

# HUNGARIAN AGRICULTURAL RESEARCH



Special Edition



MINISTRY  
OF RURAL DEVELOPMENT

*EM* 2011.hu

Introduction  
to the System of  
Agricultural  
Research Institutions

Dear reader,

During the period of the Hungarian Presidency of the Council of the European Union, the *Hungarian Agricultural Research*, the official publication of the Ministry of Rural Development, takes the form of a special issue introducing the system of the Hungarian research institutions in the area of agricultural and environmental sciences. On this occasion I am pleased to welcome you, the reader, and I am sure that you will find this brochure informative.



Hungary's natural endowments, farming traditions, rich environmental and diverse geographical conditions, outstanding soil and balanced climatic characteristics provide an excellent basis for high-quality agricultural work, food-related business and environmental management. Thus, in Hungary, the environmental and societal conditions are given. Their sustainable exploitation and utilisation need to be supported by high-level, intellectual and professional based research and development work.

The framework for this is provided by the Hungarian scientific institutional network of rural development, agriculture and environment management, which has a tradition which stretches back more than two hundred years. These traditionally practice-oriented institutions have long been the citadels of Hungarian academic life and we are striving to strengthen them after the difficult period in recent years and to retain them for the future.

The following pages introduce interested readers to the diverse and multidisciplinary work of an institutional network which is based on a rich tradition and also on constant innovation, going beyond Hungary's borders and enriching the European Union with its valuable scientific results.

I trust that you will find this publication useful and it will serve as a guide to the intellectual infrastructure and network of scientific institutions of Hungarian rural development.

*Budapest, 28 April 2011*

**Dr. Sándor FAZEKAS**  
***Minister for Rural Development***

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Agrárgazdasági Kutató Intézet (AKI)

## RESEARCH INSTITUTE OF AGRICULTURAL ECONOMICS



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The Research Institute of Agricultural Economics (AKI) is the most significant centre of agricultural economics research in Hungary. It bridges the gap between decision makers and farmers, processors, distributors and universities; it connects Hungary with the world and theory with practice. The Institute collects and analyses information, performs research and distributes the results it obtains through its publications. The annual Agricultural Reports have been qualified by the Parliament as being objective. The Institute, as a successor to a number of legal predecessors, has been providing services to the Hungarian agricultural and rural sector since 1954. AKI is supervised by the Ministry of Rural Development and has a staff of 130; one-third of which carries out research, while the rest is engaged in management and analysis of information. Data acquisition, data processing, prompt analysis of information and in-depth assessment of interrelations allow the Institute to carry out a wide range of research activities. Through its activities, AKI assists the practical work of the Hungarian government and provides scientific support to agricultural policymakers; at the same time, it aims to make its results available to the stakeholders in agriculture. For this reason, an increasing number of readers, including the Members of the Hungarian Parliament, farmers, interest groups, international organizations, researchers, professors and students, take interest in the various publications issued by the Institute. Such publications offer a real picture of the achievements of the Hungarian agri-food sector, including economic options for the sector, the information of which is particularly needed by the scientific centers of the regions, universities, other research centers, professional and interest groups and by the stakeholders in the supply chain.

The annual Agricultural Report prepared for the Hungarian Parliament and the International Agricultural Outlook Conference attract special attention.

The Institute is structured into two directorates: Directorate of Economic Analysis and Rural Development, and the Directorate of Agricultural Policy. The Directorate of Economic Analysis and Rural Development deals with statistical, market and economic questions regarding Hungarian agriculture, food industry and trade. It operates European Union (EU) compliant information systems required by both research and practice and, with the help of these, the data requirements of the EU can also be met. The Farm Accountancy Data Network (FADN) allows appraising the position of agriculture and that of farms. It monitors the production data of about two thousand small-, medium-, and large-size holdings and assesses how the measures of the Common Agricultural Policy (CAP) are implemented and with what impacts. The other major research field of the directorate is rural development. It studies the income situation of rural areas, the state of the environment as well as how to safeguard the values of rural life.

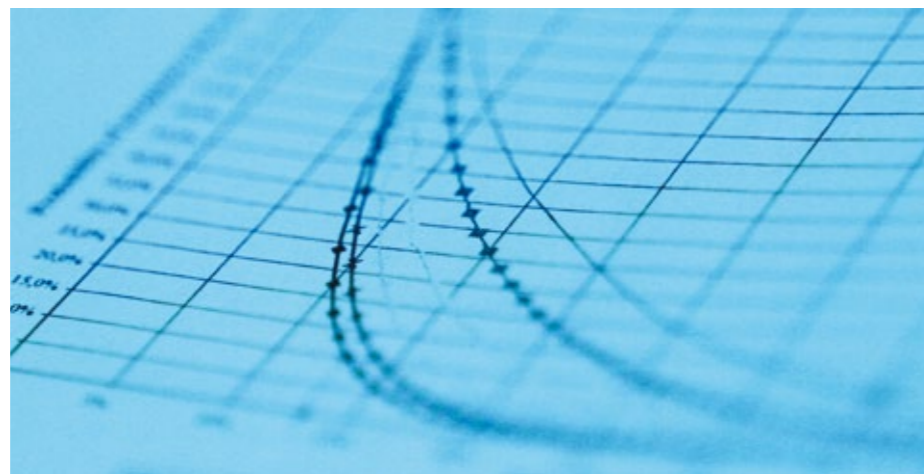
The directorate participates in the preparation of the European rural development strategy and also monitors the implementation process.

The Directorate of Agricultural Policy performs research. The researchers study international agricultural market developments, the role of foreign capital



in the Hungarian agri-food chain, profit sharing amongst the stakeholders, land market policy and competitiveness. The work focuses on the analysis of the CAP of the EU. The Market Information System gathers and processes market price information on agricultural commodities and products. The Institute's publications, describing the major market developments, are used for making operative market regulatory decisions and provide the stakeholders with market information. The scope of such activity includes processing of information, sector-specific revenue analyses and analyses of balance sheets on the financial situation of the agri-food industry.

The scope of the international relations of the Institute has increased in recent years. In addition to the OECD, World Bank, EU and FAO, consultations and international projects with research institutes of other Central/East European countries and Member States of the EU now are organized on a regular basis.



Állattenyésztési és Takarmányozási Kutatóintézet (ÁTK)

## RESEARCH INSTITUTE FOR ANIMAL BREEDING AND NUTRITION



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The predecessor to the Institute, ÁTK, was founded on the order of Ignác Darányi (Minister of Agriculture) in 1896.

ÁTK carries out basic and applied research in breeding, nutrition, reproductive biology and genetics on domestic animal species and provides extension service activities, as well.

The total number of employees is 69, including 23 academic staff members. The Institute's main building, the laboratories, the experimental slaughterhouse, milk processing unit and experimental farm (with pastures and arable land) cover an area of 100 hectares.

In addition to their basic research duties, research workers at ÁTK are working on various grant-supported projects to provide additional income for the Institute, more recently EU framework 5 funds have been obtained for special multinational projects.

Research workers at the Institute played important roles in previous years in the execution of national pig, sheep and cattle breeding programs. They contributed to the development of the Animal Feed Codex and the new protein evaluation system for ruminants. More recently, ÁTK has taken a leading role in the introduction and country-wide application of molecular genetic selection methods in animal breeding.

The most recent results which can be introduced into practice are as follows: A new EU-compatible feed microbiological testing system has been developed and introduced (new methods and quick field tests). New results have been obtained in using protected fats in ruminant nutrition. ÁTK is a member organization of the International Network of Feed Information Centres (INFIC), and has developed a domestic feed databank.

In the subject of nutrition, we deal with preservation of feeds in order to preserve their nutritional values; energy saving methods for desiccation; elaboration of methods for silage production; improving the energy and protein supply in dairy cows.

In the field of reproduction, the research areas are: examination of the biological value of oocytes and spermatozoa cells; improvement of fertility; early detection of pregnancy; research in the physiology of sexual performance and pregnancy; exploration of the reasons for embryonal and fetal losses; chromosomal and spermatological tests. Endoscopic embryo transfer in swine can assure maximum utilization of the genetic potential of superior breeding animals.

A new method has been developed to estimate methane emission values on livestock units. N and P excretion in pigs can be reduced by controlled feeding.

Technologies and methods for the objective assessment of slaughtering value in the cases of cattle and pig carcasses were elaborated and adapted. In molecular genetic research, we deal with gene preservation; introduction of modern biotechnological methods; working with molecular genetic markers in breeding practices; developing further uses of markers, especially in genetic preservation programs.



ÁTK has always considered extension service work to be an important task. The publication of the only Hungarian scientific journal in the field of animal breeding (Hungarian Journal of Animal Production) is an important part of the Institute's publication activities. Research workers at ÁTK play important role in various scientific committees, have close ties with the Association of Animal Breeders, and take part in university education, both at undergraduate and postgraduate levels. The Institute has scientific ties with several institutions in European, Overseas and Far Eastern countries.



Erdészeti Tudományos Intézet (ERTI)

## FOREST RESEARCH INSTITUTE



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The Forest Research Institute (ERTI) is a state-owned institute of long standing in Hungary, which deals with research in the area of forest sciences. The Institute has five stations throughout the country, its research and development activities have been carried out in five scientific departments; our researchers are highly qualified and well-known. The main goal of the Institute is to provide the scientific background for the forestry practice, especially in the fields of ecology, silviculture, breeding, forest protection, plantation forestry and economics.

Research can strengthen the competitiveness and the development of the sector in two ways. On the one hand, the available intellectual and material resources should be focused on key areas, and on the other hand, research activities should be coordinated. The results of forest research have already proved that, by means of sustainable forest management, we can simultaneously increase the value of forests, their adaptability and their other amenities. Professionally managed forests are more resistant to unfavorable environmental impacts and provide more timber with improved quality. Moreover, such forests are more suitable for utilization in social and recreational functions. The key tasks of forest research include the investigation of the natural processes, ecological relations, evolution and growth in order to determine the proper ways of disturbance. Accordingly, ERTI has three main priorities in its research activity.

The first priority is climate change. The task is to assess the impacts of climate change on the environment and on the management of a forest and then to elaborate the silvicultural alternatives for the forest's mitigation. The carbon budget of the forests should be analyzed, and we have to investigate its re-



lation to forestation and silviculture. We have to work out adaptation strategies and management methods, technologies serving the purpose of genetically sustainable high quality timber production, and improve the breeding of drought-tolerant varieties that are resistant to emerging biotic pests, as well. The second priority is the improvement of management methods based on natural processes. We have to develop natural silvicultural methods, and define their extended fields of application, in order to ensure continuous forest coverage, and the economic conditions for natural forest management should be defined also.

The third priority is the research in connection with the establishment and utilization of energy plantations. We have to improve the breeding of varieties that are suitable for high-yield energy crop plantations, which might be cultivated safely in light of the local site conditions and which are resistant to diseases. It is necessary to develop the proper management schedules and exact technologies for short rotation energy plantations, to assess and mitigate the plantation health issues in relation to sustainability, the optimization of solid biomass product line and the economical preparation of investment decisions.

The ERTI carries out its observations and long term experiments in the forests, in its experimental nursery, and in its ecological, mycological and genetic laboratories operating at its Experi-

mental Stations. Additionally, the Institute makes an outstanding contribution to the maintenance of forest gene collections, handles three arboreta and takes part in the educational activity of the University of West Hungary and the University of Debrecen.

The issues get publicity in research reports, scientific publications and professional books, sometimes at foreign languages, too. Those, who have questions, can find us personally or on different forums and conferences, in Hungary or in other countries. The Institute is a member of the International Union of Forest Research Organizations (IUFRO) and the European Forest Institute (EFI).



Halászati és Öntözési Kutatóintézet (HAKI)

RESEARCH INSTITUTE FOR FISHERIES,  
AQUACULTURE AND IRRIGATION

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Institutional fisheries research started in Hungary more than a century ago, when the "Royal Experimental Station for Fish Physiology and Waste Purification" was established in 1906. After several reorganizations and relocations, the research institute was reestablished in its present location in Szarvas in 1953, where fisheries have a long tradition. The research station was upgraded in the framework of an FAO/UNDP program between 1975 and 1980, and became an internationally acknowledged research and training centre. After merging the Irrigation Research Institute into HAKI, the institute's name changed to the Research Institute for Fisheries, Aquaculture and Irrigation in 2000. Since then, the HAKI has been a centre of excellence on fisheries, aquaculture and irrigation research, focusing on recent challenges: sustainability of aquaculture and agriculture systems, scarcity of water; protection of the environment; improvement of food security; protection of gene reserves. Multidisciplinary research is carried out in international collaboration, with research results then transferred to practice.

The research work done here is structured into three departments:

1. Aquatic Resources Management;
2. Fish Biology and
3. Aquaculture Systems.

The three departments stand in close cooperation in the implementation of the following main research fields:

- fish genetics, and maintenance of live and cryopreserved ex-situ fish gene banks,
- fish nutrition physiology and feeding,
- prevention and treatment of fish diseases,
- structure and function of aquatic ecosystems,

- development of water efficient and environment-friendly fish production systems and technologies,
- multi-functional pond fish farming,
- introduction of new fish species and technologies in aquaculture,
- aquaculture economics and marketing,
- fisheries in natural waters,
- rice breeding and genetics,
- mapping of excess water hazards

HAKI's wide range of activities is supported by a unique complex of facilities that comprises the following:

- well-equipped research laboratories;
- indoor experimental fish rearing system with 200 m<sup>3</sup> tank capacity;
- pilot fish hatchery with broodstock and nursery ponds;
- experimental fishpond system, consisting of 76 small ponds;
- pilot pond fish farming system of 300 ha;
- combined intensive-extensive experimental fish pond system of 22 ha;
- special fishpond system for maintaining the live gene bank of common carp strains and sturgeon species;
- experimental fields for irrigation research;

- lysimeter station;
- experimental rice fields;
- agricultural environmental analytics centre, testing laboratory;
- extension and innovation center;
- library.

The total staff of the institute is 77, the scientific staff is 23 (11 possess Ph.D. degrees). HAKI belongs to the Ministry of Rural Development (MoRD), which provides a core fund of about 30 percent of the total annual budget.

The remaining income derives from competitive grant funds, services and consultancies. In addition to national research programs (financed by e.g., the MoRD or the Hungarian Office for Research and Development), HAKI has successfully participated in several large EU projects, including SustainAqua, Eurocarp and Aquamax.

The complexity and flexibility of its research activities enable HAKI to assist aquaculture, fisheries and irrigation development programs, primarily in South-East Asia. HAKI, as the coordinating institution of the Network of Aquaculture Centres in Central and Eastern Europe (NACEE), also acts as a bridge between Western and Central and Eastern Europe.



## CENTRAL FOOD RESEARCH INSTITUTE



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The tasks of the Central Food Research Institute – as one of the research institutes of the Ministry of Rural Development – include research and development activities, based on financial support from the Ministry of Rural Development and won through successful national and international projects. The basic research areas of the institute include food science and technology and development activities. There are two departments to carry out the tasks of the institute: the Food Safety Department (Analytical Unit, Biological Unit and Microbiological Unit) and the Food Technology Department (Unit of Food Industrial Environment Protection, Unit of Food Economy and Quality, Unit of Technology, Tarcál and Tolcsva).

**The direct practical utilization of the research work is demonstrated by the following results:**

- The allergen detection methodology in food has been improved through the development of new allergen markers.
- Food safety of fruits and vegetables has also been improved due to the detection of pathological microbes on raw fruits and germinating seeds.
- It is possible to predict mycotoxin contamination on the basis of the modeling of mould reproduction. New plant varieties with favorable features have been selected, based on target-oriented data collection and on the determination of the profiles of bioactive compounds present in fruit and vegetables.
- The development of new innovative, environment protecting and energy saving food technologies (for example PEF, micro-wave vacuum drying, extraction technologies, technologies for the utilization of plant raw materials and wastes, fermentation

technologies on enlarged scale to produce N-fixing and P-solubilizing bacteria) made possible the production of more competitive products.

- Our research results concerning consumer risk perception and consumer acceptance, and additionally on the adaptation and dissemination of the attitudes towards consumer protection and healthy nutrition have supported the work of decision makers.

Within the supplementary tasks of the Central Food Research Institute, it has to be mentioned that there are also national heritage protection duties at the Tocsva wine-cellar settlement and viticulture activities in the region of Tarcál. A significant part of our research results is due to bilateral intergovernmental cooperation (Science and Technology) and to the outstanding participation within the European Union Research, Technology Development and Demonstration Framework Programmes, EU FP6 and FP7 (Trace, HEALTH-GRAIN, NovelQ, BRAFO, Q-Pork-chains; FACET, GMSAFOOD, DREAM, HighTech Europe).

Our results are presented at research seminars at the institute, scientific symposia, and scientific colloquia, among others, as well as national and international scientific events and at conferences. The Institute publishes professional publications and also participates in the editorial boards of scientific journals (Acta Alimentaria, Food Science Technology).



The educational role of the Central Food Research Institute is especially important, because of the university departments established at this institute. There is an intensive cooperation with several universities. The scientifically qualified colleagues of the Institute regularly participate in Ph.D. programs, tertiary and postgraduate education. Food safety, food technology, consumer sciences and environmental activities will remain the main research and development areas at the Central Food Research Institute in the future.

## AGRICULTURAL BIOTECHNOLOGY CENTER (ABC)



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The Agricultural Biotechnology Center (ABC) was founded in 1986, based upon the realization that biotechnology and its application are the key factors determining the future competitiveness of Hungarian agriculture. The center deals with biotechnology research and development for an environmentally sound Hungarian agriculture and participates in the training of biotechnologists and the coordination of biotechnology research activities.

ABC is the largest institute supervised by the Hungarian Ministry of Rural Development, with XXX employees, XX of which belong to the scientific staff, including graduate students in various PhD programs and visiting scientists from European and other countries. The institute has state of the art technical facilities, with a total laboratory area of 4,000 m<sup>2</sup>, greenhouses and houses for small laboratory animals. The research activity of ABC focuses on the molecular aspects of plant and animal development, breeding and modern environmental technologies, as



well as the implementation and utilization of results.

ABC works to meet the challenges of modern agriculture in the fields of plant and animal biotechnology, applying genetic breeding, molecular biology, tissue culture and in vitro manipulation technologies.

The research groups of the institute study in their selected fields the molecular mechanisms involved in plant parasite interactions, abiotic and biotic stress resistance, work on quality and quantity improving complying with the requirements, including the development of species tolerant or multi-resistant against different pathogens (such as viruses, bacteria, nematodes and insects) and abiotic factors (such as drought, low/high temperature, high-level subsoil water, increased salt or metal content). With the help of comparative genetic mapping and engineering and the use of molecular marker technology, developed gene-technology systems and bioinformatics, they elaborate innovative techniques and transformation methods. Animal biology projects are aimed at creating transgenic animal models to analyze specific gene expressions and nuclear transfer techniques, studying the role of livestock genes in milk composition and production. The areas of research cover the most strategic cultivars (vital

food plants: potato, cereals, legumes and vegetables like beans, maize and the 'Hungaricum' paprika) and the special nutritional and medical aspects of livestock and laboratory animals.

Our research teams are involved in several projects supported by national R&D funds and successfully participate in multilateral cooperative projects and the EU Framework Programs. Partnered by leading scientific research and educational institutes, collaborative projects with international partners represent an important part of the research activity. Based on the concept of the Foundation Letter of the institute, ABC encourages the implementation of scientific results and the utilization of its intellectual property benefits and has played initiative role in establishing knowledge-based spin-off companies in Hungary. Today there are three enterprises hosted by the institute which serve DNA sequencing and GMO analytics by the Biomi Ltd., provide immunodiagnostics of toxins and antibiotics in food and feed by the Soft Flow Biotechnology Ltd., and develops composite soil inoculation products by the Saniplant Ltd.

The Agricultural Biotechnology Center welcomes international and national meetings and workshops, and regularly hosts training and educational programs.

Mezőgazdasági Gépesítési Intézet (MGI)

## HUNGARIAN INSTITUTE OF AGRICULTURAL ENGINEERING



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The predecessor of the Institute, The Magyaróvár Hungarian Royal Unit of Machine Testing, was established in 1869, with the aim of assisting the equipping of the nation's agriculture with machinery. Strategic aim: The realization of sustainable, marketing-conscious rural development through the enlargement of environmental resources. Tactic aims: Cooperating with other professional areas in the conducting of research programs and developments with the use of valuable information in machine research and the measurements of rural lands and of the environment, which result in competitive goods and services and contribute to the success of rural areas. Quick and efficient provision of technological information to farmers and stakeholders. MGI have several accredited laboratories: the agricultural field testing laboratory, the energetic examination laboratory and the plant protection machine examination laboratory. Our activities are regulated and made synoptic by the quality assurance system ISO 9001, audited by TÜV Rheinland. We aim to facilitate and encourage various innovation processes. Our achievements have been acknowledged by the Agricultural Innovation Awards in the years 2002, 2004 and 2005.

In 2006, the Institute's remote sensing apparatus was enhanced by the addition of a new high-technology device for land husbandry. Our Institute, with EU support, purchased an aerial "AISA DUAL" type hyperspectral imaging sensor that can produce pictures in the 400-2500 nm spectral range and provides new possibilities for Hungarian remote sensing practice in the fields of agriculture and environmental economics.

### The planned program

Technical and technological substantiation of safe food production and safety will be improved. To prepare the technical conditions, develop competitive technologies, establish the function of market-conscious production and the logistical background will require solutions to significant research tasks. Research and development in bioenergetics will be highlighted. Efficiency biomass-based energy production will be improved in the case of first generation biofuels and the development of production technology. The production of the second generation of biofuels will be researched in cooperation with foreign institutes. Development in environment technology will be increased. Research of technological systems and monitoring solutions for effective environment protection will be cultivated, which are suitable for synchronizing agricultural production with environmental issues and methods for the assessment of conditions and remote sensing. Interventions increasing the strength of the rural economy will be focused on.

We will also work to substantiate production, processing and logistic activities in terms of technology and information science.

### Dissemination of research results

Our aim is to reach every single agricultural producer with our latest results and with our recommendations. Operating as an agricultural technical advisory centre, we organize numerous professional programs and shows and we publish a number of publications:

Reports regarding results of machine testing Technological tests on recommended systems of machines The monthly periodical "Agricultural Engineering" "Hungarian Agricultural Engineering", an English language publication of our research results The "Studies in Agricultural Mechanization" MGI Books - new series of books for researchers and producers.

### Our membership in important international organizations:

- ENTAM (European Network for Testing of Agricultural Machines),
- EurAgEng (European Agricultural Engineering Association),
- CEE-AgEng (Network of Central and Eastern European Institutes of AgEng),
- ENGAGE (European Network of Engineering for Agriculture and Environment),
- ISHS (International Horticultural Association).

Our Institute has professional connections with about 50 institutions all over the world.



Kisállattenyésztési Kutatóintézet és Génmegőrzési Koordinációs Központ (KÁTKI)

## INSTITUTE FOR SMALL ANIMAL RESEARCH AND CO-ORDINATION CENTRE FOR GENE CONSERVATION



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Founded in Gödöllő in 1897, KATKI is one of Hungary's oldest agricultural institutions. Predecessors of the Institute are the Hungarian Royal Poultry Breeding Centre and the Apicultural Centre, founded in 1897 and 1899, respectively. Supervised by the Ministry of Agriculture, the two institutions formed the Research Institute for Small Animal Breeding (KÁTKI) founded in 1952, with Poultry-, Rabbit and Fur Animal-, Fish- and Honeybee Breeding Departments. Following several reorganizations, KATKI became an independent institute again in 2010, with a significant expansion in the scope of its activity, under the name Institute for Small Animal Research and Co-ordination Centre for Gene Conservation. Its main tasks cover the conservation and sustainable utilization of traditional animal breeds of the Carpathian basin, the related research and education activities, and the gene bank work covering the most threatened domestic animal breeds, including its famous Hungarian poultry breed collection. Chief current and planned activities of KATKI are as follows:

### Co-ordination activities

- Local and international organization of gene conservation and breeding

to protect local Hungarian farm animal breeds, and to support the local breeding associations.

- Elaboration and organization of national programs to protect and utilize local Hungarian farm animal breeds, propagation and distribution of breeding animals.
- Performance of all duties in the co-ordination of gene conservation, including local gene banks, gene protection, on farm gene conservation and gene rescue, as well as organizational co-ordination between authorities and breeding organizations, breeders and producers, serving as a background institution for the Ministry of Rural Development.

### Breed protection and gene bank activities

- Preservation, development and management of in vivo and in vitro Hungarian poultry gene banks, organization and supervision of the Hungarian poultry gene bank network.
- Development and management of the central gene bank stock of the Krainian honeybee (*Apis mellifera carnica*), the only local variant in the Carpathian basin.
- Development and management of stocks of highly threatened, local farm animal breeds, for gene bank and educational purposes.

### Research, development and innovation

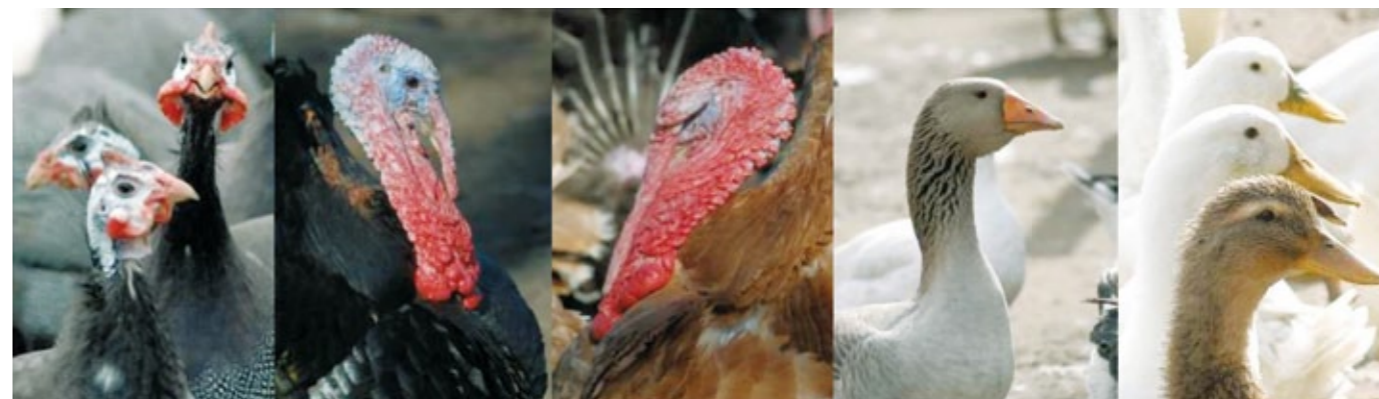
- Basic research in conservation biology and small animal breeding (genetics, reproduction biology and

physiology), and applied research in the fields of small animal production, environmental sustainability and ecological type agriculture (animal breeding, farming systems, management and nutrition).

- Research and development in the characterization and utilization for production purposes of gene bank stocks, elaboration of "Hungaricum" products.
- Field studies in the Carpathian basin and in other international activities to search for, characterize and utilize local farm animal breeds, as well as to set up new gene bank stocks.
- Research and Development.

### Educational activities

- Graduate and postgraduate training under the auspices of external departments of universities.
- Elaboration, maintenance and operation of training farms and shops.
- Extension work in breed protection, gene conservation and management of endangered farm animal breeds, participation in organization of honeybee breeding and production.
- Editing and publishing scientific and educational publications.
- Introduce and strengthen the international role of Hungarian farm animal gene conservation, organize bilateral or multilateral co-operations in gene conservation.
- Operation of historical collections and museums, related to the activities of the Centre.



## RESEARCH CENTRE FOR AGROBIODIVERSITY

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**Website:** www.rcat.hu

The predecessor of the Research Centre for Agrobiodiversity was established in Tápíószele by Lajos Szelényi's Agricultural and Educational Foundation in the second half of the 19th century. After the Second World War, the Foundation's properties were incorporated into a State Farm.

The first centralized variety collection of various seed propagated crops was established at Tápíószele in 1950, and the nation-wide responsibility was taken over by the National Institute for Agrobotany in 1958. These collections were further developed by collecting missions and seed exchange, the results of which are still being used in agrobotanical, biochemical, cytological and genetic research.

#### RCAT has the following main responsibilities:

- Exploration and collection of seed propagated crops with special emphasis on Hungarian material;
- Multiplication and regeneration of accessions to obtain sufficient quantities of high quality seeds for medium and long-term conservation, evaluation and distribution;
- Characterization and evaluation of Plant Genetic Resources (PGR) collections according to standard descriptor lists;

- Documentation of passport and evaluation data for PGR collections in Hungary (National Inventory, National Database);
- Medium and long-term conservation of seed samples in cold stores and the use of "in vitro" cultures in the case of vegetatively propagated species;
- Long-term conservation of Hungarian National Base Collection of seed-propagated species;
- Distribution of seed samples together with relevant information to users in Hungary and world-wide, under the conditions set up by the FAO International Treaty (ITPGRFA);
- Technical co-ordination of the National Plant Genetic Resources Program, and secretarial support for the Plant Gene Bank Council;
- Agro-botanical research and training concerning crop species of general and local importance;
- Biochemical, resistance and morphometric analyses for assessing the genetic value of collected accessions;
- Participation in the European PGR (ECP/GR) program;

The RCAT collaborates with several hundred institutes in the 42 member states of ECPGR and worldwide. The number of unique accessions is over 56 000, and more than 86 000 samples have been distributed for users in Hungary and abroad. The RCAT possesses the basic infrastructures required for its gene bank activities. These include 150 ha arable land, laboratories for taxonomy, seed testing, seed processing, seed drying, cold storage cabinets a deep freezers.

In addition to its main activities, a five year project (Establishment of the Pannon Seed Bank for the long-term ex situ conservation of Hungarian vascular wild plants) was established in 2010 with financial support of the LIFE+ EU program and the Hungarian Ministry of Rural Development. The coordinating beneficiary of the project is the RCAT, and the associated beneficiaries are the Institute of Ecology and Botany of the Hungarian Academy of Sciences and the Aggtelek National Park.

The main goal of this project is the long-term seed preservation of the wild vascular flora of the Pannonian biogeographical region. The project aims to achieve this goal through expanding the current functions of the world's 13th largest agricultural gene bank, the Research Centre for Agrobiodiversity, which has more than fifty years of experience in the conservation of agricultural genetic resources. The establishment of a joint seed bank for agricultural and wild flora would be a unique and demonstrative example worldwide. It is planned that, by the end of the project, approximately 50 percent – at least 4,000 seed samples of 800 species from the wild native flora - will be collected and preserved in medium and long term storage.



## RESEARCH INSTITUTE FOR FRUITGROWING AND ORNAMENTALS



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The most important research fields of the Institute are sweet and sour cherry breeding. The Institute aims to provide growers with new, disease resistant or tolerant market varieties, which satisfy the demands of the market and allow the use of environmentally-friendly growing technology.

The breeding of annual ornamentals - garden flowers - aims to produce new cultivars adapted well to the droughty continental climate of Hungary. Our Rosarium hosts the most important collection of rose varieties in Hungary, encompassing 2.5 ha and containing 1,300 accessions.

As a member of the International Plant Genetic Resources group (IPGRI), the Institute maintains and evaluates 2,200 accessions of temperate tree fruits species in its gene bank orchard for the sake of biodiversity. The most important of these include the ex-situ collection of stone fruit and shell fruit species. Virus elimination in novel cultivar propagation material and the maintenance of the Nuclear Stock Plantation have been ongoing activities for many years. There are 250 scion, rootstock and cultivars on open ground under isolating nets that provide virus-free basic material for the country's nurseries.

Micro-propagation of fruit species and their rootstocks, as well as forestry plants, is performed in the Institute's microbiological laboratory. The possibility of using symbiotic mycorrhiza fungi is also studied here, in cooperation with researchers from various scientific fields. In the field of plant protection, researchers work on the development of environmentally-friendly integrated plant protection systems of novel bred cultivars of stone and shell fruit species. Another research field is the investigation of the biological development of apple fruit, biology and the technology of apple storage.

The Institute maintains the national Growing Site Cadastre, providing details on plot level, making it possible to evaluate the suitability of a site for new plantations. On this basis, any fruit species can be planted into an ecological optimum, suiting EU criteria.

Our breeding and hybrid plantations, fruit gene bank, and our virus-free Central Stock Plantations can be found on the Institute's Experimental Farm at Érd-Elvira. Orchard system trials are set up here to help sweet and sour cherry and walnut varieties bred by the Institute to spread in Hungarian and global horticultural practice.

The Institute's nursery produces a great number of grafted trees from traditional and novel varieties, supplying high quality, virus free planting material year-round.

Among our most important results are 89 own bred fruit varieties, certified by the state, among them 5 varieties under Hungarian and 9 varieties under European patent protection. 50 % of sour cherry cultivars and 100 % of walnut varieties on the Hungarian National Variety List were bred in our Institute. The ripening period of novel sweet cherry cultivars with EU patents takes 2 months. The earliest is the Rita<sup>®</sup> followed by Carmen<sup>®</sup>, Petrus<sup>®</sup>, Annus<sup>®</sup>, Vera<sup>®</sup>, Paulus<sup>®</sup>, Aida<sup>®</sup> and Axel<sup>®</sup>.

There are more self-fertile varieties among our cultivars that can be grown safely without a pollinator. The market value of our novel walnut varieties bearing lateral buds is higher and their



growing is safer than that of traditional varieties. More than 100 novel annual ornamental varieties were bred at the Department of Ornamentals. Numerous ornamental varieties were honored by important European and American organizations.

The Institute has scientific cooperation with all parts of the world. We have built scientific relationships with most of the important European fruit growing countries, the United States of America, Chile, the Republic of South Africa, Australia, Japan and the People's Republic of China. We have strong ties with Hungarian higher education; we are an external department of Corvinus University of Budapest's Horticultural Science Faculty. Our researchers take part in postgraduate education and Doctoral Schools. We have good relationships with professional organizations. Our 'Day of Open Doors' in our sweet and sour cherry, walnut, and ornamentals programs are organized every year for growers and specialists, during which we give visitors advice, as well as present our new research results.





Ceglédi Gyümölcsstermesztési Kutató-Fejlesztő Intézet Nonprofit Közhasznú Kft.

## FRUIT RESEARCH INSTITUTE OF CEGLÉD

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For more than 60 years, the Fruit Culture Research Institute at Cegléd has been one of the Hungarian driving forces behind fruit variety research and development, and has garnered international acknowledgement for its results. Demand for and interest in fruit research can be traced back to 1846 - the year the decision to establish an institute in Cegléd was made. During the period from 1847-1852, the original plans were fulfilled and the institute became a reality. After several restructurings, the research institute has been in operation in its present form since 1950. The principal research and development activities are: apricot, plum and rootstock variety research - breeding, naturalization, selection, performance-analysis, adaptability- and stress observation of fruit varieties.

The institute of Cegléd maintains Hungarian stone-fruit stock plants and mother trees designated for propagation and a gene bank for apricot and plum varieties, as well. By introducing several new varieties, the institute of Cegléd has assisted in promoting the acknowledgement of Hungarian fruit.

On the basis of our strenuous breeding and naturalization activities, approximately 20 new apricot, 8 new plum and 18 new rootstock varieties have been developed by the inspirational researchers here in Cegléd.

The research fellows of the Fruit Culture Research Institute in Cegléd, and their main fields of activity, include:

Researchers

Mr. Dr. Zoltán Erdős, Director, rootstock research, preservation of apricot and plum varieties;

Miss. Dr. Mária Magdolna Kerek, Senior research fellow, apricot variety research;

Mr. Dr. Dezső Surányi, Senior research fellow, plum variety research, flower biology;

Mr. István Skola, Researcher, rootstock research, growing technologies; Development staff

Mr. Gábor Pap, Head gardener of production, is active in the growing of virus-free propagation stock; Miss. Erzsébet Mózes, Virologist, is active in virus testing and registration.

There are 3 assistants and 6 skilled and unskilled workers who also help with the research.

The research fellows of the institute take part in domestic and foreign scientific life, and fellows from foreign research institutes also visit our institute in great numbers. We support the next generation of gardeners with practical and theoretical courses and by consulting on PhD. and diploma theses. Through publications, specialist books, lectures and reviews, our scientific results are introduced to the growers.

Our extension service focuses on choosing fruit growing sites, variety combinations and rootstocks, and we also try to help to prevent frost damage and achieving regular cropping (thinning).

The research institute has got important international contacts, too. We are also continuously testing our varieties in different regions of Europe: Austria, the Czech Republic, France, Germany, Italy, Romania, Switzerland and in China, Iran and the USA, as well.

One of our special research targets is the safe and efficient production of

virus-free propagation through the development of micro-propagation technologies (in vitro) suitable for stone fruits.

The main strategy of our institute is to promote healthy and safe nutrition, as related to fruit consumption. Several of our projects and co-operative efforts are based on this target.

Our scientific achievements over the last half century demonstrate the truth of Prof. Mátyás Mohácsy's statement, which was recorded in our visitor's register when he visited Cegléd on April 11, 1957. Prof. Mohácsy was an outstanding personality in Hungarian fruit growing.

He wrote:

**"Research is fundamental for more and better fruit production"**



Fertődi Gyümölcsstermesztési Kutató- Fejlesztő Nonprofit Közhasznú Kft.

## FERTŐD FRUIT PRODUCTION RESEARCH AND DEVELOPMENT NON-PROFIT LTD.

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The first predecessor of the research institute is considered to be the Esterházy plant breeding plantation, founded in 1910. The present profile of the company was developed in the Seventies, the main task of which includes breeding and introducing berry plants, maintaining their biological bases and producing basic propagation material. Throughout the company's history, several varieties have been replaced with varieties bred or introduced in Fertőd and which were later placed into production. Nationwide main varieties now include the Fertődi zamatos (aromatic) raspberry. Varieties bred in Fertőd today provide the basic assortment of berry fruits in Hungary. Over the past 10 years, four raspberry varieties (Dorka, Fertődi Venus, Fertődi zenit and Julcsi) and Dorottya, a currant variety, have been introduced in Hungary. The goal of our breeding projects is to improve productivity,

yield stability and fruit quality. The varieties of berry we have introduced are among the best yielding plants involved in experiments in the various production areas of the country. The second goal of our breeding program is yield stability. Most berry varieties that are grown at present can only be grown successfully by intensified plant protection, but with unfavorable weather conditions, significant yield loss is to be expected. In the breeding process on resistance, varieties of complex resistance are to be produced, which can be fitted into integrated plant protection technology and can be protected effectively by using fewer pesticides. Good results have been achieved with cane blight resistant raspberries, leaf decease and bud-acarid resistant black currants. The third aim of breeding includes the improvement of fruit quality, its suitability for processing and market value. The raspberry variety Fertődi zamatos (aromatic) is one of the best "rolling" varieties among the firm and very aromatic types. A new category of quality is represented by the fruit of the wild-selected and artificially crossed varieties, in addition to the elder variety, which was collected from wild plant species. In addition to

previously introduced varieties further promising ones have been nominated for introduction (Julcsi, Dorka raspberry, Dorottya black currant varieties). Breeding berry fruit plants nowadays requires biotechnological methods rather than traditional ones. The institute is taking part in several biotechnological research projects. Our physiology laboratory has become a centre of hormone-physiological research projects in Hungary. A great achievement of the previous year's research work includes the detection of the in-vitro flowering enhancing capacity of ethylene inhibitors. The results in the laboratories were achieved by research work on embryo-cultures, mutants and polyploid. The institute maintains key plantations, producing virus-free, variety-specific reproduction material with EU-conform certification. Genetic preservation is a priority in our company; therefore, the Research and Development Company maintains and preserves genetically important berry species, varieties and variations. The Company preserves the national pear gene bank, as well. We have research projects with different foreign institutions, which allow the transfer of information and plant materials.



## RESEARCH AND EXTENSION CENTRE FOR FRUIT GROWING



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**History**

The Centre was founded in 1949 as the Research Station of the Horticultural Research Institute. Over the past six decades, the Research Station had been working in several structural forms. Presently, it has been operating as a non-profit organization since 2009. The Research Station is situated in Szabolcs-Szatmár-Bereg County, in northeastern Hungary, which is the largest fruit growing region in the country. It is obvious that cultivars and production technologies must be adapted to the natural and economic environment of any given region. Based on the traditions of fruit production in this part of Hungary, the research activity of the Research Station has always been focused on apple and sour cherry production. The second, yet no less important function of the Research Station is its comprehensive extension service, covering other counties and other fruit species, as well.

**Research activity****Research concerning cultivars of pome fruits:**

- introducing new apple cultivars resistant to apple scab, powdery mildew and fire blight,
- preservation breeding of apple cultivars,
- establishment and maintenance of apple, pear, quince and medlar gene banks.

**Research dealing with cultivars of other fruit species:**

- selecting self-pollinating sour cherry cultivars with fruits of high quality,
- breeding and introduction of new gooseberry cultivars from abroad.

**Research and development in production technology:**

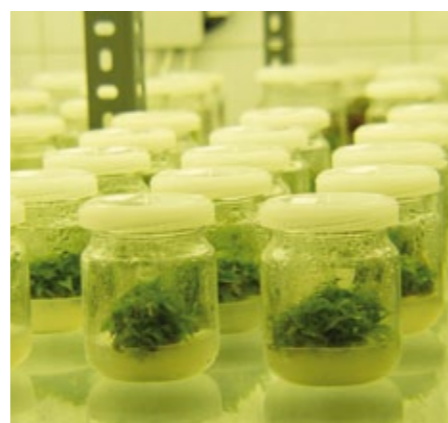
- specification of water use of trees and

elaborating fertigation techniques for young apple orchards,

- use of a feathering agent in young apple trees to improve canopy development,
- manual and chemical fruit thinning in mature apple orchards,
- investigation of frost- and drought damage of apple trees,
- Frigocur; a chemical product to increase the cropping potential of apple trees,
- developing plant protection strategies against fire blight,
- introducing integrated and organic fruit production technology in commercial apple farming,
- development of integrated fruit production technology for sour cherry production.
- developing biocontrol methods based on entomopathogenic nematodes against soil-dwelling pests (e.g. *Melolontha* sp.),
- maintaining entomopathogenic nematode and entomopathogenic bacteria strain collection,
- Developing up-to-date, energy saving and cost effective storage techniques for apples based on the SmartFreshSM Quality System.

**Extension service****Introducing results of research in the practice of fruit production:**

- organizing annual technical courses for commercial orchard owners,
- publication of technical handbooks, monographs and periodicals,
- publishing technical info sheets.

**Participating in investments in fruit production:**

- guidance in compiling applications to obtain financial aid for development programs,
- advisory service for the planning and establishing of new orchards,
- personal technical advisory service to local growers.

**Providing services to fruit growers and other participants of the fruit industry:**

- service provider for the Smart-FreshSM Quality System,
- development plans for growers participating in the Agri-Environmental Management Program

**International relations**

The Czech Republic, Holovousy: Research and Breeding Institute of Pomology (Blazek J.); Poland, Skierniewice: Research Institute of Pomology (Basak A., Sobiczewski P.); Warsaw: AgroFresh Polska (Badowski P., Paradowski A); Slovenia, University of Ljubljana (Trdan S., Laznik Z.); USA, NY Ithaca: Cornell University (Merwin I., Rosenberger D.); WA Wenatchee, Washington State University (Smith T.).

## RED PEPPER RESEARCH-DEVELOPMENT NON-PROFIT LTD.

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The Kalocsai Paprika and Chemical Research Station was established in 1917 and the Szeged Paprika and Chemical Research Station was set up in 1927, in the two paprika growing regions of the country, with the mission to conduct the chemical analyses of the increasingly exported red pepper powder and to provide red pepper with quality certification. In addition to these activities, their fundamental duty is plant breeding and to supply farmers with bred seeds. Nonetheless, the chief activity of the company is professional production, and to provide farmers with expertise in the field of processing, as well as to educate them with the help of technical publications, so that these two special territories can produce higher quality and more exportable end-products. These two research areas have been operating as one organization; namely, the Vegetable Growing Research In-

stitute's Red Pepper Research Station, since 1971, and have continuously run under their predecessors' names. As an independent legal entity, the research site has operated since the 31st December 1997 as the Red Pepper Research-Development Co. Ltd. after the transformation of the Vegetable Growing Research Institute Ltd..

After this institution was altered into a public utility company on 30th June 2000, it has been working under the name Red Pepper Research-Development Public Benefic Company.

There was another change in the name, to Red Pepper Research Development Nonprofit Public Ltd. – abbreviated as Red Pepper Nonprofit Ltd., since 1st July 2009.

The pigment content of red pepper is very high, due to the unique ecological capability of Hungary – soil and microclimate – and the pepper powder is the preeminent spice of Hungarian cuisine because of its flavor and fragrance. It is also a special Hungarian export commodity, known in today's jargon as a 'Hungaricum'.

Therefore, our most important duty is to produce new varieties in view of the high pigment content, early produc-

tion ability, resistance to the dominant causative agents as well as growth security. As a result of the resistant breeding project conducted in 1992, we produced a bacteria-resistant paprika variety.

Seventeen invariants produced by our company, as well as 5 hybrid types, provide a wide choice to the varieties of grown Hungarian paprika, of which potential pigmentation is 300-350 ASTA with the capsaicin content of 300-1000 mg/kg (4800 – 16000 Scoville Units). In addition to producing new varieties, our main task is to provide Hungarian paprika growers and the processing plants with highly vigorous, pure-bred, state controlled seed grains.

Regarding the modern varieties, we have developed a suitable growing technology according to customer demand in the areas of nutrient and water supply, plant protection and plant density.

Harnessing the results of our research, the company produces a special red pepper powder under the "Rubin" brand name in the reference plant, operating according to ISO 9001 and HACCP standards. This product received the trademark label: Finest Hungarian Food.



Gabonakutató Közhasznú Kft. (GK)

## CEREAL RESEARCH NON-PROFIT LTD.



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The Cereal Research Non-Profit Ltd. Company, keeping the line of its legal predecessors, has been the most important research company for breeding and research in the crop production technology of cereals, oil and protein crops in Hungary since 1924. The breeding work is performed in a proper integration mode at the company headquarters in Szeged, at the research station in Tápánzentkereszt, and at an additional three research sites (Kiszombor, Fülöpszállás and Kiskun-dorozsma). These locations represent various climatic conditions, soil types and other environmental factors found in Hungary. The breeding work and the selection at these locations have allowed the improvement of plant varieties with broad adaptability and top quality seed production. Field trials and breeder's seed multiplication can be accomplished on 2,000 hectares of land under our own management.

The following plant varieties are improved in the research work we undertake, coupled with the improvement of the crop production technology at the company: winter and spring wheat, durum wheat, winter and spring barley,

triticale, rye, oats, sunflower, linseed, winter rapeseed, corn (grain and silage), grain and silage sorghum, Sudan grass, soybean, red clover, millet, buckwheat, Hungarian millet. Certain research areas are of crucial importance within the scope of these activities, such as breeding for resistance to diseases, analysis of the relation between qualitative traits, the question of herbicide application and environmental protection or the enhancement of conventional breeding work on the basis of the results of biotechnological experimentation.

The company currently has 180 plant varieties registered in Hungary and 90 varieties registered in 23 foreign countries, the total growing area on which these varieties is grown covers approximately one million hectares annually. The seeds of GK plant varieties are usually accompanied by crop production guides to enable the farmers to grow the varieties most successfully. Wheat, triticale, grain sorghum, soybean, linseed are the GK cultivars, the seeds of which are grown to decisive ratios domestically. Wheat, winter rapeseed and corn are increasingly popular in neighboring countries, such as Romania and Slovakia. The demand is remarkable for the GK cultivars corn, sunflower and sorghum in Ukraine and Russia; and linseed in the UK.

Research is carried out at the company with the chief goal being that the yield of the GK plant varieties should exhibit high quality food and feed regarding



nutritive value, quality and food safety. In addition to the regular analysis of the quality of flour, protein and oil, an up-to-date laboratory has been equipped to investigate the toxin content of grains infected with Fusarium. Patients suffering from celiac disease, PKU, renal failure or diabetes can rely on the dietetic food developed and manufactured at the company. Buckwheat and soybean breeding have also been motivated by focusing on healthy food.

The scientific and research work of 60 highly qualified research workers (with 12 university doctors, 21 candidates or PhDs, 4 academic doctors and 1 member of HAS among them) is supported by a staff of 170 colleagues, employed mainly as research assistants and service personnel. The research workers participate in both domestic and foreign scientific work, as well as in the work of the Hungarian Academy of Sciences. They are either consortium leaders or co-operators in joint projects with foreign partners. They publish in prominent R&D periodicals worldwide. The company issues the quarterly entitled "Cereal Research Communications", which is known and appreciated in around 70 countries.

**Although the company is owned by the State, it is not budgeted by it; the sources of about 1.9-2 billion Hungarian Ft's come from royalties, license fees, seed sales and R&D grants.**



Zöldségtermesztési Kutató Intézet Zrt. (ZKI)

## RESEARCH INSTITUTE FOR VEGETABLE GROWING CO. LTD.



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The National Horticultural Station at Kecskemét, the legal predecessor of ZKI, was established in 1943. During its nearly 70 year-long history, ZKI Zrt. has always been the most important base for Hungarian vegetable crop research and Hungarian vegetable crop breeding. From the mid-1990s on, ZKI has taken over seed production and distribution of varieties bred by the Institute, and has become a real vegetable seed-firm with a strong, own breeding program. Following substantial streamlining driven by market possibilities and requirements, ZKI is currently involved in the breeding of 7 significant vegetable crops for professional growers and processing industries. However, as a result of previous breeding activities, there are currently over 200 varieties from a total of 23 vegetable crop species on offer in ZKI catalogues for home gardens.

The most significant breeding achievements and projects at ZKI are as follows:

**Pepper:** ZKI offers a rich variety of F1 hybrids of different types or variety groups. The breeding programs of the ZKI focus not only on the Hungarian market, but also on the markets in the surrounding countries and the Mediterranean region. However, with regard to breeding objectives, the most important types are the white "Cecei", the blocky, the "tomato-shape-pepper", the "apple-" and the "hot, long" pepper. In the variety range there are many hybrids containing the L3 or L4 gene of tobacco mosaic virus resistance, in 2009 ZKI released the first TSWV resistant hybrids in the white conical type and, a few years ago, a tomato-shaped pepper with resistance to bacterial disease.

**Peas:** ZKI has a constantly renewed range of dark green wrinkled vining pea varieties from the earliest to the latest



for the canning and freezing industries. All of them are resistant to Fusarium wilt, the newly released late varieties resistant to powdery mildew. The newest early varieties have good tolerance to downy mildew; we are close to release a real resistant variety to this disease. In addition to disease resistances, the main priorities of pea breeding are high and constant yields, which include also seed color and size, and good standing ability.

**Tomato:** Breeding processing tomato in ZKI looks back on a long tradition. Several successful varieties adapted to Hungarian conditions were introduced during the last decades, both for hand and machine harvest. The recent developments were made to improve yield, earliness, concentrated ripening and resistance to the most important diseases like Verticillium, Fusarium, bacterial speck and nematodes. Our new hybrids reach 100 tons/ha yield in many growing areas, suitable for machine harvest and produce medium to high soluble solids. These hybrids are suggested for tomato paste and ketchup production.

**Cucumber:** ZKI was the first in Europe to release downy, mildew-resistant, smooth pickling cucumber varieties. All the hybrids produced in the last decade show resistance against downy mildew, powdery mildew and cucumber mosaic virus. Currently, the primary goals of

breeding are to develop disease-resistant varieties of the parthenocarpic, spined pickling type.

**Green beans:** Recently released were a fine green podded and a yellow large podded variety for industrial use. Breeding mainly aims at the wax (yellow pods) bush type with long round straight pods, deep uniform pod colored, and robust plant type, suitable for mechanical harvesting.

**Onion:** The majority of our variety choice is spicy and pungent and suggested for one year technology with irrigation. Besides this, we have a variety for the Makó region, where the two year growing method is traditional. Breeding activity is focusing on selection of mid- and late ripening, long day storage type varieties and hybrids, with medium to high dry matter content.

**Watermelon:** ZKI has hybrids with excellent quality both in round-shaped, dark green and Crimson types. Fusarium wilt-resistant hybrids of these types are to be released soon. Breeding is directed now to oval, elongated and triploid types that are resistant to wilt, while at the same time maintaining their excellent quality parameters.

**Pathology:** The work of the group is linked to the bacteria, fungi and virus resistance breeding tasks, including the cultures, the development of infection technologies and selection.

## CENTRE FOR AGRICULTURAL AND APPLIED ECONOMIC SCIENCES, UNIVERSITY OF DEBRECEN



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The roots of agricultural higher education in Debrecen go back to the middle of the 19th century. 1868 marked the foundation of the Debrecen National School of Agriculture. After a series of changes, the school became an independent university in 1970, known as the Agricultural University of Debrecen. Then, the University of Debrecen was established on 1st January 2000, with the integration of the universities located in Debrecen, and the Centre for Agricultural and Applied Economic Sciences (CAAES) became a determining unit of the university.

During the past 140 years, a modern institution evolved, which serves agricultural education, as well as research and extension in Hungary. Its mission is to develop agriculture, the environment and rural areas in Eastern Hungary. The institution's achievements are published both nationally and internationally. Within the tasks of research development, we focus on research into the criteria of sustainable development, the preservation of soil fertility, the conservation of the peculiarities of different landscapes and ecological values. We research the development of economically and ecologically harmonized agriculture, crop production and animal husbandry.

The CAAES has successful relations with domestic partner universities, research institutes and over one hundred foreign educational and research institutes. In the framework of FP7 projects, the Centre co-operates successfully with prestigious French, British, Danish, Dutch, Italian, German, Spanish, Polish, Swedish, Belgian and Austrian universities and research centers.

The Centre operates four Doctoral Schools in the fields of agricultural, regional and economic sciences.

We integrated our scientific-research activities into 5 interdisciplinary R + D + I (Research + Development + Innovation) programs:

- Climate change and actions
- Healthy foods
- Sustainable agro-environment
- Animal sciences and animal welfare
- Regional business supporting innovation and rural development

Research at the Faculty of Agricultural and Food Sciences and Environmental Management (FAFSEM) of CAAES covers the following topics: crop production, plant protection, animal husbandry, horticulture, soil science, technology and applied sciences. Research on crop production focuses on the effects of water, nutrient supply and their interactions. The main aims are the realization of rational land use, the development of environmentally-friendly technologies, the improvement of the genetic background and the study of their effect on product quality. The research is carried out with the involvement of the Central Laboratory. Animal husbandry research concentrates on sheep, poultry, pig and fish. Research is aimed at the improvement of efficiency and product quality embracing the whole product cycle, from the raw material to the end product.



Main fields of research at the FAFSEM: extensive and intensive animal breeding systems, integrated biological and economic development, the biology and economic efficiency of quality production, environmental research, precision agricultural systems, conservation of genetic bases in animal husbandry, crop production and horticulture, landscape-fitting and environmentally-friendly agricultural technologies in horticulture, research on soils and soil preservation, utilization of the results of complex plant protection research for developing crop production, research on microelements for the production of healthy agricultural products and healthy food, quality assurance and food safety in agriculture and in the food industry.

Main fields of research at the Faculty of Applied Economics and Rural Development (FAERD): economics of agricultural enterprises and rural development, the regional characteristics of rural development programs, EU-conform management, accounting and controlling systems, further development of marketing information systems, consulting and rural development, models of environmental economics, technological and economic questions of

game management, surveys on the present environmental state of areas in Eastern Hungarian regions.

To promote our research-innovation activities and extension work we established a new unit, the Research Institutes and Study Farm (RISF) which includes Karcag Research Institute (KRI) and Nyíregyháza Research Institute (NYRI) and the Debrecen University Farm and Regional Research Institute (DUFRRRI). The KRI is an internationally acknowledged centre of R&D aimed at soil amelioration, soil fertility improvement and preservation and rational soil utilization. In their research, they focus on the production technologies of crops tolerant of dry and saline soil conditions, the utilization of grasslands of the Great Plain and the development of effective sheep breeding technologies. The NYRI deals with the breeding of plant varieties that can be safely cultivated under the unfavorable ecological conditions of the region and with the complex utilization of sandy soils. Their achievements in biotechnological

research in field crops are also remarkable. The DUFRRRI deals with developing site-specific production technologies and the improvement of production technologies.

RISF has a determining role in the conservation and development of the genetic bases of the regions flora and fauna. Among the gene preservation tasks the maintenance of old Hungarian chicken and turkey breeds and Tsigai sheep are of special significance.



RISF is the owner of 104 varieties of 32 plant species (including winter wheat, winter barley, rye, millet, triticale, sorghum, beans, peas, vetches, potato, Canna); four of these varieties have patent protection.

The Centre has important achievements in the field of fruit, vegetable and ornamental plant research and development through the breeding of new varieties and the practical improvement of production technologies.

## FACULTY OF ANIMAL SCIENCE, UNIVERSITY OF KAPOSVÁR



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### Short history of the Faculty

The school that has grown into the Kaposvár University Faculty of Animal Science was founded in 1961 as an Agricultural Junior College. During the Seventies, the institution became an Agricultural College with a three-year study program, leading to a production engineering B.Sc. degree in animal science. Keszthely University incorporated the Agricultural College as a faculty in the Eighties. During this period, students could earn an agricultural engineering M.Sc. degree through a five-year course of study. The faculty was a part of PANNON Agricultural

University from the early Nineties until Kaposvár University was founded in the year 2000.

### Short introduction of the Faculty

More than 91 percent of the faculty staff holds a scientific degree. The faculty maintains formal co-operative relationships with 27 foreign universities and research institutes. The academic staff of the faculty publishes yearly about 12 books and chapters, 60 scientific papers in foreign languages, 40 scientific papers in Hungarian, 30 conference papers, 40 conference abstracts and 55 non-scientific papers.

Due to the active participation of its students in research work, the faculty consistently does well in National Scientific Student Conferences. In 2004, the Faculty of Animal Science received the Most Innovative University Faculty Award and, in 2009, it ranked 7th out of 168 faculties in the field of talent nurturing.

Kaposvár University's educational infrastructure meets the highest standards. The campus boasts well-equipped lecture and seminar rooms, excellent laboratories, a Study Farm cultivating 1, 129 hectares and raising all major farm animal species, a Game Farming Center (deer and wild boar), an Equestrian Academy, and a fully-equipped and staffed Health Center. Students have the University Library at their disposal, which contains more than 250 thousand books and documents and 30 computers with access to electronic databases. Up to 80 percent of students can be accommodated at the student hostel in double bedrooms (including, e.g., an en-suite bath, television and Internet connection, a shared kitchen and laundry, a sauna and a gym). Students even have the unique opportunity to bring their dogs with them to school, since dog-kennels are available on campus.

**Study programs offered****B.Sc. programs:**

- Animal Production Engineering
- Agricultural Engineering
- Plant Production Engineering
- Nature Protection Engineering

**M.Sc. programs:**

- Animal Science
- Animal Nutrition and Feed Safety (in English as well)
- Agricultural Engineering Teaching (Animal Production Engineering)

**Vocational higher education**

- Environmental Protection Technology (Specialized in Waste Management)
- Stud Management

**New courses to be launched:**

- Wildlife Management Engineering (B.Sc.)
- Master's in Agriculture
- Master's in Nature Conservation

**Main research areas**

- Food quality and safety-related research: covering the entire process of food production, introducing the "from farm to fork" concept.
- Development of nutritional concepts to ensure the quality of products and safety of production.
- Use of new techniques (CT, MRI, molecular biology) as selection tools

in animal breeding to develop new strains to fulfill the changed consumer requirements.

- Study of the environmental effect of animal production systems (housing and nutrition).
- Big game (red deer, fallow deer, mouflon, wild boar) breeding and production research.
- Animal welfare studies to develop scientifically proven guidelines for animal production systems.
- Application of digital imaging techniques in the veterinary, medical and animal sciences.

**Doctoral (Ph.D.) School of Animal Science**

The Ph.D. program in Animal Sciences involves the following main scientific programs: Poultry and small animal sciences; Animal production based on grazing; Monogastric and ruminant nutrition; Pig sciences; Non-invasive digital imaging methods in animal sciences. During the past five years, on average, 5.2 full time and 1.4 part time students gained admission to the doctoral school yearly. On average, 6.2 students are yearly awarded the Ph.D. degree, which is 94% of the students who gained admission.

**Future perspectives**

The university will finish a 3 billion reconstruction in 2011, which at the Faculty

of Animal Science contains the development of the laboratory network (reconstruction of the central laboratory building, new equipments to analyze feed and food samples, set up of the soil laboratory and the molecular biology laboratory) and the reconstruction of the pig farm to a most modern 180 sow farrow to finish farm. The aim of these developments is to form the Agricultural and Food Science Knowledge Center which will develop in cooperation with the local stakeholders a "from farm to fork" traceability system resulting branded products.

The faculty is engaged in the internationalization of its education. As the first step, the Animal Nutrition and Feed safety M.Sc. program has been accredited to be taught in English. The FAO and the Hungarian Ministry of Rural Development founded a scholarship for the interested students of developing countries to participate in M.Sc programs in Hungary. As our Animal Nutrition and Feed safety program is included in this project, this year we received more than forty applications from Ukraine, Ethiopia, Afghanistan, Namibia, Kenya, Algeria, Mongolia, Tajikistan and Vietnam. In addition, five students applied from Cameroon, who will cover the study costs themselves. This level of interest encourages us to extend our portfolio of educational programs taught in English.



Károly Róbert Főiskola, Fleischmann Rudolf Kutatóintézet (KRF FRK)

## AGRICULTURAL AND ENVIRONMENTAL SCIENCES RESEARCH, KÁROLY RÓBERT COLLEGE



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The predecessor of the institution was founded in 1962. Since 2003, the institution has been known as Károly Róbert College. The College has carried out numerous research programs, in order to determine the most effective ways to produce and utilize green energy in Hungary and in the North Hungarian region. One of the topics of these experiments is the selection of those trees that have the greatest energy output in particular habitats. The researchers of the College have worked out the Social Green Energy Program and the Forced Vegetable Program Based on Renewable Energies. They also carried out research in order to help the local government institutions economically switch to green energy. The College initiated the set up of the Mátra Wood Splitting Cooperative in 2008; in March 2010 it founded the Mátra Energy Plant Production Ltd, which planted 500 acres of energetic tree plants in 3 years. The Bioenergetic Innovation Cluster has been operating

since 2009, under the auspices of the College. The 1 MW-power wood-splitting boiler, which provides heat energy for a 2000 m<sup>2</sup> greenhouse, is located in the Green Energy Research Center in Tass-pusztá.

The agro and environmental sciences research activities are concentrated in the Faculty of Natural Resources Management and Rural Development of the College. Within the circle of applied environmental sciences different projects have been carried out, for example, arctic climate research, the assessment of the impacts of the oil catastrophe in the Gulf of Mexico, or the red mud catastrophe in Kolontár. The high technologies in the field of remote sensing are world famous and unique all over the world, and can be observed in all of their training fields. Therefore, the following projects are all based on the aeronautical observations of which basic acquirement is a must for our students during their studies: as for game management: game stock assessment, as for viticulture: mapping the production sites, plant production forecasts, block mapping, state of the environment assessments, mapping production sites that are suitable for planting arboreal energy plantations and monitoring the biomass production of the plantations.

**Károly Róbert College, Fleischmann Rudolf Research Institute, Kompolt**

The institute was founded in 1918 and has belonged to the predecessor of the College since 2000. The Research Institute is the most dominant sublimation and research institution in the North Hungarian Region. Principally, it carries out research for those who deal with crop production in arable lands in the region. The aim of these projects is to enhance production effectiveness and to define new utilization methods. The former started plant sublimation, agro technology, nutrient management and plant protection projects are still been done. The institute has opened new tracks towards environmental management and sustainable agriculture, as well. Acting on the aims of the College, there are energetic examinations of arboreal plants at the institute, as well. As for the field of plant sublimation, the most intensive projects are being carried out in connection with spring barley and autumn barley, but there are sublimation works with fabaceae and autumn wheat, as well. For the effective operation of the institute, it is crucial to win effective tenders, to introduce micromalting and to constantly monitor the quality of the different types of plants. During the development of different technologies,



the institute constantly uses its project results. Additionally, together with its partner firms, the institute plays a leading part in the development of agricultural technologies and in professional consultancy systems. The institute also facilitates the practical application of the latest research results through its events and conferences.

#### **Károly Róbert College, Research Institute for Viticulture and Oenology, Eger**

Viticulture research in Eger, similar to several other such national institutes, began at the end of the 19th century, right after the phylloxera plague. The institute has been operating since 1976 on its present-day premises. Presently, a 25-acre vineyard, a 7000-hl full capacity wine-making plant, conservatory and a modern wine-making pilot plant and a laboratory belong to the institute. The most remarkable national and international projects of the Institute: The molecular biology and resistance biology examination of *Uncinula neca-*

tor populations in order to enhance the effectiveness of plant protection. As far as grapes are concerned, the most dangerous causative agent is *Uncinula necator*, even more dangerous than downy mildew or *Botrytis cinerea*. According to research results, the effectiveness of technologies against *Uncinula necator* can be increased by genetic, resistance biological and open field research.

Projects connected to the definition of the optimal ripeness of grapes in the Eger wine region

To define the phenol maturation of grapes, the definition of the characteristics and concentration of phenol chemical components, is a very time-consuming and expensive procedure. The definition of the phenol maturation is an outstandingly important factor when making special red wines with high additional values.

The impact of abiotic stress on the metabolism of grapes

Within the basic biological research groups of the Research Institute, it is

the plant physiology task force who examine the impact of extreme environmental factors on the photosynthetic activity and water management of grapes.

Maintenance and development of biological basics: the assessment of the results of the resistance sublimation research, clone section and naturalization, maintenance of strain plants.

The vine collection of almost 800 pieces in the Institute consists of 322 resistant, 52 color-leaf, 280 hybrid and 137 vine types and clones from abroad. As we maintain the most varieties, the Institute plays an important role in providing reproduction materials, as well.

Oenology technology research and development

The activities of the oenology group include the determination of harvest time (in the case of physiological research), the sample gathering of grapes, the making of pilot wines and the analytical and organ assessment of wines.

Mezőgazdaság- és élelmiszer-tudományi kutatások a Nyugat-magyarországi Egyetemen (NYME)

## **AGRICULTURAL AND FOOD SCIENCES RESEARCH, UNIVERSITY OF WEST HUNGARY**



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Prince Albert Casimir of Saxony, Duke of Teschen, established the Agricultural Higher Educational Private Institution of Magyaróvár, the legal predecessor of the Faculty of Agricultural and Food Sciences at Mosonmagyaróvár, on October 25, 1818. Legally and practically, it is one of the longest established institutions of agricultural higher education in the world. In the beginning, Latin was the official language of instruction, which was later gradually replaced by German and Hungarian. In 1872, several German-speaking professors left the institution to establish the Agricultural University of Vienna.

Successfully combining instruction with research, the professors of the institution founded ten experimental stations in Magyaróvár in the late 1800's, thus establishing the professional agricultural research system in Hungary. The Faculty of Agricultural and Food Sciences has belonged to the Univer-

sity of Western Hungary since 2000. It currently consists of the following 10 institutes: Institute of Animal Science; Institute of Plant Biology; Institute of Plant Production; Institute of Food Science; Institute of Mathematics, Physics and Informatics; Institute of Biosystems Engineering; Institute of Environmental Science; Institute of Economics; Institute of Corporate Economics and Management Science; Institute of Extension and Continuing Education. Dealing with a wide range of issues related to plant, animal, food, engineering, economic and social sciences, the major R&D&I projects, include:

#### **Institute of Animal Science**

- Development of third generation biological preservatives;
- Comprehensive development of the Hungarian waterfowl sector (optimization of fattening methods, innovation of goose/duck liver and meat products);

- Development of health-enhancing fish products based on intensively raised freshwater fish species;
- Swine embryo production using various vitrification methods;
- Pathological and immunological analyses and prevention of perinatal mortality in Holstein cattle herds;
- Horse performance studies;
- Animal welfare studies;
- Feed additives testing.

#### **Institute of Plant Biology**

- Development of multi-resistant paprika species by conventional and molecular methods;
- Examination of algal hormone production;
- Examination of *Chlorella* strains;
- Research on novel feed additives containing polyunsaturated fatty acids to produce raw materials for manufacture of functional dairy products.

#### **Institute of Plant Production**

- Screening natural substances extracted from herbs;
- Development of management software enabling economically optimal and environmentally-friendly use of herbicides;
- Research projects on providing improved protection against common ragweed (*Ambrosia artemisiifolia*);
- Recovery of metal compounds from wastes: their transformation and utilization.

#### **Institute of Food Science**

- Development of third generation biological preservatives;
- Comprehensive development of the Hungarian waterfowl sector (optimization of fattening methods, innovation of goose/duck liver and meat products);
- Development of health-enhancing fish products based on intensively raised freshwater fish species;
- Use of cheese whey as a dairy by-product for production of organic foods;
- Development of novel functional fermented milks using various biologically active substances;
- Microbiological examination and physical-chemical analysis of food raw materials and technology development.

#### **Institute of Mathematics, Physics and Informatics**

- Development and field application of complex photo-acoustic systems for monitoring environmental conditions.

#### **Institute of Biosystems Engineering**

- Effects of microwave treatment on various biological and agricultural materials;
- Examination of processes occurring in biological materials as a result of combined energy transfer;
- Utilization of renewable energy sources;
- Determination of soil moisture levels in the region of the Danube River;
- Research on plant-based biofuels with special emphasis on vegetable oils;
- Research on soil heterogeneity, plant protection and agricultural engineering issues for precision farming purposes;
- Measuring the agro-physical parameters of biological materials; thermo-physical modeling;
- Examination of *Chlorella* strains.

#### **Institute of Environmental Science**

- Recovery of metal compounds from wastes: their transformation and utilization;
- Effects of changing agriculture on pollinating insect populations of cultivated plants;
- Optimizing the production of anti-smoking agents by Indian tobacco

(*Lobelia inflata*) for use in manufacturing smoking deterrents;

- Influence of abiotic and agro-technical factors on the occurrence of common ragweed (*Ambrosia artemisiifolia*) in arable lands;
- Monitoring activities in the Szigetköz area.

#### **Institute of Economics**

- Training project for European business consultants;
- Commercial market research studies.

#### **Institute of Corporate Economics and Management Science**

- Creation and improvement of practice-oriented training systems in agricultural higher education;
- Research on ways to increase efficiency of utilization of agricultural resources;
- Examining the relationship between farm size and standard gross margin in the West Transdanubian region.

The Faculty of Agricultural and Food Sciences has good scientific relations with several European and overseas universities and research institutes. These include, among other institutions, the Slovak Agricultural University in Nitra, the University of Natural Resources and Life Sciences in Vienna, the Vienna University of Technology, Wageningen University, Auburn University, IGV Institute for Cereal Processing at Bergholz-Rehbrücke.



Szegedi Tudományegyetem (SZTE)

## FACULTY OF AGRICULTURE, FACULTY OF ENGINEERING, UNIVERSITY OF SZEGED



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Agricultural education has a 115 year tradition in Hódmezővásárhely. The agricultural vocational training school was founded in 1896. This was turned into a vocational secondary school after World War II. Higher education started in 1972 on the college level, and the institution became, after several reorganizations, a faculty of the University of Szeged in 2000.

The primary task of the faculty is education, but it also provides courses and trainings in the framework of a Life-Long Learning program, and takes part in the Hungarian agricultural extension system.

The pilot farm serves the trainings of the students, the research work and the agricultural advisory activities, as well as with its approximately 380 hectares arable land, 40 hectares pasture, with pig, sheep, poultry, dairy cattle farm and a milk processing unit.

### Research activity

Applied research is carried out at the faculty in the following fields:

- breeding, reproduction, nutrition and health of cattle, pig, poultry, sheep, roe deer and wild boar;
- fermentation of silages,
- the effects of agrotechniques, chemicals and plant breeding on the yield and quality of arable crops;
- micro-propagation of ornamental plants and breeding of pritamin paprika;
- pollination by insect fauna of cultivated plants;
- water purification by constructed wetlands;
- biogas production from communal waste and biomass;
- business management, innovation and valuation of farms;

- marketing of agricultural products and foods;
- resources and strategic planning of rural areas.

### International relations

The Faculty has educational and research cooperation with several foreign universities and research institutions in e.g., Belgium, France, Germany, Italy, Japan, Portugal, Romania, Serbia, Turkey and The United Kingdom.

### The History of the Faculty of Engineering

In Hungary, the university education of food industry experts started at the advanced food industry engineering schools of Budapest and Szeged in 1962. In 1970, combining the advanced food industry engineering schools of Budapest and Szeged, an independent college came to life under the name of College of Food Industry, Szeged. The College became the educational basis of food technology, mechanics, and process operation engineers. From 1986, the College of Food Industry became the College Faculty of the University of Horticulture and Food Industry, and it operated as József Attila University, Szeged, College Faculty of Food Industry in 1998-1999. From 1 January 2000, it had been operating as the College Faculty of the University of Szeged - the legal successor institution - under the name of College Faculty of Food Industry, Szeged, and with the same educational tasks. As a result of the growth of



the educational profile, on 1 January 2007, the name of the institution was changed to the Faculty of Engineering within the University of Szeged, with 12 faculties. The educational field of the legal predecessor - the College of Food Industry, Szeged - was initially linked to the food industry, which was extended gradually, and today, there are five university B.Sc. and two M.Sc. programs. Presently, the faculty - in accordance with today's needs - is the one of the most important bases of engineering education at the University of Szeged and in the Southern Great Plain Region, with its highly qualified experts who possess academic degrees, and with modernly equipped training rooms and laboratories.

### Our B.Sc. Programs in Food Industry Food Industry Engineering specialization

A food engineer is skilled in controlling technological processes, has overall knowledge of the theoretical and prac-



tical fields of processing, conservation, manufacture of goods, and is capable of performing tasks related to management service and business management.

### Mechanical Engineering in Agriculture and Food Industry specialization

A mechanical engineer specialized in agriculture and food industry is capable of dealing with the preparation, operation and management tasks of the production processes and industrial services, and with the subtasks of design and development.

### Agricultural Engineering Specialized in Economics and Rural Development

An agricultural engineer specialized in Economics and Rural Development is capable of managing the agricultural production, product processing, commerce and related economical, financial and infrastructural (intellectual) services, as well as carrying out the operation of personal and joint ventures, co-operatives, financial institutions, insurance

companies, local governments, special administration agencies and specialized consultancy organizations.

### Our Masters' Programs in Food Industry Certified Food Engineering Specialization (M.Sc.)

A certified food engineer is skilled in the fields of production, technology, planning of operations, management of economic processes, development of products, quality assurance, tenderwriting, and is capable of undertaking management tasks while taking into account technical and economic aspects.

### Certified Agricultural Engineering in Rural Development (M.Sc.)

A certified agricultural engineer in rural development is capable of performing the tasks related to rural development in such a way that he or she takes into consideration the specificities of the region, gives priority to environmentally-friendly procedures, and pays attention to sustainable economic development.



Budapesti Corvinus Egyetem, Kertészettudományi Kar (BCE KERTK)

## FACULTY OF HORTICULTURAL SCIENCES, CORVINUS UNIVERSITY OF BUDAPEST



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### The Faculty of Horticultural Science

The Buda campus hosting our Faculty is located in the heart of Budapest, in a scenic location on the Western slopes of Gellért Hill. Ours is one of the oldest university faculties specialized in horticultural training in Europe, with traditions dating back for more than 160 years. The original school was established in 1853 by Dr. Ferenc Entz, a medical doctor. The School for Practical Gardening became famous and enjoyed the support of the then government. Thus, in 1894, the school was raised to the rank of Royal School of

Horticulture. From that time on, the Institution has been continuously developing, along with its structure and name. In 1953/54, the school became an independent college, and later acquired a program in landscape architecture. In 1968, the School was elevated to become a University of Horticulture, with a Food Industry Section established. Between 2000 and 2003, the Faculty of Horticultural Science belonged to Szent István University, Gödöllő. In 2003, due to further integration steps, it was joined with the Budapest University of Economic Sciences and Public Administration and other Institutions, forming the Corvinus University of Budapest of today. Our university integrates education of 17,000 students, from among which 2,000 are studying in horticultural sciences, at B.Sc., M.Sc. and Ph.D. levels.

Because of its long traditions, high level training and scientific work, the Faculty has been and remains in a prominent

position in horticultural research and education in Hungary.

### Research at the Faculty

In addition to education and consultation, the staff of the Faculty of Horticultural Science performs significant scientific activities. The wide spectrum of horticultural science areas is reflected in the range of research projects in the departments. Scientific areas include vegetables and cultivated fungi,





fruit crops, medicinal and aromatic plants, ornamental plants and dendrology, viticulture, breeding of horticultural plants, postharvest biology, plant protection and organic farming, new machines in horticulture. These applied research areas are integrated with results of basic scientific disciplines of botany, genetics, biotechnology, biochemistry, plant physiology, microbiology, automation, management and informatics.

A considerable part of practical education and research work is conducted on the Research Station and Educational Farm (250 ha), which is located on the outskirts of Budapest. This facility makes it feasible to conduct large scale field experiments, extending projects from the laboratories. The Botanical Garden (60 ha) of the Faculty is also located at this site.

Viticulture has always been important part of educational programs and research at the Faculty. Two excellent Departments of our University with long traditions; the Department of Viticulture and the Department of Oenology have recently been integrated with the Research Institute for Viticulture & Oenology (Kecskemét) and the Soós István Oenology and Business Technical School, to form the Institute of Viticulture and Oenology. Theoretical and practical expertise, as well as regional, nationwide and international connections, predestine this Institute to play a leading role in research and development, the domestic wine industry and to positively influence grape and wine culture in Hungary.

In recent years, our faculty has maintained a high ranking position among

Hungarian agricultural educational institutions. Fruitful research activity contributed to these successes. The scientific potential of our staff has been strengthened by international collaboration and participation in multilateral EU networks (e.g. FP7), ERASMUS, CEEPUS and other educational connections have also helped to build scientific connections and links to research institutes and universities abroad. In the framework of a development project supported by the European Union and the Hungarian government, our laboratories have been rehabilitated and modern equipment appropriated. This project provides an advanced background for our research activity. The Buda Arboretum, which is the largest dendrological repository in Hungary, is currently under renewal, the results of which already include an expanded number of taxa in our collection. The horticultural genetic repositories are integrated in the National Network of Research Infrastructure.

Selected research areas where our departments have made important scientific contributions:

- Modeling climate changes, studies on effects of climate change on horticulture, strategies for overcoming their adverse effects.
- Studying mechanisms of water loss through leaf and fruit epidermises. Monitoring of water consumption of fruit trees by sap flow method, building empirical models to forecast water use, studies on water use efficiency.
- Development and use of molecular (biochemical and genetic) markers in breeding of horticultural crops.



- Cultivar evaluation and breeding of improved cultivars for fruit crops (apricot, apple) and rootstocks, vegetable, wine-grape, and medicinal plant varieties, as well as breeding ornamental trees and shrubs.
  - Studies on chemical diversity of active compounds of medicinal plants (antioxidants, essential oils, saccharids), chemotaxonomy.
  - Research of taxonomy and propagation biology of protected and endangered plants and species with potential ornamental use.
  - Development of cultivation technologies and quality improvements for vegetable growing, fruit crops, wine-grape, ornamental and medicinal plants.
  - Studies on organic farming, optimization of ecological factors in agricultural ecosystem.
  - Diagnosis of plant pathogens by traditional and molecular biological methods. Exploration of the Arthropod fauna in horticultural ecosystems, developing plant protection strategies.
  - Strategic analysis of ventures and product chains in horticulture.
  - Development of a model for intelligent, computer guided robot, capable of detaching fruits in orchards.
- The Faculty traditionally maintains good ties with the horticultural industry. This is achieved by means of professional consultations, fares, exhibitions, and long-term bilateral links. Interactions and dialogues come easy, as most entrepreneurs have received diplomas from our alma mater.

Szent István Egyetem (SZIE)

## SZENT ISTVÁN UNIVERSITY



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### General description

Szent István University is one of the leading higher education institutions in Hungary. It was formed in the year 2000 by the integration of many prestigious, formerly independent universities and colleges. At present, our university has nine faculties and one institute, located on seven different campuses, with more than 18,000 students.

Our scope of education is quite broad, as in addition to the classical fields of agricultural sciences, there are veterinary, environmental sciences, mechanical engineering, economics, architectural sciences, medical sciences, as well as applied arts. There are 50 B.Sc. and 30 M.Sc. courses, 70 specializations and 40 continuing education courses, as well as 7 doctoral schools. A strong emphasis on protecting traditions, embracing modernity, fastidiousness and quality can be witnessed at the center of our educational and research work. Our university offers high quality education, which is reflected in the high caliber of our graduates, whose successes reflect the relevance of their education and the university's commitment to

supplying the labor market with qualified candidates.

Szent István University is one of the most important research centers in Hungary, concentrating on agricultural and environmental sciences, and well acknowledged by international quality institutions.

### Our research work in connection with agricultural and environmental sciences

EDENext is a collaborative project for the EU FP7-HEALTH.2010.2.3.3-1 call "Biology and control of vector-borne infections in Europe". The goals of EDENext are to understand and explain the biological, ecological and epidemiological processes to develop methods and tools to improve prevention, surveillance and control of vector populations, and vector-borne human and animal diseases.

TESS (FP7\_ENV\_2007-1) will assist policy makers to integrate knowledge from the EU, national, regional and local level into the decision-making process, while also encouraging local inhabitants to maintain and restore biodiversity ecosystem services. To achieve this, a transactional environmental decision support system will be designed, linking central policy planning to local livelihoods.

CytoThreat (FP7-ENV-2010): Fate and effects of cytostatic pharmaceuticals in the environment and identifica-

tion of biomarkers for an improved risk assessment on environmental exposure.

### International relations

According to TIME magazine, the Erasmus program is one of the most important achievements of the European Union. The program began in 1998, and our university joined at the start. Since that time, we have created more than 150 bilateral agreements for teacher, student and staff mobility, as well as multilateral international projects. During the last 12 years, we have awarded a total of two million Euros in scholarships to 1,000 outgoing students, who spent altogether 6,000 months at foreign institutions. The number of our incoming students increased by a factor of ten during the last decade, and it is now over 150 students per year. We are very proud that, through our efforts in the Erasmus mobility project, Szent István University could receive the European E-quality Award given by the Minister of Education in 2004, the first among Hungarian universities to receive it. In 2010, our Intensive Program, "Educational Contributions to Building Cohesion within European Social and Institutional Life," appeared among the most successful EU 20 projects in the Erasmus Success Stories periodical.

We have also been involved in the Central European Higher Education Exchange Program (CEEPUS) since





its start in 1998. The program framework handles research cooperation and mobility among partners within unique thematic networks. By 2010, SZIU managed to become a member of 9 CEEPUS networks, helping SZIU to stand out among Hungarian HEIs as an excellent partner in transnational research cooperation. During the last few years, our university managed to organize five successful summer university courses, in addition to the mobility exchange possibilities.

Participation in international research projects and mobility schemes has allowed SZIU students and academic staff to work and study internationally on international issues. Our active involvement in the ERASMUS and CEEPUS programs is proof of our commitment to educating internationally minded and qualified graduates.

#### Available patents

Szent István University has one regis-

tered and another patent pending:

- P0800629: Combined composting of sewage sludge and ligno-cellulose plant cuttings and its utilization as a nutrient
- P1000439: Method for the treatment of sewage sludge

#### Plans for the future

It is clearly listed among the aims of our university which are those educational and research purposes in which we are better than our competitors:

1. As Hungary has unique characteristics in agriculture with rich practical traditions, production of primary commodities of plant and animal origin, as well as education and research of food safety and food quality are logically among our top priorities.
2. Limited quantities and worsening quality of water supplies are causing world-wide problems. Many of our faculties research the implications and practical solutions to our water problems, as water is a commodity

of strategic importance. It is an international and domestic priority to effectively and efficiently utilize this precious resource.

3. The world's energy consumption needs are ever increasing while the current sources of energy are rapidly being diminished. Our faculties have the capacity and knowledge to address these challenges and create modern, energy saving technological innovations and new methods to utilize alternative energy solutions.
4. Adopting a holistic approach to environmental protection and management is paramount for success. Sustainable and environmentally friendly agriculture, rational water-usage and renewable energy research are all effective steps which must be taken to successfully protect our environment. It is very important for us to educate and research all of the above mentioned sciences, while at the same time we want to strengthen our image of being a "green university."

Pannon Egyetem, Georgikon Kar (PE GK)

## GEORGIKON FACULTY, UNIVERSITY OF PANNONIA



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#### Short history

On the basis of its legal predecessors, the Georgikon Faculty of Agricultural Sciences in Keszthely is the oldest institution of higher education for agricultural sciences in Europe. The Georgikon that was established by Count György Festetics, in 1797, is proud of its history of more than 200 years. After its foundation in 1962, the College of Agriculture in Mosonmagyarórvár and in Keszthely was established and then, in 1970, the two institutions were united under the name of University of Agriculture, Keszthely. In 1987, the Faculty of Animal Breeding founded at the Agricultural College of Kaposvár became part of the insti-

tution. The next transformation of the Georgikon Faculty of Agricultural Sciences at the Pannon University of Agricultural Sciences took place in 1990. The Faculty operated under this system until January 1st, 2000, when the Pannonian University of Agriculture closed down as a result of the integration of institutions of higher education. The Georgikon Faculty became part of the University of Veszprém. As a result of the integration, an intellectual centre came into being that fills a real regional role in Pannonia. Since 1 March 2006, the name of the university has been: The University of Pannonia.

Georgikon Faculty offers a wide range of educational possibilities to its prospective students: the applicants can choose from nine B.Sc. and the same number of M.Sc. courses. Two M.Sc. courses are available for foreign students in English language. Additionally, ten higher vocational training programs are also offered to would-be students.

Our Faculty offers three doctoral Schools for earning the Ph.D. degree: The Doctoral School in Animal and Agricultural Environment Sciences, The Doctoral School in Crop Production and Horticultural Sciences, The Doctoral School in Management and Business Administration

#### International relations

The Faculty puts great emphasis on international exchange programs and relationships, maintaining and renewing the old ones and constantly seeking for new possibilities. It has partner universities in Albania, Austria, Belgium, Bulgaria, The Czech Republic, The United Kingdom, Finland, France, The Netherlands, Croatia, Poland, Germany, Italy, Slovakia and Turkey. Active research cooperation characterizes the Georgikon; some of these projects go back to the distant past, mainly in European countries, but there also projects related to Asia.



#### Potato Research Centre, University of Pannonia, Keszthely

The Centre operates in a university system and is the only institution exclusively dedicated to potato research and breeding in Hungary. This institution has been an appreciated centre of basic and applied research, breeding, extension and education of experts for potato since 1960. One of its major duties is the breeding of profitable potato varieties, those suitable for Central European agro-ecological conditions, due to their resistance against major potato pests, pathogens and extreme weather conditions. The research fields of the Centre, spanning from basic to applied, are all dedicated toward this goal and try to cover all important issues of the potato sector.

Due to its consistent resistance-breeding program utilizing wild species germplasm, the Centre currently has 12 varieties on the EU list (Démon, Balatoni rózsza, Katica, Lorett, Góliát, Rioja, Hópehely, White Lady, Vénusz Gold, Luca XL, Kánkán és Somogyi kifli). These varieties, due to their complex resistance, high yielding potential and outstanding University of Pannonia, Centre for Agricultural Sciences Research Institute for Viticulture and Oenology, Badacsony

The Institute's predecessor was founded in 1951. By 1972, it had developed into a Research Station and had achieved considerable success. In 1982, reorganization and union with the Badacsony State Farm took place. The Research Institute of Viticulture and Oenology in Badacsony began its independent operation on 1st January 2002; on 15th March 2008, the Institute was inte-

grated into the Pannon University, and has been operating since as part of the Centre for Agricultural Sciences.

The experimental and research activities at the Institute concentrate on the following areas:

- Maintenance and development of biological assets
- Species-value research (focusing on the Balaton Wine Region)
- Autochthon grapevine varieties (e.g., Kéknyelű, Juhfark)
- Clonal selection, value analysis and spreading of new clones
- Research of integrated grape-growing and wine-making methods
- Analysis of wine-marketing strategies

The Institute achieved the most significant results in breeding, species-value research and in the examination of environmentally-friendly wine growing methods. The breeding activity is embodied in several Italian Riesling, Pinot Gris and White Riesling clones, as well as in several new grape varieties (Zeus, Zefir, Vulcanus, Rózsakő). Within the framework of species-value research, viticulture and wine-making analysis of characteristic varieties in the Balaton region is ongoing. The achievements of species-value research are marked by the re-accreditation of the "Juhfark" and "Budai" varieties.

Within the framework of the integrated grape production topic, the transfer of predator mites, upkeep of its population level and the observation of the swarming-dynamism of grape-moths produced remarkable results. Experience gained in the instrumental prognosis of fungal diseases help winegrow-

ers of the region in realizing integrated plant protection. The results of soil cultivation and fertilization experiments are put to practical use through professional advisors.

consumption quality, are unique in their kind. All the varieties, except for the Somogyi kifli, show extreme resistance to the economically most important potato viruses. Out of twelve, nine varieties are resistant to common scab, potato wart and golden cyst nematodes, while two of them are resistant to potato late blight as well, which makes these especially recommended for organic production.

The second major duty of the Centre is the maintenance, seed propagation and marketing of the varieties. In pursuance of the above activities, the Centre operates an in vitro gene bank with more than 500 genotypes, well-equipped pathology-, tissue culture- and quality control laboratories, owns several hundred m<sup>2</sup> of greenhouse and screen-house surface area, 70 ha irrigated propagation and 10 ha experimental fields with suitable machinery and storage capacity. The Centre produces about 500 Mts super elite quality seed, as well as a few million so-called "minitubers" annually. For the advising, promotion of cultivation and marketing of the varieties, the Centre operates a variety representation system for Hungary and abroad. The Centre maintains active contacts with the most important foreign and Hungarian research institutes working on potato. The researchers of the Centre take part in the graduate and postgraduate education programs of the University.



Pécsi Tudományegyetem, Természettudományi Kar, Szőlészeti és Borászati Intézet (PTTK SZBKI)

## INSTITUTE OF VITICULTURE AND OENOLOGY, FACULTY OF SCIENCES, UNIVERSITY OF PÉCS



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Viticulture and enology in Transdanubia possess a long history and many traditions. Pécs is one of the cultural and economic centers of this extraordinarily rich region, abundant in natural beauty, where scientific viticultural and enological research began in 1949.

The Institute was entrusted with the modernization and improvement of the 1, 500 hectares of hillside vineyards in the region, and with the development of new grape varieties and production methods.

Its activities further the development of viticultural technology and the culture of wine consumption. In Pécs, eleven engineers, biologists, economists and associates take part in research, development, counseling and education.

The Institute consists of three parts: the Department of Viticulture and Agrobotany, the Department of Oenology and the Department of Grapevine Breeding and the Gene Bank.

Associates of the Institute have played an appreciable role in the development of Hungarian viticulture and enology in the past half century.

### The main research topics of the Institute include

- Exploring the genetic and cultivation values of historic Hungarian grapes.
- Improvement of fungal disease resistant grape varieties by crossbreeding.
- Clonal selection and evaluation of new clones.
- The effect of rootstocks on the performance of quality white and red wines. Quality and quantity of grape production. The composition and quality of must and wine. The effect of rootstocks on the absorption of nutrition elements.
- Development of variety composition and technology of quality wine pro-

duction in hilly areas. The relationship between quality and quantity. Up-to-date planting, training systems and pruning.

- Variety and technological problems of environmentally-friendly viticulture on hilly vineyards.
- Study of regional variety Cirfandy. Development of the ecological, biological and technological aspects of their production.

- Affinity experiments. Rootstock and fruiting variety interaction. The behavior of four fruiting varieties has been studied on 10 rootstocks, at four wine districts since 1984.

Examinations were extended on 8 other rootstock and fruiting varieties in 1999.

- Environmentally-friendly grape production. Issues of variety and technology. Technical and agronomic methods for the defense against erosion.
- Integrated methods of grape protection on hillsides.
- The effect of climatic change on the grape growing climatic trends and their effects on grape production.
- Promotion of the value of the Cirfandy wine grape variety.
- The effect of yeast strains on characteristics of Riesling and Riesling Italian varieties.

### International projects

- EU-project CT 96 No 81: "European network for grapevine genetic resources conservation and characterization"



- EU project: European Project GrapeGen 06 Grapevine Genetic Resources.
- Breeding program in co-operation with the University of Novi-Sad (Serbia), and the Department of Horticultural Sciences, Geneva (USA).

### Consultancy and education

- Participation in undergraduate and postgraduate education.
- Consultation for commercial and small producers in viticulture and enology, based on laboratory experiments.
- Preparing development projects, applications for investments.
- Organization of trade presentations (pruning, variety, wine) at the experimental stations.
- Organization of and contribution to wine competitions and judging.



Állatorvos-tudományi Kutatóintézet (MTA ÁOTKI)

## VETERINARY MEDICAL RESEARCH INSTITUTE, HAS

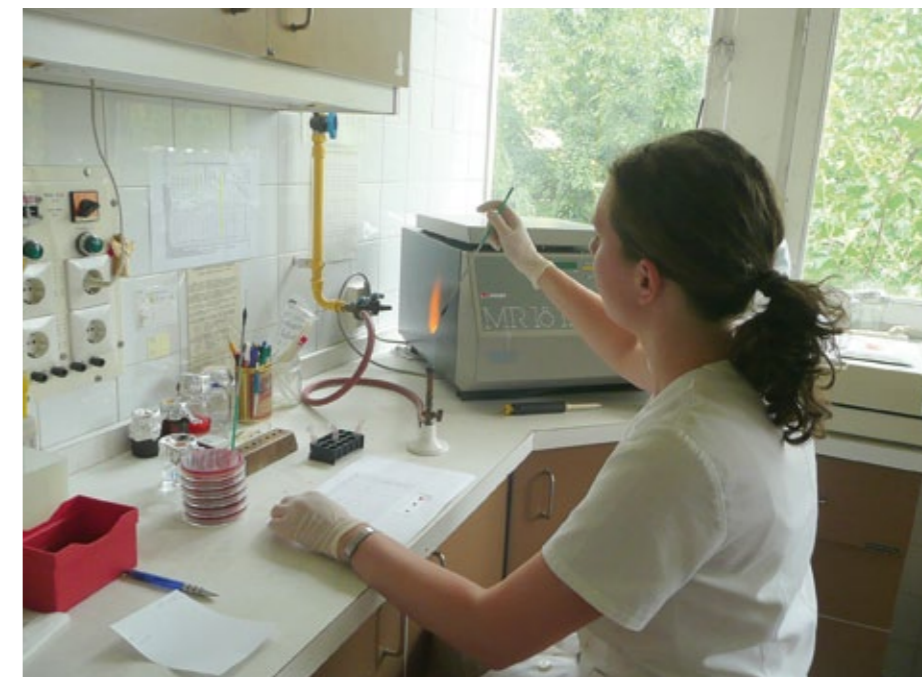
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### Scope of activities

The Institute was originally established in 1949. Its mandate is to investigate the viral, bacterial and parasitic diseases of farm and wild animals by using both classical and state-of-the-art molecular biological approaches. The overwhelming part of its work is basic research. Molecular and genetic aspects are increasingly emphasized. The duties of the Institute also include the improvement of diagnostic and vaccination methods, as well as participation in different forms of graduate and postgraduate training, promotion of international collaborative activities, dissemination of information to the public about scientific achievements, and assistance in the technological transfer of research results for application purposes.

### Research aims and topics

Most of the research concentrates on the study of the properties of pathogens (viruses, bacteria and parasites) of high animal health importance. Among the viruses, primarily the adeno-, herpes-, rota-, reo- and parvoviruses are investigated. Among bacteria, members of *Escherichia*, *Pasteurella*, *Salmonella* and *Bordetella* are being studied, to gain information especially about virulence characteristics. An important direction of the research is the elaboration of modern diagnostic methods based on the detection of nucleic acids of different infective agents. It is also important to study the relationship between the virulence and antigenic composition of the pathogenic organisms. Basic research activities on fish parasites are related to the etiology of the diseases and to the biology of myxosporean species. Environmental health aspects of certain infections are also investigated.



### Virology projects

- The genome analysis of adenoviruses originating from different vertebrates including fish, frogs, reptiles, birds and mammals, to study adenoviral evolution, to produce diagnostics, vaccines and gene delivery vectors.
- The study of herpes viruses of fish, fowls, cattle and bats and developing DNA based diagnostics (PCR) for their detection.
- The genetic study of rota- and reoviruses responsible for enteral diseases.
- Screening the wild life for different viruses to help in the preservation of biodiversity.
- Development of vaccines against avian influenza and Marek's disease virus.

### Bacteriology projects

- The interaction of different bacteria and viruses in the pathology of atrophic rhinitis; study of nasal deformations and lung lesions in pigs with computer tomography.
- Enteric bacteriology, food born zoonoses (salmonellosis, colibacillosis): the genetic basis of growth and colonization inhibition in *Salmonella*; gene transfer in *Salmonella* and *Escherichia coli* pathotypes; *E. coli* toxic

and adhesion virulence and antibiotic resistance genes.

- The diversity of *Pasteurella* strains isolated from a wide range of host species.

### Fish parasitological projects

- The life-cycle, host-specificity and infection pathomechanism of fish parasitic myxosporeans; phylogenetic studies.
- Correlation between the inbreeding of salmonids and their susceptibility to the fish parasite, *Myxobolus cerebralis*, the causative agent of whirling disease.
- Survey on parasitic infections and diseases of fishes in Lake Balaton and the water-reservoir Balaton Minor.

### Postgraduate and graduate training

There are generally about 14 Ph.D. students, supervised by scientists of the Institute in the subject areas of molecular virology, bacteriology and fish parasitology. Lectures on veterinary microbiology, molecular evolution, fish diseases and research ethics are regularly given to graduate and postgraduate students at the Faculty of Veterinary Sciences, Szent István University, Budapest.

Mezőgazdasági Kutatóintézet (MTA MKI)

## AGRICULTURAL RESEARCH INSTITUTE, HAS



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The profile of the Agricultural Research Institute of the Hungarian Academy of Sciences (www.mgki.hu) involves complex, interdependent, basic, methodological and applied research projects culminating in practical applications. The basic aim is to use the internationally renowned germplasm accumulated in Martonvásár over the past sixty years, combined with up-to-date methods from the fields of genetics, physiology, cell and reproduction biology, molecular breeding, functional genomics, biotechnology, plant breeding and crop production, in order to develop new plant genotypes satisfying the future demands of society and to carry out research on production technologies and the environment. Ongoing projects include an analysis of the agroecological equilibrium, the production of raw materials for healthy nutrition, cereal chemistry and grain quality analysis, the development of durable stress resistance, and improvements in seed safety, in order to meet the requirements of sustainable development. The development of new germplasm is greatly promoted by the cereal gene bank established in the institute.

The first international success achieved by Martonvásár plant breeders came in 1953, with the development of the first hybrid maize in Europe. The main aim of the present research program is to achieve better abiotic and biotic stress tolerance, leading to stable yielding ability under the continental climate conditions of Eastern Europe. Some of the new grain maize hybrids satisfy special processing needs: hybrids with high starch content, suitable for fermentation, have been developed for bioethanol production, while high-yielding, easily digestible hybrids with altered plant architecture, resulting in a larger number of leaves above the ear, have been bred for silage production.

Martonvásár wheat varieties occupy over half a million hectares each year, almost half the wheat-growing area of Hungary. The Martonvásár wheat program has thus been a market leader for more than 15 years. A major aim is to select varieties with excellent grain quality and high protein content. A total of 15 Martonvásár varieties have been registered abroad in 10 countries over the last decade.

The international compatibility of the institute's research program is well illustrated by its participation in four integrated projects in the 6th EU Framework Program (HEALTHGRAIN, BIO-EXPLOIT, MICROMAIZE, BIOSAFENET) and two in the 7th Framework Program (DROPS, SOLIBAM). Based on experiments carried out in the phytotron, basic and applied research has been underway for nearly 20 years on the probable effects of climate change. In 2008, this led to the institute being the first in Hungary to be awarded a grant from the 7th Framework

Program for the AGRISAFE Project, aimed at turning the institute into a regional research and training centre for Central Europe with the task of preparing agricultural scientists, breeders, innovation experts and farmers to cope with the consequences of climate change.

Institute staff play an active part in undergraduate and postgraduate education, especially at the Szent István, Pannon, Debrecen and Corvinus Universities, all of which have established teaching departments in Martonvásár, and at Károly Róbert College.

As a sign of the international recognition of plant breeding in Martonvásár, the secretariat of EUCARPIA, the European Association for Plant Breeding Research, has been located in the institute since 2008. The institute is also the headquarters of the Pannonian Plant Biotechnology Association, and is home to the first organic plant breeding research unit in Hungary.



Növényvédelmi Kutatóintézet (MTA NKI)

## PLANT PROTECTION INSTITUTE, HAS

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The Plant Protection Institute (PPI) is a non-profit institution of the Hungarian Academy of Sciences, with widespread international connections. PPI's primary task is basic research, but with links to applied research. PPI is divided into six scientific departments, as follows:

**Biotechnology**

Our main goal is to establish disease/stress-resistant plants using molecular biological techniques such as transformation, in vitro selection, and induced resistance. Bacteriophages are studied if they can be used against the disease called fire blight of pome fruits. Cross protection is studied against phytoplasma diseases that may protect the plants for their entire lifespan.

**Organic Chemistry**

The department aims at the molecular modeling, design and synthesis of new pesticide molecules, as well as the study of their biological activity, types of activity and side effects. The department searches for lead compounds displaying bioactivity of interest in the field of pest control and performs molecule optimization using computer-aided molecule design methods. Projects are

being carried out to remove pesticide residues from polluted soils by using plants.

**Ecotoxicology and Environmental Analysis**

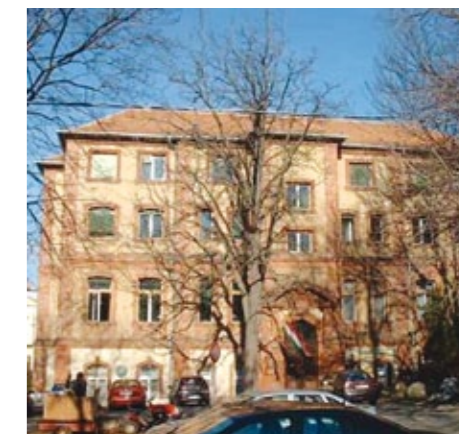
Research at the department focuses on the effects of pesticides and agricultural technologies on the environment, partly by monitoring the presence of given pollutants (chemical and bioanalysis), and partly by studying the consequent modifications in the biota at individual and population levels (ecotoxicology).

**Pathophysiology**

The main goal is to investigate the mechanisms of plant disease resistance against viruses, bacteria and fungi. The Bacteriology Group studies various defense responses of plants against bacteria, mainly Pseudomonads. The Biochemistry Group studies the role of plant hormones, glutathione and of various oxylipins in the focus of its investigations. The Pathophysiology Group concentrates on the resistance of plant diseases, on the role of pro- and antioxidants in disease/stress response. Studies on the virulence analysis of wheat leaf and stem rusts are also involved. The Virology Group investigates the epidemiology of new, economically important viruses.

**Plant Pathology**

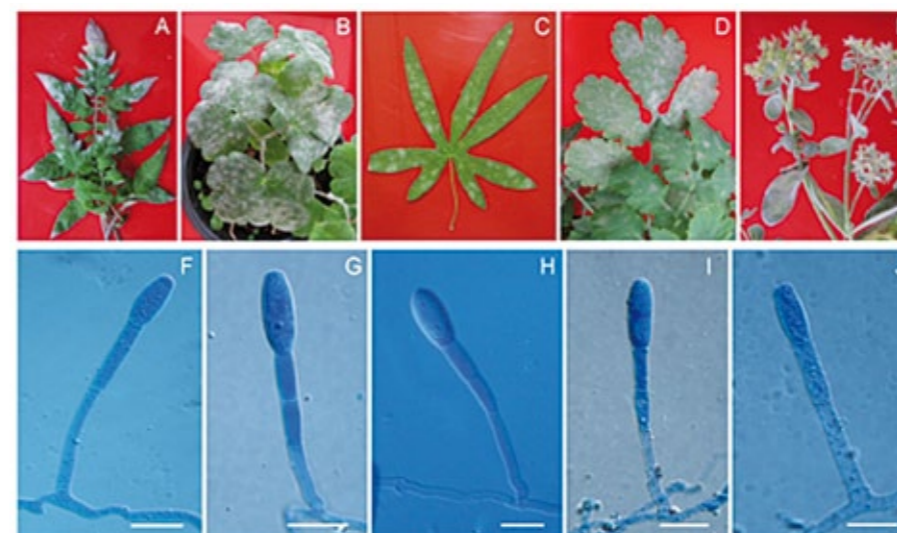
Activities have been focused on the biology and control of fungal plant pathogens infecting agricultural and



horticultural crops, ornamentals in urban environments and/or causing plant health problems in forestry, natural reserves. Fungal species useful in the biological control of fungal plant pathogens and weeds have also been studied. Studies deal with the etiology and epidemiology of fruit tree diseases, mycotoxin production of Fusarium spp., powdery mildew infections and plant diseases caused by Phytophthora spp. Molecular tools have been applied in the precise identification, phylogeny and intraspecific variability of several fungal pathogens, as well as in the study of their fungicide resistance.

**Zoology**

The department studies the ecology and biology of pests with the final aim of developing new, environmentally sound plant protection methods. The regulatory role of beneficial parasitoids and predators of pests, in the frame of integrated pest management (IPM) is investigated. Special attention is paid to virus causing epidemics in cultivated plants. Biodiversity of natural parks are studied with special regard also to landscape management. Developing new methods against key pests in urban ecosystems serves improvements of human habitats. By studying the infochemical ecology of insects and identifying their pheromones, evolutionary processes are tracked, and species-specific, highly sensitive traps for monitoring of pests, beneficial biological control agents, and for studying biodiversity are developed. New projects focus on challenges by invasive pests and the impact of climate change on insects.



## RESEARCH INSTITUTE FOR SOIL SCIENCE AND AGRICULTURAL CHEMISTRY, HAS



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### 1. About the Institute

The Research Institute for Soil Science and Agricultural Chemistry of HAS was established in 1949. It is the scientific centre for soil science, agrochemistry, soil biology and soil biochemistry in Hungary.

The aim of the Institute's activities is to contribute to the development of sustainable agriculture, soil conservation and rational soil management. In addition to fundamental research, the Institute participates significantly in applied research, educational, advisory and information activities within the framework of extensive national and international cooperation projects.

### Main research topics:

- Qualitative and quantitative characterization of the soils' physico-chemical-biological state and the methodological development of their monitoring.
- Quantification and prediction of soil processes.
- Development of scientifically based, rational plant nutrition.
- Analysis of the role of micronutrients in soil processes.
- Prevention and reduction of soil pollution and its unfavorable environmental consequences.

### Research objectives and topics

Soils represent a considerable part of the natural resources of Hungary, their rational utilization, conservation and the maintenance of their multipurpose functionality are of particular significance both, for the national economy and environment protection, and require continuous, deliberate efforts. The smooth operation of soil functions is ensured by the integrated impacts of soil properties, which are the result

of soil biogeochemical processes. The main task in sustainable land use and rational soil management is the control of soil processes: mass and energy regimes, abiotic and biotic transport and transformation and their interactions.

### Research topics in the field of soil science

- Soil degradation processes and the possibilities of their control and prevention.
- Characterization of soil water management, and the control of extreme moisture situations. Modeling of the moisture regime in soil-plant-atmosphere systems.
- Characterization of soil quality by the exploration of the relationships between physical, chemical and microbiological soil properties.

### Research topics in the field of environmental informatics

- Elaboration and development of expert and monitoring systems supporting agricultural, environmental, landscape and water management.
- Spatial-temporal modeling of environmental resources, environmental information modeling.
- Development, integration and analysis of spatial soil information systems. Digital soil mapping.
- Development of a soil ecological indicator system: studying soil biological activity and biodiversity, building a soil mesofauna database.



### Research topics in the field of soil biology and soil biochemistry

- Development of soil (bio)technological risk-eliminating methods and tools for environment conservation, for the reduction of environmental stress effects, and for the remediation of damaged, polluted areas.
- Study and controlled application of soil-plant-microbe interactions.
- Development of alternative soil ameliorants, study of the role of beneficial microbes and potential pathogens in the food chain.
- Study of the vegetation components of phytoremediation and phytostabilization, analysis of soil-vegetation interrelations.
- Taxonomy of AM fungi.

### Research topics in the field of agrochemistry and plant nutrition

- Elaboration of a site-specific precision plant production system.
- Recycling of organic matter originating from the crop production process into the natural nutrient cycle.
- The processing and utilization of hazardous wastes of animal origin.
- Development and testing of a new, cost and environmentally-friendly fertilization advisory system.
- Dynamic simulation modelling of water balance, nutrient balance and biological processes of the soil-plant-atmosphere system.

## THE GEOGRAPHICAL RESEARCH INSTITUTE, HAS



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The Geographical Research Institute of the Hungarian Academy of Sciences was established in 1951 as a research group and it became a research institute in 1967. The main task of the institute is the development of theoretical bases and methodology for physical, human and regional geography, studies on spatial processes and interrelationships; temporal and spatial survey of the interaction between man and environment; assessment of factors of the geographical environment with a special reference to natural and socio-economic resources and to the emerging socio-economic problems in the Carpatho-Pannonian area (mainly in Hungary); international cooperation; documentation and dissemination of research results.

The institute maintains important international contacts with many countries world-wide and has taken part in many international projects, including several EU FW projects.

The importance of research activities in the fields of physical geography and soil science has increased tremendously, mainly because nature protection and environmental problems are presently the focus of scientific and public interest. Soil erosion, land and landscape degradation processes also threaten the area of Hungary, and the main task of the Department of Physical Geography is to investigate these topics from the aspect of practicality.

The Department of Physical Geography undertakes the following activities: soil erosion research (field measurements on plots and in catchments, erosion mapping and modeling), agricultural pollution research, basic and applied geo-ecological investigations with special reference to ecosystems, land degradation and desertification studies in semi-arid and sub-humid environments, application of geographi-

cal information systems in land evaluation studies and in land use planning, application of remote sensing methods, land capability analysis and climate change studies (aridification and its consequences). The department has a well-equipped laboratory for physical and chemical analyses of soil, sediment and water samples. The department has been involved in many national and international projects e.g. MEDALUS (Mediterranean Desertification And Land Use) II. and III. (EU FW 4 and 5), SOWAP (SOil and WAter Protection, EU LIFE), BORASSUS (FP6 - INCO).



### Main Research topics

- Landscape studies, including ongoing research on the natural micro-regions of Hungary, and updating the volume entitled "Cadastre of the natural micro-regions of Hungary" published by the Institute.
- Investigations on land degradation and desertification in Hungary, in the Mediterranean and in the Third World.
- The effects of climate change on the environment, assessment of the risks of increasing drought in the central part of the country, on the Danube-Tisza Interfluvium, changes in flora and soil dynamics.
- Soil erosion on agricultural land, modeling, plot measurements on soil

loss, nutrient loss and runoff, studies on sheet and gully erosion, mapping of rills and gullies, identification of the main factors of gully development, soil erosion control.

- The effects of conservation agriculture on the soil, on the environment and on biodiversity; sustainable agriculture and its role in future landscape development.
- Accumulation and remobilization of heavy metals on active flood plains.
- Spatial information techniques.
- Land use history and land use changes in Hungary, land use planning, investigations on sustainable land use for the future.



## CENTRE FOR REGIONAL STUDIES, HAS



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The Centre for Regional Studies of the Hungarian Academy of Sciences (CRS) was founded as a network of institutes in 1984 as the legal successor of the Transdanubian Research Institute, founded in 1943. The CRS has its headquarters in Pécs and four institutes with further departments covering the entire territory of Hungary.

As the fundamental institute of regional studies in Hungary, the Centre contributed to the survey of spatial principles and the domestic and international dissemination of research results; its research laying the groundwork for the territorial policies and development strategies of the European Union and Hungary. Its applied research has directly contributed to the establishment and management of balanced and sustainable spatial structures. The eight decentralized research units of CRS consider the analysis of specific territorial features a major task, beyond their own research profiles.

**Research directions:**

- International environment of regional development, EU cohesion policy and funding
  - Regional development in Central and Eastern Europe
  - Territorial processes and regional policy in Hungary
  - Factors influencing the territorial structure of the economy
  - Typology of spaces and network of settlements
  - The impact of the system of public administration and institutions on competitiveness and territorial cohesion
  - Human resources and social environment, human capital
  - Territorial aspects of environmental protection
  - Methodology of regional research
- Published books containing detailed studies on environmental and agrarian

related issues from previous decades: Regions of the Carpathian Basin (12 volumes), Great Plain Studies (19), Village Conference (3), Discussion Papers (6), as well as 18 individual volumes in the Hungarian or English language.

**Major research programs from the last 2 years:**

- Bioenergetics – society – balanced rural development (The program studies the details of the use of the thermal capacity of solid biomass, as well as the social and economic environment of the production and use of bio-fuels, with the purpose of maximizing the positive impacts of bioenergetics on rural development, in the broader sense of the enumeration of micro-regional development effects and factors of reindustrialization.)
- The Role of Environmental Industry in Regional Reindustrialization in Hungary (The book deals with the Hungarian characteristics and possibilities of environmental industry; with individual chapters dedicated to its various segments. Taking the characteristic Hungarian features into consideration, the book places

special emphasis on biomass-based renewable energy production and the related issues of waste management.)

- Delineating a new – complex – micro-regional typology of rural spaces (The results have made it clear that it is possible to identify complex agrarian space types which can serve as a basis for a future, renewed Hungarian agrarian and rural development policy, regional and rural planning.)
- For several years, the Centre for Regional Studies has assisted the government in laying the groundwork for the development of the Danube region. In 2009, research staff analyzed national development plans concerning the river from countries situated along the Danube, prepared the English-language edition of the almanac titled “The Danube in Hungarian regional development”, and, developing three alternate scenarios, examined the possibility of the construction of the Danube–Tisza canal.

A significant program under realization is the ESPAN Pannon Energy Strategy (with the aim of elaborating a joint cross-border regional renewable energy strategy).



## HUNGARIAN DIARY RESEARCH INSTITUTE



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**Website:** www.mtki.hu



The Institute was founded by Imre Ujhelyi. The Institute currently employs a staff of about seventy and operates as a commercial company, with a market-oriented approach and through the continuous development of its research achievements and services. Presently, the Institute is self-supporting and

profitable. The Institute owns ten patents and processes, which are used by Hungarian dairy processors, as well as by dairy processors in other countries worldwide. There are several successful and popular new generation products on the Hungarian dairy market (including cheeses and processed cheeses, low calorie butters and dairy spreads, desserts, functional dairy products), the production technologies of which have been elaborated by the Institute.

Over the past two decades, the Institute has excelled in the advancement of membrane separation technologies. New products and their technologies have been developed, such as cream white cheese (Feta type cheese) based on the combination of ultrafiltration and vacuum evaporation, high-fat cream cheeses, whey cheeses, milk protein concentrates and micellar casein obtained by combining microfiltration and ultrafiltration. The processes invented by the Institute are now being used not

only in Hungary, but also worldwide (Ireland, Argentina, the USA).

In addition to its research and development (R&D) activities, by capitalizing on its intellectual capacities, the Institute also provides a broad range of services and expert advisory services in Hungary and abroad. These services are supported by well-equipped, hygiene-microbiology and physical-chemical laboratories that have food and pharmaceutical accreditations.

In Hungary, the Institute represents several renowned multinational manufacturers of natural food additives and distributes their products to the entire food industry. The aim is to support foodstuff manufacturers in producing healthy foods that satisfy the highest consumer demands by using the Institute's development experiences gained over more than a century, by utilizing its unique laboratory and pilot plant background and by offering the reliable, innovative, natural additives of its partners.

## HUNGARIAN MEAT RESEARCH INSTITUTE



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The Hungarian Meat Research Institute was founded in 1959. Over a period of more than fifty years, the Institute has become the most important professional center for meat science and processing and has contributed to the knowledge of this discipline with a number of achievements also acknowledged at international level. The most outstanding research achievements: research findings on the study of meat maturing and curing, salami drying and ripening processes, preservation of casings; protein extractability; development of technology for new types of raw fermented sausages; introduction of application of starter cultures; nutritive value

examinations, environment protection; control of food-borne micro-organisms causing health and spoilage problems; development of analytical methods for quality control, thermal treatment and production technologies, development of machines and products. Some of the timeliest tasks are in connection with efforts made for healthy nutrition, including the education of consumers, the correct application of additives and ingredients in the meat industry and the introduction of modern packaging technology. The Institute's underlying research activities were carried out primarily in the framework of international co-operation financed by the European Union, e.g. it has proven results that through the use of fermented dry sausage technologies presently employed in Hungary, producers may always guarantee a minimum 5 log reduction of E. coli O157:H7 count; the Institute offered a model in cattle slaughtering to meet the new requirements related

to BSE, developed EU-conform “organic” meat products from indigenous Hungarian animals (Mangalitsa pig and Hungarian Grey cattle) and new functional meat products with olive oil, oat bran, CLA, antioxidants of plant origin, as well as a method of assessing the shelf life of meat products with particular reference to food safety.



Környezetvédelmi és Vízgazdálkodási Kutató Intézet Nonprofit Közhasznú Kft. (VITUKI)

## RESEARCH INSTITUTE FOR ENVIRONMENT AND WATER MANAGEMENT



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VITUKI was founded in 1952 on the foundations of the former Hydrologic Institute, to perform for the Hungarian Water Management service both basic and applied research, as well as studies related to the development, conservation and sound management of water resources of the country. Integrated with the Hungarian Hydrological Service, established in 1886, and supported by hydraulic, hydro-machinery, hydro-chemical, hydro-biological and soil mechanical laboratories; equipment, instrumentation and computer facilities, VITUKI has emerged as one of the most complex water-oriented, full-service professional organizations in Europe, with an annual turnover of 6.7 million Euros. There are approximately 110 highly qualified specialists on the staff of the total 235 employees, including civil, chemical, electrical, mechanical engineers, geologists, biologists, mathematicians, geophysicists and agronomists. VITUKI offers a comprehensive range of research, consulting

and engineering services in the following domains:

### SCIENTIFIC AND INTERNATIONAL AFFAIRS

- Secretarial Services for IHP/NHP National Committee
- Education and training
- Remote sensing and aerial photography
- Co-ordination of Water Framework Directive activities

### WATER MANAGEMENT

- Surveys and investigations on the various types of surface and groundwater
- Water resources studies, flood control-, hydropower- and navigation development
- Short- and long-term hydrological forecasting
- Surveillance of existing structures
- Design, laboratory- and field calibration of measuring weirs, flumes, devices and current meters
- Seepage studies

### ENVIRONMENTAL AND NATURE PROTECTION

- Quality surveys and monitoring strategies elaboration
- Toxicological and hydro-biological analyses

- Environmental baseline surveys, impact reports, assessments
- Comprehensive water quality management studies
- Quality assurance - quality control, inter-calibration programs
- National Water Quality Central
- Co-ordination of the National Clean-up Program

### SUPPORT SERVICES

- Soil mechanical explorations and testing
- Licensing, e.g. products and equipment for use in the Hungarian water industry



Országos Meteorológia Szolgálat (OMSZ)

## HUNGARIAN METEOROLOGICAL SERVICE



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The Hungarian Meteorological Service (OMSZ) is a central authority that is responsible for governmental tasks associated with atmospheric environment and meteorology. Since its foundation in 1870, it has always carried out its duties in accordance with international

standards and has tried to follow the demands of the government, economy and general public. One portion of the operational costs of the OMSZ is covered by the central budget, while the other portion is met through the Service's own business activities and scientific foundations. Being a national service, the OMSZ represents the country at international meteorological organizations. In order to know more about atmospheric phenomena and processes, as well as to provide relevant and comprehensive information on the past, present and future state of the

atmosphere, the OMSZ continuously takes measurements and collects data, which are then statistically processed and archived. The operational meteorological and atmospheric measuring and observational network constitutes a major part of the budget expenditures. The information system of the OMSZ now can handle 140 GB of data daily, which means transmitting, post-processing and systematizing not only Hungarian, but also international, data provided by satellites, radar and lightning detectors. The most important tasks of meteorology are forecasting

and climate data processing. Research and development have always been a part of the Service's domestic scope of activities; however, research work today is mostly done within the scope of international co-operation. Through its data collection and scientific work, the OMSZ is linked with other disciplines and often participates in international projects, as well. The OMSZ is an active participant in flood protection works, air quality control and disaster prevention. The liaison with the general public and the contact with experts on impact studies are essential elements of our work, too. In addition to daily weather reports, we also carry out special sub-regional computations.



Földmérési és Távérzékelési Intézet (FÖMI)

## INSTITUTE OF GEODESY, CARTOGRAPHY AND REMOTE SENSING



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FÖMI was established in 1967, and is the basic institute for the implementation of research and development programs resulting in applied technologies of remote sensing and GIS mainly in the areas of agriculture and environmental protection. FÖMI works in close cooperation with the Hungarian Space Office, and it is member of the European Association of Remote Sensing Laboratories (EARSeL).

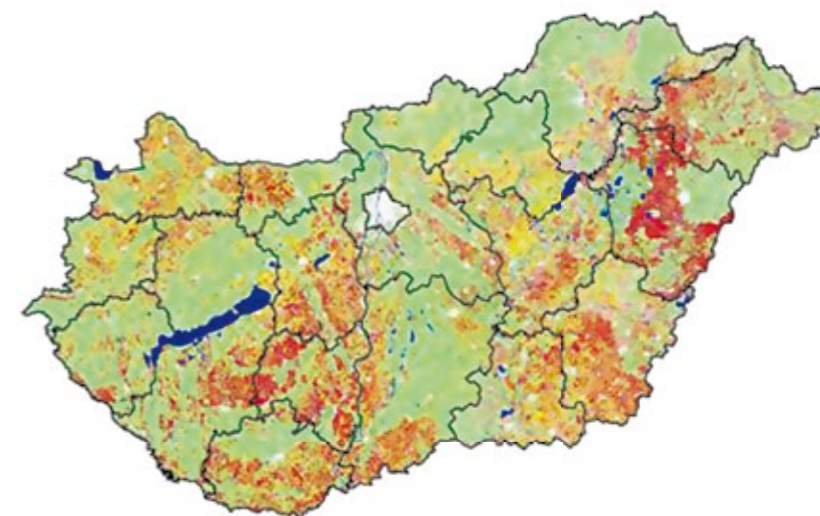
FÖMI carries out applied research activities in partnership with European institutions (e.g. FP7 projects) in the field of the advanced methods of land coverage / land use mapping, statistical validation and environmental applications. Within the framework of the National Crop Monitoring and Production Forecast Program (CROPMON 1997-2003), FÖMI provided country and county-level crop production forecasts spanning an entire season, based on the remote sensing, measurements of the areas and the expected yields of the 8 main crops in Hungary.

Other operational applications, such as remote sensing control of national and EU area-based subsidies (its basis is the LPIS\_Hu), satellite-based waterlog assessment and impact monitoring, flood and drought monitoring and the assessment of vineyard and orchard areas were growing out from the CROPMON technology basis. The ESA Prodex (2000-2004)- and ESA-PECS ENVISAT (2004-2007) projects for regional flood/waterlog and drought monitoring were also conducted by FÖMI.

Based on CROPMON technologies, a specific ragweed recognition methodology was developed and validated

(2002-2004). Based on its results, an ambitious national Operational Ragweed Control Program could be designed and is currently being carried out every year. Its main pillar is the production of the ragweed risk map using remote sensing. Recent research activity is focusing on utilization of radar remote sensing data, as well.

The FÖMI's GNSSnet.hu service also provides real-time corrections for precision farming. Using the automatized steering of the engines, the farmers can save significant amounts of seed, fertilizers and pesticides. FÖMI also started the official calibration of GPS receivers applied in the SAPS on-the-spot-checks.



Gyógynövénykutató Intézet Kft. (GYKI)

## RESEARCH INSTITUTE FOR MEDICINAL PLANTS

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The primary aim of founding the Institute in 1915 was the exploration, collection, processing and domestication of wild medicinal plants (MPs). Propagation of valuable stocks, API analysis of MP drugs and control over the trade with MP drugs were set as further tasks. The MP control and qualification system, elaborated here in the 1930s, has been introduced in numerous countries as a model to be followed.

During the past almost 100 years, activities have been expanded significantly by extending MP research and development (R+D).

R+D are focused on three areas:

### 1. *Biological agronomy R+D*

- MP breeding: by classical and molecular methods. Breeding of poppy varieties with high morphine, codeine, thebaine and oripavine contents. The Institute is owner of 30 registered MP varieties.
- Agrotechnological research projects: for utilization of the varieties' genetic values.
- Genetic basic research projects: inheritance and correlation analyses; genotype-environment interactions.
- Gene reservation: exploration, monitoring of wild MPs; diversity examinations. In-ex situ gene-bank preservation of 1100-1300 MP species. The Institute's chemotaxonomic garden is a nature-conservation area.

### 2. *MP drug analysis*

- API analyses: in R+D experimental samples using modern techniques.

- Chemical, analytical development: plant-analytical research projects; development of new chromatographic and coupled methods (GC-MS, CE-MS, HPLC-MS).
- Extraction-technological R+D: isolation of new active-ingredient compounds from plant basic materials.
- Plant-tissue identification work.

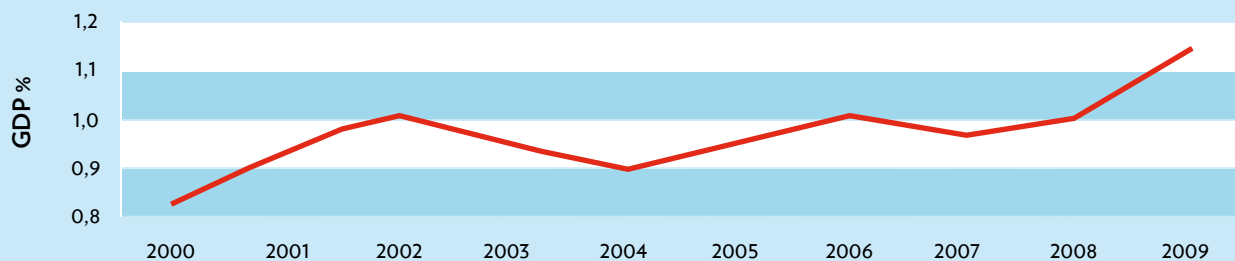
### 3. *Production of herbal medicines and APIs*

- Production of MP extracts and herbal medicines in GMP (Good Manufacturing Practice) system.
- Production of herbal medicines (CHOLAVIT, DIURO, PROSTAGUTTA, RESCULINI, ROBOFIT), developed as a result of R+D in the Institute's modern pharmaceutical plant.
- Production of MP-based dietary supplements and functional foods.



## HUNGARIAN AGRICULTURAL SCIENCE IN FIGURES

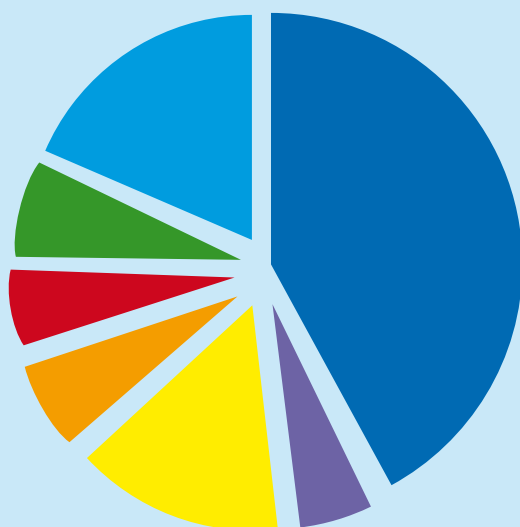
### GDP share of R&D expenditure (2000-2009)



The gross domestic expenditure (private and public sector) on Research and Development was EUR 1,060 million in 2009, equal to 1.15% of GDP.

- Lisbon target: 3% of GDP, Hungary's commitment: 1.80% of GDP.
- EU average: 1.85% of GDP.

### Share of agricultural R&D units by field of science (2009)

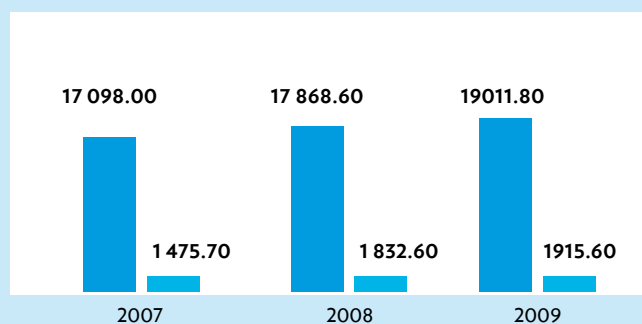


- Cultivation horticulture 43%
- Other 18%
- Food product sciences 8%
- Agricultural biotechnology 6%
- Veterinary sciences 7%
- Animal sciences 13%
- Forestry and hunting 5%

In 2009, 240 Research and Development units were active in agriculture. About half of them were enterprises and about 100 belonged to higher education. The rest carried out their activities under the direction of other governmental supervisory bodies.

More than 4000 people were employed in agricultural R&D units in 2009, of which the average percentage of scientists and engineers was 47%.

### R&D expenditure in agricultural sciences, mil. HUF (2007-2009)



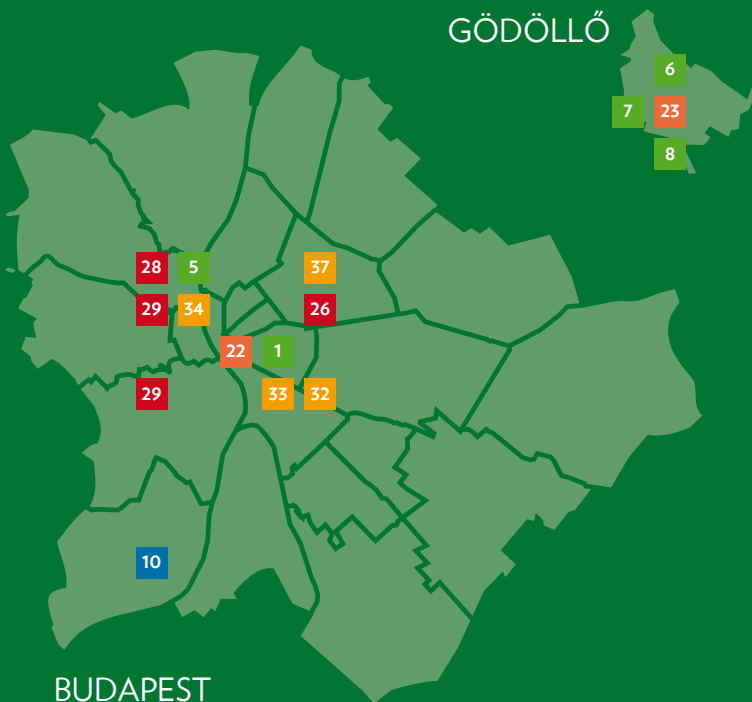
- current expenditure
- capital expenditure

Despite the economic crisis, there was a slight increase in both the current R&D expenditure and R&D capital expenditure between 2007 and 2009.





## GÖDÖLLŐ



## BUDAPEST

### I. INSTITUTIONS OF THE MINISTRY OF RURAL DEVELOPMENT

- 1 Research Institute of Agricultural Economics
- 2 Research Institute for Animal Breeding and Nutrition
- 3 Forest Research Institute
- 4 Research Institute for Fisheries, Aquaculture and Irrigation
- 5 Central Food Research Institute
- 6 Agricultural Biotechnology Center
- 7 Hungarian Institute of Agricultural Engineering
- 8 Institute for Small Animal Research and Co-ordination Centre for Gene Conservation
- 9 Research Centre For Agrobiodiversity

### II. OTHER STATE OWNED INSTITUTIONS

- 10 Research Institute for Fruitgrowing and Ornamentals
- 11 Fruit Research Institute of Cegléd
- 12 Fertőd Fruit Production Reserach and Development Non-profit Ltd.
- 13 Research and Extension Centre for Fruit Growing
- 14 Red Pepper Research-Development Non-profit Ltd.
- 15 Cereal Research Non-profit Ltd.
- 16 Research Institute for Vegetable Growing Co. Ltd.

### III. INSTITUTIONS OF THE MINISTRY OF NATIONAL RESOURCES

- 17 Centre for Agricultural and Applied Economic Sciences, University of Debrecen
- 18 Faculty of Animal Science, University of Kaposvár
- 19 Agricultural and Environmental Sciences Research, Károly Róbert College
- 20 Agricultural and Food Sciences Research, University of West Hungary
- 21 Faculty of Agriculture, Faculty of Engineering, University of Szeged
- 22 Budapest Covinus University
- 23 Szent István University
- 24 Georgikon Faculty, University of Pannonia
- 25 Institute of Viticulture and Oenology, Faculty of Sciences, University of Pécs

### IV. INSTITUTIONS OF THE HUNGARIAN ACADEMY OF SCIENCES

- 26 Veterinary Medical Research Institute, HAS
- 27 Agricultural Research Institute, HAS
- 28 Plant Protection Institute, HAS
- 29 Research Institute for Soil Science and Agricultural Chemistry, HAS
- 30 The Geographical Research Institute, HAS
- 31 Centre for Regional Studies, HAS

### V. OTHER INSTITUTIONS

- 32 Hungarian Diary Research Institute
- 33 Hungarian Meat Research Institute
- 34 Research Institute for Environment and Water Management
- 35 Hungarian Meteorological Service
- 36 Institute of Geodesy, Cartography and Remote Sensing
- 37 Research Institute for Medicinal Plants