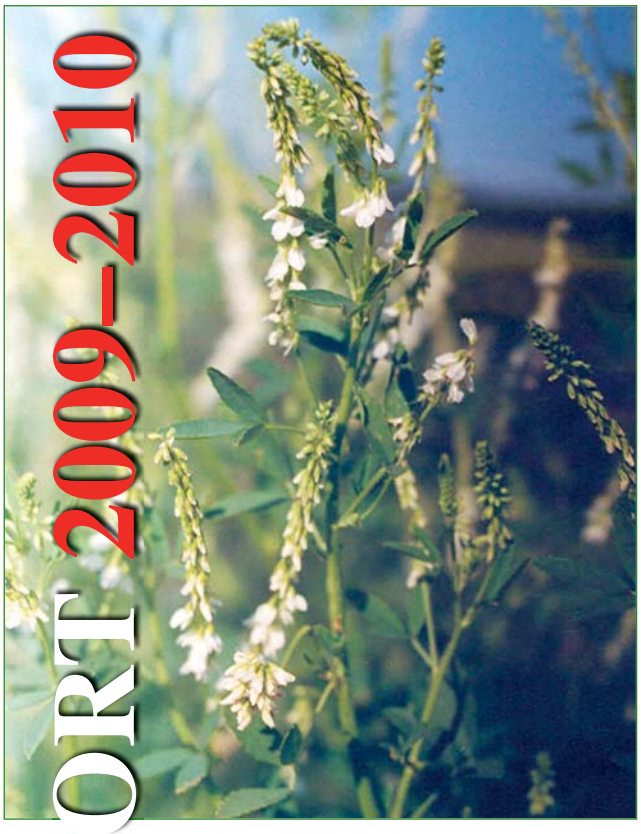
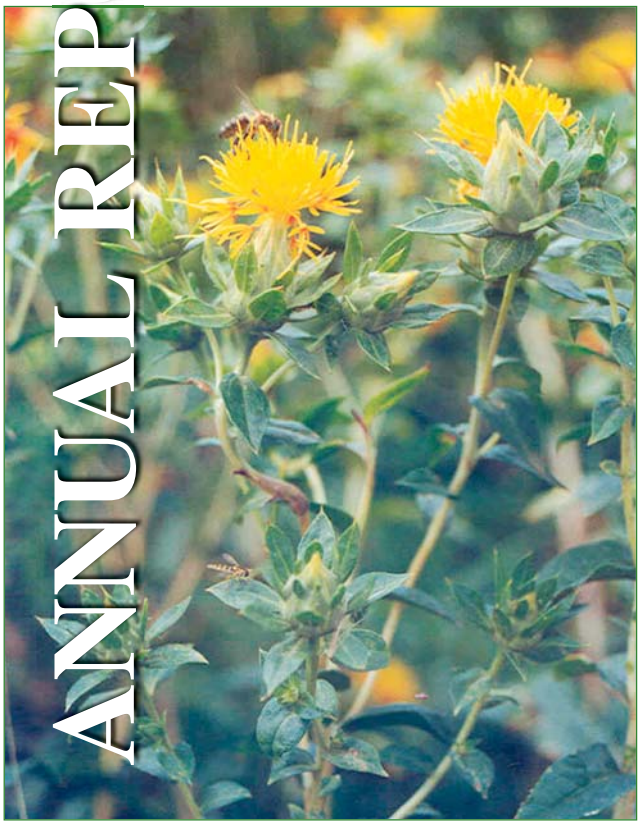
ANNUAL REPORT 2009–2010





RESEARCH INSTITUTE FOR FODDER CROPS, Ltd. (RIFC, Ltd.)
AGRICULTURAL RESEARCH, Ltd. (AR, Ltd.)
664 41 TROUBSKO, CZECH REPUBLIC

CERTIFIKAČNÍ ORGÁN č. 3046

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Foto: Ing. Ladislav Rýgl

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CONTENTS

THE BOOK „CHAPTERS FROM MODERN FORAGE CROP PRODUCTION“

A team of workers from the Agricultural Research Ltd. Troubsko and the Research Institute for Fodder Crops Ltd. in Troubsko present in a book entitled “Chapters from modern Forage Crop Production” a collection of knowledge from diferent disciplines associated with forage crop production predominantly on the arable land, which was acquired in the course of carrying out the research task and other research project.

The book is systematically divided into chapters dealing both with genetics breeding and production technology aspects of modern forage crop production. The genetics and breeding sections present result obtained by newly developed methods improving current methodologies, that enable better to understand the genetic diversity of plant species of special interest such as alfalfa, red clover and white clover and also annual forage crops, including corn. The new results will be useful for the detection and characterization of sources of resistance to the most serious pathogens so that they might be consequently used for increasing variety resistance or developing a “core-collection”.

On the basis of the determination of dimensions, parameters and indicators of management systems the growing technology section presents models of development of new modern components of growing technologies for stand establishment, crop management and plant production with respect to sustainable agricultural production and landscape. Essential components are the evaluation of the effect of perennial and annual forage crops and different method of their incorporation into the soil on the quality of soil environment and the environment as a whole, selection and development of complex cultivation technologies for forage crops grown as main crops, intercrops and crops on set aside land, and crops for agricultural and non-agricultural use, all this with respect to sustainable development.

The book is designed for the general public, professionals and laymen alike, for specialists involved in research, breeding practitioners, teachers, and for high school, college and university students.

The book originated as an output of the research project MSM 2629608001 entitled “Genetics breeding and technological aspects of sustainable forage crop production” supported by the Ministry of Education, Youth and Sports of the Czech Republic.

FOREWORD

Ladies and gentlemen,

You are opening a new annual report from the ***Research Institute for Fodder Crops, Ltd. Troubsko*** *and* ***Agricultural Research, Ltd. Troubsko.*** *The authors try to present all activities of both institutes and offer some co-operation possibilities and other services for the future.*

You have a chance to get acquainted with the projects solved in the years 2009–2010.

Agricultural and environmental research, breeding, consultancy, trading activities and services, and agricultural production have been the main activities of the Institutes. Both organisations are conducting a number of relevant research project funded mostly by the Ministry of Agriculture of the Czech Republic and Ministry of Education of the Czech Republic. We are collaborating with various specialised workplaces and other companies in the Czech Republic and abroad on many projects. The institute is holder of ISO certificates of the Quality management system (ISO 9001:2001) and the Environment management system (ISO 14001:2005).

The aims of both institutions are to promote the development of agricultural business through advanced and conceptual research, to make it competitive and to sustain its competitiveness.

The main research lines are:

- *Fodder crops genetic resources conservation and utilisation*
- *Genetic studies and the methods of molecular biology*
- *Studies of resistance to the main pathogens*
- *Non-traditional fodder crops breeding*
- *Management of fodder crops*
- *Management of other crops*
- *Plant protection systems*
- *Phytoremediation*
- *Mycotoxicology*
- *Pollinators*

The Institute owns fifteen non-traditional crop varieties and other newly bred varieties have been tested in the official state trials. Seed propagation and trading is provided.

Other services linked with all research lines are offered (see below).

The research and breeding results are presented in different workshops and conferences. Every year the Institutes take part in agricultural trade fairs (TECHAGRO Brno, Země živitelka České Budějovice). In last two years they have organised some international conferences.

The Research Institute for Fodder Crops, Ltd. Troubsko, is a member of the Association of Private Agricultural Research Organisations located in Troubsko, and the Association of Research Organisations located in Prague.

Ladies and gentlemen, I hope that the annual report will inspire you to linking-up.

Jan NEDĚLNÍK
director

SERVICES OFFER

The Research Institute for Fodder Crops, Ltd. Troubsko and Agricultural Research, Ltd. Troubsko provide the following services and activities:

CONSULTANCY

1. **Complex technologies of forage crop cultivation**
   - production of forage crops on the arable land and permanent or temporary grasslands
   - seed production of legumes and grasses, including technology of harvesting
   - consultancy on varieties
   - systems of plant protection
   - pollination of leguminous crops
2. **Consultancy on grassing down and bringing soil to rest**
   - special mixtures for different purposes
   - propagation of wild flora
   - production of regional mixtures
3. **Revitalization of soils contaminated with heavy metals or organic pollutants**

SERVICES

4. **Accredited workplace for testing pesticides and fertilisers**
   - registration and pre-registration tests of preparations for plant protection and fertilisers in a wide spectrum of field crops
5. **Accredited laboratory for diagnostics of a wide spectrum of plant viruses**
6. **Analysis of mycotoxins in agricultural products**
7. **Fodder crop genotypes resistance testing**
8. **Bumblebee production for pollination in greenhouses**
9. **Field achievement performance trials**
10. **Variety performance testing for the List of Recommended Varieties**
11. **Gas chromatography**
12. **Molecular-genetic methods for material identification**

THE EXECUTIVE COMMITTEE

RNDr. Jan Nedělník, Ph.D. – director

RNDr. Jan Hofbauer, CSc.

Ing. Jaromír Procházka, CSc.

Head of department:

– Genetic resources:	Ing. Jan Pelikán, CSc.
– Plant physiology and genetics:	Ing. Karel Vejražka, Ph.D.
– Plant protection:	Ing. Pavel Kolařík
– Agronomy:	Ing. Barbora Badalíková
– Administration and personal services:	Marie Janušová
– Support services:	Josef Báca

RESEARCH DEPARTMENTS

1. DEPARTMENT OF GENETIC RESOURCES

Head of the department: **Ing. Jan Pelikán, CSc.**

Staff:

Ing. Daniela Knotová

Ing. Simona Raab

Mgr. Tomáš Vymyslický

Marie Belová

Renata Doležalová

Milena Jandová

Mgr. Helena Hutyrová (maternity leave)

Ing. Pavlína Minjaríková (maternity leave)

Activities:

- Evaluation and description of the main and marginal forage species, and other wild-growing plant species.
- Conservation of plant biodiversity in the system of sustainable agriculture and landscaping.
- Diversity of neglected cereals and pseudocereals and its use in sustainable agriculture and in healthy food production.
- Providing genetic resources and respective information for users in the Czech Republic and abroad.
- Minor crops for specific food utilization.
- Increasing of the diversity of forage crop communities.
- Cooperation with protected landscape area Moravský kras and Podyjí national park.
- Botanical monitoring of the permanent grass growths.
- Breeding of the non-traditional fodder crops.
- Study of vegetation of fallows and barrens.

2. DEPARTMENT OF PLANT PHYSIOLOGY AND GENETICS

Head of the department: **Ing. Karel Vejražka, Ph.D.**

Staff:

Mgr. Alena Bučánková

RNDr. Jan Hofbauer, CSc.

Mgr. Tereza Cholastová

Doc. RNDr. Vladimír Ptáček, CSc.

Zuzana Absolínová

Ing. Miroslava Strejčková

Lada Štěpánková

Ing. Petra Hájková (maternity leave)

Mgr. Olga Komzáková (maternity leave)

Ing. Eva Pernová (maternity leave)

Activities:

- Physiology of fodder plants, symbiotic nitrogen fixation.
- Pollination service, greenhouses pollination and nutrient plants for the pollinators providing.
- Bumblebees rearing.
- Gas chromatography – bee wax, ethylen.
- Molecular-genetic methods.
- Plant breeding.

3. DEPARTMENT OF PLANT PROTECTION

Head of the department: Ing. Pavel Kolařík

Staff:

Ing. Karla Martínková

RNDr. Jan Nedělník, Ph.D.

Doc. Ing. Jiří Rotrekl, CSc.

Ing. Petr Šmahel

Jana Bácová

Taťána Hájková

Ing. Eva Kolaříková

Tamara Novotná

Marie Smetanová

Ing. Hana Moravcová (maternity leave)

Activities:

- Accredited workplace for the plant protection formulations testing.
- Accredited workplace for the viral pathogens testing.
- Mycological and mycotoxicological laboratory.
- Study of important harmful organisms – fungal, viral, insectual and weedy.
- Plant protection consultancy.

4. DEPARTMENT OF AGRONOMY

Head of the department: Ing. Barbora Badalíková

Staff: Ing. Jaroslava Bartlová
Ing. Jaroslav Lang
Ing. Irena Novosadová
Jitka Mlénská
Zlatuše Pacnerová
Ing. Zuzana Kubíková (maternity leave)
Ing. Ivana Šindelková (maternity leave)

Activities:

- Study of management of fodder plants on the arable land.
- Regeneration of natural and seminatural grasslands.
- Study of ecological farming.
- Models of soil management.
- Crop rotations.
- Soil protection from erosion.
- Soil science – soil physical properties, chemical properties, some biological properties, soil water.
- Recultivation through the use of nontraditonal crops.
- Chosen soil analysis.

5. DEPARTMENT OF ADMINISTRATION AND PERSONAL SERVICES

Head of the department: **Marie Janušová**

Staff: Dana Kuchaříková

Marie Partyková

Dana Pokorná

6. DEPARTMENT OF SUPPORT SERVICES

Head of the department: Josef Báca

Staff:

Jan Čudán

Karel Doležal

Ing. Karel Fical

Hana Haiserová

František Jonáš

Břetislav Lukášek

Irena Nováková

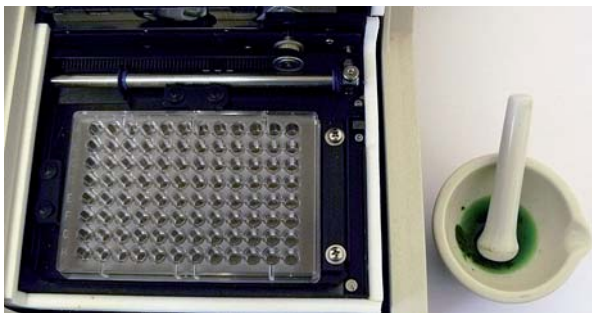
František Pokorný

Rudolf Trunec

SPECIALISED LABORATORIES

ACCREDITED LABORATORY FOR DIAGNOSTICS OF A WIDE SPECTRUM OF PLANT VIRUSES

Head of the laboratory: Ing. Karla Martínková



- diagnostic of important plant viruses – field crops, grasses and legumes (BYDV - MAV, BYDV - PAV, BYDV - RMV, CYDV - RPV, WDV, SCMV, MDMV, BYMV, BCMV, PSbMV, PEMV, CYVV, AMV, BNYVV)
- ELISA tests
- tests of resistance under greenhouse conditions

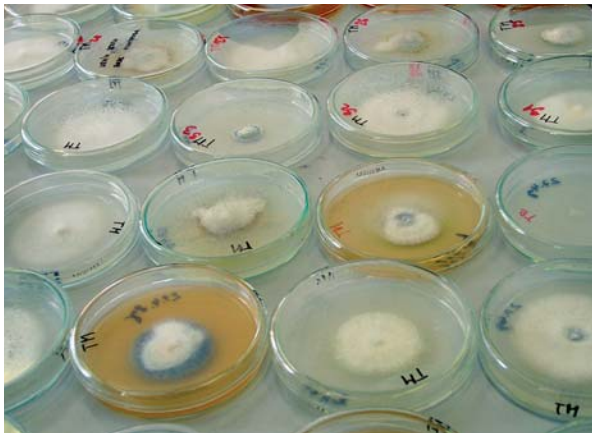
LABORATORY OF AGRONOMICAL PRACTICES

Head of the laboratory: Ing. Barbora Badalíková

- analyses of soil physical properties
- soil moisture
- soil respiration
- preparing of soil samples for determination of soil humus
- preparing of soil samples for determination of humus quality
- preparing of soil samples for determination of basis of chemical elements in soil
- chosen soil analysis

MYCOLOGICAL AND MYCOTOXICOLOGICAL LABORATORY

Head of the laboratory: RNDr. Jan Nedělník, Ph.D.



- the important fungal pathogens isolation and determination
- fungal isolates storage
- virulence tests of the individual fungal isolates
- resistance test of various plant material
- mycotoxicological analyses - DON, T2, AFL, ZEA, FUM, OTA content

ENTHOMOLOGICAL LABORATORY

Head of the laboratory: Ing. Pavel Kolařík

- monitoring of important insect pests
- evaluation of harmfulness of pests
- methods of plants protection
- evaluation of efficacy of insecticides

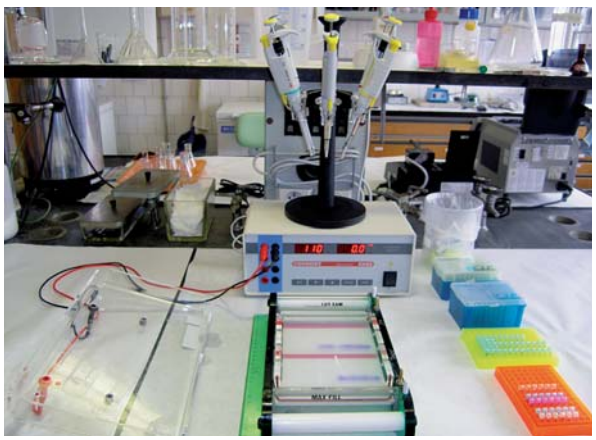
LABORATORY OF GAS CHROMATOGRAPHY

Head of the laboratory: RNDr. Jan Hofbauer, CSc.

- chromatograph Agilent Technology 6820 with ECD detector and autosampler
- fatty acids analyses in plant material
- determination of residues (acrinathrine, fluvalinate) in beewax
- determination of bumblebeewax and plant quality

LABORATORY OF MOLECULAR BIOLOGY AND PLANT PHYSIOLOGY

Head of the laboratory: Mgr. Tereza Cholastová



- molecular methods based on PCR – quantitative trait loci detection, genetic diversity study of plants and living beings and phylogenic analyses
- isolation of important fungal plant pathogens at the DNA level, molecular determination and study
- mechanisms of plant resistance against selected fungal pathogens
- cryptic species identification based on molecular level

LABORATORY SEED AND SCENE ANALYSIS

Head of the laboratory: Ing. Simona Raab

- analysis of seed purity
- seed cleaning
- seed germinations
- 1000 – seed weight
- image analyses of plant parts
- seed calculation in machine counter
- observation of biological materials with a stereomicroscope

LABORATORY FOR BUMBLEBEES REARING

Head of the laboratory: Mgr. Alena Bučánková

- monitoring of bumblebees
- rearing of bumblebees and improving laboratory methods
- methods for pollination

AGROLAB SPOL. S R. O.

Staff: Mgr. Ivana Volanková

Mgr. Tereza Otrusinová

Agrolab, LtD. is a subsidiary company of RIFC in Troubsko and it is situated at the same address.
It is a chemical laboratory where we make chemical analyses of: soil
feed
water
plants
fertilizers.

We also work for small farmers as well as for big companies (e.g. organic incineration plant).
The employees are not only chemists but also professional advisers in feeding rations (mainly in cattle, pigs and horses).
The laboratory work has two main advantages: high speed and optimum prices.
At the same time the analyses are first-rate and accurate. Three times a year tests are carried out voluntarily within the framework of the Czech Republic. Central Institute for Supervising and Testing in Agriculture is the control authority of these interlaboratory tests.

For more details contact: agrolab@vupt.cz

RESEARCH PROJECTS COMPLETED 2009–2010

• INTERNATIONAL •

Eureka E! 3824 INWASCOMP: From industrial waste to commercial product

Coordinator: Research Institute of Building Materials, JSc., Brno
Investigator: Mgr. Tomáš Vymyslický
Supported by: Ministry of Education, Youth and Sports of the Czech Republic
Time of solving: 2007–2010

Summary:

Within the frame of the project the possibilities of built embankments revegetation by using of the material called "EnviMix" were solved. Selected industial waste (slags, ashes, fly-ashes etc.) were used as components of the material "EnviMix". The project supposed elimination of such negative effects, which are connected with destruction of stabilization elements in the countryside (soil erosion, high surface loss of nutrients, floodings etc.). Other negative effects on countryside, especially diversity changes of permanent cultures – mainly in the surrounding of river systems and water reservoirs – were also solved.

Selected publications:

Vymyslický T., Knotová D., Badalíková B., Hrubý J., Bartlová J., Nedělník J. (2010): Monitoring of vegetation changes on dykes after sowing selected species. – In: Biotechnology in animal husbandry, Vol. 26/2 (special issue): 567–575. ISSN 1450-9156.
Badalíková B., Bartlová J., Vymyslický T., Knotová D. (2010): Utilization of fly ash products for stream and reservoir bank stabilization. – In: Proceedings of the 14th Conference on Environment and Mineral Processing, Ostrava, Part I: 19–24. ISBN 978-80-248-2208-2.
Hrubý J., Knotová D., Vymyslický T., Badalíková B., Bartlová J., Svoboda M. (2010): Revitalisation of the dykes of water resources with the use of EnviMix product. – In: Ecology and new building materials and products, Proceedings of the 14th international conference, Telč: 86–89, In CD, p. 1–4. ISBN 978–80–87–02–2. [In Czech]

• CZECH PROJECTS •

Minor crops for specific food utilization (project No. QG60130)

Coordinator: Research Institute of Crop Production, Praha-Ruzyně
Investigator: Mgr. Tomáš Vymyslický
Supported by: Ministry of Agriculture of the Czech Republic
Time of solving: 2006–2009

Summary:

The aim of submitted project was the enlargement of diversity of cultivated crops in the Czech Republic and recommendation to their suitable utilization. The subject of project were minor species of cereals (hulled wheat, hulled oat and barley, millet and tartar buckwheat), legumes (pea, cowpea, chickpea) and oil bearing crops (safflower). The new genotypes of all species are evaluated for important agronomical and morphological characteristics. The growing systems of crops not yet grown in the Czech Republic (cowpea, chickpea) were recommended. The main attention for crops with developed growing system was paid to searching of their specific traits utilizable in products attractive for consumers with accompanied effect to health.

Selected publications:

Rysová J., Ouhrabková J., Gabrovská D., Paulíčková I., Winterová R., Vymyslický T., Prokeš J., Hutař M. (2010): Food with addition of little-known legume varieties. – Agronomy Research 8 (special issue II), 339–344.
Balounová M., Vaculová K., Vymyslický T., Janovská D. (2010): The influence of locality and year on the mineral macro-element content in the grains of minor and marginal cereals. – Úroda 12 (scientific supplement), p. 613–616. ISSN: 0139–6013. [In Czech]
Vymyslický T., Pelikán J., Janovská D., Rysová J., Hofbauer J., Šmahel P., Vaculová K., Balounová M., Prokeš J. (2010): Growing of selected minor crops under the conditions of the Czech Republic for their use in food industry. – Úroda 12 (scientific supplement), p. 65–70. ISSN: 0139–6013. [In Czech]

Raising of quality and efficiency of milk products manufacture in ecological farming (project No. 1G5863)

Coordinator: Dairy Research Institute Praha, (MILCOM, a. s. Praha)
Investigtor: Ing. Zdeněk Vorlíček, CSc.
Supported by: Ministry of Agriculture of the Czech Republic
Time to solving: 2005 – 2009

Summary:

The project focused on complex solution of bio milk production in ecological farming as a whole. It started with cow milk nutrition (fodder production, storing, preparation and composition), technology of cattle breeding, milk production and its storage, providing of milk quality and safety and finishes with the milk processing in small and big enterprises and the evaluation of proposed systems GAP, GMP, GHP and HACCP. These systems were be available under conditions of biomilk production and its processing on biomilk products.

Selected publications:

Vorlíček, Z., Staňová, I. (2009): Energy share in bulk feed. Naše pole 6/2009, s. 39 – 41. ISSN 1335-2466. [In Slovak]
Vorlíček, Z., Hanuš, O, Šindelková, I. (2009): Increasing share of energy in voluminous pasturages of ecological farms with cultivation of suitable grass and clovergrass mixtures. Certified methodology, Troubsko 2009, 16 s. ISBN 978-80-86908-09-0. [In Czech]

The selection and regionalization of suitable catch crops, their utilization for reduction of risk of nitrate leasing (project No. 1G60124)

Coordinator: Research Institute of Crop Production, Praha-Ruzyně
Investigator: Ing. Jaromír Procházka, CSc.
Supported by: Ministry of Agriculture of the Czech Republic
Time of solving: 2006 – 2009

Summary:

Research was aimed at the selection of optimal catch crops for conditions of the Czech Republic and utilization of the diversity within species and varieties. The objectives of the project were to produce knowledge basis for selection of the catch crops that have good chance to produce satisfactory yield of biomass before winter and to decrease risk of nitrate leaching by accumulation of nitrogen in phytomass under specific site and year conditions. At least 12 catch crops plus control - fallow soil were studied in field trials (four sites, years and replications). The dynamic of growth, production of aboveground and root mass, N content of plants, concentration of NO_3-N a NH_4-N in soil and soil solution, the content of soil total N, C, S and active C were determined in the experiments. The mineral N content was determined in top and subsoil before sowing, at the end of growth period and before ploughing down the biomass in early spring. Pot experiments were conducted to determine the effect of soil mineral N content, temperature and soil moisture on the growth, N depletion and root/shoot ratio and root growth to depth. In incubation experiment the degrability of root and shoot biomass of catch crops was studied. Cost of introducing different catch crops under various combinations of site conditions, sowing terms and agriculture machinery was calculated. The environmental benefits were estimated using suitable indicators. The data were used for regionalization of suitable catch crop for different soil-climatic conditions of the Czech Republic (including maps in GIS) and for programming simple on-line expert system aimed at selection of suitable catch crops in farms.

Selected publications:

Procházka J., Procházková B., Mikušová Z. (2008): Impact of catch crops for green manure on soil structure. Úroda (Scientific supplement) 12/2008, 2008, 197 – 200, ISSN 0139–6013. [In Czech]

Genetic-breeding and technological aspects of sustainable forage crop production (project No. MSM 2629608001)

Coordinator: Agricultural Research, Ltd. Troubsko
Investigator: RNDr. Jan Nedělník, Ph.D.
Supported by: Ministry of Education, Youth and Sports of the Czech Republic
Time of solving: 2004 – 2010

Summary:
The goal of the research project in genetics and breeding was to get a detailed knowledge of gene pool diversity of plant species represented predominantly by alfalfa, red clover and white clover using new and improved methodologies. An important component of the project was application of molecular genetic methods for determination of this diversity. New findings were used for detection and characterization of sources of resistance to the most serious pathogenic agents so that they might be subsequently used to increase variety resistance.

The goal in the technology field was to bring forward proposals for new, modern components of cultural methods connected with stand establishment, agronomy practice and plant protection in compliance with sustainable agricultural production or land formation on the basis of the determination of the dimensions, parameters and indicators of management systems. Fundamental components were the assessment of the impact of growing perennial and annual forage crops and various methods of their incorporation into the soil on the quality of soil and the environment, the selection and proposal of complex technologies of growing forage crops as main crops, intercrops, retirement crops, crops for non-agricultural and non-crop producing purposes with respect to ensuring sustainable development.

Results of the research project were assessed annually by the opponent council, which always had two opponent reports in addition to the annual reports. Within the whole research project 257 useful results were obtained and many others that are in the process of application (e.g. application for registration of varieties, minor indications etc.). 8 contributions were published in impacted journals, 99 articles in reviewed non-impacted journals, eight chapters were published in reviewed scientific books and one general monograph was published from the results of the research project titled “Chapters from Modern Forage Crop Production”. Furthermore 11 certified methodologies were prepared from the obtained results. Several tested technologies were applied mainly in the field of the plant protection. On the base of the knowledge 15 new genetic materials were registered for legal protection and 3 new varieties of agricultural crops were registered. Furthermore 6 utility models and 1 patent were registered.

The most important results available for development in the field forage included a detailed description of the 239 newly acquired varieties and breeding lines both of the main and of the minor forage species. After a detailed examination of morphological, phytopathological and yield characteristics the original seeds were stored in the gene bank for further

research and breeding usage. The important result was creation of the Czech original – "core collection", which was also original in some species in the global context. "Core Collection" contains 99 items *in Medicago* sp., 76 items *in Trifolium pratense,* 10 items *in Lotus corniculatus* and *Phacelia tanacetifolia,* 11 items *in Trifolium hybridum* and 41 items *in Trifolium repens.* In the species *Trifolium alexandrinum, Trifolium resupinatum* and *Trifolium incarnatu*m the core was not established because of the small range of the collection. Only some similarities were detected to avoid any duplication in the collection. Microsatellite markers were used for analyses of polymorphism in the collections of the genus *Trifolium* and *Medicago*. Varieties included in the main "core colection" were subjected to detailed phytopathological studies and donors of resistance to *Fusarium* fungi and BYMV were selected. These data were included in the database EVIGEZ and they are again available to breeders. Another applicable result was methodological knowledge in genetic analyses processed into certified methodology and useful in the process of breeding. As an important element of the innovation process of breeding cross-pollinated plants was a study of possibility of the use of pollinators. The basis for effective use was the possibility of continuous breeding in particular species of the genus *Bombus* in laboratory conditions. It was managed to initiate establishment of the cell also in the mother species of *Bombus lucorum, B. lapidarius, B. pratorum, B. hypnorum, B. hortorum, B. pascuorum, B. sylvarum, B. soroensis, B. ruderarius.* Except for *B. soroensis, B. ruderarius,* we succeeded in raising young mothers in all species. Classical development of nests was achieved in laboratory conditions in the species *B. lapidarius* and several nests in the species *B. lucorum, B. pratorum* and *B. hypnorum.* The species *B. lucorum* and *B. lapidarius* even managed to raise mothers of the second generation, in fully laboratory conditions.

Under current conditions of agricultural production, when the area of fodder crops is decreasing together with the number of livestock, paradoxically the need for integration of the crops into the crop sequence as major innovators and the stabilizing factor of soil fertility increases. Effects on soil and environmental and agronomic importance of the main types of multi-file legumes (Medicago sativa diploid and tetraploid forms of Trifolium repens), grass mix, corn and many stubble intercrops (*Sinapis alba, Phacelia tanacetifolia, Secale cereale* var. *multicaule, Malva verticillata, Carthamus tinctorius, Phalaris canariensis, Lolium multiflorum, Lolium perene and Trifolium repens*) were studied. Parameters and indicators of forage were quantified and their effect in farming systems in selected crop rotation sequences and their productivity were assessed. The positive effect of legumes in crop rotations sequences and their value as a preceding crop is widely recognized and was confirmed by the achieved results. Integration of suitable intercropping, especially in farming systems without livestock, deserves the same evaluation. Clovers as well as stubble intercrops increase biodiversity of crop sequences, contribute to increased supply of quality organic matter into the soil and thereby maintain or improve their physical (oxidizable carbon content, the structural condition of the soil, soil aggregate stability), chemical (reducing the risk of nitrate leaching) or biological (respiration, enzyme activity) properties. Growing the clover grass mixture on arable land seems to be a suitable fodder option for ensuring high-quality pasture base. Cultivation of properly composed

mixtures can increase stability of production in a certain quality. After several years of experimental verification of composed mixtures some of them became an object of patent protection. Integration of intercrops into sequences and their impact on improving the soil structure is also an important soil protection against erosion. On the base of the results from the field experiments conducted on localities with a risk of erosion an important methodology was developed for using selected intercropping as an important soil-protecting factor in the cultivation of maize on steeper landscapes. Especially nowadays, when requirements for wide-row crops in relation to the implementation of the GAEC 2 are becoming stricter, the importance of this study is even more significant. The best soil protection technology of maize either directly into the stubble of frozen mallow or to the desiccated biennial rye in spring. Also, minimization soil tillage technology contributes to reducing surface runoff to catch the remains in such way that intercrops are slightly dug under the soil surface. Both

these technologies are highly effective against mechanical erosion. The first technology is based on a layer of mulch on the soil surface absorbing kinetic energy of falling drops of water from torrential rains and the second technology inserts organic matter into the soil, thereby improves its structure and infiltration ability and consequently reduces the surface runoff. The research project contained also a part of the solution focused on the landscape-formation effect of fodder or their mixtures. During the five-year monitoring the possibility of effective rehabilitation of anthropogenically damaged areas was proven. For example a municipal waste landfill site and some areas after mining were covered green with new vegetation within the research project. These results were published as well as processed into a certified methodology. The project also studied a number of forage species usable for both agricultural and non-agricultural production. For example utility model of Annual compounds for pollinators and two new varieties *Trifolium pannonicum* Panon (2009) and *Crambe abyssinica* Katka (2010) were registered. An important part of the research solution was verification of yield and suitability of species available for energy purposes. In conditions of South Moravia the yields of potential energy crops: biennial rye (*Secale cereale* L. var. *multicaule* METZG. ex ALEF), greater burdock (*Arctium lappa* L.), oriental goat's rue *(Galega orientalis* L.*),* schavnat *(Rumex tianshanicus x Rumex patientia),* knotweed (*Reynoutria* spp) were tested for several years. Pulses were grown for use in food industry and these 3 varieties: *Lathyrus sativus, Phaseolus vulgaris* and *Lablab purpureus* were applied for legal protection. Based on the results of the crops a utility model was granted: Bread with added non-traditional pulses, mixture for bread with non-traditional pulses and cottage cheese spread with safflower oil. An important part of the research project was the area of plant protection and study of harmful agents in maize and forage plants. The results were used for methodological procedures published in the form of methodological manuals, as well as many extensive registrations, in so-called minor indications. The last stage of the research project was focused on possibility of biological decontamination of soils contaminated with diesel fuel or high content of heavy metals. The suitability of the so-called "Two-step decontamination" was proven and confirmed. Compost with high microbial activity is incorporated into the soil and then plants able to accumulate in their tissues undesirable substances are planted on the locality. Phytoremediation technologies were processed and given to users in the form of certified methodology.

• IN PROGRESS •

National programme of conservation and utilization of plant genetic resources and agro-biodiversity

Coordinator: Crop Research Institute, Praha-Ruzyně
Investigator: Ing. Jan Pelikán, CSc.
Supported by: Ministry Agriculture of the Czech Republic
Time of solving: 2006 – 2011

Summary:

Within the framework of the research project "National Programme on Conservation and Utilization of Plant Genetic Resources and Agro-biodiversity" the sub-stage "Gene-pool of leguminous fodder plants" is solved. The main aim of this project is collecting, testing and describing of leguminous species according to available descriptors. Available varieties, ecotypes and wild forms are collected, sown, tested and described. Among the tested and described species are *Medicago sativa, Medicago* spp., *Trifolium pratense, Trifolium repens, Trifolium* spp. and other fodder crops. Also meadow species, some wild-growing endangered species and rare weed species are collected. All the seed samples are preserved in the national gene bank in the Crop Research Institute in Praha-Ruzyně and they are used in the joint projects.

Selected publications:

Knotová D., Pelikán J., Vymyslický T., Hutyrová H.(2010): Study of Variability and Similarities Among *Lotus corniculatus* L. Ratar. Povrt. / Field Veg. Crop Res. 47, 479-484.
Pelikán J., Knotová D. (2010): Forage production in assortment of the red clover *(Trifolium pratense)* varieties. – Úroda 12 (scientific supplement), p. 187 – 190. ISSN: 0139–6013. [In Czech]

A pilot project of prevention of soil biological degradation under conditions of arid climate (2B08020)

Coordinator: Mendel University in Brno, Czech Republic
Investigator: Ing. Jan Pelikán, CSc.
Supported by: Ministry of Education, Youth and Sports of the Czech Republic
Time of solving: 2008 – 2011

Summary:

The objective of this project is to elaborate a methodology enabling to eliminate adverse effects of climatic factors on soils in arid regions of the Czech Republic, to define these negative factors, and the suggest some corrective measures contributing to the improvement of their ecological stability and, thus, of biodiversity.

Selected publications:

Minjaríková P., Pelikán J., Hutyrová H., Knotová D. (2010): Comparison of laboratory germination and field emergence of annual species of the family *Fabaceae.* – In: Influence of biotic and abiotic stressors on the plant characters, ČZU Praha, VÚRV, v.v.i. Praha: p. 245 – 248. ISBN 978–80–213–2048–2 (ČZU Praha) a 978–80–7427–024–6 (VÚRV Praha-Ruzyně). [In Czech]
Pelikán J., Knotová D., Ševčíková M., Straková M., Hutyrová H. (2010): Biomass production of sown recultivation mixtures under different agro-ecological growing conditions. – Úroda 12 (scientific supplement), p. 733 – 736. ISSN: 0139–6013. [In Czech]
Knotová D., Vymyslický T., Hutyrová H., Pelikán J., Ševčíková M., Straková M. (2010): Solutions of problems caused by arid climate with help of the soil conditioners and special plant mixtures. In: Biotechnology in Animal Husbandry 26 (spec. issue), p. 409 – 416, ISSN 1450-9156.

Study of methods and crop management practices for seed yield of selected grass, legumes and intercrop species and its quality increase in organic farming (101C167)

Coordinator: Oseva, development & research, Ltd. Zubří
Investigator: Ing. Jan Pelikán, CSc.
Supported by: Ministry of Agriculture of the Czech Republic
Time to solving: 2010 – 2014

Summary:

The project concentrates on some important problems in organic grass, legumes and intercrops seed growing. The main goals are: new ways of establishing of seed stands and their protection against difficult weeds, pests and diseases (including searching for sources of resistance to stem rust in perennial ryegrass). The solving can bring the new and interesting knowledge not only for the organic farmers, but non-chemical crop management will be available for conventional grass, legumes and intercrop seed growers, too.

Innovation of safflower protection against fungous disease (project No. QH81029)

Coordinator: Agricultural Research, Ltd. Troubsko
Investigator: Ing. Karel Vejražka, Ph.D.
Supported by: Ministry of Agriculture of the Czech Republic
Time of solving: 2008 – 2012

Summary:

As a result of the project is finding the patogens spectrum on safflower in the Czech Republic, with more emphasis on *Colletotrichum acutatum.* Diagnosis of fungal patogens and suggestion of technology of protections against patogens of safflower are the main aims of the project.

Selected publications:

Víchová, J., Vejražka, K., Cholastová, T., Pokorný, R., Hrudová, E. : *Colletotrichum simmondsii* Causing Anthracnose on Safflower in the Czech Republic. Plant Disease. 2011. sv. 95, č. 1, s. 79. ISSN 0191-2917.

Staňková B., Víchová J., Pokorný R., Vejražka K. (2010): *V*irulence of selected isolates of *Colletotrichum acutatum* to safflower. Úroda 12 (Scientific supplement) s. 359 – 362. ISSN 0139–6013. [In Czech]

Bumblebees as an active element of the enviroment biodiversity (project No. 2B06007)

Coordinator: The Academy of Sciences of the Czech Republic
Investigator: Mgr. Alena Bučánková
Supported by: Ministry of Education, Youth and Sports of the Czech Republic
Time of solving: 2006 – 2011

Summary:

The aim of project is to complete missing information of the occurence of the bumblebee species in our territory and to obtain more knowledge on the biology, communication taxonomy and ecology of bumblebees. This knowledge is crucial for protection of diversity of the indispensable plant pollinators. This project should contribute to extension of knowledge of the biological cycle of *Bombus terrestris* in the laboratory conditions, to bring information about occurrence of *Bombus cryptarum* and *Bombus magnus* in the Czech Republic, to give methodical recommendation to producers of the bumblebees hives for commercial pollination leading to the successfull breeding of the local bumblebees, to get to know the bionomy of the moth *Aphomia sociella* and to offer the way of the bumblebees protection against this parasite. The Research Institute for Fodder Crops solve the problems regarding the influence of the food quality on overwintering of queens and the changes in the quantity of their lipids and glycogen. Furthermore we occupy ourself with determination of the problematic species of genus *Bombus* with using of molecular methods within this project.

Selected publications:

Bučánková, A., Ptáček, V., (2010): Experiences in rearing of *Bombus lucorum* L. *(Hymenoptera: Apoidea)* in captivity. Úroda 12 (Scientific supplement 621 – 624. [In Czech]
Kofronova E, Cvacka J, Vrkoslav V, Hanus R, Jiros P, Kindl J, Hovorka O, Valterova I (2009): A comparison of HPLC/APCI-MS and MALDI-MS for characterising triacylglycerols in insects: Species-specific composition of lipids in the fat bodies of bumblebee males. Journal of Chromatography, B-Analytical Technologies In The Biomedical and Life Sciences 877 (30): 3878-3884.

Interactions of insect biodiversity in a landscape with various methods of agricultural land use and technologies with respect to pests of grasses and alfalfa and their bioregulators.

Coordinator: OSEVA PRO
Investigator: Ing. Pavel Kolařík
Supported by: Ministry of Agriculture of the Czech Republic
Time to solving: 2007 – 2011

Summary:

Biodiversity of both agricultural land and adjacent areas is strongly influenced by both management methods and technologies used. Agrobiodiversity (both planned and associated) has many specific functions beside production. We strongly stress the ecological, environmental and production services produced by associated biodiversity for productive and and sustainable agriculture. In the main focus of our interests are pests (including vectors of diseases) and their bioregulators. The following hypothesis will be evaluated: associated biodiversity may serve as an indicator of the overall influence of technologies used on biodiversity as a whole. Recently, management strategies of European agriculture is changing as well as land use patterns. These changes are partly influenced by transition from central planned economies and collective land ownership to decentralized agriculture and private land ownership in the East and Central Europe and partly by CAP leading to direct payments to those fulfilling criteria of agroenvironmental policies of the EU. In the Czech Republic, these changes result in implementation of relativelly new technologies (conservation tillage, mulching, ecological agriculture) and creation of new habitats (spontaneous fallows).

Selected publications:

Kolařík, P., Rotrekl, J., Barták, M., Fechtner, M., Frydrych, J., Cagaš, B. (2010): Biodiversity of insect in alfalfa fields (*Medicago sativa* L.) in 2008 a 2009. Úroda 12, (Scientific supplement), s. 297 – 300 ISSN 0139-6013. [In Czech]
Hlava, J., Barták, M., Frydrych, J., Cagaš, B., Rotrekl, J., Kolařík, P. (2010): Arthropod diversity in agrosystems under different management – a two year. Workshop of animal biodiversity, Jevany, 2010, p. 36 – 45 ISBN 978-80-213-2146-5. [In Czech]

Testing of new accesses to stem weevils (*C. pallidactylus* and *C. napi*) control in oil seed rape based on more precise monitoring of their occurrence and behaviour and testing of *Meligethes aeneus* subpopulations to pyrethroid resistance

Coordinator: AGRITEC, Research, Breeding and Services, Ltd. Šumperk
Investigator: Ing. Pavel Kolařík
Supported by: Ministry of Agriculture of the Czech Republic
Time to solving: 2008 – 2012

Summary:
The project is aimed at an innovation of plant protection methods of oilseed rape to stem weevils, *Ceutorhynchus pallidactylus, Ceutorhynchus napi* and at detection of occurrence of pyrethroid resistant *Meligethes aeneus* (sub) populations in the Czech Republic. On the base of stem weevils monitoring within the whole Czech Republic the important information for delimitation of locations with clear and long-lasting predomination of *C. pallidactylus* over *C. napi* will be obtained. The new methodics of oilseed rape protection just to *C. pallidactylus* will be elaborated. The methodics will be built up on the results of detailed bionomic studies of the species. The results of residual effects of insecticidal applications (primarily targeted to *C. pallidactylus*) on *Meligethes aeneus* will be a component part of the methodical access too. The findings of occurrence of pyrethroid resistant *Meligethes aeneus* (sub)populations within the Czech Republic will contribute to a knowledge store mapping insecticide resistance situation not only in the Czech Republic but also in the whole Europe.

Selected publications:
Hrudová, E., Seidenglanz, M., Kolařík, P., Poslušná, J., Rotrekl, J., Tóth, P. (2010): Species spectrum of pollen Beatles from genus *Meligethes a*t selected localities of the Czech republic, Úroda 12, 2010, (Scientic supplements), s. 267 – 270 ISSN 0139-6013. [In Czech]
Seidenglanz, M., Rotrekl, J., Havel, J., Hrudová, E., Poslušná, J., Kolařík, P., Bernardová, M. (2010): Differences in the sensitivity of pollen beetles from different localities of pyrethroids. Sborník příspěvků z konference Svazu pěstitelů a zpracovatelů olejnin, Hluk 25. – 26. 11., s. 59 – 68, ISBN 978-80-87065-25-9. [In Czech]

The influence of microorganisms and their secondary metabolites on hygienic feed quality (project No. QH71041)

Coordinator: Agricultural Research, Ltd. Troubsko
Investigtor: RNDr. Jan Nedělník, Ph.D.
Supported by: Ministry of Agriculture of the Czech Republic
Time to solving: 2007 – 2011

Summary:
The main project aim is to evaluate an influence of microfungi and some of their secondary metabolites occurence of feed (maize and grass sillages) quality.
Results will be indicated:

- knowledge of suitability of different physiological maize hybrids for high quality maize silage
- mycotoxins content in green maize matter and in silages
- knowledge on grass species as components for production of high quality silages
- dynamics in mycotoxins content in green matter and silage prepared from monoculture or mixture
- influence of *Ustilago maydis* on maize silage quality

Selected publications:
Nedělník, J., Moravcová, H., Vymyslický, T. (2010): Mycotoxins, GMO and bulk feed. Biotechnology in Animal Husbandry, vol 26, spec. Issue, 519 – 523. ISSN 1450-9156.
Skládanka, J., Nedělník, J., Adam, V., Doležal, P., Moravcová, H., Dohnal, V. (2010): Forage as a Primary Source of Mycotoxins in Animal Diets. International journal of environmental research and public health. 2011. sv. 8, č. 1, s. 37 – 50. ISSN 1660-4601.

The CULTAN (Controlled Uptake Long Term Ammonium Nutrition) systems for nitrogen nutrition of grasses and clover/grass mixtures (QH71077)

Coordinator: Czech University of Life Science Prague, Czech Republic
Investigtor: Ing. Jaroslav Lang
Supported by: Ministry of Agriculture of the Czech Republic
Time to solving: 2007 – 2011

Summary:

New system CULTAN (Controlled Uptake Long Term Ammonium Nutrition) has been studied in Germany for many years and introduced as an alternative metod of nitrogen application. In this project CULTAN system will be compared to traditional method of nitrogen application durig growing period of grasses and clover/grass mixtures. The aim of this project is the improvement of clover growig conditions in clover/grass mixtures. In experiments the effect of CULTAN system on additional growth of grass and clover biomass and portmon of grass:clover, content of macro and micronutrients, quality of plant production, and content of mineral nitrogen in soil, content of easily extractable organic nitrogen and carbon will be investigated during the growing period. Grass and clover/grass mixtures will be cultivated in precise field experiments in different soil and climate conditions. Transformation of nitrogen compounds in soil and plant will be investigated using 15N izotope in micro field and pot experiments.

Selected publications:

Lang, J., Novosádová, I. (2010): Comparison of fodder quality with different nitrogen fertilization system. Úroda 12, (scientific supplement), p. 657 – 659. ISSN 0139-6013. [In Czech]

Study of main factors influencing stability of sustainable management of grasslands in the Czech Republic (project No. QH81280)

Coordinator: Research Institute of Crop Production, Praha – Ruzyně, Czech Republic
Investigtor: Ing. Jaroslav Lang
Supported by: Ministry of Agriculture of the Czech Republic
Time to solving: 2008 – 2012

Summary:

The project's aim is to define main factors of sustainable management of grasslands in the Czech Republic considerate of environment with forage production of required quality for herbivores to sustain competitiveness of agricultural enterprises. The project research is focused on: (A) defining main factors influencing stability of sustainable management of permanent grasslands; (B) designs of utilisation of permanent grasslands by cattle herd (dairy cows and suckler cows) in the conditions of the Czech Republic with milk and beef production fulfilling "European model of multifunctional agriculture"; (C) working out an innovated system of nutrition and fertilization of grasslands; (D) perfect mastering of the modified Tilley-Terry method for accurate evaluation of organic matter digestibility for herbivores in the laboratory with a nationwide field of activity as the basis for establishment of a national research unit for determination of digestibility and energy of grassland forage.

Selected publications:

Novosádová I., Lang, J. (2010): Productivity evaluation of perspective clovers. Úroda 12, (scientific supplement), s. 665 – 668. ISSN 0139-6013. [In Czech]

Evaluation of soil degradation as effected by anthropogenic activities in connection with crops cultivation (project No. QH72039)

Coordinator: Agricultural Research, Ltd. Troubsko
Investigator: Ing. Barbora Badalíková
Supported by: Ministry of Agriculture of the Czech Republic
Time of solving: 2007 – 2011

Summary:

The project is aimed at soil degradation changes in spring barley growth under different types of management regimes. It will be evaluated changes in soil physical, chemical and biological properties that influence the nutrient availability and quality of production. Possibilities for the elimination of soil degradation processes and the influence between land use and soil adaptability under differing agroecological conditions will be investigated in connection with crop growing.

Selected publications:

Badalíková B. (2010): Influence of Soil Tillage on Soil Compaction. Chapter in book In: Soil Engineering, Soil Biology, Amity University Uttar Pradesh, Noida, UP, India, vol. 20: 230, p. 19 – 30. ISSN 1613–3382 ISBN 978–3–642–0380–4.
Badalíková B., Červinka J. (2010): Influence of different method of soil tillage on its physical properties. In CD proceedings: The 9th Alps-Adria Scientific Workshop, Špičák, Czech Republic, Crop production, Vol. 59, 2010, Suppl.2, p. 69-72 ISSN 0546-8191.

Optimization of water regime in landscape and increasing of its retention ability through application of compost from biologically degradable waste on arable land and permanent grassland (project No. QH81200)

Coordinator: Research Institute of Agriculture Engineering, Praha
Investigator: Ing. Barbora Badalíková
Supported by: Ministry of Agriculture of the Czech Republic
Time of solving: 2007–2012

Summary:

The organic matter decrease in soil and excessive soil loading with farm mechanization leads to the soil structure degradation and consequently to water regime failure.

By means of controlled composting it is possible to produce organic matter (compost) usable for soil physical and hydro physical properties improvement. In selected soil-climatic areas there will be established pilot plan trials with aim to verify the compost impact on deficiency soil using model treatment of graded compost portion and simplified crop circulation. There will be established experiments on arable soil and by permanent grassland rehabilitation.There also will be investigated compost effect on soil hygrophysical properties and its influence on soil hydrophysical water infiltration.

After the experiments evaluation the compost recommended portion and composition from the residual biomass will be processed. The residual biomass belongs to the category of crop and agricultural farming activity where will be defined for the soil conditions change of soil structure and its physical and hydrophysical properties as well as water infiltration into soil.

In the final part of the project there will be carried- out economical evaluation of verified methodological procedures of soil hydrophysical properties improvement with regard to its protection, water preservation and possibility to increase water retention and accumulation in the soil.

Selected publications:

Badalíková B., Marešová K. (2009): Improvement Of Soil Infiltration Through Compost From Biodegradable Waste. In CD: International conferences, Využitie výsledkov výskumu k zlepšeniu vzťahu poľnohospodárskej činnosti a životného prostredia, Mužla, Slovensko, s.1 – 9, ISBN 978-80-552-0191-7.
Badalíková B., Bartlová J. (2010): Effect of different application of compost from biologically degradable waste on soil infiltration. In Proc.: Agro 2010 the XIth ESA Congress, Montpellier, Francie, p. 235 – 236, ISBN 978-2-909613-01-7. [In Czech]

Technical facilities for harvest and processing of wine wood rests from vineyards (project No. QH82242)

Coordinator: Mendel University in Brno
Investigator: Ing. Barbora Badalíková
Supported by: Ministry of Agriculture of the Czech Republic
Time of solving: 2007 – 2012

Summary:

The project will solve ablation and next usage of wine wood rests from vineyards to energy functions in technological process with collection of whole vine woods and contemporary output of wood chips.

Selected publications:

Badalíková B., Červinka J. (2009): Nutrient balance in soil after embedding of grapevine wood. Vinařský obzor, č. 7-8, roč. 102/2009, s.322 – 323, ISSN 1212-7884. [In Czech]
Badalíková B., Červinka J. (2010): Utilization of agricultural mechanization in alternate rows of vineyard and its influence on the soil structure. In: Technofórum 2010, Zborník vedeckých prác, Nitra, Slovensko, s. 20 – 22, ISBN 978-80-552-0380-5. [In Czech]

Agricultural land fund valuation with respect to the environment protection (project No. QH72257)

Coordinator: Institute of Agricultural Economics and Information, Praha, Czech Republic
Investigator: Ing. Jaroslava Bartlová
Supported by: Ministry of Agriculture of the Czech Republic
Time of solving: 2007 – 2011

Summary:

Project is finding yield and cost relations with respect to the soil-climatic conditions, agricultural engineering and good agricultural practices. Solution is in the yields and costs monitoring of selected crops at well-defined conditions of physical of soil, climatic conditions, agricultural engineering and available nutrients. Special attention is devoted to the agricultural engineering influence on the soil quality, evaluation of quantity and quality of grass with reflection to the local conditions. Project is dealing with yield generalization on local conditions with product functions of evaluated crops. At the end of the project will evaluate relations of economic effect on local production conditions with the help of standardised conditions of production functions and with comparison of economic results of agricultural farms. Use of results is expected for tax purposes at appreciation order of Ministry of finance for soil bonity units (BPEJ), for Ministry of agriculture needs at decision making about agricultural subsidies, environmental arrangements, regulation of agricultural farms and for consultancy.

Selected publications:

Mikušová, Z., Kubík, L. (2009): The soil compaction on soil type chernozem round the Brno. Úroda 12, (scientific supplement), p. 397 – 400. ISSN 0139-6013. [In Czech]

Optimization of both agricultural and river landscape in the Czech Republic with an emphasis on the biodiversity process (project No. B06101)

Coordinator: Institute of Agricultural Economics and Information, Praha, Czech Republic
Investigator: Ing. Jaromír Procházka CSc.
Supported by: Ministry of education, youth and sports of the Czech Republic
Time of solving: 2006 – 2011

Summary:

The project integrates a number of experts from different institutions of basic and applied research who are trying different methods and approaches to optimize a usage of Czech landscape. The aim of this project is to determine the condition and use of representative cultural landscape, to define their negative impacts, to propose remedial measures which enable the increase of ecological stability and create conditions for enhancing the biodiversity.

Selected publications:

Procházka J., Procházková B., Mikušová Z. (2010): Effect of Catch Crops on Oxidable Soil Carbon Content. In Proc.: Agro 2010 the XIth ESA Congress, Montpellier, Francie, p.249 – 250, ISBN 978-2-909613-01-7.

Pelikán J., Knotová D. (2010): Enforcement of the wild species of the family *Fabaceae* in grassland communities. – In: New knowledge of genetics and breeding of farm crops, CVRV Piešťany: p. 53–56. ISBN 978-80-89417-23-0.

Free and bound forms of fusarium mycotoxins in cereals and processed products; strategy of control and minimisation (Project No. 2B08049)

Coordinator: Institute of Chemical Technology Prague
Investigator: RNDr. Jan Nedělník, Ph.D.
Supported by: Ministry of Education, Youth and Sports of the Czech Republic
Time of solving: 2007–2011

Summary:

Fusarium toxins, a like other xenobiotics, are partly metabolized by living plants including food crops. Humans (and also farm animals) consuming parts of the contaminated plants, especially cereals or their processed products, like bread or beer, are therefore not just exposed to the native (free) mycotoxins, but also to altered forms. Little is known about the occurrence, bioavailability and further transformations of some of these bound compounds, which additionally also escape from usual analytical detection techniques used for routine control. This may lead to an underestimation of the total consumers' exposure.

The transfer of *Fusarium* toxins from barley to beer has been demonstrated in several earlier studies. However, only recently, the issue of „masked“ mycotoxins occurring in barley, the key raw material in brewing process, has become of great concern. The presence of DON-3-glucoside, at levels equal or even higher than DON, currently the only regulated trichothecene, was documented for the first time. The data indicated relationship between the technology used for beer production and *Fusarium* toxins levels. Similarly, the occurrence of release / origination of fusarium conjugates can be expected within other fermentation processes such as bread making. Clearly further studies are necessary to verify the source of this problem and to generate data providing solutions for the food technologies.

The objective of the project is to develop modern analytical methods to control the fate of *Fusarium* toxins in the food chain: raw material (cereals) – processing intermediate – final food commodity. The data obtained within this project should facilitate taking measures aimed at production of safe, cereal based foods.

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Support of cooperation among MENDELU in Brno and next institutes in tertiary education and research

CZ.1.07/2.4.00/12.0045

Project title: Operational Program Education for Competitiveness, the priority axis 2.4 Partnership and networks, administrated by MŠMT ČR

Coordinator: Mendel University in Brno, Faculty of Agronomy

Investigator: RNDr. Jan Nedělník, Ph.D.

Supported by: Ministry of Education, Youth and Sports in Czech Republic

Time to solving: 1. 1. 2010 – 31. 12. 2012

Summary:

The main project aim is a integrating of universities and scientific institutions into units, which are referred to as partnership. This will result in a network, with the possibility of future branching into further subjects of private sector and public administration. At the level of universities and research organizations attention is paid to the creation of common projects with the possibility of common exploitation of research and development capacities. The primary focus will be put on exchanging information and enhancing cooperation with various subjects created by the network partners. The established cooperation will be finalized by creating a contact point at Mendel University in Brno which will be aimed at providing relevant information about aplication and employment sector.

This project is financed by the European Social Fund and state budget of the Czech Republic.

RESULTS TRANSFER

We transfer our results into practice through many different ways. Varieties are transferred by seed sale, licence and sales of property rights. Certified methodologies and technologies are offered to customers as a direct sale and consultancy. Utility models and patents are realized in the form of exclusive and non-exclusive license. Potential customers will get a wide and systematic support with implementation of new products on the market. It is really time and money consuming to introduce new things on the market. Our situation is harder, because products are mainly by-products for food and other industries. Our motto is "Our results will not remain in the drawer."

RESULT: 12 certified methodologies

USER: researcher, breeder, teacher, student, farmer

RESULT:
4 utility model in years 2009–2010

USER:
producer, farmers – companies in the Czech Republic

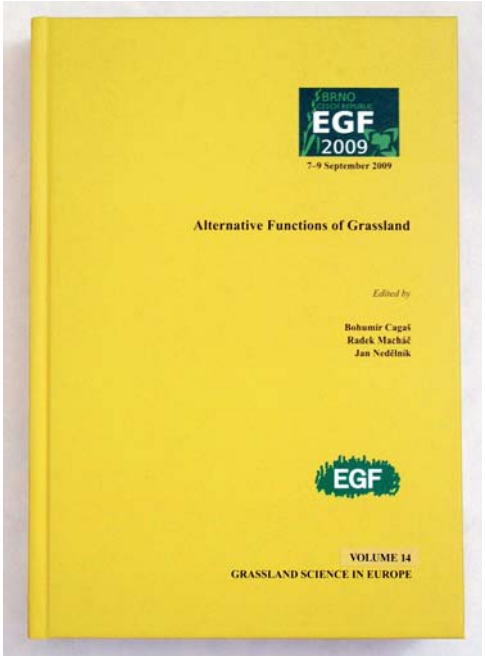
FIELD TRIALS EXHIBITIONS

INTERNATIONAL EXHIBITION

CONFERENCE REPORTS

15th EGF Symposium 2009 "ALTERNATIVE FUNCTIONS OF GRASSLAND" (7th– 9th September 2009)

Venue: Brno (Hotel Voroněž), Czech Republic



Organizers:

Research Institute for Fodder Crops, Ltd., Troubsko (www.vupt.cz)

OSEVA PRO Ltd., Grassland Research Station Rožnov-Zubří (www.oseva.cz),

Under the auspices of the Minister of Agriculture of the Czech Republic and in co-operation with the Czech Academy of Agricultural Sciences

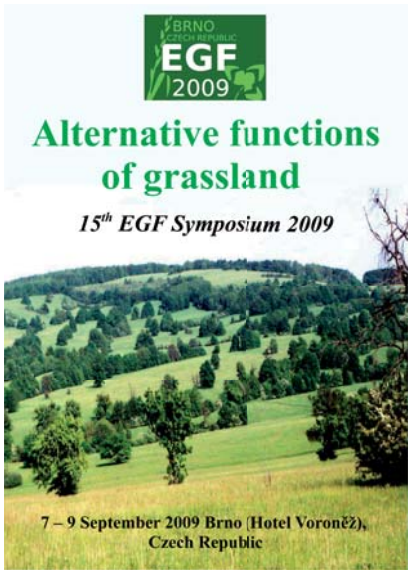
Number of participants: 155

The symposium consisted of 4 sections of lectures and poster presentations covering the area of:

- Non marketable functions of grassland
- Alternative use of grassland
- Methods of grassland preserving

On the whole, 130 papers were published in the proceedings

All papers were published in conference proceedings **Grassland Science in Europe volume 14** (ISBN 978-80-86908-15-1, 566 p.)



Actual knowledge in cultivation, breeding, plant protection and products treatment

11th and 12th INTERNATIONAL CONFERENCES

(November 12th – 13th, 2009 and November 11th – 12th, 2010)

Venue: Brno, Czech Republic

Organizers: Research Institute for Fodder Crops, Ltd. Troubsko
Agricultural Research, Ltd. Troubsko

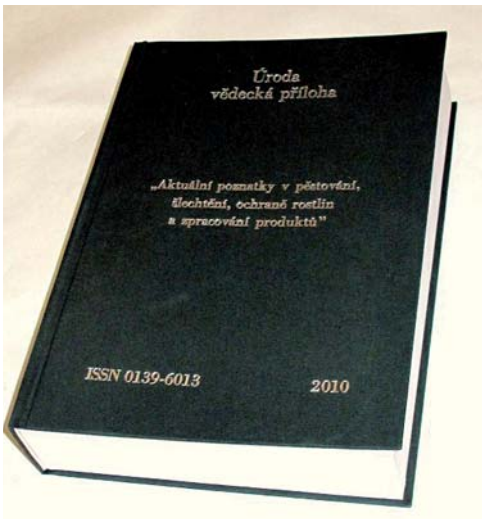
Number of participants: 120, resp. 180

Both meetings were held in the Avanti hotel in Brno, Czech Republic.

The meetings consisted of 5 sections of lectures and poster presentations covering the area of:

- Breeding
- Cultivating technologies
- Crop protection
- Ecology
- Quality and products treatment

All presentations were published in CD conference proceedings (ISSN 0139-6013) and summaries are on **www.vupt.cz** available.



COLLECTING EXPEDITIONS

Collecting expeditions in the Czech Republic started in 1993. They are organised annually in the frame of National Programme on Conservation and Utilization of Plant Genetic Resources and Agro-biodiversity. Since 2003, the main organiser have been the Research Institute for Fodder Crops, Ltd. Troubsko. The main aim of collecting missions is to explore some geographically defined region and to collect seeds / vegetative samples of plants related to agriculture. This can be landraces, old cultivars, crop wild relatives, meadow species, medicinal, aromatic, decorative plants etc. Wild species and also old landraces are important reservoir of genes important for breeding use or for direct cultivation. That is why it is important to gather and preserve these materials for future generations. Collecting expeditions are organised as five day international events, foreign partners usually join the Czech group. Slovakia, Slovenia, Hungary, Poland are the collaborating foreign countries. Database of collected samples is recorded and each collecting mission has its own acronym.

Seed samples gathered during the collecting missions are divided directly between the participants. If the collected sample is so small, that the division of the sample is senseless, it is retained in the competent institutions in the country in which the collecting mission took place. Collected samples are divided among competent institutions within the Czech Republic. After exsiccation the samples are threshed out and purified. Vegetative samples are planted. Bigger samples are now stored in the Czech national gene bank in Crop Research Institute, Praha-Ruzyně together with respective passport and description data. Smaller samples are regenerated during the next years in competent institutions. In the frame of regeneration (multiplication) process the seed samples are described and evaluated. Obtained data are stored in the central evidence of plant genetic resources called EVIGEZ (http://genbank.vurv.cz/genetic/resources/asp2/default_a.htm), where the data are available for wide public. All the gathered samples are available for researchers from participating institutions. Most of the collected seed samples are available also for the wide public.

The survey of collecting expeditions in the Czech Republic:

1993 Bílé Karpaty

1994 Šumava

1995 Krkonoše

1996 Orlické hory

1997 Podyjí

1998 Krušné hory

1999 Beskydy

2000 Jeseníky

2001 Krkonoše

2001 Moravský kras

2003 Pálava

2004 České Středohoří

2005 Křivoklátsko

2006 Novohradské hory

2007 Jihomoravské Panonikum

2008 Českomoravská vrchovina

2009 Jizerské hory

2009 Bílé Karpaty

2010 Jihomoravské Panonikum

201 0 Český Les

BREEDING PROGRAMME

Varieties bred in the Research Institute for Fodder Crops, Ltd. and Agricultural Research Ltd. Troubsko

- *Carthamus tinctorius* L. – SABINA (1997)
- *Cicer arietinum* L. – IRENKA (1998)
- *Coronilla varia* L. – EROZA (1990)
- *Crambe abyssinica* (L.) Hochst. – KATKA (2010)
- *Lathyrus sativus* L. – RADIM (2010)
- *Lotus ornithopodioides* L. – JUNÁK (1997)
- *Malva verticillata* L. – DOLINA (1993)
- *Medicago lupulina* L. – EKOLA (1998)
- *Melilotus alba* MEDIC. – ADÉLA (1997)
- *Melilotus alba* MEDIC. – KRAJOVÁ (1950)
- *Phalaris canariensis* L. – JUDITA (2000)
- *Secale cereale* L. var. *multicaule* METZG. ex ALEF – LESAN (2003)
- *Trifolium pannonicum* – PANON (2009)
- *Trigonella foenum-graecum* L. – HANKA (2006)

Breeding lines

- *Trifolium alexandrinum* L. FARAON
- *Lablab purpureus* (L.) Sweet ROBIN
- *Phacelia congesta* Hook. FIONA
- *Trifolium ochroleucon* Huds. HELIAN
- *Trifolium fragiferum* L. FRAGAN
- *Trifolium arvense* L. ROLAN
- *Oenothera biennis* L. BIENA
- *Trifolium pratense* x *Trifolium medium (T.* x *permixtum Neumann)* PRAMEDI

SAFFLOWER

Carthamus tinctorius L.

SABINA

Year of registration: 1997

Origin:
Species from *Compositeae* family. It is native to steppe and semi-steppe regions. It resembles a thistle. The variety Sabina was breed from materials originating from botanical gardens in Austria and the Czech Republic by individual selection.

Description:

- growing season: 100 – 130 days
- the time of blooming: 3 – 4 weeks
- 1000-seed weight: 25 – 50 g
- the oil content of achenes: 25 – 27 %, oil content in seeds: 45 – 55 %, protein content: 30 – 35 %
- seed yield: 1,5 – 2,5 t/ha

Agronomical traits:

- annual fodder crops
- the best results are reached in warm regions
- the plant is valued by beekeepers for high content of nectar in late summer

Practical advice to growers:

- dry and warm regions
- no special requirements for soil
- germinates at 5 – 6 °C
- sowing rate: 20 – 25 kg/ha, in mid-March or in early April at the latest

Advantages:

- raw oil can be used for human consumption (higher proportion of linoleic acid than in sunflower oil)
- resistant to spring frosts
- drought resistance
- very rapid growth in summer months
- high content of sugars
- highly palatable for animals

CHICKPEA

Cicer arietinum L.

IRENKA

Year of registration: 1998

Description:

- annual plant with a strong stem resistant to lodging, covered with glandular hairs
- branched root with nodule bacteria
- the flowers are red to pink
- the pods contain 1 – 2 brown seeds

Agronomical traits:

- a legume with high protein content
- a crop suitable for food utilisation (flour, whole seeds are eaten cooked or roasted)
- for its high drought resistance and atmospheric N fixation potential it is suitable for improvement of sandy, podzolic soils dump heaps and for increasing yields of subsequent crops on the arable land
- dump heaps and for increasing yields of subsequent crops on the arable land

Practical advice to growers:

- termophilous crop productive in warm and dry regions
- sowing in early spring to utilise moisture in the soil
- sowing rate 80 – 120 kg/ha
- the growing season: 130 days

CROWN VETCH

Coronilla varia **L.**

EROZA

Year of registration: 1990

Description:

- perennial plant
- stem is hollow, angular and 80 cm tall, its adventitious rhizomes spread approximately up to 200 cm from the mother plant
- leaf: green to dark green, imparipinnate
- flower: pink, sporadically pinkish white
- fruit: formed by constricted lomentum, the seed is oblong, mahogany in colour
- 1000-seed weight: 4 – 4,1 g

Agronomical traits:

- used predominantly for technical purposes, preventing the soil erosion, slope revegetation
- feeding to ruminants as a forage crop and for grazing
- good health condition
- good overwintering and good perenniality even of the stand is not mown

Advantages:

- very good suitability of utilization for road slopes greening, recultivation and erosion control
- long period of flowering
- no demands on soil conditions
- high seed yields
- good tillering ability
- possibility of using as a forage crop

Practical advice to growers:

- slow development in the seeding year but a dense, compact stand is formed in subsequent years

ABYSSINIAN KALE

Crambe abyssiniva L.

KATKA

Year of registration: 2010

Origin:
Crosses of wild genotypes followed by individual selection.

Description:

- annual oil crop from *Brassicaceae* family
- suitable for dry conditions, 50 – 80 cm tall
- flowering time June
- thousand grain weight is 6 – 7 grams
- average oil content is 36 % in dry matter
- high content of erucic acid (50 – 55 %)

Advantages:

- suitable for dry regions
- intercrop and feed source for pollinators
- non-traditional oil composition

GRASSPEA

Lathyrus sativus L.

RADIM

Year of registration: 2010

Origin:
Bred from the material originated in the White Carpathians by the method of negative selection

Description:

- annual plants with decumbent stem, having narrow long leaves
- branched root with nodule bacteria
- white-violet colour of the flower
- pod with 1–2 cream white seeds

Utilization:

- pulse crop with high protein content
- medium content of beta-N-oxalyl-L-alfa, beta-diaminopropionic acid (beta-ODAP): 0,46 g/100 g of seeds (2006) and 0,47 g/100 g of seeds (2007)
- crop for food use (flour, consummation of the whole boiled or roasted seeds)
- grasspea is suitable as a part of diverse diet, not as regular food
- both fresh and dry matter can be used for feeding of domestic animals, seeds can be fed in the form of scrap
- because of high drought resistance, ability of nitrogen fixation of atmospheric nitrogen is suitable for fertilizing sandy and podzolic soils, dumps and for increasing the yields of subsequent crops on arable land

Agronomical characteristics:

- Thermophilous crop
- Sowing in April (because of effective use of the spring soil moisture)
- Sowing rate 150 kg/ha
- Vegetation period according to climatic conditions 120 days on average
- Seed harvest according to climatic conditions in August
- No diseases and pests observed

TREFOIL

Lotus ornithopodioides L.

JUNÁK

Year of registration: 1997

Origin:
Individual selections of materials obtained from botanic gardens and by mixing of selected progenies.

Description:

- stem: lodging, seldom erect, branched
- leaf: petuiolate leaflets, obovate
- inflorescence: capitular umbel with 2 – 5 flowers
- flower: egg yolk-yellow petals
- fruit: sickle-shaped pod, 4 – 5 cm long, greatly depressed, reddish-brown, pointed
- seed: lentil-like flattened, yellow-brown to green-brown, smooth to bright
- 1000-seed weight: 1,156 – 1,650 g

Agronomical traits:

- annual, multi-cut forage crop which can be left without cutting for autumn ploughing down
- tolerates all soil and climatic conditions
- it makes best growth when sufficient soil moisture is available, but it is resistant to drought
- when seeded in wide rows the cluster becomes prostrate

Practical advice to growers:

- if grown for forage, it should be sown from April to May into 12,5 cm rows
- sowing rate 12 – 15 kg/ha
- if grown for forage it is cut at the time of blooming
- the time of cutting can be chosen as required because even at the time of pod maturation the stand continues to grow and does not become senescent

FODDER MALLOW

Malva verticillata L.

DOLINA

Year of registration: 1993

Description:

- stem: erect, not lodging, when grown as spaced plants branched
- leaf: orbicular, lobed with five to seven lobes
- inflorescence: umbel, flowers are coloured from pink to lilac
- fruit: mature is splitted into 10 – 12 parts

Agronomical traits:

- annual fodder crops, under favourable conditions two cuttings can be obtained
- as main crops grown for green and dry matter is very yielding
- when grown as catch crop the yield is uncertain
- this crop prefers good soils, high level of nitrogen in soil promote higher level of nitrates in green matter
- the best performance is reached in warm regions with high level of moisture

BLACK MEDIC

Medicago lupulina L.

EKOLA

Year of registration: 1998

Origin:
It was derived from the restricted variety Slapská – stock breeding and individual selection

Description:

- the plant is susceptible to lodging
- height of 40 – 60 cm
- trifoliate leaves
- flower: yellow flowers are borne in heads
- fruit: one or two-seeded black kidney-shaped pod
- seed: egg-shaped greenish-yellow to yellow
- 1000-seed weight is 1,7 – 2 g

Agronomical traits:

- it belongs among nectar-bearing crops and is suitable for dry soils
- annual or biennial plant
- in permanent stands it maintains itself by natural reseeding
- constituent of specially-designed legume-grass mixtures for permanent and temporary meadows and pastures
- it is suitable as underseeding for green manure
- nutrient content is comparable with lucerne, but the yield is lower

Practical advice to growers:

- all types of soil except wet soils
- sown in mixtures at a rate of 10 – 15 kg from March to August
- harvest should start before until blooming

Advantages:

- suitable for dry regions as a constituent of legume-grass mixtures
- it gives reliable seed yields
- no special requirements for soil and climatic conditions
- a supplementary forage crop

WHITE SWEET CLOVER

annual form

Melilotus albus Medic.

ADÉLA

Year of registration: 1997

Origin:
Selection of annual forms from the population of biennial sweet clover, their propagation with subsequent individual selections and mixing of selected progenies.

Description:

- root: taproot penetrating up to greater depths
- stem: erect, reaches a height of 150 cm or more
- leaf: small, trifoliate, dentated margins
- flower: white, borne in short-pedicelled racemes
- seed: in one-seeded yellow to yellow-brown pods, sometimes greenish
- 1000-seed weight 1,8 – 2,3 g

Agronomical traits:

- annual form, seeds in the first year
- suitable for less fertile or non-fertile soils, it does not tolerate wetlands and very heavy soils
- used as a forage crop, for improvement of nonfertile soils and as a good green-manure plant
- it is valued by beekeepers
- forage contains aromatic coumarin
- feeding – freshly harvested young plants or silage

Practical advice to growers:

- it is grown in monoculture or in mixtures with others leguminous plants and grasses
- sowing rate is 20 kg/ha
- sowing time March-April
- if grown for seed it must be cultivated under better conditions with a sufficient number of pollinators

WHITE SWEET CLOVER

biennial form

Melilotus albus Medic.

KRAJOVÁ

Year of registration: 1950

Description:

- root: taproot penetrating up to greater depths
- stem: erect, reaches a height of 150 cm or more
- leaf: small, trifoliate, dentated margins
- flower: white, borne in short-pedicelled racemes
- seed: in one-seeded yellow to yellow-brown pods, sometimes greenish pods
- 1000-seed weight 1,8 – 2,3 g

Agronomical traits:

- it does best on less fertile or non-fertile soils, not tolerate wetlands and very heavy soils
- used as a forage crop, for improvement of nonfertile soils and as a good green-manure plant
- valuable for beekeepers
- forage contains aromatic coumarin and cattle must get accustomed to it
- freshly harvested young plants or silage are used as feed

Practical advice to growers:

- it is grown mostly in monoculture
- sowing rate is 20 kg/ha
- sowing time from early spring to late May
- if grown for seed it must be cultivated under better conditions with a sufficient number of pollinators

CANNARY GRASS

Phalaris canariensis **L.**

JUDITA

Year of registration: 2000

Origin:
Selections from materials obtained from botanical gardens and mixture of selected offsprings

Description:

- stalks: immediate, glabrous
- leaf: wide, slightly rough
- inflorescence: highly contracted panicle
- spikelet: shortly peduncled, with one branch, 2 couple of glumes
- seed: 2–3 mm long, yellowish, smooth, bright

Agronomical traits:

- annual, one cut and thermophilous grass for growing either in pure stands or in mixtures with annual species. It is used for green or dry matter
- this species has very good feeding rate
- unassuming for soil conditions
- it is very good preceding crop
- the grain can be used for feeding of poultry and exotic birds

Practical advice to growers:

- for fodder production this crop have to be sown as soon as possible after the harvest of preceding crop
- for grain production it have to be sown in the second half of April (it needs 10°C for emergence)
- seeding in 12,5–25 cm rows
- seeding rate 15–20 kg/ha
- overall time of vegetation is 80–120 days

RYE

Secale cereale L. *var. multicaule METZG. ex* ALEF

LESAN

Year of registration: 2003

Origin:
Ecotypes from Beskydy region.

Description:

- biennial species
- used as a forage crop and for food production

Economical traits:

- cover crop for legume-grasses mixtures
- feed for forestal animals
- autumn sowing for seed production
- spring and summer sowing for pasture use
- grains for food use

HUNGARIAN CLOVER

Trifolium pannonicum **L.**

PANON

Year of registration: 2009

Origin:
Crosses of wild genotypes followed by mass selection

Description:

- perennial clover, suitable for dry conditions
- stem is round shape, hairy and 50 cm tall
- leaves are 4 – 5 cm long
- proportion of leaves is approx. 50 %
- inflorescence is white, egg-shaped and 3.5 – 5 cm long
- flowering time is June-July
- thousand grain weight is 2.9 grams

Advantages:

- suitable for dry regions as a constituent of species-rich mixtures

FENUGREEK

Trigonella foenum-graecum L.

HANKA

Year of registration: 2006

Origin:
Fenugreek belongs to the very old genus *Trigonella* L. Fenugreek has spread as a cultivated crop across the Asian and the African continents. Later it was also introduced to Europe and America. The plant became agriculturally important as a forage crop and medicinal plant.

Description:

- stem: erect, reaching a height of 0,4 – 0,6 m
- leaf: short-petiolated, the leaflets are obovate to lanceolate, the stipules are large, ovate pointed and finely pubescent
- flower: singly or in pair are born in leaf axils, calyx is tube-like, pale yellow corolla is twice the length of the calyx, wings are as long as the banner, the keel is rounded at the tip
- fruit: elongated pods are sabre-like pods are glabrous straight or distinctly curved, seeds are yellow to light brown, 10 – 20 of seeds per pod

Agronomical traits:

- annual forage crop (consumed not only by domestic animals but also by wild ones)
- it is consumed raw as a good quality vegetable with a high content of ascorbic acid
- seeds of this aromatic legume are used in medicine (digestive troubles, to treat neurasthenia, in recon valescence, it promotes appetite, helps to reduce the level of blood sugar and blood pressure, external it is used to treat unhealed wounds, arthosis, ulcers, bruises)
- it is used in food industry as a cheese flavouring and as spice for meat, smoked foods, soups
- in veterinary medicine it is used as a drug promoting lactation in cattle and higher food intake

LIST OF SCIENTIFIC CO-OPERATORS

1. CZECH REPUBLIC

Ministry of Agriculture of the Czech Republic
Ministry of Education, Youth and Sports of the Czech Republic
Academy of Sciences of the Czech Republic
Czech Academy of Agricultural Sciences
Grant Agency of the Czech Republic
Technology Agency of the Czech republic
Agricultural Research Institute, Ltd. – KROMĚŘÍŽ
AGRITEC, Research, Breeding and Services, Ltd. – ŠUMPERK
Agrogen, Ltd. – TROUBSKO
Bee Research Institute, Ltd. – LIBČICE NAD VLTAVOU
Breeding Station – HLADKÉ ŽIVOTICE
MILCOM, Plc, Dairy Research Institute – PRAHA
OSEVA PRO, Ltd. – PRAHA
– Grassland Research Station, ZUBŘÍ
– Research Institute of Oilseed Crops, OPAVA
Potato Research Institute, Ltd. – HAVLÍČKŮV BROD
Research Institute for Cattle Breeding, Ltd. – RAPOTÍN
Research Institute of Building Materials, JSc. – BRNO
Crop Research Institute – PRAHA
– Grassland Research Station – JEVÍČKO
– Grassland Research Station – LIBEREC
Research Institute of Agricultural Engineering – PRAHA
Mendel University – BRNO
Czech University of Agriculture – PRAHA
University of South Bohemia – ČESKÉ BUDĚJOVICE
Masaryk University – BRNO
Institute of Chemical Technology – PRAHA

2. ABROAD

Agricultural Institute of Slovenia, Ljubljana, SLOVENIA
Agricultural Faculty, Agricultural Institute, Osijek, CROATIA
Agricultural Research Institute, Kompolt, HUNGARY
Agricultural University of Vienna, AUSTRIA
Bio Gen, Tapolca, HUNGARY
Forage Institute, Kruševac, SERBIA
Forage Institute, Pleven, BULGARIA
INRA, Lusignan, FRANCE
Istituto Sperimentale per le Colture Foraggere, Lodi, ITALY
Lithuanian Institute of Agriculture, LITHUANIA
Institut Uprawy, Nawozenia i Gleboznawstwa, Pulawy, POLAND
Plant Breeding and Acclimatization Institute, Radzików, POLAND
Polska Akademia Nauk, Komitet Uprawy Roslin, Krakow, POLAND
Institute for Forage Crops, Kruševac, SERBIA
The Belgrade University, SERBIA
Agricultural University, Nitra, SLOVAKIA
Slovak Centre of Agricultural Research, Research Institute of Plant Production, Piešťany, SLOVAKIA
Research Institute for Grass Ecosystems and Mountain Agriculture, Banská Bystrica, SLOVAKIA
Tubitak Marmara Research Center, Gebze, TURKEY
Erdemir, Eregli, TURKEY
Turf-Seed, Inc., Willonghby, USA
Central Agricultural Office, Research Centre for Agrobotany, Tápiossele, HUNGARY
Faculty of Agriculture, University of Novi Sad, SERBIA

STAFF PUBLICATIONS 2009–2010

2009

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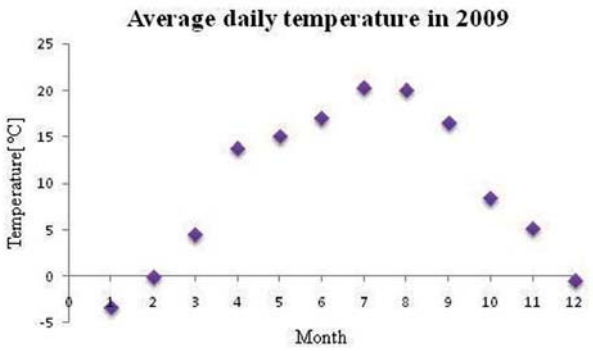
METEOROLOGY

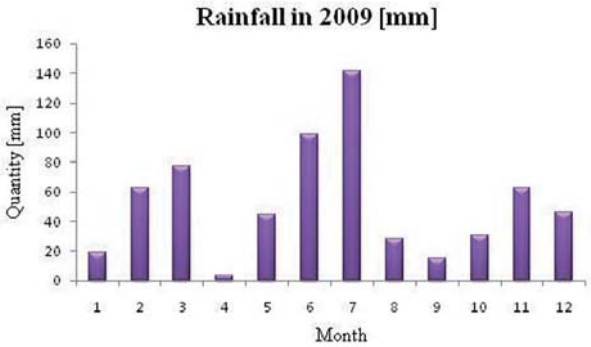
Head of station: Ing. Pavlína Minjaríková
Ing. Simona Raab

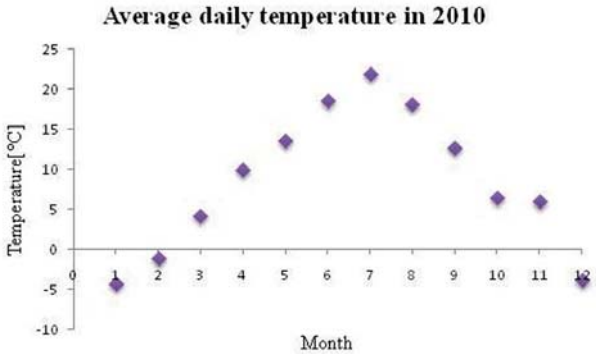
Altitude:	280 m
Average annual temperature:	9,3°C
Annual preciptation sum:	529 mm
Absolute max:	37,7°C (13.8 2003)
Absolute min:	-24,1°C (28. 12. 1996)

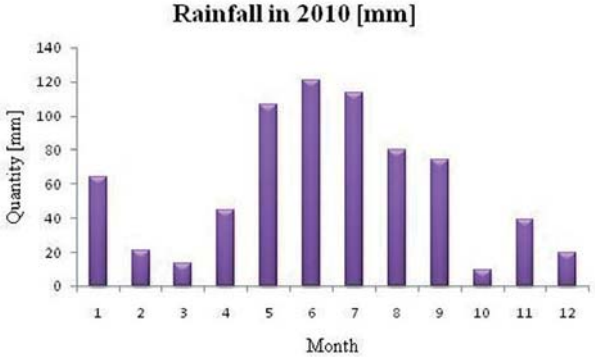
On the land RIFC in Troubsko is located meteorological station belonging to Czech Hydrometeorological Institute. In 2010 the station was digitized.

This station measures air temperature - extreme and ground, relative humidity, wind speed and direction, cloud cover, soil conditions, rainfall and soil temperatures – in 5, 10, 20, 50 and 10 cm. Furthermore, storms and atmospheric phenomena are observed.









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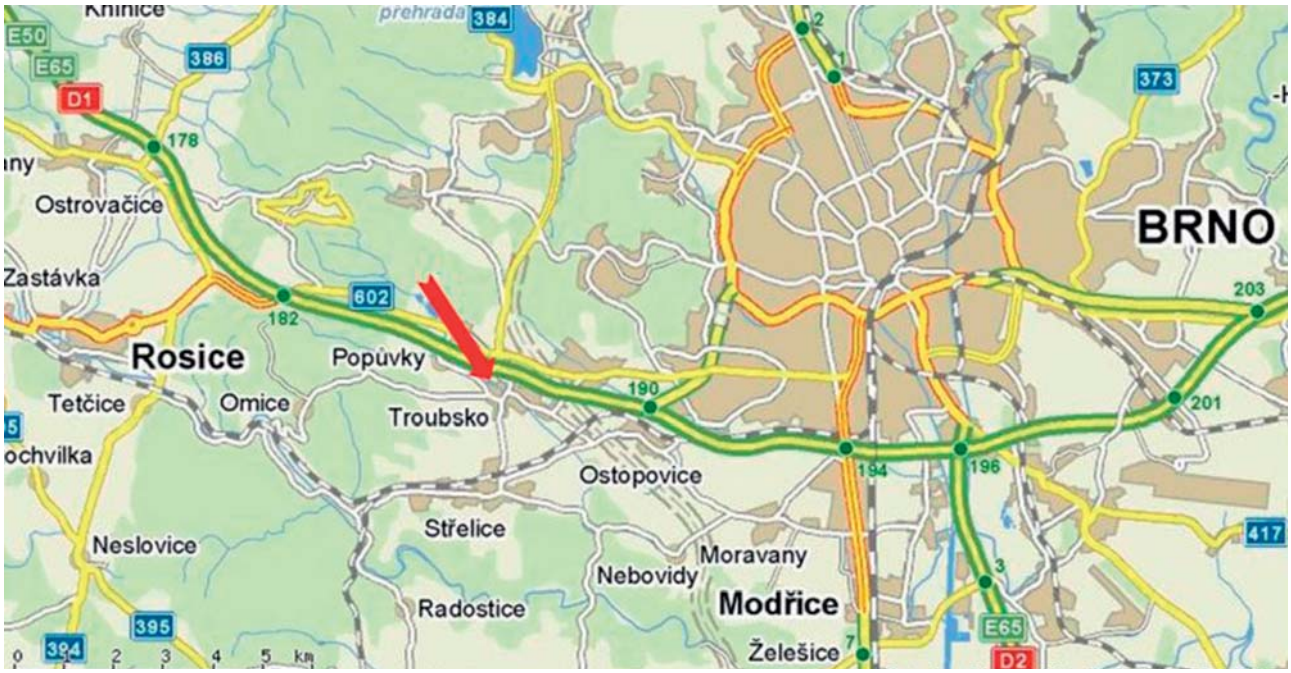

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