. habil. Zenonas Dabkevičius, director of the Lithuanian Research Centre for Agriculture and Forestry, Vice-Chairman of the LAS, active member of the LAS Board, an upholder and supporter of the public professional activity of LAS.

From the left Rector of Aleksandras Stulginskis University Prof. Dr. Antanas Maziliauskas, director of the Centre Prof. Dr. habil. Zenonas Dabkevičius and Editor-in-chief of newspaper "Ūkininko patarėjas" Vytenis Neverdauskas

9. FUNDING

The Centre's budget is composed of state budget appropriations, funds from national and international projects, funds from contract works for Lithuanian and foreign economic entities and other income (sale of agricultural products, rent of premises, etc.) (Figure 8). In 2017, the Centre's income was 11.6 million EUR. The main costs are for salaries and wages and social insurance (54 %), depreciation and amortization (21 %), purchasing of goods (11 %) and services (5 %). The remainder of the costs was allocated to public utility services, transport, in-service training, doctoral scholarships, etc.

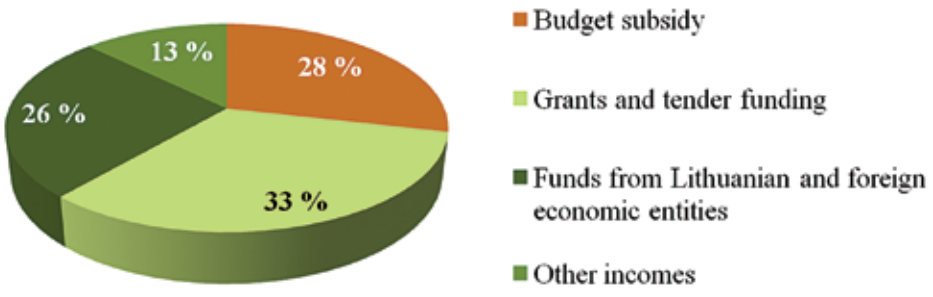


Figure 8. Funding of the Centre for 2017

10. APPENDICES

10.1. All projects

10.1.1. National

Projects funded by the Lithuanian Research Council

Projects of the national research programme "Sustainability of agro-, forest and water ecosystems"

1. "The influence of long-term contrasting intensity resources management on genesis of different soils and on other agroecosystems components" (AGROTVARA). Partners: LAMMC, ASU, VU. Project leader Dr. Virginijus Feiza. 2015–2018.
2. "Establishment and diversity of a newly emerging cereal pathogen in the agroecosystem due to changing climate and farming practices". Partners: LAMMC, NRC. Project leader Dr. Gražina Kadžienė. 2015–2018.
3. "Response and plasticity of different tree species & juvenile-stage forest communities under impact of climate change and other environmental stressors" (MIŠKOEKOKAITA). Partners: LAMMC, NRC. Project leader Prof. Dr. Alfas Pliūra. 2015–2018.
4. "Study of impact of clear cuttings on biodiversity dynamics in forest ecosystems". Partners: LAMMC, VMU. Project leaders: Dr. Remigijus Daubaras (VMU), Dr. Vidas Stakėnas. 2015–2018.
5. "Integrated impact of climate and environmental changes on the productivity, biodiversity and sustainability of agro-ecosystems" (KLIMAGRO). Partners: LAMMC (Dr. Sandra Sakalauskienė, Dr. Jurga Miliauskienė), VMU. Project leader Prof. Dr. habil. Romualdas Juknys (VMU). 2015–2018.
6. "Anthropogenic influence on vegetation as component of Lithuania river ecosystem stability". Partners: LAMMC (Dr. Laisvūnė Duchovskienė), VMU. Project leader Prof. Dr. habil. Donatas Žvingila (VU). 2015–2017.

Projects of researchers' teams

1. "Biogeography and spread of local and invasive tree pathogens: focus on climate, tree species and intensity of forest management". Project leader Dr. Audrius Menkis. 2017–2020.
2. "GrowGene – Genome-wide functional analysis of perennial ryegrass for improved growth under water limiting conditions". Project leader Dr. Kristina Jonavičienė. 2017–2020.
3. "Dynamic light spectrum and intensity modelling and photoresponse in different vegetable morphogenesis stages". Project leader Dr. Giedrė Samuolienė. 2017–2020.
4. "Improvement of apple fruit quality by application of innovative horticultural technologies". Project leader Dr. Darius Kviklys. 2017–2020.
5. "Involvement of oxidative stress in molecular mechanism of seed response to cold plasma treatment". Project leader Dr. Danas Baniulis. 2017–2019.
6. "Control of nitrate reduction in green vegetables: metabolic effects of light and other environmental factors". Project leader Dr. Akvilė Viršilė. 2015–2018.
7. "Development of molecular markers for genomic selection of adaptation in perennial ryegrass" (ADAPTGENAS). Project leader Dr. Gintaras Brazauskas. 2015–2018.
8. "Role of lipids in low-temperature adaptation of apple". Project leader Dr. Perttu Haimi. 2015–2018.
9. "Supercritical fluid extraction of lycopene and the application of its extracts in development of innovative products". Project leader Prof. Dr. Pranas Viškelis. 2015–2018.

High level R&D projects (SMART)

1. "Development of wood modifying eco-friendly technology for higher value products". Project leader Dr. Marius Aleinikovas. 2017–2021.
2. "Closed plant cultivation system for production of raw materials for peptide nanoengineering applications". Project leader Dr. Danas Baniulis. 2017–2021.

3. "UV-A lighting strategies for controlled environment horticulture: upgrade to sustainable, high-value production". Project leader Dr. Akvilė Viršilė. 2017–2021.
4. "Quality diagnostics of biogas production by-product (digestate) for innovative use as a biofertilizer". Project leader Dr. Alvyra Šlepetienė. 2017–2021.
5. "Development of winter wheat varieties for amylose-free starch and vital gluten processing". Project leader Dr. Gintaras Brazauskas. 2017–2021.
6. "Enhancement of the multifunctional properties of legumes in feed and food value chains" (SmartLegume). Project leader Dr. Žydrė Kadžiulienė. 2017–2021.

Grant for high-level researchers' group project

"Insights into future forests: challenges of climate change and diseases, and possible measures for saving biodiversity and ecosystem functioning". Project leader Dr. Audrius Menkis. 2017–2021.

Implementation of Postdoctoral internships in Lithuania

1. "The resistance of different Scots pine (*Pinus sylvestris* L.) genotypes against root rot (*Heterobasidion annosum* (Fr.) Bref.)". Post-doc Dr. Adas Marčiulynas. Research supervisor Dr. Virgilijus Baliuckas. 2017–2019.
2. "The metabolic response of summer rape (*Brassica napus* L.) to negative effects of climate change". Post-doc Dr. Austra Dikšaitytė. Research supervisor Dr. Akvilė Viršilė. 2017–2019.
3. "The impact of light quantity and quality parameters on changes of the *Fragaria x ananassa* pathogens bioecological properties". Post-doc Dr. Neringa Rasiukevičiūtė. Research supervisor Dr. Aušra Brazaitytė. 2017–2019.
4. "Assessment of different perennial herbaceous plant species as potential feedstocks for conversion into bioenergy products". Post-doc Dr. Kristina Amalevičiūtė-Volungė. Research supervisor Dr. Bronislava Butkutė. 2017–2019.

Students' scientific practice

1. "The metabolic relations of nitrates and ascorbic acid: the management of nutritional value of vegetables cultivated in closed vegetable-growing systems", student Linas Simanavičius, supervisor Dr. Akvilė Viršilė. 2017.
2. "The response of lettuce morphology and photosynthesis and distribution of nitrogen under the effect of assimilated light", student Mantas Kačiušis, supervisor Dr. Giedrė Samuolienė. 2017.

Projects funded by the Ministry of Agriculture of the Republic of Lithuania

The agriculture, food and fisheries research and development projects

1. "Evaluation of the most harmful seed borne diseases of cereals and fodder legume crops, and the establishment of their thresholds in certified cereal and fodder plant seed". Project leader Dr. Roma Semaškienė. 2017–2019.
2. "Assessment of the potential of carbon sequestration in agriculture". Project leader Dr. Žydrė Kadžiulienė. 2017–2019.
3. "Evaluation of cereal varieties susceptibility for integrated pest management (IPM)". Project leader Dr. Jūratė Ramanauskienė. 2017–2019.
4. "The use of digestate for the fertilization of agricultural crops". Project leader Dr. Vita Tilvikienė. 2017–2019.
5. "The inventory of greenhouse gas emissions in crop production". Project leaders Dr. Jūratė Aleinikovienė (ASU), Dr. Vita Tilvikienė. 2017–2019.
6. "Analysis of epidemiological and laboratory research of ASF (African swine fever), prognosis of disease transmission, risk analysis and disease management strategy in wildlife and pig farming localities in the Republic of Lithuania". Project leader Dr. Olgirda Belova. 2017–2019.
7. "The nurture facilities of Stelmuze's progeny clones *in vitro* culture". Project leader Dr. Sigutė Kuusienė. 2017–2018.
8. "The dynamics of grain contamination with mould fungi as influenced by climate, grain storage facilities and conditions" Leader Dr. Audronė Mankevičienė. 2017–2018.
9. "Optimization of horticultural plants' mineral nutrition using of biostimulants of natural origin". Project leader Dr. Ona Bundinienė. 2017–2018.
10. Scientific research of risk factors of plant origin products produced in Lithuania and preparation of methodological recommendations". Project leader Prof. Dr. Pranas Viškelis. 2017–2018.
11. "Long-term monitoring of soil agrochemical properties". Project leader Prof. Dr. habil. Gediminas Staugaitis. 2016–2020.

12. "Pest risk analysis for *Xylella fastidiosa* (*Wwlls et al.*)". Project leader Dr. Artūras Gedminas. 2016–2018.
13. "The state of agricultural crop stands and yield predictions in Lithuania". Project leader Dr. Virginijus Feiza. 2016–2018.
14. "Research into pollen species composition and its content in honey in relation to bee foraging distance". Project leader Dr. Kristina Jonavičienė. 2016–2018.
15. "Health evaluation of new varieties of orchard plants and development of the highest category of planting material". Project leader Ingrida Mažeikienė. 2016–2018.
16. "Selection of lupine cultivars suitable for cultivation under Lithuania's climate conditions". Project leader Dr. Zita Maknickienė. 2015–2017.
17. "Cultivation technologies of soy". Project leader Dr. Žydrė Kadžiulienė. 2015–2017.
18. "Winter wheat crop stand formation for good overwinter survival and yield". Project leader Dr. Sigitas Lazauskas. 2015–2017.

Support for the beekeeping sector in Lithuania

1. "Evaluation of proteins of pollen extracted from honey and collected by hand and plant preference by bees". Project leader Dr. Kristina Jonavičienė. 2017.
2. "Development and assessment of *Apis mellifera carnica* lines and their beneficial properties adapted to Lithuania's honey flow conditions" Project leader Dr. Violeta Čeksterytė. 2017.
3. "The efficacy of *Apivar* and *MAQs* acaricides against *Varroa destructor* mites and their effects on bee colonies". Project leader Dr. Violeta Čeksterytė. 2017.

Support for projects of the measure "Knowledge transfer and information activities" (Program for the Lithuanian rural development 2014–2020)

1. "Quality and risk assessment of conserved forages aimed at ensuring high feeding-value forage and well-being for dairy cattle". Project leader Dr. Audronė Mankevičienė. 2017–2020.
2. "Crop rotation diversification and agro-technology optimization for the restoration of biodiversity and agro-ecosystem functions". Project leader Dr. Lina Šarūnaitė. 2017–2020.

Support for international research and technology development projects

1. "IT-solutions for user friendly IPM-tools in management of leaf spot diseases in cereals". Project leader Dr. Antanas Ronis. 2017–2020.
2. "Fertility building management measures in organic cropping systems" (FertilCrop). Project leader Dr. Žydrė Kadžiulienė. 2015–2017.

EIP activity group project (Program for the Lithuanian rural development 2014–2020)

The "Innovation gateway" centre for knowledge gathering and transfer, development and demonstration of agricultural technologies". Project leaders Rimtautas Petraitis (LAAS), Dr. Roma Semaškienė. 2017–2019.

Applied research projects funded by the Ministry of Environment of the Republic of Lithuania and its subordinate state institutions

1. "Sustainable forests for the future society". Project leader Dr. Marius Aleinikovas. 2017–2019.
2. "Selection of Scots pine genotypes resistant to root rot". Project leader Dr. Virgilijus Baliuckas. 2017–2019.
3. "Maintenance and renewal of national genetic resources field collections". Project leader Dr. Virgilijus Baliuckas. 2017.
4. "The services for level II forest monitoring". Project leader Dr. Vidas Stakėnas. Customer – State Forest Service. 2017.
5. "Identification of the old Lithuanian orchard plant varieties growing in Samogitia and Central Lithuania, investigation of their phytosanitary state and their propagation". Project leader Prof. Dr. habil. Vidmantas Stanys. Customer – Plant Gene Bank. 2017.
6. The contract on the purchase of services on "Preparation of the maximum density norms of wild boars in the different regions of Lithuania". Project leader Dr. Olgirda Belova. 2016–2017.
7. "Guidelines for breeding of spruce, larch, birch and black alder plantations". Project leader Dr. Gintautas Urbaitis. 2015–2017.
8. "Dependence of wood properties of Norway spruce and silver birch on growing conditions and genotype". Project leader Dr. Virgilijus Baliuckas. 2016–2018.

10.1.2. International

"Horizon 2020" projects

1. "Fostering sustainable legume-based farming systems and agri-feed and food chains in the EU" (LEGVALUE). Coordinator in the Institute of Agriculture Dr. Žydrė Kadžiulienė. 2017–2021.
2. „Tematinis tinklas ne maisto paskirties žemės "A thematic network to design the penetration path of non-food agricultural crops into European agriculture" (PANACEA). Coordinator in the Institute of Agriculture Dr. Vita Tilvikienė. 2017–2020.
3. "Optimizing the management and sustainable use of forest genetic resources in Europe" (GENTREE). Coordinator in the Institute of Forestry Dr. Darius Danusevičius. 2016–2020.
4. "European Fruit Network" (EUFRUIT). Coordinator in the Institute of Horticulture Dr. Audrius Sasnauskas. 2016–2019.

"Interreg" Programme projects

1. "Revival of old traditional fruit, vegetable and ornament plants and their products: Heritage Gardens Tour". Coordinator in the Institute of Horticulture Dr. Darius Kviklys. 2017–2019.
2. R004 "Advancement of nontechnological innovation performance and innovation capacity in fruit growing and processing sector in selected Baltic Sea Region countries" (InnoFruit). Coordinator in the Institute of Horticulture Dr. Darius Kviklys. 2016–2019.
3. "Water Management in Baltic Forests (WAMBAF)". Coordinators in the Institute of Forestry: Dr. Marius Aleinikovas and Dr. Olgirda Belova. 2016–2019.

The 7th Framework Programme projects

1. FP7 ERA-NET SUMFOREST "Benchmarking sustainability performance of value chains using ToSIA, the tool for sustainability impact assessment" (BenchValue). Coordinators in the Institute of Forestry Dr. Marius Aleinikovas. 2017–2019.
2. FP7-ERANET-2013-RTD "IT-solutions for user friendly IPM-tools in management of leaf spot diseases in cereals" (SpotIT). Coordinator in the Institute of Agriculture Dr. Antanas Ronis. 2017–2019.
3. FP7-ERANET-CORE Organic Plus project "Fertility Building Management Measures in Organic Cropping Systems (FertilCrop)". Coordinator at Institute of Agriculture Dr. Žydrė Kadžiulienė. 2015–2017.

Other projects

1. Swedish Institute Baltic Sea Cooperation project "Baltic Sea Region network for sustainable wheat production (BALTICWHEAT)". Coordinator in the Institute of Agriculture Dr. Rita Armonienė. 2017–2018.
2. Swedish Institute Baltic Sea Cooperation project "Cooperation in the Baltics on the development of strategies to foresee outbreaks of *Fusarium* damage". Coordinator in the Institute of Agriculture Dr. Skaidrė Supronienė. 2017–2018.
3. SNS (Nordic Forest Research Co-operation Committee) project CAR-ES III "Centre of advanced research on environmental services from Nordic forest ecosystems". Coordinator in the Institute of Forestry Dr. Iveta Varnagirytė-Kabašinskienė. 2016–2020.
4. Long Term Forest Research CoFoRD Programme 14C/846: WP3 – FORM Forest Management "Research required to investigate genetic resistance to ash dieback disease *Hymenoscyphus pseudoalbidus* (anamorph *Chalara fraxinea*) and the development of disease resistant ash planting stock". Coordinator in the Institute of Forestry Prof. Dr. Alfas Pliūra. 2016–2019.
5. SNS-NKJ (Nordic Joint Committee for Agricultural and Food Research-Nordic Forest Research Cooperation Committee) network „Effects of bioenergy production from forests and agriculture on ecosystems services in Nordic and Baltic landscapes". Coordinator in the Institute of Forestry Dr. Kęstutis Armolaitis. 2016–2017.
6. "Perennial ryegrass breeding research in Nordic and Baltic countries". Coordinator in the Institute of Agriculture Dr. Gintaras Brazauskas. 2014–2018.
7. "EUFORGEN – The European forest genetic resources programme – V". Coordinator in the Institute of Forestry Dr. Virgilijus Baliuckas. From 2010.
8. SNS (the Nordic Forest Research Cooperation Committee) project "Northern European database of long-term forest experiments". Coordinator in the Institute of Forestry Dr. Marius Aleinikovas. From 2008.
9. "Winter wheat breeding, variety testing and marketing in Estonia". Project leader Assoc. Prof. Dr. Vytautas Ruzgas. Since 2000.

10. "European plant genetic resources conservation programme". Coordinator in the Institute of Agriculture Assoc. Prof. Dr. Vytautas Ruzgas. From 1998.
11. "Research on winter wheat winter hardiness and diseases". Coordinator in the Institute of Agriculture Assoc. Prof. Dr. Vytautas Ruzgas. Since 1994.
12. "Research on facultative and winter wheat". Coordinator in the Institute of Agriculture Assoc. Prof. Dr. Vytautas Ruzgas. Since 1993.

COST Programme

1. FP1406 "Pine pitch canker – strategies for management of *Gibberella Circinata* in greenhouses and forests". Coordinator of Action in the Vokė Branch Dr. Audrius Kačergius. 2015–2019.
2. FA1306 "The quest for tolerant varieties – phenotyping at plant and cellular level". Coordinator of Action in the Institute of Horticulture Dr. Rytis Rugienius. 2014–2018.
3. FP1303 "Performance of biobased building materials". Coordinator of Action in the Institute of Forestry Dr. Mindaugas Škėma. 2013–2017.
4. FP1301 "Innovative management and multifunctional utilization of traditional coppice forests – an answer to future ecological, economic and social challenges in the European forestry sector" (EuroCoppice). Coordinator of Action in the Institute of Forestry Dr. Marius Aleinikovas. 2013–2017.
5. FP1203 "European non-wood forest products network" (NWFPs). Coordinator of Action in the Institute of Forestry Dr. Olgirda Belova. 2012–2017.

10.2. Main scientific papers

Articles in journals indexed in *Clarivate Analytics Web of Science database*

1. Abdullah S., Sehgal S. K., Ali S., **Liatukas Z**., Ittu M., Kaur N. 2017. Characterization of *Pyrenophora triticirepentis* (tan spot of wheat) races in Baltic States and Romania. The Plant Pathology Journal, 32 (2): 133–139.
2. Adamson K., Mullett M. S., Solheim H., Barnes I., Müller M. M., Hantula J., Vuorinen M., **Kačergius A**., Markovskaja S., Musolin D. L., Davydenko K., Keča N., Ligi K., Priedite R. D., Millberg H., Drenkhan R. 2017. Looking for relationship between the populations of *Dothistroma septosporum* in northern Europe and Asia. Fungal Genetic and Biology, 110: 15–25.
3. **Aleinikovienė J., Armolaitis K., Česnulevičienė R., Žėkaitė V.,** Muraškienė M. 2017. The status of soil organic matter decomposing microbiota in afforested and abandoned arable *Arenosols*. Zemdirbyste-Agriculture, 104 (3): 195–202.
4. **Asakavičiūtė R., Bražinskienė V.,** Ivanauskas L., **Ražukas A.** 2017. Effects of organical and conventional growing on the content of biologically active compounds of potatoes. Acta Alimentaria, 46 (2): 223–230.
5. **Araminienė V., Varnagirytė-Kabašinskienė I., Stakėnas V**. 2017. Response of artificially defoliated Betula pendula seedlings to additional soil nutrient supply. iForest – Biogeosciences and Forestry, 10: 281–287.
6. Balciūnaite G., Dam S., Pesliakas H., Zvirblis G., Mistiniene E., Ragazinskiene O., Pampariene I., Zymantiene J., **Baniulis D.**, Savickiene N. 2017. Investigation of echinacea purpurea root proteins with hemagglutinating activity. Natural Products Communications, 12 (6): 947–950.
7. Bednarska I., **Brazauskas G.** 2017. *Festuca galiciensis*, a new species of the *F. valesiaca* group (Poaceae) from Ukraine. Phytotaxa, 306 (1): 21–36.
8. Bednarska I., Kostikov I., Tarieiev A., **Stukonis V.** 2017**.** Morphological, karyological and molecular characteristics of *Festuca Arietina* Klok.– a neglected *Psammophilous* species of the *Festuca Valesiaca* Agg. from Eastern Europe. Acta Biologica Cracoviensia series Botanica, 59 (1): 83–101.
9. **Belova O., Šežikas K.** 2017. Dynamics and sustainable use of moose (*Alces alces* L.) population. Baltic Forestry, 23 (3): 711–723.
10. Borutinskaitė V., Treigytė G., Matuzevičius D., Zaikova I., **Čeksterytė V.,** Navakauskas D., Kurtinaitienė B., Navakauskienė R. 2017. Proteomic analysis of pollen and blossom honey from rape seed Brassica *Napus* L. Journal of Apicultural Science, 61 (1): 69–88.
11. **Bražinskienė V., Asakavičiūtė R., Ražukas A.,** Ivanauskas L. 2017. Quantification of biologically active compounds in the tubers of potato varieties of different maturity. Zemdirbyste-Agriculture, 104 (1): 41–46.

12. Brophy C., Finn J. A., Lüscher A., Suter M., Kirwan L., Sebastià M-T., Helgadóttir A., Baadshaug O. H., Bélanger G., Black A., Collins R. P., Čop J., Dalmannsdottir S., DelgadoI., Elgersma A., Fothergill M., Frankow-Lindberg B. E., Ghesquiere A., Golinska B., Golinski P., Grieu P., Gustavsson A-M., Höglind M., Huguenin-Elie O., Jørgensen M., **Kadziuliene Z.,** Kurki P., Llurba R., Lunnan T., Porqueddu C., Thumm U., Connolly J. 2017. Major shifts in species' relative abundance in grassland mixtures alongside positive effects of species diversity in yield: a continental-scale experiment. Journal of Ecology, 105 (5): 1210–1222.

13. **Butkutė B.,** Benetis R., Padarauskas A., **Cesevičienė J.,** Dagilytė A., Taujenis L., Rodovičius H., **Lemežienė N.** 2017. Young herbaceous legumes – a natural reserve of bioactive compounds and antioxidants for healthy food and supplements. Journal of Applied Botany and Food Quality, 90: 346–353.

14. **Butkutė B.,** Padarauskas A., **Cesevičienė J.,** Pavilonis A., Taujenis L., **Lemežienė N.** 2017. Perennial legumes as a source of ingredients for healthy food: proximate, mineral and phytoestrogen composition and antibacterial activity. Journal of Food Science and Technology, 54 (9): 2661–2669.

15. Connolly J., Sebastià M.-T., Kirwan L., Finn J. A., Llurba R., Suter M., Collins R. P., Porqueddu C., Helgadóttir A., Baadshaug O. H., Bélanger G., Black A., Brophy C., Čop J., Dalmannsdottir S., Delgado I., Elgersma A., Fothergill M., Frankow-Lindberg B. E., Ghesquiere A., Golinski P., Grieu P., Gustavsson A.M., Höglind M., Huguenin-Elie O., Jørgensen M., **Kadziuliene Z.,** Lunnan T., Nykanen-Kurki P., Ribas A., Taube F., Thumm U., De Vliegher A., Lüscher A., 2017. Weed suppression greatly increased by plant diversity in intensively managed grasslands: a continental-scale experiment. Journal of Applied Ecology, *In Press*.

16. **Čiuldienė D.,** Aleinikovienė J., **Muraškienė M.,** Marozas V., **Armolaitis K**. 2017. Release and retention patterns of organic compounds and nutrients after the cold period in foliar litterfall of pure European larch, common beech and red oak plantations in Lithuania. Eurasian Soil Science, 50 (1): 49–56.

17. **Dabkevičienė G., Kemešytė V., Statkevičiūtė G., Lemežienė N., Brazauskas G.** 2017. Autopolyploids in fodder grass breeding: induction and field performance. Spanish Journal of Agricultural Research, 15 (4): e0706.

18. Danilcenko H., Jariene E., **Slepetiene A.,** Sawicka B., Zaldariene S. 2017. The distribution of bioactive compounds in the tubers of organically grown jerusalem artichoke (*Helianthus tuberosus* l.) during te growing period. Acta Sci. Pol. Hortorum Cultus, 16 (3): 97–107.

19. Dróżdż P., **Šėžienė V.**, Pyrzynska K. 2017. Phytochemical properties and antioxidant activities of extracts from wild blueberries and lingonberries. Plant Foods for Human Nutrition, 72 (4): 360–364.

20. Follo G., Lidestav G., Lugvig A., Vilkriste L., Hujala T., Karppinen H., Didolot F., **Mizaraite D.** 2017. Gender in european forest ownership and management – reflections on women as "new forest owners". Scandinavian Journal of Forest Research, 32 (2): 174–184.

21. **Gorash A., Armonienė R., Liatukas Ž., Brazauskas G.** 2017. The relationship among freezing tolerance, vernalization requirement, Ppd alleles and winter hardiness in European wheat cultivars. The Journal of Agricultural Science, 155 (9): 1353–1370.

22. **Gorash A., Armonienė R.,** Mitchell J., **Liatukas Ž., Danytė V.** 2017. Aspects in oat breeding: nutrition quality, nakedness and disease resistance, challenges and perspectives. Annals of Applied Biology, 171 (3): 281–302.

23. Gruznova K. A., Bashmakov D. I., **Brazaitytė A., Duchovskis P.,** Lukatkin A. S. 2017. Efficiency index as the integral indicator of *Triticum aestivum* response to growth regulators. Zemdirbyste-Agriculture, 104 (4): 299–304.

24. **Haimi P., Vinskiene J., Stepulaitiene I., Baniulis D., Staniene G., Šikšnianienė J. B., Rugienius R.** 2017. Patterns of low temperature—Induced accumulation of dehydrins in *Rosaceae* crops–Evidence for post-translational modification in apple. Journal of Plant Physiology, 218: 175–181.

25. **Jurkšienė G., Janušauskaitė D., Armolaitis K., Baliuckas V.** 2017. Leaf litterfall decomposition of pedunculate (*Quercus robur* L.) and sessile (Q. *petraea* [Matt.] Liebl.) oaks and their hybrids and its impact on soil microbiota. Dendrobiology, 78:51–62.

26. Juknys R., Velička R., Kanapickas A., Kriaučiūnienė Z., **Masilionytė L.,** Vagusevičienė I., Pupalienė R., Klepeckas M., Sujetovienė G. 2017. Projecting the impact of climate change on phenology of winter wheat in northern Lithuania. International Journal of Biometeorology, 61 (10): 1765–1775.

27. **Janušauskaitė D., Feizienė D., Feiza V.** 2017. Relationship between spring triticale physiological traits and productivity changes as affected by different N rates. Acta Agriculturae Scandinavica, Section B – Soil & Plant Science, 67 (6): 534–541.

28. **Janusauskaite D., Feiziene D., Feiza V**. 2017. Nitrogen-induced variations in leaf gas exchange of spring triticale under field conditions. Acta Physiologiae Plantarum, 39: 193.

29. Jasinevičius G., Lindner M., Verkerk P. J., **Aleinikovas M**. 2017. Assessing impacts of wood utilisation scenarios for a Lithuanian bioeconomy: impacts on carbon in forests and harvested wood products and on the socio-economic performance of the forest-based sctor. Forests, 8 (4): 133.

30. **Jasinskas A., Šiaudinis G., Martinkus M., Karčauskienė D., Repšienė R., Pedišius N, Vonžodas T.** 2017. Evaluation of common osier (*Salix viminalis* L.) and black poplar (*Populus nigra* L.) biomass productivity and determination of chemical and energetic properties of chopped plants produced for biofuel. Baltic Forestry, 23 (3): 666–672.

31. Kacienė G., Dikšaitytė A., Januškaitienė I., Miškelytė D., Žaltauskaitė J., Sujetovienė G., **Sakalauskienė S., Miliauskienė J.,** Juozapaitienė G., Juknys R. 2017. Different crop and weed performance under single and combined effects of elevated CO_2 and temperature. Crop Science, 57 (2): 935–944.

32. **Kadžiulienė Ž., Tilvikienė V., Liaudanskienė I., Pocienė L.,** Černiauskienė Ž., Zvicevičius E., Raila A. 2017. *Artemisia dubia* growth, yield and biomass characteristics for combustion. Zemdirbyste-Agriculture, 104 (2): 99–106.

33. **Kemesyte V., Statkeviciute G., Brazauskas G.** 2017. Perennial ryegrass yield performance under abiotic stress. Crop Science, 57 (4): 1935–1940.

34. Klupsaite D., Juodeikiene G., Zadeikaite D., Bartkiene E., **Maknickiene Z**., Liutkute G. 2017. The influence of lactic acid fermentation on functional properties of narrow-leaved lupine protein as functional additive for higher value wheat bread. LWT – Food Science and Technology, 75: 180–186.

35. Kolosej R., Jonuškienė I., Venskutonis P., Kazernavičiūtė R., **Brazienė Z.,** Jakienė E., Kvederavičiūtė K., Kanopka A., Vilys L., Mickevičius V. 2017. The influence of β-alanine derivative products on spring oilseed rape yield and oil quality. Zemdirbyste-Agriculture, 104 (2): 139–146.

36. **Konstantinavičienė J., Škėma M., Stakėnas V., Aleinikovas M., Šilinskas B., Varnagirytė-Kabašinskienė I.** 2017. Above-ground biomass of willow energy plantations in Lithuania: pilot study. Baltic Forestry, 23 (3): 658–665.

37. **Kviklys D., Lanauskas J., Uselis N., Viškelis J., Viškelienė A., Buskienė L., Staugaitis G., Mažeika R., Samuolienė G.** 2017. Rootstock vigour and leaf colour affects apple tree nutrition. Zemdirbyste-Agriculture, 104 (2): 185–190.

38. **Lanauskas J., Kviklys D., Liaudanskas M.,** Janulis V., Uselis N., **Viškelis J., Viškelis P.** 2017. Lower nitrogen nutrition determines higher phenolic content of organic apples. Horticultural Science, 44 (3): 113–119.

39. Liaudanskas M., Zymonė K., **Viškelis J.,** Klevinskas A., Janulis V. 2017. Determination of the phenolic composition and antioxidant activity of pear extracts. Journal of Chemistry, 2017: 1–9.

40. Lygis V., Prospero S., Burokiene D., Schoebel C. N., **Marciulyniene D**., Norkute G., Rigling D. 2017. Virulence of the invasive ash pathogen *Hymenoscyphus fraxineus* in old and recently established populations. Plant Pathology, 66 (5): 783–791.

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42. Lõhmus A., Leivits M., Pēterhofs E., **Zizas R.,** Hofmanis H., Ojaste I., Kurlavičius P. 2017. The Capercaillie (*Tetrao urogallus*): an iconic focal species for knowledge-based integrative management and conservation of Baltic forests. Biodiversity and Conservation, 269 (1): 1–21.

43. **Marciulyniene D.,** Davydenko K., Stenlid J., Cleary M. 2017. Can pruning help maintain vitality of ash trees affected by ash dieback in urban landscapes? Urban Forestry & Urban Greening, 27: 69–75.

44. **Marčiulynienė D.,** Davydenko K., Stenlid J., Shabunin D., Cleary M. 2017. *Fraxinus excelsior* seed is not a probable introduction pathway for *Hymenoscyphus fraxineus*. Forest Pathology, *In Press*.

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47. **Mazeikiene I., Bendokas V., Baniulis D., Staniene G., Juskyte D. A., Sasnauskas A., Stanys V., Siksnianas T.** 2017. Genetic background of resistance to gall mite in Ribes species. Agricultural and Food Science, 26 (2): 111–117.

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