RESEARCH INSTITUTIONS

supported by
the Ministry of Agriculture of the Czech Republic

MINISTRY OF AGRICULTURE
OF THE CZECH REPUBLIC

RESEARCH INSTITUTIONS

supported by
the Ministry of Agriculture
of the Czech Republic

This publication presents the research organisations within the competence of the Ministry of Agriculture of the Czech Republic (hereafter also as Ministry of Agriculture or MoA), which have the status of a research organisation according to the Framework for State aid for research and development and innovation (2014/C 198/01) on the basis of Commission Regulation (EU) No. 651/2014. These are 9 research organisations established by the Ministry of Agriculture and 11 private research organisations.

Content

ZVT | Agricultural Research, Ltd. Troubsko

Agricultural Research, Ltd.
(Zemědělský výzkum, spol. s r. o.)

Zahradní 1, 664 41 Troubsko
Telephone: +420 547 138 811
E-mail: vupt@vupt.cz
Website: http://www.vupt.cz

Agricultural Research, Ltd. is a research and development subsidiary of the Research Institute for Fodder Crops, Ltd. Troubsko. The company's main activities include applied research in agricultural and environmental areas, a breeding programme, advisory and sales activities. It is currently conducting a number of research projects on national and international levels. The company has created and owns the rights to several field crop cultivars and has published a wide range of certified methodologies. The collective of authors publishes books, and the company organises national and international conferences. The organisation holds an ISO 9001:2009 certificate for Quality Management and a 14001:2005 certificate for Environmental Management.

Keywords:
applied research, agriculture, environment, fodder crops, genetic resources, genetics, plant protection, agronomy

Main Activities

The main activity of the Department of Genetic Resources is the "National programme of the plant gene pool preservation and utilisation", which involves creating a national collection of species of the *Fabaceae* family (*Medicago* spp., *Trifolium pratense*, *T. repens*, *Trifolium* spp., among others), *Carthamus tinctorius*, *Phacelia tanacetifolia*, *Phalaris canariensis*, and other wild-growing plant species. Other important activities are pre-breeding and the use of non-traditional fodder species in agriculture and landscaping (*Phacelia tanacetifolia*, *Phacelia congesta*, *Trifolium alexandrinum*, *Phalaris canariensis*, *Onobrychis viciifolia*, *Anthyllis vulneraria*, *Lotus corniculatus*, *L. ornithopodioides*, *Secale cereale var. multicaule*, *Phaseolus vulgaris*, *Lathyrus sativus*, *Lablab purpureus*, *Salvia* spp.). A significant part of activities is related to bumblebee research and methods of their laboratory rearing. A project oriented towards minor crops and organic farming comprises the study of methods and crop management practices for increasing seed yields of selected grasses, legumes and catch crop species and for boosting quality in organic agriculture. Other projects are focused on biogenic amines and their influence on silage quality, composition of different mixtures for vineyards and the cultivation of maize in mixed culture together with legumes.

The Department of Plant Physiology and Genetics pursues several interconnected and complementary activities. A major part of the activities is constituted by the selection of perspective breeding materials, breeding of new cultivars and preliminary production of their seed. The company currently co-owns 25 cultivars and has applied for legal protection of a group of other new varieties. These

activities appropriately complement gas chromatography analysis, which is directed at the analysis of fatty acids, determining acaricide residues, and establishing nitrogenase activity. The Molecular Biology and Genetics lab is focused on phylogenetic analysis, dealing especially with genetic diversity of fodder species and determining fungal pathogens, with an emphasis on the *Fusarium* genus and determining the species of the *Bombus* genus.

The research activities of the Plant Protection Department address issues related to the protection of important and minority field crops against pests. In particular, this concerns controlling field weeds, insect pests and pathogenic fungi. New advances in the complete integrated plant protection system are being found. The Department's laboratory activities are focused on virology (diagnostics of viral pathogens in plant materials, especially using ELISA methodology in relation to Wheat Dwarf Virus and Barley Yellow Dwarf Virus), mycology and mycotoxicology, with an emphasis on selected mycotoxins in agricultural products. While building upon new knowledge, the objective is to provide the most modern, comprehensive means of protection for the control of pests regularly encountered in agricultural practice. It provides advisory services to agricultural practitioners with the aims of introducing the newest trends in plant protection and applying integrated plant protection in practice.

The core activity of the Agronomy Department is the monitoring of anthropogenic impacts on the soil environment with regard to tillage, fertilisation, growing agronomic crops and maintaining crop rotation. It deals in detail with evaluating the physical, chemical and biological properties of soil related to preserving its fertility. Recently, its main domain has been the study of protection of the soil environment against water erosion. Efforts are therefore devoted to using catch crops produced in the parent organisation by the cultivation of "high-risk" row crops. It also uses non-traditional crops for decontamination of soil polluted with oil substances, known as phytoremediation. It performs testing of maize hybrids for grain and silage, as well as custom soil sampling and testing for various firms, especially concerning the physical and chemical properties of soil. In the fodder area, it tests new fodder crop cultivars and performs evaluations through the growing season, evaluates fodder yields, quality and silage properties, tests various technologies for growing fodder crops, undertakes special orders from customers and provides cultivar testing.

Professional Cooperation

The institute also has a long tradition of bilateral and multilateral cooperation with many countries, recently including bilateral projects with Slovakia, Slovenia, Hungary, Serbia, Montenegro, Argentina, China, Bulgaria, France. A research team was active in the international Eureka project: Sustainable and innovative use of waste from grape and fruit processing (WINEREST, LF 12006). The HORIZON 2020 project: Breeding forage and grain legumes to increase EU's and China's protein self-sufficiency (EUCLEG, project No. 727312), with coordination by the French Institut National de la Recherche Agronomique (INRA), is a new project for the institute.

Important Research Results

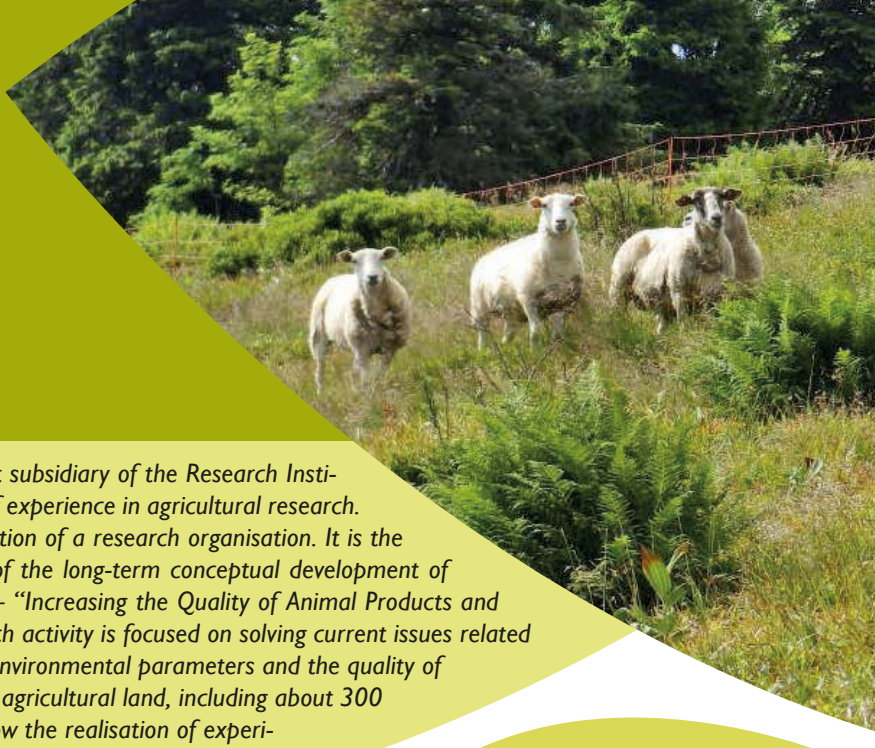
- Pelikán J., Knotová D., Hofbauer J. (2016): Less known species of agricultural crops. 272 pp, ISBN 978-80-88000-06-8 – book
  This book introduces 97 less known or even unknown plant species, potentially utilisable both in large-scale and small-scale agricultural production. The text is supplemented by photographic documentation of seeds, plants and fruit. The book was awarded the "Golden Spike" at the 43rd annual "Země živitelka" exhibition in České Budějovice.
- Badalíková B., Novotná J., Pospíšilová L. (2016): Effect of incorporation of organic matter on soil properties and reduction of water erosion. 41 s. ISBN 978-80-88000-10-5 – Certified methodology 33/16
  The aim of certified methods is to inform specialists and the public about the importance of increasing soil fertility by using compost produced from plants' biomass. Compost can be used to prevent soil erosion as well as during reclamation processes of anthropogenic damaged soils. Compost application is also useful as a substitute when organic matter is lacking in the soil.
- Minority registration of Corum herbicide
  The minority registration of the Corum herbicide in traditional and non-traditional minor clover, against a wide range of monocotyledonous and dicotyledonous weeds is an important supplement to the protection system, with wide application in agricultural practice
- Alfalfa-grass seed mixture – utility model No. 28743
  The Alfalfa-grass mixture fully complies with recent climatic conditions. It is designed to give sufficient forage yields of high quality under dry climatic conditions. The mixture of crops has an improving influence on the soil. The growth leaves a lot of residual biomass – both aboveground and underground. It disturbs compacted soil and increases its water retention ability.
- *Camelina sativa L.* – False flax – ZUZANA variety
  Year of registration: 2013. Annual oil plant of the Brassicas family, suitable for drier conditions. Plants have a short growing season (3 to 3.5 months). Camelina is suitable as a green manure, as an intercrop, as a source of food for pollinators and as an oil-bearing plant with an oil content of 30–40. Seed production was 40 tons, three years after registration. The distribution of seeds is in the Czech Republic and Germany. The variety was awarded the "Golden Spike" at the "Země živitelka" exhibition in České Budějovice.

- Test bed of specific markers in set of clover signs for evaluating hybrid character Trifolium pratense x T. medium for breeders' purposes – PV 2014-719 patent
  In the present invention, 795 novel SNP markers are disclosed and defined, based on proper sequencing of the next generation of two parenteral *T. pratense* genotypes, i.e. Tatra cultivar and *T. medium*, which were the starting material for obtaining the hybrid population. SNP markers are distributed all over the entire clover genome.

AGROVÝZKUM
RAPOTÍN

Agriresearch Rapotin, Ltd.
(Agrovýzkum Rapotín s. r. o.)

Výzkumníků 267, Rapotín, 788 13 Vikýřovice
Telephone: +420 583 392 111
E-mail: vuchs@vuchs.cz
Website: http://www.vuchs.cz



Agriresearch Rapotin Ltd., is a research and development subsidiary of the Research Institute for Cattle Breeding, which has more than 60 years of experience in agricultural research. The company was founded in 2004 and meets the definition of a research organisation. It is the recipient of institutional support within the framework of the long-term conceptual development of the research organisation of the Ministry of Agriculture – "Increasing the Quality of Animal Products and Competitiveness of Cattle and Small Ruminants". Research activity is focused on solving current issues related to nutrition, breeding, reproduction and animal welfare, environmental parameters and the quality of animal and plant production. More than 900 hectares of agricultural land, including about 300 hectares of pastureland for cattle and sheep farming, allow the realisation of experimental activities to a great extent.

Keywords:
Agriresearch, Rapotin, cattle breeding, agricultural research, development, agriculture, animal nutrition, breeding, reproduction, welfare, environment, laboratory, analysis, feed, experiments

Main Activities

At present, 30 employees deal with various national and international projects, focusing on the current issues and requirements of the agricultural sector. Collaboration with universities, research institutions, food producers and farmers is crucial for these R & D activities.

The Research Departments of the company are engaged in basic and experimental research and development. However, with the increasing importance of applied research, the emphasis is on innovative approaches in the following areas:

- cattle breeding (using molecular genetic techniques in breeding, more efficient reproduction techniques);
- improving the quality and use of livestock products (meat, milk);
- analytical assessment of the quality of animal products (chemistry, microbiology, nutritional value, etc.);
- use of feed from permanent grasslands for feed and energy purposes;
- utilisation of biologically transformed organic matter in the soil profile for improvement of physico-chemical and biological soil properties, stability of soil structure, stabilisation of soil organic matter, increase of water retention in soil and increase of yield potential;
- ensuring livestock grazing in protected areas as a measure to increase biodiversity, while minimising the impact of livestock production on the environment (soil erosion).

Professional Cooperation

The company's strategy is based on a long-term conceptual development plan, aimed at enhancing international cooperation with renowned institutions, improving the competitiveness of the workforce and achieving significant employee results that will be applicable in practice.

Foreign partners

- College of Animal Science and Technology, Anhui Agricultural University (Hefei, China)
- The University of Kentucky (Lexington, USA)
- Eastern Regional Research Center (Wyndmoor, USA)
- French National Institute for Agricultural Research (Saint-Gilles, France)
- Bundesanstalt für alpenländische Landwirtschaft Raumberg-Gumpenstein (Irdning, Austria)
- Landeskontrollverband (Halle, Germany)
- Milchprüfring Bayern e.V. (Wolnzach, Germany)
- LfL Institut für Tierernährunag und Futterwirtschft (Grub, Germany)
- Degli studi di Milano University (Milano, Italy)
- RIKILT – Institution of Food Safety (Wageningen, Nederland)
- Norwegian Institute of Bio-economy Research (Ås, Norway)
- Norwegian Institute for Water Research (Oslo, Norway)
- National Research Institute of Animal Production (Krakow, Poland)
- Faculty of Veterinary Medicine (Skopje, Macedonia)
- SE Pieno Tyrimai (Kaunas, Lithuania)
- Dairy FM, a.s. (Žilina, Slovakia)
- Slovak Agricultural Research Centre, (Nitra, Slovakia)
- Slovak University of Agriculture in Nitra, (Nitra, Slovakia)

Partners in the Czech Republic

- Mendel University in Brno
- University of South Bohemia in České Budějovice
- University of Veterinary and Pharmaceutical Sciences Brno
- Masaryk University
- Czech University of Life Sciences Prague
- University of Chemistry and Technology, Prague

Important Research Results

In the last five years, the company has created 255 results in the RIV (National R & D) database of all kinds (publications and applied results). One of the most important is a patented device for continuous measurement of the concentration of ammonium ions in the rumen of ruminants. Other significant results are the utility models of the glycerol-dosing device for feeding water according to animal needs, and the bio-impedance measuring device in raw meat. 12 methodological guides for use in agricultural practice were published, one proven technology and more than 120 scientific papers were implemented. The results of research projects and other technical information are also published in our own scientific journal, Research on Cattle Breeding, founded in 1958.

Agritec Plant Research Ltd.
(Agritec Plant Research s.r.o.)

Zemědělská 2520/16, 787 01 Šumperk
Telephone: +420 583 382 111
E-mail: info@agritec.cz
Website: http://www.agritec.cz

Agritec Plant Research s.r.o. (APR) is a private research organisation located in Šumperk, dealing with applied research in agriculture, especially with growing, breeding, usage and integrated protection of fibre crops, grain legumes and oil plants. APR was established in 2002 as a subsidiary of the parent company, AGRITEC, výzkum, šlechtění a služby, s.r.o. (AGRITEC, Research, Breeding and Services, Ltd.). The history of this company dates back to 1942. Throughout its existence, it has dealt with the research of fibre plants and later also with pulses. APR is a non-profit organisation in accordance with the Community Framework for State Aid focused on research, development and innovation instituted by the European Commission, and, as such, reinvests all funds back into research.

Keywords:
Grain legumes, pea, linseed, hemp, caraway, winter rape, plant biotechnologies, research in agriculture, integrated plant protection

Main Activities

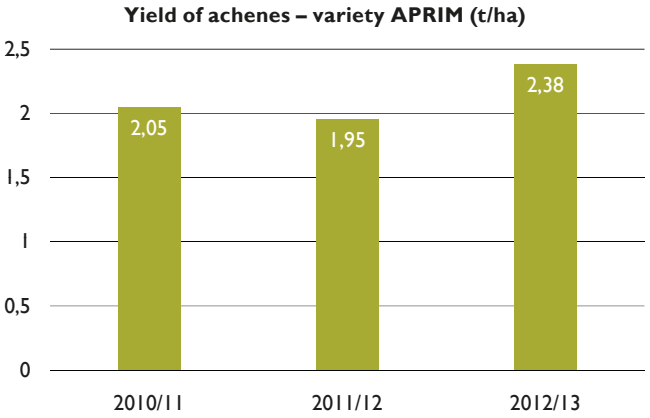
At present, the company is engaged mainly in applied and fundamental research in agriculture, the environment and the food industry. Major activities include research on gene sources of grain legumes and flax, research into genetic breeding and biotechnological methods of flax, grain legumes, winter rape, cannabis and caraway, research in the field of growing technologies and integrated protection of these crops. Another important activity is the breeding of new varieties of pea, oil flax, rape and caraway, and maintenance breeding of own and licensed varieties. The company is engaged in research into the use of linseed for nutrition, the use of short fibre from oil flax as an industrial raw material. Other activities include the production of grain legume and flax seed.

Research

- Growing technologies including integrated protection of peas, beans, lupins, caraway, flax and hemp plant
- Germplasm resources of grain legumes, flax/linseed and hemp plant
- Genetic and breeding methods and biotechnology of grain legumes, flax, caraway and winter rape

Plant Breeding and Seed Production

- Breeding of flax/linseed, caraway, pea, horse bean and winter rape
- Maintenance breeding of own and licenced varieties
- Representation of foreign companies for variety testing
- Production, adjustment, storage and sale of seeds of grain legumes and technical crops

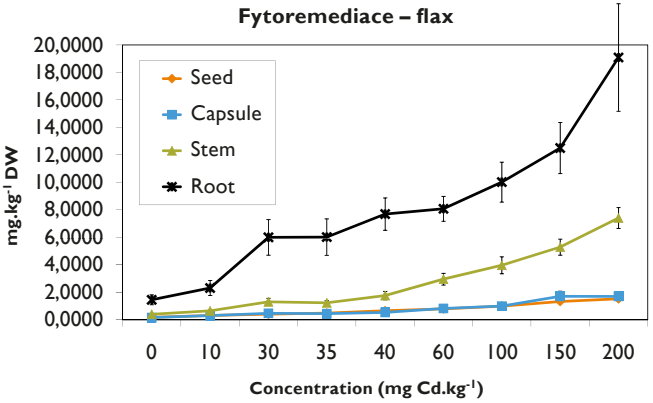


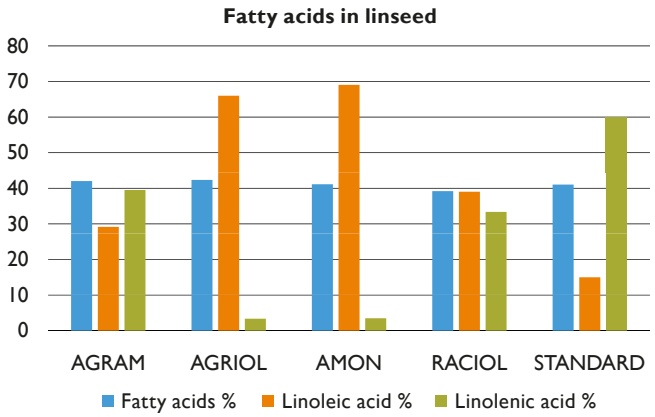
Services

- Testing of plant protection products in the GEP system for registration in the EU
- Running of an accredited "Entrepreneurial and Innovation Park" with the lease of offices and office space
- Testing and chemical analyses of inorganic and organic compounds, analyses of mycotoxins
- Scutching flax processing and analysis of fibre content and quality
- Meristem multiplication of plants

Consultancy

- Use of research results in agricultural practice and in the processing of plant products
- Lectures and expert activities in the field of agriculture
- Technological and economic counselling for growers, agricultural practice





Professional Cooperation

- FAO (Flax and Other Bast Plants Network)
- AEP (European Association for Grain Legume Research)
- IPGRI (International Plant Genetic Resources Institute)
- INFMP (Institute of Natural Fibres and Medicinal Plants)
- and various crop research institutes in the Czech Republic and abroad

International cooperation is partly tied to AGRITEC, Research, Breeding and Services, Ltd., which is required as a small medium-sized enterprise in foreign projects.

Important Research Results

- 2016 – Variety registration: linseed (*Linum usitatissimum* L.) – AGRIOL
- 2015 – POLYMIX, 2014 CLONOPLUS – Biological preparations for reducing pathogens of utility plants
- 2014 – The variety of "APRIM" winter caraway (Grand Prix Techagro 2014). APRIM is the first Czech variety of winter caraway. This variety is resistant to winter killing. Due to the shorter growing period, Acceria carvi attack is rare
- 2012 – 2017 Specialised maps with professional content – Sensitivity of Melligethes a. to insecticides
- 2011 – RACIOL linseed variety – a new fatty acid composition
- 2007 – Variety registration: linseed (*Linum usitatissimum* L.) cv. AMON

Agrotest Fyto, Ltd.
(Agrotest fyto, s. r. o.)

Havlíčkova 2787, 767 01 Kroměříž
Telephone: +420 573 317 109, +420 573 317 111
E-mail: vukrom@vukrom.cz
Website: http://www.vukrom.cz

Agrotest Fyto, Ltd. is a "Research and Knowledge-Dissemination Organisation" according to EC regulation (No. 651/2014). It deals with applied research and development projects in the field of crop production, and operates an accredited testing laboratory (accredited according to ČSN EN ISO / IEC 17025: 2005) for the analysis of cereals, and other field crops, feed, soil and related products. Its research activities are complemented by the provision of specialised services, consulting and advisory services. The company is authorised to conduct basic courses for the management of plant protection products pursuant to Act No. 326/2004 Coll.

Agrotest Fyto, Ltd. is a member of the Association of Research Organisations, a founding member of the Czech Technology Platform of Plant Biotechnology "Plants for the Future" and the Czech Technology Platform for Agriculture.

Keywords:
Crop management practices, monitoring, long-term experiments, breeding cereals, genetics, cereals, genetics resources, resistance to diseases, molecular methods, quality of cereals, cereal diseases, plant protection, laboratory analysis, cereals for healthy nutrition, coloured wheat, spring barley, oats, rye, triticale, soil, mycotoxins

Main Activities

Main Scientific and research activities:

- Crop management practices, study of the structure of field crops, methods of cereal cultivation
- Study of crop diseases, and creation of complex systems of plant protection, study of the resistance of pathogenic organisms to pesticides
- Monitoring changes in soil properties and their impact on the production potential of the stand
- Research on methods of genetics and breeding of cereals, study and creation of new genetic resources
- Quality and health safety of agricultural products and inputs

End users – Agricultural, purchasing and processing enterprises, breeders, breeding and professional associations and state administration are the main end users of the research results. Our company organises lectures, courses and conferences for specialists, with the participation

of consultants, as well as scientific and research staff. Researchers of Agrotest Fyto, Ltd. participate as lecturers in a number of similar professional activities organised by other companies. The annual "Cereal Quality" conference is organised to evaluate the quality of the current harvest of cereal crops.

Professional Cooperation

International Cooperation in Research
On January 1st 2017, framework research cooperation agreements were concluded with research partners in Estonia, Russia, Hungary, Germany, Lithuania, France and Slovenia.

Informal international collaboration – is based on personal contacts between researchers (e.g. Australia, China, France, Japan, Slovakia, USA) and is often complemented by joint publications in prestigious international journals.

Membership of EU Programme Management Committee
Representatives for the Czech Republic on the Management Committee of the international project: COST-FA1208 Pathogen – informed strategies for sustainable broad-spectrum crop resistance.

Cooperation on R & D projects (2013–2017)
- Czech University of Life Sciences Prague
- Mendel University in Brno
- Palacký University Olomouc
- University of Chemistry and Technology, Prague
- Centre for Global Change Research AV CR
- Institute of Experimental Botany AS CR
- Institute of Global Change Research AS CR
- Food Research Institute Prague
- Crop Research Institute
- Research Institute of Agricultural Engineering
- Agricultural Research, Ltd.
- Agritec Plant Research Ltd.
- Agriresearch Rapotín, Ltd.
- OSEVA PRO Ltd., Branch Research Institute of Oilseeds Opava
- OSEVA Development and Research Ltd.
- SELTON Research Centre, Ltd.

Collaboration on an informal basis takes place with a number of other research organisations, universities and companies.

Important Research Results

Authorship or co-authorship of papers in prestigious international scientific journals indexed in the Web of Science database (2013–2017)
- Annals of Applied Biology (2014)
- Crop & Pasture Science (2017)
- European Journal of Plant Pathology (2013, 2014, 2017)
- Food Additives and Contaminants (2014)
- Frontiers in Plant Science (2017)
- Fungal Biology (2014)
- Journal of Agricultural Science (2016)
- Journal of Cereal Science (2013, 2016, 2017)
- Phytopathology (2015)
- Plos One (2016)
- Starch / Stärke (2016)
- Theoretical and Applied Genetics (2015)

Hull-less barley varieties for healthy nutrition
In 2014, the AF Cesar barley variety was successfully completed. It is the first high-fibre, gluten-free barley variety grown in the Czech Republic that is specifically designed for use in food production for healthy human nutrition and the prevention of diseases of civilisation. The AF Cesar variety, with genetically determined higher beta-glucan content, non-starch polysaccharides with health and preventive effect in human nutrition, has become the basic raw material of the "Antique" baking mix developed by IREKS ENZYMA, one of the cooperating companies. "Antique"

bread won the prestigious "Prize of the Czech Food Chamber for the Best Innovative Food Product" in the 2016 competition. Among bakery products, this bread is unique, with a demonstrably higher beta-glucan content complying with EU Regulation 432/2012, which requires that a food that can be recommended to maintain normal blood cholesterol levels contains more than 1 g of beta-glucan in a quantified portion.

Wheat varieties with unusual grain colour
Colourants in wheat seed – anthocyanins and xanthophylls – are not only the cause of the unusual wheat grain colour, but mainly have antioxidant effects, i.e. they have the ability to reduce the presence of free radicals in consumer bodies and open up entirely new possibilities for the use of cereals in human nutrition. Agrotest Fyto, Ltd. was involved in the cultivation of PS Karkulka, a winter wheat with a purple grain colour caused by anthocyanins stored in the uppermost grain layer – the pericarp. Since anthocyanins are minimally scattered in flour, it is preferable for food products to use whole wheat flour from this wheat. Another variety of winter wheat with an unconventional colour, with the cooperation of Agrotest Fyto, Ltd., is the Skorpion winter wheat variety, whose grain is characterised by a blue colouring.

Barley lines resistant to barley powdery mildew
Spring barley lines with complete resistance to powdery mildew were created by multiple crossing of wild barleys that contained new genes providing complete resistance to powdery mildew, with selected cultural spring varieties of barley. Line selection was focused not only on resistance to the disease but also on the morphotype, grain yield and some parameters of the malting quality of the grain, and was performed in the plant populations after each crossing. Selected lines bearing new resistant genes were passed to all workplaces that are involved in the breeding of spring barley in the Czech Republic and also to the National Gene Bank of Barley.

Authorship or co-authorship on utility models, prototypes, functional samples and certified methodologies (2013–2017) are other major achievements, e.g.:

Prototypes:
- Online sensor for simultaneous measurement of nutritional status and canopy density (2015)
- The tool for measuring of cereal stem resistance against artificially induced pressure (2015)
- Mobile instrument for simultaneous measurement of stand nutrient status and density (2013)

Utility models:
- Bread mixture for making multigrain bread (2013)
- Mill cereal mixture for making bakery products and biscuits (2013)

Methodologies:
- The impact of soil tillage technologies and other agronomic measures in cereal growing (2015)
- Use of measuring spectral reflectance and derived vegetation indices in crop management practices of spring barley (2014)

Crop Research Institute
(Výzkumný ústav rostlinné výroby, v. v. i.)

Drnovská 507/73, 161 06 Praha 6 – Ruzyně
Telephone: +420 233 022 480, +420 233 022 111
E-mail: cropscience@vurv.cz
Website: http://www.vurv.cz

The Crop Research Institute (CRI) conducts research in the areas of agricultural and environmental sciences, leading to developing sustainable systems and technologies of crop production, in order to improve plant production potential, and to enhance the quality of food-, feed- and crop-based raw materials in a changing climate.

The Institute carries out a wide range of agricultural research activities, covering various different types of crops and research topics in the area of crop production systems in the soils and climatic conditions of Central Europe. CRI's primary research areas include: crop production, agro-ecology, genetics and breeding, plant nutrition, crop protection and plant health, plant physiology, cryobiology, weed science, farming systems, soil science, plant biotechnology, molecular biology, food quality and others.

Keywords:
crop production, genetics, plant breeding, plant nutrition, plant health, molecular biology, biotechnology, food and feed safety, biowastes and biomass, sustainable agriculture, biodiversity

Main Activities

The Institute conducts basic and applied research, ranging from traditional studies of crop production, genetics, plant breeding, plant nutrition, plant health and the safe storage of agricultural products, to the fast-developing fields of molecular biology, biotechnology, food and feed safety and the use of biowastes and biomass energy production. Moving to the forefront of CRI research are the issues of sustainable agricultural production and organic farming, with the aim of maintaining high soil fertility, supporting natural processes and biodiversity, reducing water pollution and minimising the overall negative impacts of agricultural production on the environment and human health.

The main research and development objectives comprise three basic areas. Sustainable arable land management and cropping systems represents the optimisation of farming systems and technologies for crop production in terms of their long-term sustainability, leading to maintenance of soil fertility and the quality of arable land and improvement of plant nutrition and the prevention of adverse effects of farming on soil and the environment. Genetics, plant breeding and quality of plant products focuses on studying the genetic properties of economically important traits, selecting, creating and conserving genotypes with desired

properties and characteristics and using them to improve the production potential and value of agricultural crops. Environmentally balanced systems of crop protection and plant health requires advanced knowledge of the interaction among plants, pathogenic microorganisms and pests in agro--ecosystems for the development of sustainable systems of protection of cultivated plants to ensure the stability of their production potential and the safety of plant products.

The Institute runs long-term experiments to study long--term changes in soil fertility and soil properties, examining the effects of inorganic and organic fertilisers and crop rotation on the nutrition and yield of a number of crops, and the changes in weed species and soil fertility. The Institute coordinates two national programmes on the conservation of genetic resources: the National Programme on Conservation and Utilisation of Plant Genetic Resources and Agro--biodiversity and the National Programme on Conservation and Utilisation of Genetic Resources of Microorganisms and Small Animals with Economic Importance.

Emphasis has been placed on the transfer of research results to practical farming through advice and consultancy, the organisation of 'theme' days and seminars for farmers and agricultural advisers and the publication of technical guidelines. The Institute is directly involved in the implementation of new processes, plant protection products, plant varieties and technologies in agricultural practice. Our research results are also fed into the legislation and used in national policy development.

Professional Cooperation

The Institute cooperates with leading international research institutions and universities, international companies and professional organisations. The Institute participates in many EU projects, in particular the COST and KONTAKT projects. Collaboration under the Cross--border Cooperation Operational Programme takes place mainly with German partners. The Institute coordinates projects under the 7th Framework Programme and is also a successful member of project consortia under this programme. Cooperation with European non-EU countries takes place through bilateral projects e.g. SCOPES (Scientific Cooperation between Eastern Europe and Switzerland) and the Czech-Norwegian Research Programme (Norway grants). The MOBILITY programme enables bilateral agreements on cooperation in research and development between the Czech Republic and other countries. Under this programme, our Institute collaborates mainly with partners from Austria, Switzerland, Finland and Argentina. Recently, collaboration has successfully started on projects under the INTER-EXCELLENCE and HORIZON 2020 programmes.

Extensive international cooperation is also carried out as part of the intensive long-term cooperation in the area of research, exchange of biological material and training and internship of researchers. Among the traditional partners of the Institute are food and agricultural research institutes from most European countries and institutes from China, the United States, India, Israel and others. The Institute works closely with many professional networks and international food and agricultural organisations, such as the European Food Safety Authority (EFSA), the European Network of GMO Laboratories (ENGL) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

Important Research Results

In recent years, the Institute has produced a number of excellent results, with a growing citation index published in prestigious scientific journals, e.g. the identification of proteins revealing significant differences in their relative abundance, and post-translational modifications between wheat, barley and related species' genotypes under stress conditions and their potential role underlying the differential stress response. Valuable results were published on a series of methods and procedures for the identification and processing of Czech garlic. Another significant publication on the testing and assessment of the efficacy of aromatic compounds and their mutual binary combinations for acute toxicity against the larvae Spodoptera littoralis and Culex quinquefasciatus, provided important results on the synergistic and antagonistic effects of these compounds. Whereas thymol and p-cymene were selected as the most effective against C. quinquefasciatus and L-carvone, gallic acid created an antagonistic effect with the highest frequency.

Original technical solutions include new fertilisers and new or improved technologies and equipment, such as liquid leaf fertiliser especially intended for grapevine, oilseed and cereal nutrition as well as for plants grown in organic farming systems, and dimensionally stable compounds for healthy growth and protection of plants against pests and for nutrition of plants and support of the flowering of ornamental plants. New technology of controlled atmosphere for the protection of stored agricultural products and a device for simulation of hydrothermal-catalytic processing of biomass and biowastes under laboratory conditions are other examples of practical outputs. The system of application of new soil conservation technologies in potato growing with stone windrowing, based on using original machines and technological processes, improves rainwater infiltration into the soil, reduces water erosion risk, increases nutrient use from applied fertilisers and stabilises yields and production quality. The new technological process for establishing growth of agricultural crops is based on a parallel sowing of two different compensation varieties, two different seeding rates and seeding depth, by even and odd seeding shoots during stand establishment of agricultural crops.

Software as an expert system for decision making on the control of field crops against pests, based on analysis of economic parameters and evaluation of the impact of pesticides on the environment, enables the determination of the economic threshold, balance of costs and profits and the forecast of losses on yields for 77 important field crop pests and diseases. Other software was developed for the prediction of the occurrence of Wheat Dwarf Virus (WDV) and Barley Yellow Dwarf Virus (BYDV). After entering the input parameters, the user obtains the resultant risk of the harmful occurrence of WDV/BYDV in cereals.

An excellent example of published methodology is the publication for apple and pear growers involved in organic farming systems. The book comprises detailed information on important apple and pear pests and diseases, recommendations for plant protection compatible with organic fruit growing and other practical information.

The Institute has also bred or cooperated in the breeding of various new plant varieties of agricultural crops, such as the new wheat varieties, Lotte and Tosca, Rumona einkorn wheat, Orex new winter rape, Ruberit foxtail millet, the first Czech Ruzrok sorghum variety, and the rootstock V 94 variety of hawthorn.

Dairy Research Institute, Ltd.
(Výzkumný ústav mlékárenský s. r. o.)

Ke Dvoru 12a, 160 00 Praha 6
Telephone: +420 235 354 551-2
E-mail: milcom@milcom-as.cz
Website: http://www.vumlekarensky.cz

The Dairy Research Institute was established in 2002. It is a research organisation that fulfils the demands of the Community Framework for State Aid for Research and Development and Innovation 2006/C 323/01. Moreover, its research activities continue in the more than 60-year-old tradition of highly specialised dairy research in the Czech Republic.

Keywords:
milk and dairy products, raw milk quality, farmers, dairy technology, functional foods, probiotics, spoilage, food safety, microbiological and chemical analyses

Main Activities

The Dairy Research Institute is concerned with research and development in the field of milk and dairy products, namely from basic dairy production, the collection of milk and its technological processing, to the quality and safety of final dairy products. The main topics are e.g. improvement of raw cow, goat and ewe milk quality; methods for the determination of microbiological, physical, chemical and sensory parameters of milk and dairy products, including PCR, DGGE, HPLC, GC and others; changes during the ripening and storage of dairy products, including the identification of spoilage causes; milk processing technologies, both low-capacity farmers' production and dairy plant technologies, including membrane processes, UHT and sterilised product technologies; cheese and fermented dairy products' technologies; dairy starters, including protective starters and probiotics; bacteriophages; bacteriocins and natural antimicrobials; hygiene and sanitation, including biofilms and persistent microorganisms; the influence of dairy products on human health; functional foods, food supplements, foods for people with changed nutritional demands and foods for special medicinal purposes; whey utilisation for both food and non-food purposes, including biodegradable polymers; the application of lactic acid bacteria in non-dairy food technologies and biotechnologies; bioactive packaging. Emphasis is on the transfer of results to practice, i.e. as quality and safety control, cost reduction, product innovation and the increase of product added value.

The Dairy Research Institute has the appropriate devices and equipment for the above-mentioned purposes, e.g. IR milk composition analyser, cryoscope, HPLC and GC technique, electrophoresis, izotachophoresis, spectrophotometer, viscosimeters and rheometers, oil bath for the measuring of heat stability, inoculation flow boxes and biohazard box, PCR devices and identification systems for lactic acid bacteria, microscopes, aeroscope, luminometer, microtiter plates reader, ultrasound homogeniser, shocker for mild freezing of samples, freeze-dryer, fermenter,

pilot-plant cheese production line including plate heater, homogeniser and ripening chamber with controlled temperature and humidity, batch devices for mixing and heating, etc. Small measuring devices (pH-meters, thermometers, aw--meters, etc.), water baths, shakers, centrifuges, thermostats, autoclaves, refrigerators, deep-freeze boxes, scales, dryers, hoods, etc. are standard equipment.

Professional Cooperation

The Dairy Research Institute cooperates with other research organisations (e.g. University of Chemistry and Technology, Prague, Czech University of Life Sciences Prague, Mendel University in Brno, Tomas Bata University in Zlín, Charles University in Prague, University of Veterinary and Pharmaceutical Sciences Brno, Institute of Animal Physiology and Genetics of the Academy of Science of the Czech Republic, Food Research Institute Prague, Veterinary Research Institute, Institute of Animal Science, Crop Research Institute, Research Institute of Brewing and Malting, etc.), as well as with enterprises and professional associations as the users of results (e.g. Bohemian and Moravian Dairy Association, Bohemian and Moravian Breeders Association, Federation of the Food and Drink Industries of the Czech Republic, Danone, Madeta, Bohušovická mlékárna, Choceňská mlékárna, BOHEMILK, Mlékárna Olešnice, Moravia Lacto, Brazzale Moravia, Polabské mlékárny, LACRUM Velké Meziříčí, Zeelandia, BETULA PENDULA, INGREDIA, Agricultural Co-operative Kojčice, Agricultural Co-operative Jeseník, Agro Měřín, Beskyd Fryčovice, SYNPO, INVOS, Fabric Constructions, Chiromed Group, Bentley Czech, EUROFINS CZ, among others).

Recently, the Dairy Research Institute participated in international collaboration on the COST LD14123 project, which was focused on probiotics, their adherence and biofilm formation.

Cooperation is cordially welcomed with current and new partners, both national and international.

Important Research Results

Examples of recent results applied in practice:

- Patent 306548 Probiotic humectant preparation for special applications (dNU medical care)
- Patent 306229 Varnish with an antimicrobial culture for the application on bioactive packaging

- Patent 305450 Processing of cheese manufacturing waste water
- Patent 304791 Bifidobacterium longum CCM 7952 bacterial strain and its application in human nutrition
- Patent 304158 Manufacturing technology of fermented whey beverage with lactulose
- Software STA4MIL PRO as a tool for the management of technological process stability by monitoring of production variability
- Software DF-Report as a tool for the improvement of datum yield from dairy experiments, efficiency control and consultancy on raw milk quality
- Manufacturing technology of capsules containing dried bovine colostrum, freeze-dried probiotic mixture and selected vitamins.
- Manufacturing technology using mixed protective culture for the pre-treatment of raw milk
- Manufacturing technology of fermented dairy products with a lowered lactose content designed for dogs and cats
- Manufacturing technology of sterilised, nutritionally defined liquid food for seniors with a high protein content for administration by gastric tube
- Manufacturing technology of sterilised, nutritionally defined liquid food for diabetics containing a high whey protein ratio, alternative sweeteners, dietary fibre and hydrolysed collagen
- Manufacturing technology of probiotic semi-hard scalded Italian-type cheese containing bioactive compounds
- Manufacturing technology of fermented dairy beverage with bifidobacteria and Lb. acidophilus designed for the robotic mini-dairy with a consumer outlet
- Manufacturing technology of better spreadable butter
- Manufacturing technology of dried cereal-fruit or cereal--fruit-vegetable flavouring component
- Manufacturing technology of retro-yoghurt with optimised ripening conditions.
- Certified methodology SVS/2016/152031-G for the prediction of heat stability of raw cow milk as a raw material for the manufacturing of evaporated milk using farming parameters
- Certified methodology SVS/2016/148099-G for the non--cultivation analysis of cheese, brine and pickle using denaturation gradient gel electrophoresis (DGGE)
- Certified methodology SVS/2016/135388-G for the testing of microbiological and antimicrobial properties of active packaging with an antimicrobial layer
- Certified methodology SVS/2015/135598-G for the identification of Acinetobacter bacteria in the milk and dairy industry using PCR with genera-specific primers.
- Certified methodology SVS/2015/129869-G for the testing of sanitation solutions' efficiency against moulds persisting in dairy plants
- Certified methodology SVS/2015/135589-G for the isolation of DNA of PCR grade using magnetic microparticles

FRIP
FOOD RESEARCH INSTITUTE PRAGUE

Food Research Institute Prague
(Výzkumný ústav potravinářský Praha, v. v. i.)

Radiová 1285/7, 102 00 Praha 10
Telephone: +420 296 792 100
E-mail: vupp@vupp.cz
Website: https://www.vupp.cz/

The Research Institute of Food Industry (since 2007, the Food Research Institute Prague) was founded in 1958. The Institute is a complex workplace that fulfils the tasks of basic, cross-sectional and applied research in chemistry, biochemistry and food technology, nutrition and food engineering and technology.

The Food Research Institute Prague (FRIP) focuses mainly on improving the level of our population's diet and on restoring the food supply in our market. It focuses on improving the processing of food products from the start of production to their final preparation, the development of special foods for groups of people with exceptional health claims, the search and development of related control and evaluation methods, analytics, including the performance of specific analyses, the manufacture of special measuring equipment and technology. In recent years, the main activities of the Institute have included the implementation of research projects and tasks, and economic activities, consisting of the performance of services, consultancy and consulting services.

Keywords:
Food industry, Science, Basic research, Applied research, Research in the food industry, Nutrition, Foodstuffs, Food analysis, Analysis of raw materials, product analysis, Food evaluation and analysis, Gluten-free foods, gluten-free products, Food chemistry, Biochemistry, Microbiology, Biotechnology, Food technology, Food Engineering, Organic food, Population feeding

Main Activities

The Food Research Institute Prague, a public research institution, has already been a full profile research institute in the field of food processing for almost 60 years. The objective of its main activities consists of basic and applied research and development in the fields of food chemistry and biochemistry, microbiology, food engineering, food processing procedures and machinery, and human nutrition. The Institute also performs further publicly beneficial activities, based on the requirements of the bodies of various state administration bodies.

The main research areas of FRIP activities are divided into the three following directions:

- FRIP deals with the evaluation of basic and minor substances of nutritive importance and the development of

food for healthy and safe nutrition, as well as of the food products for population segments with specific dietetic requirements. It participates in the development of analytical methods for quality evaluation of agricultural raw materials and processed foods and in the area of food authenticity.

- FRIP examines the processes of microorganism cultivation, with the aim of optimising the generation of new products including biomass, and the issue of food processing by-product utilisation, fermentation and separation technologies. It participates in the development of analytical methods for proving food authenticity. Within the broad area of FRIP's analytical and scientific activities are the utilisation of various by-products and wastes within the agricultural and food complex, the cultivation of microorganisms in order to create new products, as well as the development and implementation of analytical methods to prove food authenticity.
- FRIP studies modern processes of food manufacture, including their mathematical modelling. Long-term efforts are being made to study the high-pressure processing of foods. The research programme is focused on thermal conditions during pressure treatments. FRIP studies the influence of high pressure on allergens, microorganisms and the nutritionally important quality parameters of selected foods, mainly of plant origin (e.g. fruit-vegetable juices).

Professional Cooperation

FRIP collaborates with 20 national associations dealing with food, e.g. the Federation of Foods and Drinks Industries CR, Coeliac Association CR, Czech Technology Platform – Food for Life, etc.

The Institute is co-participant in the international HighTech Europe project.

With the Matris Research Institute in Reykjavik, we are working on an international interlaboratory study of model fish detection (real-time singing) using Real Time PCR.

The results of this study are currently prior to submission to the Journal of Agricultural and Food Chemistry. In this study takes part also the Food Research Institute in Bratislava (as a participant). We also communicate about this project with the Max Rubner Institute in Hamburg. We plan to address this workplace with an offer of participation in another international study.

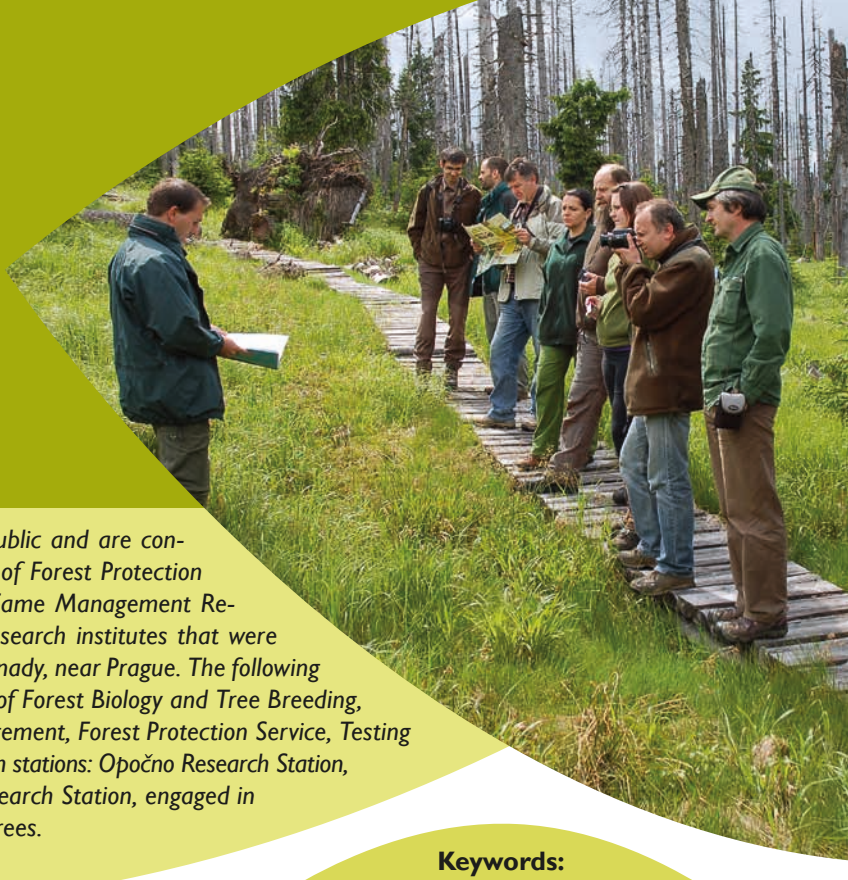
Possible cooperation on nanotechnology is now under way in Peru, China and India.

Important Research Results

- Pilot plant production of probiotic microorganisms encapsulated in biopolymer microparticles. The subject matter of the invention is a technology and equipment allowing gentle drying and encapsulation of probiotic microorganisms by carbon dioxide-assisted spray nebulisation drying. Encapsulation of microorganisms into biopolymer microparticles improves their durability and resistance against environmental stress.
- The method of nozzleless centrifugal manufacture of nanofibres and microfibres of the present invention is characterised by the fact that fibres are formed from a thin film of a solution of a spun polymer or melt formed

on the surface of a cylinder or a system of cylinders, rotating at a speed of at least 1000 rpm. The surface of the cylinder or cylinders is profiled with grooves or projections and the edges of these profiles on the cylinder surface increase the quantity of fibres produced. These collect within a collection space or are laid in the form of a non-woven fabric. The apparatus is based on a new method for preparation of nanofibres and can be adjusted to produce various types of polymeric nanofibres for use in a wide spectrum of industrial applications, including the food industry. Production of biopolymeric nanofibrous delivery systems for nutraceuticals, active semipermeable food packages, membrane enzyme reactors, filtration membranes with functional active inserts, and biosensors are among the typical examples of utilisation of the apparatus in the food industry. The aim is to prepare a machine capable of large-scale production.

- Pilot plant production of probiotic microorganisms encapsulated in biopolymer microparticles. The subject of the invention is a technology and apparatus for the gentle drying and encapsulation of probiotic microorganisms by sputter spray drying using carbon dioxide. Encapsulation of microorganisms into biopolymeric microparticles improves their resistance and resistance to environmental stress.
- Ferdinand gluten-free beer is similar to the classic 12-degree light lager Premium from the Ferdinand Benešov brewery, except that people who suffer from coeliac disease can enjoy it without fear. The product has been tested in several accredited laboratories. This beer belongs to the ELS licensing system, which is unified in all European countries.
- Hops – chocolate truffles with hops filling. These are shaped candies in 70% bitter chocolate filled with traditional Czech hops, without pasteurisation or drying. Hops after the harvest are treated only with high pressure, known as pascalisation, without high-temperature heating. In this way, hops preserve the properties of the fresh raw product.
- Smrkáček – Kitl Smrkáček BIO is a syrup of young spruce shoots with Vitamin C. It is suitable for treating colds in children and adults. Spruce shoots were used in traditional folk medicine for colds and Smrkáček follows on these traditions. Kitl Smrkáček contains only 3 ingredients: BIO spicy young spruce, BIO cane sugar, Vitamin C. The result is a unique product on the market – a BIO quality food supplement.
- UGO juice – High-pressure-treated fruit-vegetable juice (cooperation with Kofola, a.s in connection with the preparation of industrial production). The research team participated experimentally as consultants in implementing the production of high-pressure-treated fruit-vegetable juices (the UGO trademark). It is the second producer of this type of juice in the Czech Republic.
- Rape native protein for use in the food industry. The technical solution is a protein isolate or rape protein concentrate in the native state, with a nanostructured particle size of 30 nm to 30 microns. These particles are hollow nano- and microspheres. Due to the fact that these proteins have not been subjected to high temperature, as is the case with the methods used to produce them, they have not undergone thermal denaturation and are thus in the native, natural form. These proteins are then more readily dispersible in aqueous solutions and are especially suitable for use in the food or pharmaceutical industries.



Forestry and Game Management Research Institute

(Výzkumný ústav lesního hospodářství a myslivosti, v. v. i.)

Strnady 136, 252 02 Jíloviště
Telephone: +420 257 892 222
E-mail: admin@vulhm.cz
Website: http://www.vulhm.cz

Forests cover one-third of the land area of the Czech Republic and are considered as being part of the national wealth. The Institute of Forest Protection was established on 31st October 1921. The Forestry and Game Management Research Institute (FGMRI) became a successor of several research institutes that were merged in 1959. The headquarters are located in Jíloviště-Strnady, near Prague. The following departments are located there: Management, Department of Forest Biology and Tree Breeding, Department of Forest Ecology, Department of Game Management, Forest Protection Service, Testing Laboratories, and Research Library. There are also two research stations: Opočno Research Station, focused on forest nursery and Silviculture; and Kunovice Research Station, engaged in problems related to reproductive sources and fast-growing trees.

Keywords:
forest research, afforestation and silviculture, forest protection, tree breeding and seed management, ecology, hydrology, forest health, monitoring, game management

Main Activities

All the departments focus on the current directions in forest research within the Central European context. Great emphasis is placed on applied research, with practical outputs for forest management, forest owners and administrators. Collaborative projects in applied research are also pursued to promote the connection between theoretical knowledge and practice.

Research in Silviculture focuses on forest nursery and the quality of forest tree species' planting stock. It also deals with natural and artificial regeneration, including afforestation of abandoned agricultural land, thinning, and measurements that support forest function. The main task of silvicultural research is biodiversity improvement, enhancement of integrity and forest stand resistance with respect to possible global and landscape changes.

Long-term research in Forest Ecology is focused on assessment of the vitality of forest stands, their response to abiotic and anthropogenic factors, forest hydrology, bioclimatology, pedology, as well as on the assessment of the nutritional and water balance of forest stands and research of forest ecosystem processes connected with climate

change. The aim of ecological research is the determination of risks threatening the stability of forest ecosystems, forest productive and non-productive functions and, last but not least, the maintenance and improvement of the international system of forest stand monitoring.

The aim of long-term research in forest protection is to prepare and promote new protective methods against insect pests, fungal diseases and other biotic and abiotic damage, including invasive species, in connection with management changes, forest tree species' composition, climate change, and change in the anthropogenic load, with respect to protection of forest biodiversity. An important objective is the increase of the effectiveness and rationalisation of control and protective measures, including their ecological improvement. Close connection between research and forest practice is provided by the Forest Protection Service.

Research in biology and forest tree breeding is aimed at genetic variability of forest tree species' populations, conservation and reproduction of valuable genetic resources, biology experiments, provenance research of autochthonous, introduced and fast-growing tree species, and forest seed production. Breeding studies also take into account tree species' production and resistance. The research objective is to gain a deeper knowledge of the genetic diversity of autochthonous tree species' populations, to create new

methods for conservation and reproduction of important genetic resources, taking into account resistance, production and other beneficial elements.

Concurrently, the Forestry and Game Management Research Institute is authorised to operate the National Bank of Forest Tree Seed and Explants. The main objective of the Bank is to establish a seed collection representing the gene pool variability of Norway spruce, Scots pine, European larch, Birch, Alder and other population species, in particular from the most valuable stands, especially in endangered populations.

Long-term and conceptual research in Game Management is focused on analyses, regeneration and environmental adjustments, biomonitoring and health of game animals, as well as on molecular genetic methods and their development. Prevention and settlement of conflicts resulting from the difference between man's economic attitude towards the landscape and the natural behaviour of game populations also fall within its scope.

The following departments provide analytical services and expertise to the Institute's research divisions. The Testing Laboratory carries out proper analyses of soil and water

samples and plant material. The Research Library and Publishing is engaged in special library services, using its unique holdings. Moreover, this Department is also responsible for publishing. The peer-reviewed journal "Zprávy lesnického výzkumu" (Forestry Research Reports) releases scientific articles by Czech and Slovak authors. Technical handbooks published in the series "Lesnický průvodce – certifikované metodiky" (Certified Methodologies) are intended for forestry practice and forest owners, to whom they convey the knowledge resulting from applied research. The Březka Game Preserve falls under the Department of Game Management. It primarily serves to keep and breed fallow deer, and is closely connected with game research. Several monitoring and experimental plots that are used for demonstrating research results are also found there.

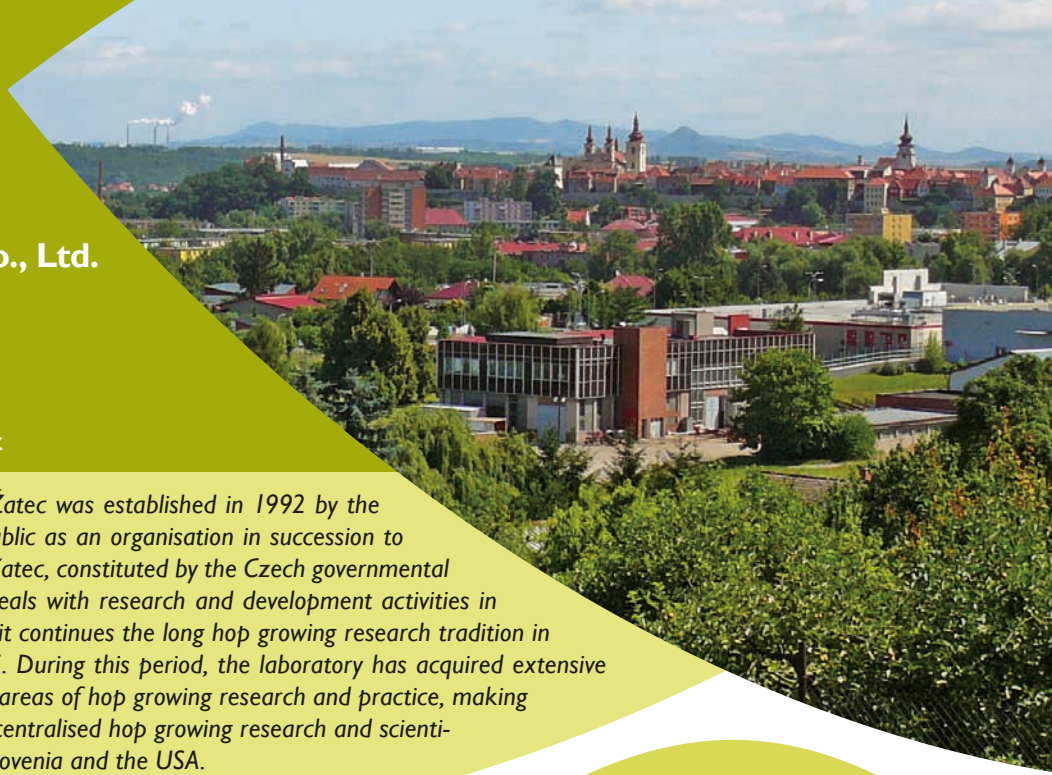
Professional Cooperation

FGMRI is a member of several international organisations, e.g. IUFRO (International Union of Forest Research Organisation), EFI (European Forest Institute), EUFORGEN (European Forest Genetic Resources Programme), ISTA (International Seed Test Organisation), among others.

It cooperates within the European network, ICP Forests, for the monitoring of forest health and participates in different international research activities and consortia e.g. within COST, EEA Grants and INTERREG projects.

Important Research Results

The most significant scientific results are published in journals with an impact factor (46 articles in the past 5 years), or journals in other databases (Scopus 130 articles in the past 5 years). Most important results for forest owners, forest administration and other stakeholders are published in the form of certified methodologies or certified maps (60 outputs in the past 5 years) dedicated to various relevant topics, e.g. Harvest, storage and pre-sowing treatment of Fagus sylvatica seeds (2013), Silvicultural measures in spruce stands of former agricultural land (2013), Selection of appropriate plots for forest soil liming (2014), Thinning of forest stands with Douglas fir (2014), Integrated methods for protection of forest stands (2014), Micropropagation of *Betula nana* (2015), Map of drought stress risk for Norway spruce (2016), Use of pheromone traps in forest protection (2016) and Genetic characterisation of silver fir using microsatellite markers (2016).



Hop Research Institute Co., Ltd.
(Chmelařský institut s. r. o.)

Kadaňská 2525, 438 01 Žatec
Telephone: +420 415 732 111
E-mail: patzak@chizatec.cz
Website: http://www.chizatec.cz

The Hop Research Institute Co., Ltd., Žatec was established in 1992 by the Hop Growers Union of the Czech Republic as an organisation in succession to the Hop Growing Research Institute in Žatec, constituted by the Czech governmental authorities in 1952. The organisation deals with research and development activities in the Czech hop growing industry, where it continues the long hop growing research tradition in the Czech Republic that began in 1925. During this period, the laboratory has acquired extensive research and scientific experience in all areas of hop growing research and practice, making it a world class facility of its type. Such centralised hop growing research and scientific laboratories exist only in Germany, Slovenia and the USA.

Keywords:
Hop, Humulus lupulus L., research and development, hop breeding, protection, chemistry, biotechnology, cultivation, Saaz hops, organic hops

Main Activities

The research site has up-to-date instrumental and expert equipment at its disposal, enabling it to perform hop research activities in all natural science branches as well as in branches related to agricultural and technical research. In the field of hop cultivation technologies, the HRI deserves mention for conversion to wide-spacing planting of hop rootstock, for progressive methods in hop cultivation, mechanisation, harvesting and processing. A great deal of attention has been devoted to qualitative parameters of Saaz hops and their utilisation in the brewing industry. Research activities cover hop cultivation, production of propagation material with a spatial and technical insulator and the national collection of genetic resources fitting into the structure of support from the Ministry of Agriculture of the Czech Republic. Experimental and farming activities are carried out at a special-purpose farm – Stekník – with its 138 ha of hop gardens.
The research laboratory is divided into five departments.

The Hop Breeding Department performs breeding of new hop cultivars and maintenance and propagation of Czech hop cultivars. Over the years, a total of 10 out of the 12 hop cultivars permitted in the Czech Republic have been registered (Sládek, Bor, Premiant, Agnus, Harmonie, Vital, Rubín, Kazbek, Bohemie and Saaz Late). To verify the brewing quality of future hop cultivars, the Department also has a trial micro-brewery (50 l) at its disposal.

The main task of the Hop Chemistry Department is performing chemical analyses of hops, analyses of hop products

and beers for growers and trading organisations per order, quality declaration for the purposes of hop purchasing and sales (e.g. LC-MS/MS). In terms of research activities, e.g. the process for preparing of pure beta hop acids was patented.

The Biotechnology Department is mainly focused on the production of young, virus-free hop rootstock, carrying out health status checks of young plants and reviewing the genetic stability and purity of hop cultivars. In terms of its research activities, it participates in the characterisation of the hop genome and analysis of the separate genes involved in lupulin biosynthesis and their regulation. In addition to research publications, the authenticity control system for Czech hop cultivars is an important research result.

The main task of the Hop Protection Department is the protection of hops against disease and pests. The integrated plant protection system and the first production of organic hops are among the important research results of this Department. The most important activity is the establishment and evaluation of registration trials of new prospective pesticides within the framework of international cooperation according to the valid EPPO rules, using methodologies and based on the GEP (Good Experimental Practice) certificate. The research station in Tršice, near Olomouc, falls under this Department.

The Hop Cultivation Department mainly deals with agrotechnology in hop gardens, advisory services for growers and research in the field of hop agriculture, irrigation, nutrition and fertilisation. In terms of research activities, it focuses on the modification and development of machines for agrotechnological operations.

In addition to the comprehensive research and development of the hop plant, which form the core of the enterprise, the company is engaged in commercial activities: production and sale of hop rootstocks, hops, organic hops and crop production. Other activities include consultancy and training services for entrepreneurs in hop growing, testing of new active substances in pesticides for plant protection and organising a beer-tasting competition during the 'Hop Harvest Festival in Žatec'.

Professional Cooperation

In terms of research activities, in the Czech Republic the Hop Research Institute Co., Ltd. collaborates with universities (Czech University of Life Sciences Prague, University of Chemistry and Technology, Prague, Masaryk University, Mendel University in Brno), institutes of the Academy of Sciences of the Czech Republic (Biology Centre of the Czech

Academy of Sciences, Institute of Experimental Botany of the Academy of Sciences of the Czech Republic), institutes of the Czech Ministry of Agriculture (Crop Research Institute, Food Research Institute Prague) and private research institutes (Research Institute of Brewing and Malting, Plc., Potato Research Institute Havlíčkův Brod, Ltd., Research and Breeding Institute of Pomology Holovousy, Ltd.), as well as enterprises (Chmelařství družstvo Žatec) and breweries (Suntory, Heineken, SAB, Budvar). On the international level, it works with universities, research institutes and enterprises from Slovenia, Poland, Slovakia, Ukraine, Russia, Great Britain, Germany, USA and Japan. Research activities are supported within the framework of research projects run by the Grant Agency of the Czech Republic and the Academy of Sciences of the Czech Republic, the Technological Agency of the Czech Republic, the Ministry of Agriculture, the Ministry of Industry and Trade, the Ministry of Education, Youth and Sport and by the European Commission and breweries.

Important Research Results

- MALIAR, Tibor, Peter NEMEČEK, Eva ÜRGEOVÁ, Mária MALIAROVÁ, Vladimír NESVADBA, Karel KROFTA, Katarína VULGANOVÁ, Erik KROŠLÁK and Ján KRAIC. Secondary metabolites, antioxidant and anti-proteinase activities of methanolic extracts from cones of hop (*Humulus lupulus* L.) cultivars. *Chemical Papers*, 2017, 71(1), 41-48. DOI: 10.1007/s11696-016-0034-2.
- MATOUŠEK, Jaroslav, Tomáš KOCÁBEK, Josef PATZAK, Jindřich BŘÍZA, Kristýna SIGLOVÁ, Ajay Kumar MISHRA, Ganesh Selvaraj DURAISAMY, Anna TÝCOVÁ, Eiichiro ONO and Karel KROFTA. The 'putative' role of transcription factors from *HIWRKY* family in the regulation of the final steps of prenylflavonid and bitter acids biosynthesis in hop (*Humulus lupulus* L.). *Plant Molecular Biology, 2016*, 92(3), 263–277. DOI: 10.1007/s11103-016-0510-7.
- OLŠOVSKÁ, Jana, Karel KROFTA, Vladimíra JANDOVSKÁ, Josef PATZAK and Karel ŠTĚRBA. Metody pro ověřování autenticity odrůd chmele – účinný nástroj proti falzifikaci / Methods for verifying the authenticity of hops – an effective tool against falsification. *Kvasný průmysl.* 2016, 62(10), 294–305. ISSN 0023-5830. DOI: 10.18832/kp2016030.
- NESVADBA, Vladimír, Miroslav BRYNDA, Alena HENYCHOVÁ, Josef JEŽEK, Jiří KOŘEN, Karel KROFTA, Ivana MALÍŘOVÁ, Josef PATZAK, Zděnka POLONČÍKOVÁ, Petr SVOBODA, Vladimír VALEŠ and Josef VOSTŘEL. Vývoj a tradice českých odrůd chmele / Development and tradition of Czech hop varieties / Развитиз и традиции чешских сортов хмеля. Žatec: Chmelařský institut s.r.o., 2013, 2013, 2014. 104 s., 104 s., 96 s. ISBN 978-80-87357-11-8, ISBN 978-80-87357-11-8, 978-80-87357-14-9.

IAEI

Institute of Agricultural Economics and Information

(Ústav zemědělské ekonomiky a informací)

Mánesova 1453/75, 120 00 Praha
Telephone: +420 222 000 508
E-mail: podatelna@uzei.cz
Website: http://www.uzei.cz

The Institute of Agricultural Economics and Information (IAEI) is a subsidised organisation established by the Ministry of Agriculture. IAEI has long been active in the area of basic and applied economic and agricultural research, as well as in the area of information, library and other services. Primarily, it provides research-analytical and educational services for the Ministry of Agriculture and other organisations operating within its sphere. Another important activity of the Institute is the fulfilment of thematic tasks undertaken for the MoA. Operational-analytical support for MoA decision making in the area of agricultural politics is also related to this activity. IAEI further provides expert consultations, creates expert opinions and participates in grant and other research projects, and administers the Registry of Accredited Advisors. IAEI operates the 3rd largest Agricultural and Food Library in the world – the Antonín Švehla Library (KAŠ).

Keywords:
agrarian sector, agrarian policy, agrarian market, agricultural consultancy, applied research, FADN (Farm Accountancy Data Network), LFA, Antonín Švehla Library, food processing industry, land fund, agricultural economics, agricultural politics, agricultural advisory and educational centre, agriculture

Main Activities

The main activity of IAEI is the implementation of basic research, applied research and development and the dissemination of results through teaching, publishing and transfer of technologies in the fields of agricultural economics and politics, including the development of the multifunctional nature of agriculture and rural areas. Furthermore, activities include dissemination of research and development results for the needs of the agrarian sector and rural areas, with the provision of comprehensive professional services for the MoA and other state administration bodies. In addition, it ensures the functions of the departmental expert library, information and educational centre in the areas of agriculture, the food processing industry and rural development. IAEI ensures comprehensive operation of the Farm Accountancy Data Network (FADN) in Czechia and executes the function of the FADN Contact Centre on behalf

of Czechia within the EU relationship. Tasks undertaken by IAEI concern mainly current economic and political issues related to the application of the EU Common Agricultural Policy under conditions of Czech (i.e. Bohemian, Moravian and Silesian) agriculture. One important output is processing of the Report on the state of Czech agriculture.

Research carried out within the framework of the concept of development of the IAEI as a research organisation mainly involves the following directions:

- Agrarian-political conditions of sustainability, i.e. balanced production of private and public goods in Czech agriculture within the context of forming the CAP conditions after 2014 and 2020.
- Holistic solution of the risks of agricultural business in Czechia under conditions of increased price fluctuations on the agrarian market and ongoing climate change.
- Improving the efficiency and competiveness of the Czech agrarian sector and food processing industry under conditions of advancing globalisation and changing consumer demand.
- Comprehensive (territorial) approach to the economic and social problems of the Czech countryside within the context of regional development.
- Implementing the financially balanced distribution of added value for vertical input suppliers – farmers – processors – retail shopping and trade in Czechia.
- Rural development as a whole, both in the substitutional and complementary relationship to agriculture.
- Economic and environmental aspects of the production and use of biomass as a renewable energy source.

Professional Cooperation

IAEI researchers are involved in international and national projects and collaborate with other research institutions and universities.

In recent years, IAEI has been part of significant projects of FP6 and FP7 programmes; currently this is the HORIZON 2020 project. As an example of current international

cooperation within the framework of the EC calls for proposals, the PEGASUS projects can be mentioned: "Public ecosystem goods and services based on soil management – Unleashing synergies" (14 partners from 11 countries) and the currently starting AgriLink project under the same programme: "Knowledge of agricultural issues: Linking of farmers, advisors and researchers to support innovations" (15 partners from 12 countries).

On the Czech level, there has been cooperation in the Applied Research Programme for the 2017–2025 period – ZEMĚ (THE LAND) – on the project called "Economic support of strategic and decision-making processes" on national and regional levels, leading to the optimum use of renewable energy sources, in particular biomasses, while respecting food self-sufficiency.

Other recent activities include e.g. synergy with the AdaptaN project: comprehensive, planning, monitoring, information and educational tools for adaptation in the territory to the impacts of climate change, with the main focus on agricultural and forestry management in the landscape, financed from EEA and Norwegian funds. In addition, there is cooperation on the Leader Method project – transfer of V4 experiences to Georgia (Visegradsky Fund) and Evaluation Criteria and modelling of the production potential of the Czech and Slovak agriculture and food processing industry (Ministry of Education). IAEI research activities were also carried out in connection with the Framework Agreement on Slovak-Czech-Hungarian joint research cooperation.

IAEI further cooperates with the food composition international database network – European Food Information Resource (EuroFIR – http://www.eurofir.org).

IAEI cooperates with the International Food Information Service (IFIS) and FAO to build the industry-specific international bibliographic databases – Food Science and Technology Abstracts (FSTA) and FAO AGRIS database, respectively.

Contributions to professional publications (articles, books, proceedings) add to the visibility of science and research results in Czechia in the area of agriculture and the food processing industry on an international level.

Significant research results

Research conducted by the IAEI in the course of 2016 included the following research projects:

- Welfare of cattle and other breeding conditions in the CR, with a link to the economy of breeding.
- Modelling of the impact of LFA policy on the economy of enterprises.
- Analysis of the agricultural land market price determinants in the CR, with a focus on the characteristics of buyers.
- Evaluation of the effects of structural supports within the I PRV 2007–2013 axis.
- Second housing and its role in rural development.
- Strategic analysis of meat processing and meat products in the CR.

The results of this research are published in the scientific press and are further utilised for the purposes of current thematic tasks for the Ministry of Agriculture. This allows for deeper analyses to be conducted of the impacts of agricultural policy, as well as of its future formation under conditions in the CR.

Furthermore, with the support of the Ministry of Agriculture, the IAEI administers and updates the Food Composition Database – NutriDatabaze.cz – which is being built as the main reference source on the nutritional composition of food in the Czech Republic.

IAEI, as the main partner, participated in the elaboration of EuroFIR for the calculation of the nutritional value of food, which is designated for food business operators in the EU when fulfilling the mandatory labelling of nutritional data for packed foodstuff according to the current EU legislation (Regulation 1169/2011).

Národní zemědělské muzeum

National Museum of Agriculture

(Národní zemědělské muzeum, s.p.o.)

Kostelní 44, 170 00 Praha 7
Telephone: +420 220 300 278, +420 220 308 200
E-mail: nzm.praha@nzm.cz
Website: http://www.nzm.cz

The National Museum of Agriculture, a state-sponsored organisation established by the Ministry of Agriculture, is a traditional science and research centre. It presents agriculture and other areas administered by the Ministry of Agriculture as important social and cultural phenomena which have enabled the development of historical civilisations and continue to shape our modern society. The Museum, established in 1918 by the foundation of a Czech Agricultural Museum Association, was perceived in the interwar era as one of the most progressive of such institutions in Czechoslovakia. Its main building is in Prague–Letná, its five specialised branches are outside Prague: in Čáslav (agricultural machinery), Kačina Chateau (Museum of Czech Countryside), Ohrada Chateau (forestry, gamekeeping and fisheries), Valtice (viniculture, gardening and landscape), and Znojmo (beer and brewing). In January 2015, the Museum launched a two-year revitalisation project whose aim is to offer visitors reconstructed spaces and new exhibitions. Preparations are being made for opening a branch of the Museum in Ostrava in 2019/2020.

Keywords:
Museum, science, research, collection, exhibition, agriculture, forestry, gamekeeping, fisheries, gardening, viniculture, breweries, botany, agricultural technology, environment, processing agricultural produce, food production, countryside, landscape

Main Activities

According to its actual Foundation Charter, the National Museum of Agriculture creates collections of Czech and foreign material evidence related to the development of agriculture, forestry, gamekeeping, fisheries, zoology, gardening, viticulture, botany, the environment, processing of agricultural produce, food production, gastronomy, evolution and development of rural life and its traditions, as well as changes in the environment and cultural landscape. Its focus is on the professional management of materials from its own collections, as well as on investigation of the environment, phenomena and context within which these objects that document technical, economic, social, cultural, and political development originated. The Museum's aim is to study these materials within their wide context, while implementing new evidence and methods, especially those related to traditional approaches and long-term sustainability of agricultural practice. Our collections are not only a unique source of information, but also an instrument of popularisation of this area of human activity. Research results are presented in the form of permanent and temporary exhibitions, publications, educational activities, lectures, and

cultural and educational activities aimed at the wider public. The aim of our educational, popularisation, and research activities that take the form of expositions, educational programmes, events, and publications, is to assist in building a positive relationship of the general public to agriculture, forestry, gamekeeping, fisheries, gardening, processing of agricultural produce, cultural landscape, the countryside, its development, evolution, and roots, and to stimulate interest in the knowledge offered by the natural, technical and social sciences that focus on the subjects covered by the Museum. The Museum develops new interactive exhibitions inspired by modern Museum Science, with the aim of making them optimally attractive to visitors.

In its science and research activities, the Museum follows the Conception of Science and Research of the National Museum of Agriculture for 2016–2022. The Museum publishes one peer-reviewed, non-impacted journal, the *Sources and Studies*. The publishing activities of the Museum reflect the main areas of research practised here, which in turn correspond to the structure of its collections. Museum workers actively publish work, as evidenced by the Registry of Information about Results (RIV). The research carried out by the Museum focuses on 12 main areas: Museum Science; the countryside, agriculture, landscape, ethnography, and traditions; aquatic ecosystems, pond management and fisheries;

gardening, viticulture and beekeeping; mechanisation of agriculture and forestry; technical buildings linked to agriculture, forestry and other areas; food production, industry linked to agriculture and meat production; culinary legacy of the Czech Lands; the countryside in art; notable personalities of agriculture, forestry, fisheries, gardening, and agricultural enterprise and related areas. In addition to these activities, the Museum participates in research projects supported from sources other than the above-mentioned long-term conceptual development of research organisations, such as the Programme for Applied Research and Development of National and Cultural Identity of the Ministry of Culture (NAKI) and programmes of the Czech Grant Agency (GAČR).

Professional Cooperation

In order to expand and improve its scientific activities, the National Museum of Agriculture also concludes framework agreements on contractual research with other institutions. The Museum strives to stimulate interdisciplinary discussion with representatives from agricultural practice, private and non-governmental sectors, state and local administration, as well as with academia. To this end and in order to improve its research activities, in 2016 it announced the first year

of a competition called "Science for the Land" for the best Bachelor's, Master's and Doctoral theses. The second year of this competition, 2017, is held under the patronage of the Minister of Agriculture.

In terms of cooperation with other institutions, the Museum views international conferences as being of utmost importance for the exchange of knowledge and views. In 2016,

the Museum organised an international conference called "Countryside, Farmers, and War in Central Europe in the Modern Era. From the Thirty Years' War to the Cold War". It was attended by participants from Germany, Slovakia, Hungary and Slovenia. In 2014, the Museum organised an international interdisciplinary conference called "Game Reserves and Pheasantries in Cultural History". In 2014, the Museum participated in several international projects, such as "Museo mundial / Muzeum světa" and "300 lat zamku mysliwskego Ohrada w Czechach" [300 Years of the Ohrada Hunting Lodge in Bohemia].

Important Research Results

Since 2013, the Museum has noted an increase in the number of publications submitted to the Registry of Information About Results, and a growing number of exhibitions. Museum publications are publicly accessible on the Museum's website, at http://nzm.cz/centrala/verejne-informace/publikacni-cinnost/. The organisation of specialised both national and international conferences, which function as a platform for presenting current research and for communication among experts, is becoming an integral part of the Museum's scientific and research activities.

OSEVA Development and Research, Ltd.

(OSEVA vývoj a výzkum s. r. o.)

Hamerská 698, 756 54 Zubří
Telephone: +420 571 658 195
E-mail: zubri@oseva-vav.cz
Website: http://www.oseva-vav.cz

The main activities of the Oseva company are agricultural, environmental and renewable energy resource research and consultancy. The company deals a number of research project supported by the Ministry of Agriculture of the Czech Republic or the Ministry of Education of the Czech Republic. Oseva company collaborate on research projects with other research institutes, universities and other companies in the Czech Republic and abroad. Oseva has two workplaces: Grassland Research Station at Rožnov-Zubří and Oilseed Research Institute Opava.

OSEVA Development and Research Ltd. meets the conditions of Community Framework for State Aid for Research and Development and Innovation (2006/C 323/01).

Keywords:
research, grasses, buckwheat, lupine, winter rape, poppy, mustard, agronomy, phytopathology, breeding

Main Activities

Agricultural Research:
- grass seed crops (establishment, nutrition, phytopathology, harvest)
- increasing grassland biodiversity
- study and utilisation of endophyte fungus Neotyphodium spp. in grasses
- energy utilisation of grass and waste biomass
- study and utilisation of genetic resources of grasses and oil crops
- innovation of agronomy of winter rape and poppy
- phytopathology study of oil crops

Breeding:
- winter rape
- poppy (white and blue seed, spring and winter cultivars)
- mustards
- forage and amenity grasses
- buckwheat, white lupine

The workplace is responsible for managing the collections of genetic resources of oilseed crops of the National Programme of Conservation and Use of Plant Genetic Resources and Agrobiodiversity. In addition to the most important collections of winter rape, poppy and white mustard, are also genetic sources of turnip-rape, black mustard, Chinese mustard, camelina, rocket, radish oil and crambe.

Professional Cooperation

The organisation collaborates with research institutions (Agricultural Research, Ltd., Agrotest Fyto, Ltd., Agritec Plant

Research, Ltd., Potato Research Institute Havlíčkův Brod, Ltd., Agriresearch Rapotin, Ltd., Crop Research Institute, Research Institute of Agricultural Engineering, Research Institute for Building Materials Brno), universities (Mendel University in Brno, Czech University of Life Sciences Prague, University of South Bohemia in České Budějovice, Palacký University Olomouc, University of Ostrava), breeders (DLF Seed, BS Větrov, BS Slavice, BS Chlumec nad Cidlinou – Selgen, Slapy u Tábora – Sempra) and with users of research results. Cooperation on an international basis is also important – Agroscope Reckenholz (Switzerland), HBLFA Raumberg-Gumpenstein (Austria), GMARI Banská Bystrica (Slovakia).

Important Research Results

- Dihaploid varieties of winter rapeseed – Orex (2016), Orava (2016) and Ornament (2017) – were cooperatively bred in the "Czech Rapeseed" association. They are historically the first dihaploid varieties of winter rape of Czech origin.
- The Onyx variety of oilseed poppy (registered 2016) is currently the most yielding material in the Czech selection of registered poppy varieties. This variety was awarded the Golden Spike at the 2016 Mother Nature Exhibition.
- Varieties bred in Opava (according to tradition, the names begin with the letter "O"):

- Winter rape: Silesia (the first Czechoslovak erucic acid-free variety), Sonáta (the first Czechoslovak double-zero variety), Aglona, Omikron, Odila, Oáza (high erucic acid for technical purposes = E0 quality), Optimian (E0).
- In collaboration with research and breeding organisations forming an association called Czech Rapeseed, the modern varieties: Oponent, Oksana, Opus, Orion, Oceania, Odeta, Odeon, and dihaploid varieties: Orex, Orava and Ornament, were developed.
- Oilseed poppy: Orel, Racek and Sokol white-seeded varieties; Redy ochre-seeded variety, and Orfeus, Orbis, Opex and Onyx blue-seeded varieties.
- Spring rape: Ovace
- Chinese mustard (Brassica juncea): Opaleska, Oportuna
- Oilseed pumpkin: Opavská
- Buckwheat: Zita, Zoe, Zamira
- White lupine: Zulika
- Perennial ryegrass: Zekol, Zendo, Zifer, Zamini

Patents:

- Patent No. 305975 – Plant biostimulator (20.04.2016)
- Patent No. 305283 – Species-varied seed mixture for dry regions, (03.06.2015)
- Patent No. 305285 – Reclaiming seed mixture for dry regions, (03.06.2015)

Certified guidelines:

- Macháč R., (2013) Guideline of Annual ryegrass seed crop in organic agriculture
- Frydrych J. et al., (2013) Guideline for insect biodiversity assessment in grassland
- Salaš et al., Management leading to the prevention of biological soil degradation and increasing biodiversity in dry regions of the Czech Republic.
- Seidenglanz M. et al., (2013) Guideline for Cabbage stem weevil (*Ceutorhynchus pallidactylus*) control in winter rape

Articles in journals with impact factor, articles in recensed journals and proceedings. 25 special content maps – the development of pollen beetle resistance to insecticides.

POTATO RESEARCH
INSTITUTE
Havlíčkův Brod, s. r. o.

Potato Research Institute Havlíčkův Brod, Ltd.

(Výzkumný ústav bramborářský Havlíčkův Brod, s. r. o.)

Dobrovského 2366, 580 01 Havlíčkův Brod
Telephone: +420 569 466 200
E-mail: vubhb@vubhb.cz
Website: http://www.vubhb.cz

The Potato Research Institute Havlíčkův Brod, Ltd. (PRIHB) is a research and advisory centre for potato growers, users and processors throughout the country. It was founded in 1923 and has always fulfilled the role of an important agricultural research workplace. It is especially focused on applied research in growing technologies, nutrition and fertilisation, pest and disease control, harvest and post-harvest technologies, and also collaboration on basic research projects. These activities are devoted to genetic resource maintenance, initial breeding material development and breeding, with the successful release of five new varieties in recent years (Valfi, Valkýra, Valmont, Valy and Val Blue). Consultancy services directly provided to agricultural enterprises via the Advisory Association Potato Club form an integral part of the activities.

Keywords:
potatoes, research, breeding, consultancy, varieties, genetic resources, growing technologies, pest and disease control, processing, storage, potato propagation, starch, table potato quality

Main Activities

The main activities involve research in the field of potato breeding, growing and utilisation. Research activities are directed at two fields – genetic breeding and technological.

In the former field, PRIHB ensures the collection and systematic enlargement of the potato genetic resource collection, long-term and reliable maintenance of collected potato germplasm and its recovery, systematic study, evaluation and characterisation of accessions entering the germplasm, documentation of potato genetic resources, international cooperation in the field of potato genetic resources, provision of genetic resources and information on germplasm in the gene bank within the National Programme on Conservation and Utilisation of Plant Genetic Resources and Agro-biodiversity – Potato Collection. Further, PRIHB is directed towards biotechnological procedures and methods for the acquisition and maintenance of healthy breeding materials of potato, characterisation of selected items for MAS (marker-assisted selection) and new genotype development. Important results are obtained in the application on non-conventional processes in the technology of new potato breeding material development. Studies on decreasing the risk of potato bacterial ring rot in breeding and propagation material are carried out for use by the state administration.

In the second field, PRIHB is directed at the wider issues of growing technology and potato utilisation of all utility types, especially research on new technological procedures

of soil processing for potatoes, cultural measures and nutrition, including manure, and weed management. Within soil conservation to counter water erosion in potato growing systems, the effect of tied ridges and hollows in the technology of de-stoning is observed on the volume of topsoil loss after natural rainfalls in friendly production systems.

Great attention is paid to pest control. Monitoring of aphid flights, such as virus disease vectors, is performed in potato crops and control measures are recommended. Individual potato varieties are studied, their sensitivity to occurrence of the most important pests and response to control measures.

Insect control, e.g. Colorado potato beetle, wireworms and turnip moth, is also an objective of the research.

Maximum and long-lasting attention is paid to integrated late blight control, where important success has been achieved in the field of forecasting methods and control in recent years.

A great research objective is the response to climate changes, represented by the project focused on new findings for economically and ecologically effective potato productions under drought and weather fluctuations, resulting in a sustainable soil management system in potato-growing regions.

In addition to potatoes, PRIHB is also focused on the study of other crops usable in the food industry, e.g. Jerusalem artichoke.

Research projects are realised within the conception of the long-term development of PRIHB sustainable systems of quality potato production and also within individual R&D projects from public contests of the Ministry of Agriculture and Technology Agency.

Another independent part is performing contract research for clients, usually in the field of plant protection product manufacturers or fertiliser manufacturers, aimed at registration trials.

PRIHB cooperates with state administration within its orders for research and expert activities.

An integral part of its activities is formed by consultancy, which is provided in particular via the Advisory Association Potato Club, after 20 years of its existence, involving 45 agricultural enterprises specialised in potato growing.

Every year, members of the Association receive information about the current state, incl. effective measures (at least 10 times per year). Specific consultancy activity is personally provided in enterprises; consultations may be carried out via e-mail and telephone. PRIHB organises and co-organises three workshops and one conference every year, introducing recent research results. The constantly updated website www.vubhb.cz is a suitable tool for providing specialised information.

Professional Cooperation

R&D projects are realised under cooperation with partnership research organisations (Crop Research Institute, Research Institute of Agricultural Engineering, Hop Research Institute Co., Ltd., Institute of Agricultural Economics and Information, Research Institute for Soil and Water Conservation) and universities (Czech University of Life Sciences Prague, Mendel University in Brno, University of South Bohemia in České Budějovice). PRIHB cooperates with the Czech Potato Union, breeding organisations (Sativa Keřkov, Vesa Velhartice and Selekta Pacov), state institutions (Ministry of Agriculture, Vysočina Region) and have a close relationship with agricultural and processing enterprises.

Important Research Results

Results applied in agricultural practice or state administration could be considered as being the most important. For example:

- Patents: Erosion control tillage equipment; Reaction mixture for molecular detection of potato tuber spindle viroid using quantitative RT-PCR
- Certified methodologies: Methodology for growing and potato protection to improve the environment; based on that, supports for starch potato growers are beginning to be realised; a series of certified methodologies directed at all important pests and diseases (late blight, silver scurf, black scurf, Colorado potato beetle, wireworms); an atlas of pests and diseases was issued; attention was paid to abiotic injuries
- Verified technologies: Technology of potato protection against late blight, use of NoBlight system – a new forecast of the first occurrence of this most important potato pathogen. Technology of potato growing directed at higher efficiency of fertilisation and water conservation
- Utility design: Erosion control tillage equipment
- Varieties: Valy, Valfi, Valmont, Valkýra, Val Blue potato varieties
- Utility designs: Hybridisation probe for potato virus Y detection in potatoes. LI reaction mixture for molecular detection of potato leafroll virus (PLRV) using quantitative RT-PCR
- Technical book – monograph: "Potatoes: breeding – growing – use – economics" (in Czech)

Many applied results were concentrated on the proposal of the integrated technology of potato growing, aimed at the introduction of a potato-growing system which takes into account growing and protection principles for improvement of the environment and which will not limit potato production and thus the economic indicators of growers to a great extent.

From the field of bibliometry, many articles in the Jimp, Jrec categories; articles on proceedings from the Thompson Reuters database.

Research and Breeding Institute of Pomology Holovousy, Ltd.

(Výzkumný a šlechtitelský ústav ovocnářský Holovousy s. r. o.)

Holovousy 129, 508 01 Hořice
Telephone: +420 491 848 205
E-mail: info@vsuo.cz
Website: http://www.vsuo.cz

The Research and Breeding Institute of Pomology Holovousy Ltd. is the only research institute in the Czech Republic focused on pomological research of the main fruit species of the moderate climatic zone. In its more than 65-year history, the Institute has been focused mostly on applied research and development. Its direct reflection of the requirements of fruit growers' practice and the transfer of results in the past 20 years has been successfully realised primarily through the Union of Czech Fruit Growers, which represents more than 520 entities. Currently, the Institute is dealing with projects of the Ministry of Agriculture, Ministry of Education, Youth and Sport and the Technology Agency of the Czech Republic. Thanks to the Pomology Research Institute (OVI) project – reg. No. CZ.1.05/2.1.00/03.016 – the Institute has become one of the supported regional applied research centres within the OP RDI – Priority Axis 2 – Regional Research and Development Centres.

Keywords: research in pomology, breeding of fruit species, fruit gene pool, fruit plant protection, fruit growing technology, contractual research in pomology, licences

Main Activities

Within the "National programme of conservation and use of plant germplasm in the Czech Republic", the RBIP Holovousy preserves and annually evaluates field collections of more than 2300 cultivars of important fruit species of the moderate climatic zone. Duplicate preservation is tested, using biotechnological methods in actively growing in vitro cultures and regeneration after cryopreservation in liquid nitrogen.

The breeding programme has been ongoing for more than 50 years and is focused on sweet cherries, apples, plums and apricots. Hand in hand with breeding, the introduction and testing is carried out of new prospective cultivars from abroad, to provide the breeding programme with suitable genotypes with valuable properties.

Research activity aimed at increasing the competitiveness of the Czech growing sector in the European area focuses on the following priorities:

- Sanitation of prospective pome and stone fruit cultivars, using modern biotechnological methods, with subsequent transfer of virus-free primary sources to users.
- Innovations of pome and stone fruit-growing technologies, using new knowledge of integrated and organic fruit production systems and of fruit storage, mainly in the field of varieties and rootstocks, and protection against harmful organisms.

- The essential aim is to reduce the entry of extraneous substances into the orchard ecosystem and the environment.
- Specification of agrotechnical interventions in newly established commercial stone and pome fruit orchards, with a focus on soil care and its effective usage; research in modern methods of fertilisation and nutrition, as well as in pruning and thinning.
- Refinement of optimal harvest date determination within pome and stone fruit, as well as finding optimal storage conditions for prolongation of the use of domestic products on the market.
- Formulation of propagation and growing technologies, including ecological systems in small fruit and neglected fruit species, in order to enforce their inclusion into the agrarian sector.
- Selection of pome cultivar and genotype prospects for breeders, using new effective methods, with the aim of intensifying the usage of genetic markers with a direct connection to important economic traits.
- Contractual research in the fruit-growing sector for completing specific tasks in testing of plant protection and auxiliary preparation treatments, innovations in fruit processing technologies and testing of new materials in fruit production.
- Transfer of research and development knowledge to the professional public through organisation of seminars and workshops, and to students through participation in the OP Education for Competitiveness educational projects.

Professional Cooperation

At the international level, RBIP Holovousy is actively involved in the following major European and international organisations:

- ISHS (International Society for Horticultural Science) which associates 7 000 members from 140 countries.
- EUFRIN (European Fruit Research Institutes Network) which includes 30 universities and members of research institutes.
- EUCARPIA (European Association for Research on Plant Breeding) connecting breeders' stations.

In 2019, RBIP Holovousy will be the organiser of the international EUCARPIA congress. This conference is preceded by the 4-year year period during which RBIP Holovousy is a presiding member of the EUCARPIA organisation.

In progress at present are the implementation of the Czech-Norwegian collaborative project entitled Conservation and breeding potential of native fruits in the Czech Republic and Norway, and the Czech-Portuguese collaborative project within the framework of the EUREKA CZ programme, entitled Introduction of high-quality cherry cultivars suitable for the European market, with the acronym INNCHERRY. Successfully completed projects include the Integrated approach for increasing breeding efficiency in fruit tree crops entitled "Fruit Breedomics", which was financed from 7th Framework programme. This project, with participation of 26 partners (Europe, USA, China) focused on the genome research of local fruit cultivars.

The project: Building and promoting a European Pyrus collection – A case study, acronym – ECoHisPy (European Collection of Historical Pyrus), with participation of 12 European research bases, was also successful.

An important area in the field of international cooperation is the testing of cultivars and genotypes of the RBIP Holovousy breeding programme. This testing is being carried out in many countries worldwide (USA, Chile, Argentina, Australia, Japan, China, SAR and EU, etc.) and cooperation is granted by contracts for testing of the plant material.

Other forms of collaboration include e.g. cooperation with Albania, Bosnia and Herzegovina under the project No. CZDA-RO-BA-2013-3-31192 – Institutional support for certification and control of plant material supported by the programme for Development Assistance of the Czech Republic assisting Albania, Bosna and Herzegovina; cooperation with Moldova within the framework of ACSA – National Agency for Rural Development; cooperation with Switzerland within the framework of Monitoring of *Venturia inaequalis* virulences, with participation by 40 institutions within and outside the EU.

Important Research Results

Publication and editorial activities are important aspects of the transfer of results to practice. For 57 years, the Institute has been issuing the publication *Scientific Papers of Pomology* (*Vědecké práce ovocnářské*). The Institute also arranges the publication of certified methodologies for fruit-growing

practice. The publication of directives for integrated plant protection in fruit plantations is also a very important chapter. Its last innovated version was issued in 2015 for pome and stone fruits. These directives are aimed especially at the members of the Association for Integrated Fruit Growing Systems (Svaz pro integrované systémy pěstování ovoce – SISPO) as methodical guidelines for fruit production with the minimal addition of chemicals and agro-environmental burden.

Research and scientific workers publish results of their research in journals with an impact factor, reviewed journals and in other professional and popular periodicals. Annually, the Institute participates in national and regional exhibitions. It provides consultancy and pest and disease forecast services in plant protection of the orchards. In addition to these activities, the Institute provides economic consultancy, expert opinions and activities for natural and legal persons, state institutions and local governments. As part of the transfer of research results to practice, the Institute ensures the organisation of important national and regional professional events for fruit growers and nurserymen. The annual "Fruit Growers' Days" event, celebrating its 60th anniversary in 2017, is one of the most important.

In 2015, a grant project was completed within the framework of the Operational Programme Education for Competitiveness CZ.1.07./2.3.00./45.0045, aimed at the creation of educational models focused on fruit growing and the health benefits of fruit. Among other things, the project results include 35 methodological lists on research

practice for teachers and 8 e-learning materials focused on research in fruit-growing and horticulture areas.

Breeding of the 'Tamara' sweet cherry cultivar is also an important result. The cultivar is registered, legally protected and propagated with a licence in foreign countries. To date, 83 cultivars of apples, sweet cherries, pears, plums, apricots, elderberry and rootstocks are registered by the RBIP. Fifteen new cultivars are currently under the registration process. Cultivars are propagated on the basis of licence agreements. In 2016, the Institute was granted Patent No. 306341, entitled "Mobile sprinkler for small areas" (Pojízdný postřikovač pro malé plochy).

In 2015, thanks to the accepted grant application from the Operational Programme Research and Development for Innovations (OP RDI), Priority Axis 2 – Regional Research and Development Centres, the Fruit Research Institute (Ovocnářský výzkumný institut – OVI) was constructed. It is fully equipped with the new infrastructure necessary for performing top quality research in the field of fruit growing. To enlarge research capacity, 30 new employees were recruited. In 2015, a follow-up project was launched under the National Programme of Sustainability I. (Národní program udržitelnosti I. – NPU I.) which aims to assist in the stabilisation of newly built infrastructures of the OP RDI.

Research Institute for Soil and Water Conservation

(Výzkumný ústav meliorací a ochrany půdy, v. v. i.)

Žabovřeská 250, 156 27 Praha 5 – Zbraslav
Telephone: +420 257 027 111
E-mail: info@vumop.cz
Website: http://www.vumop.cz

The history of the Institute has been written since the 19th century when the Technical Office of the Agricultural Council was founded. The present-day Research Institute for Soil and Water Conservation – RISWC was established as an independent authority on 1 January 2007 after a series of transformations of amelioration and pedological research organisations.

Applied research and basic research are the main activities according to the Foundation Deed. These activities are carried out in eight departments: Headquarters, Central Laboratory, Department of Hydrology and Water Conservation, Department of Pedology and Soil Protection, Department of Soil Hygiene, Department of Landscape Use and Engineering, Economic and Interior Management, and Soil Service. The high quality of research and development results is due to the strong ties among the departments and their mutual cooperation.

Keywords:
agricultural soil, surface and groundwater, soil protection, water protection, point and diffuse contamination sources, soil and water contamination, soil remediation, landscape engineering, remote sensing, geographical information systems, soil service

Main Activities

The main activities of the Institute are focused on the research of Pedology, Hydrology, landscape engineering and the application of remote sensing and geographical and information systems. The budget is provided in the form of institutional support and public research programme support (projects of Research Agencies, e.g. National Agency for Agricultural Research, Technological Agency of CR, Safety Research of Ministry of Interior, Czech Science Foundation). The complex institutional research project – "Integrated protection of Soil, Water and Landscape" – is financed by institutional support. RISWC successfully collaborates on international research programmes (HORIZON 2020, Norway Funds).

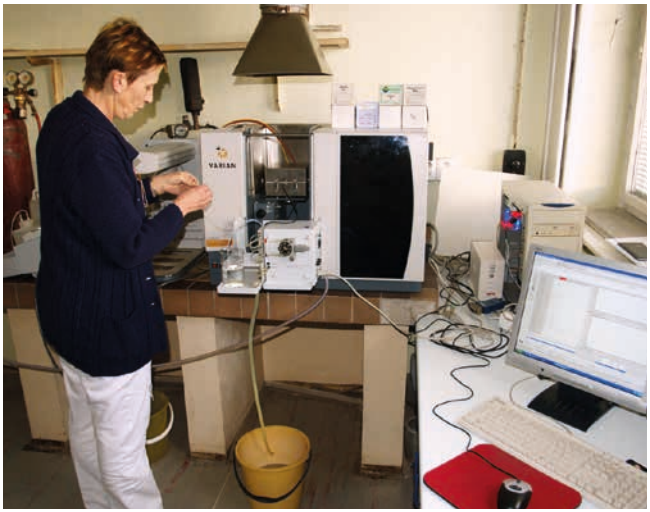
Professional Cooperation

RISWC cooperates with national and foreign research institutions, e.g. resort and private research institutions, research institutions of the Czech Academy of Sciences, and universities. Practical cooperation is important, in particular

cooperation with farmers and other organisations (SKANSKA, RSD, etc.). Research results are used in the field of husbandry on agricultural soils by planning of long-term sustainable husbandry systems with respect to soil, water and landscape protection. RISWC is a member of international research projects. Direct international cooperation is provided, for example, on the development of tools to combat soil erosion in Ethiopia. RISWC researchers teach at universities and are members of national and international scientific and professional boards, commissions and unions (International Union of Soil Sciences, European Society for Soil Conservation, etc.). Attention is paid to counselling activities (collaboration with the Agricultural Association). RISWC was established as a scientific technological park in 2017.

Important Research Results

RISWC research results exist in the form of publication results (scientific and professional journals and books) and are used in agricultural practice. Examples of important applied results are support materials for legislative norms in the field of soil, water and landscape protection (rules, directives, governmental regulations, juridical and technical norms) and patents, certified methodologies, technical patterns and support materials for the Common Agricultural Policy. RISWC deals with the information when organising workshops, conferences and scholarships for governmental administrative bodies. RISWC collaborates on the "Demonstrations Farms" project of the Ministry of Agriculture. RISWC researches current topics in the public media. The applied results of RISWC won the "Zlaty klas 2016" award by the Ministry of Agriculture.



Research Institute of Agricultural Engineering

(Výzkumný ústav zemědělské techniky, v. v. i.)

Drnovská 507, 161 01 Praha 6
Telephone: +420 233 022 111
E-mail: vuzt@vuzt.cz
Website: http://www.vuzt.cz

The Research Institute of Agricultural Engineering – RIAE is a public research institution focused on applied research and development in the spheres of agricultural engineering, technology, energy industry and building, as well as on the bordering scientific disciplines of animated and lifeless nature related to these branches. These specifically entail agricultural, technical, economic and environmental sciences. Research and development are also aimed at the solution of problems in agriculture, rural areas and municipal spheres. RIAE workers are the authors of many utility models and patents. The practical results of research are implemented in practice by certified methodologies. Research workers have published a number of specialised books and articles in scientific journals.

Keywords:
animal welfare, biomass, agricultural machinery, soil erosion, water retention, biodegradable wastes, animal breeding, renewable energy, briquettes, pellets, bioeconomy, biofuels, air pollution, economy of production, product storage

Main Activities

Research activities are divided into the following main directions:

Agricultural machinery, technology and construction

- Material and energy intensity of variously solved systems of soil management and farm animal breeding and their optimisation by the application of targeted research results and new technological systems
- Increase of farm product quality and safety by utilisation of sensor systems, actuating devices and automatic data collection. Utilisation of these systems for the control of production processes in real time, control of production processes´ quality based on critical points, and processing of documentation related to the course of production processes
- Relationship among technological systems for farm animal breeding and their effect on product environment, welfare, health state and performance
- Influence on the environment of modern technological systems and production technologies destined for productive and also ecological husbandry
- Reaction of farm animals to variously implemented breeding systems and their parameters. Adaptation of technological

systems to requirements and needs of breeding animals, with utilisation of the results of performed research work
- Landscape management under conditions of sustainable development
- Land care under conditions of multifunctional agriculture (development of productive, non-productive, ecological, social, cultural and recreational functions); adaptation of technological systems
- Ecologically and economically acceptable management of soils threatened by erosion
- Care of soil and crop covers, with the aim of reducing risk of pesticide residue occurrence in foodstuff and feed
- Soil management with favourable impact on landscape in rural areas
- Care of aesthetic aspects of landscape under conditions of intensive agricultural production
- Utilisation normative of operational and investment costs of agricultural machinery
- Normative of technical and economic parameters of recommended sets for technical provision of agricultural production
- Evaluation of state and innovation of technical equipment in agriculture
- Evaluation of necessary machinery in agricultural enterprises
- Recommended technological processes in crop growing; input evaluation, production and general economic profitability of crops
- Rational systems of reserve and productive fertilisation; selection of suitable material input with minimisation of costs
- Evaluation of production purposes of agricultural enterprises; effect of fixed and variable costs; influence of subsidies
- Recommended technological processes in growing of non-food crops
- Recommended systems of material and energetic utilisation of production
- Economic and energetic effectiveness of biofuels
- Creation of expert systems as support to decision-making process in agricultural practice – modelling and calculation of operational costs of machines and machinery sets; technology and economy of crop cultivation; technology and economy of production and utilisation of biofuels, etc.
- Mobile energy means and machinery; transport and handling of machinery and facilities
- Optimisation of logistic chains; implementation of transport tasks on different levels of agro-food complex
- Determination of normative fuel consumption for specific operations, crops and products
- Optimisation of energy needs of agricultural enterprises, working operations and final products
- Research in problems relating to the effect of agricultural activities on the environment – atmospheric burden of ammonia, greenhouse gas, odour and dust emissions
- Verification of methods serving for utilisation of suitable agricultural machinery for renewal of historical countryside, and processing of biologically degradable waste originating from agricultural activities, or countryside maintenance
- Direct application of outputs resulting from solution of particular problems originating from processes of law formation, government decrees or departmental ordinances
- Advisory activity on spheres of air pollution, biologically degradable waste processing and improvement of agricultural activities in the cultural landscape
- Authorised measurement of gas emissions (certificate)

Agricultural energetics and construction

- Utilisation of biomass and waste materials as renewable sources of energy – biogas plants in agriculture
- Utilisation of biogas for electrical energy production and integration of biogas plants into rural energy systems
- Co-fermentation of energy plants in mixture with biologically degradable waste
- Technology for sustainable waste management in agricultural enterprises
- Production and utilisation of organic and organo-mineral manures on the basis of farmyard manure and biologically degradable waste
- Non-food utilisation of agricultural production
- Effective production and utilisation of renewable sources of energy originating from agriculture
- Utilisation of biomass for electrical energy production and its integration into rural energy systems
- Control and optimisation of energy and technological processes
- Illuminative systems in agricultural production structures
- Ventilation and heating systems in buildings destined for agricultural production
- Production and use of fuels from biomass, fuels of first and second generations
- Production and utilisation of solid fuels of biomass (wood chips, briquettes, pellets)
- Production and utilisation of thermally gasified fuels produced of biomass

Professional Cooperation

Representatives of the Research Institute of Agricultural Engineering, p.r.i. (RIAE, p.r.i.) are members of the following organisations:

EAPR – European Association of Potato Research,

ESSC – European Society for Soil Conservation,

ISTRO – International Soil and Tillage Research Organisation.

The RIAE, p.r.i. is an active member of ENGAGE (Association of European Institutes of Agricultural Engineering). This association is included in EurAgEng as a regional association of agricultural graduates for Europe within the CIGR.

Our Institute is also a member of the Association of Agricultural Engineering Institutes of Central and Eastern Europe (CEEAgEng).

Important Research Results

The results of research are continuously presented in specialised and scientific publications, and at national as well as international conferences. Agricultural land in the Czech Republic is largely exposed to the risk of water erosion on grounds of habitat, but as well of agrotechnology. The beginning of the surface runoff during conventional tillage with ploughing was the shortest of all the variants; while the surface runoff during reduced tillage was reduced significantly more than by conventional tillage with ploughing. The results of the surface runoff speed and the speed of infiltration of water into the soil with the simulation of intense rain, confirm the significant benefits of soil conservation tillage technology.

Production of solid particles significantly increases the danger of combustion engines. The excellent sorption characteristics of solid particles increase their harmful effects and make them very dangerous components of emissions which causes health problems. The following fuels were tested: diesel, rapeseed methyl ester, rapeseed oil, Jatropha curcas oil, biobutanol, hydro-treated oil, and other blended fuels. Measurement and comparison of results showed that the use of biofuels can significantly reduce combustion engine smoke by up to tens of percent in comparison to diesel.

VÚŽV
Institute of Animal Science

Research Institute of Animal Science
(Výzkumný ústav živočišné výroby, v. v. i.)

Přátelství 815, 104 00 Praha Uhříněves
Telephone: +420 267 009 650
E-mail: vuzv@vuzv.cz
Website: http://www.vuzv.cz/

The Institute of Animal Science (IAS) in Prague is a public research institution. Since its foundation in 1951, it has been a centre of research into the biological and biotechnical principles of livestock farming.

The IAS carries out basic and applied research concentrating on innovation and practical use of knowledge in animal husbandry. Eight research departments conduct research in the fields of animal genetics and breeding, bio-technology and reproduction, nutrition, quality of products, animal ethology and welfare, breeding technology, herd management and production economy.

The IAS has its own comprehensive experimental base and farmsteads working on almost 800 hectares of farmland in Uhříněves, Netluky and Královice. In addition, it has a detached pig-breeding workplace in Kostelec nad Orlicí.

Keywords:
research, animal production, animal husbandry, genetic resources, quality of products, genetics, bio-technology, reproduction, nutrition, ethology, technology, herd management, production economy

Main Activities

Basic and Applied Research – Departments:

- Biology of Reproduction
- Genetics and Breeding of Farm Animals
- Physiology of Nutrition and Quality of Animal Production
- Nutrition and Feeding of Livestock
- Ethology
- Livestock Technology and Management
- Cattle Breeding
- Pig Breeding

In addition to basic and applied research, the IAS carries out other expert activities. One of the most significant of these is the implementation of the National Programme for the conservation and use of genetic resources of farm animals, in which the Institute acts as an expert and coordinating body and also facilitates all the related international agendas. The Institute also ensures the activities of the Scientific Board for Animal Nutrition.

Professional Cooperation

- International cooperation – collaborative research and internships
- Partnership with leading Czech universities and the Academy of Sciences of the Czech Republic
- Cooperation with breeding associations, agricultural businesses and farmers
- Membership of and cooperation with renowned international institutions (EAAP, FAO-UN)

The IAS contributes to a number of international projects, of which the most important is currently co-operation in the European SOUNDWEL project, which aims to create an effective non-invasive tool for assessing the standard of living of pigs on farms, by means of emotions expressed by vocalisation. It is also well worth mentioning the collaboration with a Polish partner within the MOBILITY programme on a project concerning the determination of the fatty acid profile in the meat of locally adapted pig breeds.

Important Research Results

The IAS publishes in high-impact and peer-reviewed journals and issues certified methodologies. Results applicable in practice are transferred in the form of patents, utility models and various forms of advisory activities (online advice, e-mail and correspondence consultation, personal consultation visits, consultant training).

A fundamental discovery by Josef Fulka Jr., published as an important finding in the prestigious journal "Trends in Molecular Medicine", has reached international significance.

Josef Fulka Jr., DSc. is an expert in the biology of reproduction and a leading Czech specialist in nuclear transfer. Together with his team working on a research project funded by the Grant Agency of the Czech Republic, he disproved the existing knowledge in the field of developmental biology.

He demonstrated that the nucleolus in the egg is not the bearer of important material from which further nucleoli are formed after fertilisation, but that its presence is necessary for a very short period of time following fertilisation. This theoretical finding is essential in the development of assisted reproduction. The project is assessed as "excellent" on the Grant Agency's website.

Excellent results have also been achieved in the area of embryo biotechnology research by Prof. Jaroslav Petr, DSc. and his team. They are studying the negative impacts of environmental pollutants on the quality of mammalian oocytes. In co-operation with the Czech University of Life Sciences in Prague and the Faculty of Medicine at Charles University in Plzeň, they were the first to prove that bisphenol S causes extremely serious damage to mammalian eggs. They tested the effects of this substance on the eggs of sows, which are far more similar to human eggs than the eggs of laboratory mice or rats. The study published in the respected scientific journal, "Scientific Reports", shows that bisphenol S causes at least the same level of serious damage to sows' eggs as its notorious predecessor, bisphenol A.

Research into the effective use of phosphorus in feed mixtures for laying hens has provided great benefits to rearing practice. The working team led by Prof. Miloš Skřivan, DSc., on the basis of its long-term study, has proposed a modification to the dosage of phosphorus in feed mixtures for laying hens which is reduced by 25% (and by as much as 50% for the addition of the enzyme phytase) in comparison with the standard issued by the Czech Academy of Agricultural Sciences (2007). These measures also result in a considerable economic saving, while lowering the environmental burden of phosphorus from chicken droppings by as much as 28 to 50%.

The team of Prof. Ing. Luděk Bartoš, DSc. has also achieved interesting results in the area of horse and dog reproduction. The results of their research have been presented in the prestigious scientific journal, "Scientific Reports".

Research Institute of Brewing and Malting, Plc.

(Výzkumný ústav pivovarský a sladařský, a. s.)

Lípová 15, 120 44 Praha 2
Telephone: +420 224 900 160
E-mail: info@beerresearch.cz
Website: http://www.beerresearch.cz

The Research Institute of Brewing and Malting (RIBM) was founded in Prague in 1887. It consists of two workplaces, the Brno Institute of Malting (founded in 1920) and the Brewing Institute in Prague. Both workplaces are accredited by ČIA CR according to EN ISO 17025. RIBM is the only research organisation in the Czech Republic whose main activity is comprehensive research in the field of malting and brewing. It covers the whole range of malting and brewing issues in their entirety from the research of barley and hops, malting and brewing technology to quality parameters, health benefits and health safety issues. The spectrum of research issues covers basic research as well as industrial research and development. The research team consists of 23 experienced researchers. The RIBM has fully equipped analytical, microbiological and sensory laboratories and pilot facilities.

Keywords:
malting barley, malt, malting technology, hops, brewer's yeast, microbiology, brewing technology, beer, fermented beverages, analyses of malt and beer, LC / MS-MS, GC / MS-MS, food safety

Main Activities

The core research activities are concentrated under the overarching programme called "Czech Beer". Comprehensive research of raw materials, technological and analytical aspects of Czech beer specifics were crowned by the European Commission's adoption of the Protected Geographical Indication "České pivo" in 2008. RIBM tests the malting quality of barley varieties in the registration process of the Central Institute for Supervising and Testing in Agriculture, and also the brewing characteristics of new varieties of hops. Thanks to the activities of RIBM, the Czech Republic is the only country that recommends certain varieties of barley and hops for national (Czech) beer production.

Strategic activities of the Institute include the further research of the raw materials, technological and product specifics of Czech beer and the positive health aspects of the Czech beer phenomenon. Research is supported by the Ministry of Agriculture within the framework of the long-term programme for research organisation development. The aim of the LO1312 project is to research sensory active substances in beer and their precursors, from raw materials to the final product by the new Sensomics technique. Research is ongoing of Sensomic profiles of malting barley and hop varieties, prediction of organoleptic characteristics of beer based on a variety of properties and soil-climatic variability of raw materials. The resulting "Sensomic Map"

of Czech beer will be a tool for preserving the beverage character, a standard for future generations.

An important segment is the research of contaminants (metals, N-nitrosamines, mycotoxins, pesticide residues) in raw brewing ingredients, cereals, beer and beverages. The method for the determination of "masked" Fusarium mycotoxins and a multi-residue method for the determination of pesticide residues in hops have been certified.

The Microbiological Department manages an internationally registered collection (RIBM 655, yeast, bacteria) and conducts research in brewing yeast strains (physiology, genetics, preservation) and deals with new strains for the production of cereal- and fruit-fermented beverages. Of course, the microbiological safety of brewing operation and products is an important matter.

For many years, RIBM has been conducting research projects for partners in the industry. Traditional contracting partners are from small as well as large companies (Sladovny Soufflet ČR, Pilsner Urquell, Budweiser Budvar, PMS Přerov, a.s., among others). RIBM also prepares training modules for industrial partners, in which the latest international scientific knowledge is shared, as well as its own results from research projects. Such activities enable the direct transfer of up-to--date scientific knowledge to practical application.

RIBM is an important partner in the "Centre for Innovative Use and Enhancing Competitiveness of Czech Brewing Raw Materials and Products" (TE02000177, 6 research organisations, 11 industrial enterprises). The aim is to increase the profitability of the Czech food industry by new products with health benefits and friendly, economically efficient raw ingredient processing technologies.

The modern RIBM equipment and laboratory facilities allow for new processes and recipes to be developed and validated, and new process control devices to be tested. Within the scope of the CZ.2.16 / 3.1.00 / 28030 project – "Research Sensory Centre in Prague" – the largest laboratory was built for sensory tasting and as a sensory centre for the needs of the food industry in the Czech Republic.

The Institute's publishing house publishes the Czech/English peer-reviewed journal "Kvasný průmysl" (Fermentation Industry) and has published a number of monographs, authored in part by Institute staff participation, such as "Brewing and Malting Analytics", "Technology of Malt and Beer Production", "Sensory Analysis of Beer", "Quality of Herbal Products on the Threshold of the Third Millennium".

The Institute organises regular "Brewing and Malting Days" national conferences.

New research activities of the Institute are involved in other areas, not only the agricultural and food segments, but also in purely technical fields and healthcare. Examples are projects: EC 613665 "Development of Multisensor Device for Monitoring and Control of Process Parameters of Food Production", TA01011363 "Development of Sensor System for Diacetyl Determination in Beer", GAMZ "The potential of xantohumol and beta bitter acids for the treatment of cerebrovascular infections" and GA14-10233S "Humulus Lupulus L. – source of substances with antimicrobial effects".

Professional Cooperation

In the field of international cooperation, RIBM is active in all three committees of the European Brewery Convention (EBC) and the Central Brewery Analytical Commission (MEBAK). Close cooperation was established under the V4 grant programmes with universities in Poland (Lodz University of Technology), Hungary (Corvinus University of Budapest) and Slovakia (Slovak University of Technology in Bratislava). Cooperation has also been established under the 7th EU Framework Programme with 11 research organisations from 6 European countries (Spain, Finland, UK, Italy, Netherlands) The Multi Sensor Technology project

for management of food processes operated by the Spanish IRTA-Monells company has enabled the Institute's research activities to be expanded into high-end sensor technologies for management of the key processes of selected food production, including brewing.

Research and educational collaboration with the Agricultural Academy in Sofia, the University of Maribor (Slovenia) is ongoing within the Leonardo da Vinci and Erasmus+ programmes. The Institute also conducts significant research activities for Japanese, Korean and French companies.

The RIBM cooperates with a number of Czech universities, public and private research organisations on a project or contractual basis: Mendel University in Brno, University of Chemistry and Technology, Prague, Charles University Faculty of Mathematics and Physics, Institute of Microbiology of the Czech Academy of Sciences, Czech University of Life Sciences Prague, Hop Research Institute Co., Ltd., Agricultural Research Institute Kromeriz, Ltd., etc.

In the past decade, numerous Bachelor's, Master's and Doctoral theses have been completed under the leadership of Institute staff. RIBM is an active member of the Czech Membrane Platform.

Important Research Results

RIBM researchers are the authors of many articles in impact journals, contributions at international conferences and applied results. The complete data on R & D & I projects and the results obtained are available in the VUPSIS information system at: https://vupsis.beerresearch.cz/verejne/.

Some results are applied in industrial production and have won awards in competitions. These include:

- Patent (CZ 304725) – the strain of Lactobacillus paracasei is isolated from "Tibetan crystal" and its use in the production of non-alcoholic and low-alcoholic beverages from fruit and/or cereal substrates. In the 2016 competition for the best realised result of research and experimental development, RNDr. Dagmar Matoulková, Ph.D. was awarded the 1st prize by the Minister of Agriculture of the Czech Republic.
- The output of the FI-IM5 / 067 project – Research and development of the technology for the production of beer for coeliac disease sufferers (gluten-free beer) is patented (CZ 303804) under the beer tradename "Celia" and is produced by Žatec brewery. The beer was awarded 2nd place in the prestigious "Innovation of the Year" contest organised by the Association of Innovation Business of the Czech Republic (AIP CR). Celia beer is produced in several mutations and exported to 5 countries worldwide.
- The QI101B090 patent (EN 304 200) – is the output of the project for a dietary supplement based on green hops with effect on Helicobacter pylori (cause of stomach ulcer diseases). Under the tradename "Chmelinky", it is manufactured by Carla company.
- Patent CZ 303 565 – The cultivation medium for cultivation and identification of Pectinatus bacteria – in 2015 was protected in all European countries. A licence agreement with an industrial partner has been signed.
- Patent CZ 306 371 – The production of non-alcoholic beer with reduced gluten and carbohydrate content is prepared by this method.

SELTON Research Centre, Ltd.
(Výzkumné centrum SELTON, s. r. o.)

Kolodějská 24, 250 84 Sibřina
Telephone: +420 281 012 458
E-mail: selton@selton.cz
Website: http://www.selton.cz

The SELTON Research Centre is a non-profit private research organisation, founded in 2004. Its purpose is to strengthen technology and genetic resources' transfer from basic and applied research to agricultural practice. This is achieved in collaboration with commercial plant breeders by applying new varieties of field crops. The Research Centre employs eight scientific workers and undertakes several applied research projects.

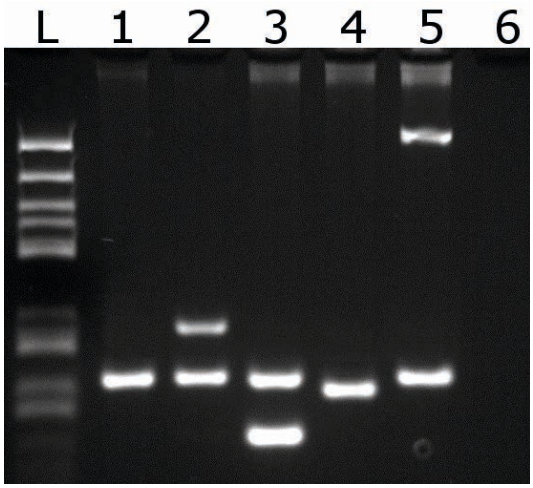
Keywords:
plant breeding, resistance, quality, genetic resources, wheat, barley, legumes

Main Activities

Applied research and the transfer of results to practical plant breeding. Study of genetic diversity and identification of basic breeding materials, research of methods in marker-assisted selection. Production of genotypes with combined resistance to several simultaneous stress factors. Verification of breeding materials' quality in diverse growing systems of low and high input. Ensuring food safety by applied research of *Fusarium* and development of tolerant materials with low mycotoxin content. Development of new materials with specific production quality; development of quality evaluation methods. Study of possibilities of food allergen reduction. Apart from research activities, SELTON is also involved in education and the popularisation of research results.

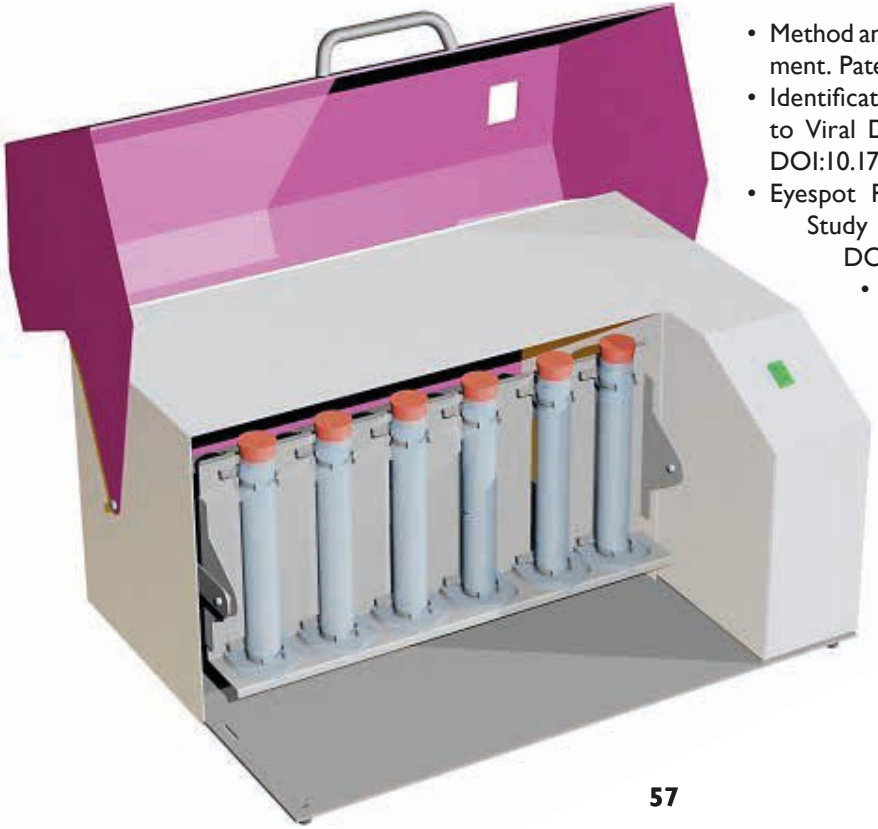
Professional Cooperation

Extensive cooperation with Crop Research Institute in Praha Ruzyně, v.v.i. and other research companies, e.g. Agrotest Fyto, Ltd. Collaboration with important national and foreign breeding companies, e.g. SELGEN (CZ) and Florimond-Desprez (FR) in the practical application of research results.



Important Research Results

- Derivatives of 5-ethyl-1-(phenyl)-4-oxo-1.4-dihydropyridazine-3-carboxylic acid and their use as pollen development inhibitors. Patent CZ305296



- Method and device for sedimentation value measurement. Patent CZ304733
- Identification of Genes Conferring Resistance to Viral Diseases of Barley Using Multiplex PCR. DOI:10.17221/171/2015-CJGPB
- Eyespot Resistance Gene Pch1 and Methods of Study of its Effectiveness in Wheat Cultivars. DOI:10.17221/157/2015-CJGPB
- Wheat – Alicia, Lotte, Penelope, Registana
- Field peas – Lump
- Field clover – Feng, Gregale
- Ryegrass – Protektor

VRI VETERINARY RESEARCH INSTITUTE

Veterinary Research Institute

(Výzkumný ústav veterinárního lékařství, v. v. i.)

Hudcova 296/70
Telephone: +420 5 3333 1616
E-mail: vri@vri.cz
Website: http://www.vri.cz

The Veterinary Research Institute (VRI) is the only research institute in the Czech Republic involved in research in veterinary medicine, and one of the few in Europe able to conduct the most demanding studies with the right balance between basic and applied research, due to the professional level of its teams, methodological basis and instrumentation. Its investigations cover all types of farm animals, whilst the control of cattle, pig and poultry diseases is a top priority. The VRI also focuses its efforts on other animal species. From the point of view of public health, studies of major zoonotic diseases and food safety are carried out.

Keywords:
veterinary medicine, zoonosis, animal health, antimicrobial resistance, cattle, pig, poultry, virology, bacteriology, food and feed safety, immunology, genetics, toxicology, pharmacology

Main Activities

The research objective of the VRI comprises basic as well as applied research in the field of agriculture. It also includes an area of broad preclinical and clinical disciplines, including human medicine, ecology and other specialisations in biomedicine. From the aspect of public health, of paramount importance is the research focused on diseases transmissible to humans such as food- and water-borne diseases of zoonotic origin. Traditional research areas are also aetiology, pathogenesis, diagnosis and epidemiology and prevention of infectious diseases that cause consequential economic losses in cattle and pig herds, as well as in poultry and fish. One of the important activities is focused on monitoring the trends in resistance to antimicrobial agents among bacteria isolated from animals, food and humans, and on identifying the transmission routes of resistance from animals to humans directly or via the food chain.

The main scientific activities are carried out in 7 departments of the Institute:

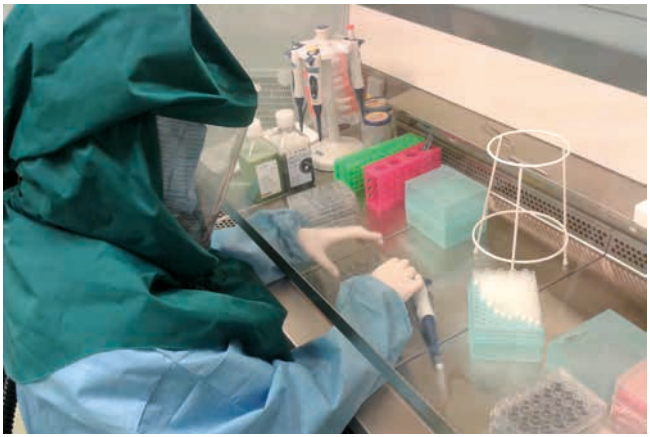
- Department of Virology
- Department of Bacteriology
- Department of Immunology
- Department of Food and Feed Safety
- Department of Genetics and Reproduction
- Department of Chemistry and Toxicology
- Department of Pharmacology and Immunotherapy

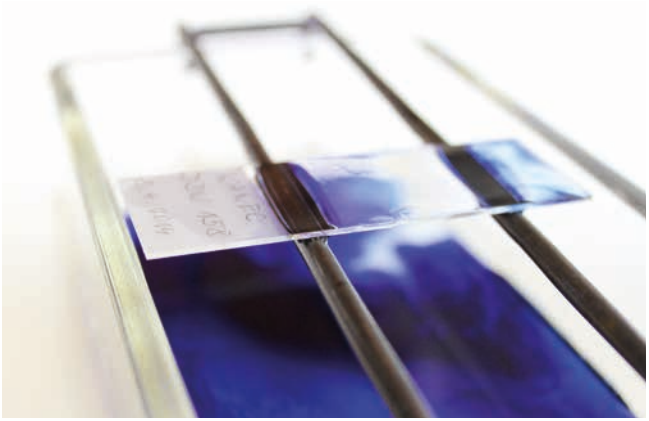
The VRI provides the necessary background for a series of national and international organisations. In the sphere of infectious diseases, the Institute has a statute of the National Reference Laboratory of the State Veterinary Administration for *Escherichia coli* and coli infections, the National Reference Laboratory for Viral Diseases of Fish and the OIE Reference Laboratory for Paratuberculosis.

One of the most significant parts of the Institute is a complex of accredited experimental stables, in which both non-infectious and infectious experiments can be carried out on common animal laboratory models such as mouse, rat and rabbit, as well as on livestock models, e.g. pigs (including gnotobiotic ones), ruminants, fowl and fish. In some of the experimental stables, genetically modified animals can be kept and genetically modified microorganisms can be used for experimental infections.

Professional Cooperation

The Institute has achieved a reputation in most specialisations, acknowledged within the Czech Republic and, in many cases, worldwide. Research teams have succeeded in obtaining and implementing international projects (e.g. EU





FP, Bill and Melinda Gates Foundation, etc.). The VRI is a consortium member in the largest project in FP7 EU, in terms of EU funding in the field Animal Health – Production diseases compromise health and welfare, generating inefficiencies which impact adversely on profitability, environmental footprint, antibiotic use and product quality – ProHealth. Other major projects include a project named "Advanced Studies towards Knowledge on Lyssavirus Encephalitis Pathogenesis Improving Option for Survival – ASKLEPIOS" coordinated by the Erasmus University Rotterdam.

International collaboration is also realised by study stays, long-term training courses and visits to the Institute by researchers and scientists from abroad.

The Institute enjoys long-term collaboration with prestigious universities in the UK, USA, France, Australia, etc., as documented by collective projects, publications and patents. Certain specific collaboration has been formalised by agreements on cooperation, e.g. with The Kielanowski Institute of Animal Physiology and Nutrition of the Polish Academy of Sciences, Poland; the Federal State Public Scientific Institution, Irkutsk, Russia; the Scientific Veterinary Institute Novi Sad, Serbia, etc. The VRI is a member of The Farm Animal Breeding and Reproduction Technology Platform (FABRE TP) professional platform.

The VRI plays an important role in the application of research outcomes. Veterinary bio preparations and diagnostic kits developed within project implementation have been given to manufacturers, many of which are commercially very successful and have resulted in advances in diagnosis and prophylaxis. Some of these results are protected by patents. In cooperation with commercial companies, such as ABRAXIS, R-Biopharm, Ceva Sante Animale S.A., Life Technologies, etc., the VRI has been involved in the production and testing of diagnostic kits for more than 15 years.

Important Research Results

The most significant results of applied research include a vaccine against infectious bovine rhinotracheitis in cattle, vaccines against salmonella infections in poultry and swine, kits for the determination of minimal inhibition concentrations in specific veterinary antimicrobials, nano-based drug delivery methods, diagnostic kits for detection of antibodies against *Mycobacterium avium* subsp. *paratuberculosis*, diagnostic kits for detection of acrylamide and neopterin, and methods developed for detecting food adulteration. All these products are manufactured by companies in the Czech Republic or abroad.

The Institute has also obtained significant results within the framework of basic research studies, such as the impact of chemical contaminants in the environment on the health of animals and humans, including the development of novel methods in this area. Immunoenzymatic methods and biosensors are used for the development of innovative screening methods for rapid detection of trace residues in the environment, feeds and foodstuffs. Novel information has been obtained in the area of feed additives and their effect on animal health. The VRI is the only institution in the Czech Republic to perform physical mapping of farm animal genes.

Other significant studies have been published in prestigious scientific journals on topics of intestinal microflora, pathogenesis of tick-born encephalitis, controlled drug release, molecular epidemiology of *Mycobacterium avium* subsp. *paratuberculosis*, and the role of macrophages in the pathogenesis of infectious swine diseases.

MINISTRY OF AGRICULTURE
OF THE CZECH REPUBLIC

Published by
Ministry of Agriculture of the Czech Republic
Těšnov 65/17, 110 00 Praha 1, Czech Republic
www.eagri.cz

Praha 2017

Photo: Cover – Shaiith, Alex_Traksel/Shutterstock.com
Other photos were provided by the institutions presented.

ISBN 978-80-7434-392-6