

## SHORT SCIENTIFIC REPORTS

### **AGRITEC Research, Breeding & Services Ltd. – 65 Years of Research and Breeding of Technical Crops and Legumes at Šumperk (1942–2007)**

Suitable natural conditions for flax growing and a long tradition of the advanced flax processing industry in the region were the main reasons for the establishment of a flax research institute at Šumperk in northern Moravia. The “Kaiser Wilhelm Institut für Bastfaserforschung” founded at Sorau in Silesia in 1938 as one of the research institutes of the “Kaiser Wilhelm Gesellschaft”, see [http://en.wikipedia.org/wiki/Kaiser\\_Wilhelm\\_Institute](http://en.wikipedia.org/wiki/Kaiser_Wilhelm_Institute), moved 1942 to Šumperk, the then Mährisch-Schönberg. Prof. Dr. Ernst Schilling was the first director of the institute till 1945. In the surrounding mountainous area of the Jeseníky Mts. (Altvatergebirge) one sixth of the Czechoslovak flax production was regularly achieved, even during the deep crisis of Czechoslovak flax growing and production in 1932. The original research projects of the institute were ambitious and complex, and included flax growing, breeding, maintenance of genetic resources, protection against harmful organisms, and harvesting technologies, and also industrial processing like water retting, stem processing, spinning, weaving, yarn dying and textile adjustments. The industrial part of flax research moved later to the Research Institute of Bast Fibres, founded in 1949 at Šumperk. Till 1945, the main activities of the institute were research on the breeding and processing of fibre crops. Growing systems and crop protection of flax represented only a small part of the activities. A flax farm of the Agricultural High School at Šumperk-Temenice (founded in 1867) was affiliated to the institute for field research purposes at that time. After World War II, the research areas of the institute continued, but the name of the institute changed many times as well as its organizational subordination to the Ministry of Agriculture or the Czech Academy of Agricultural Sciences. In addition, the spectrum of investigated crop species widened gradually.

Three important milestones can be highlighted in the period after World War II. In 1961, the original focus on fibre crops was extended to grain legumes (by transferring legume research from the Cereal Research Institute at Kroměříž) which dominated the institute activities in the sixties. In 1977, the crop research institutes and breeding stations in Czechoslovakia were integrated into the state breeding enterprise OSEVA in Prague with the aim to join genetic research, practical plant breeding and seed production into one organisation. At that time (1977–1993) seven breeding/research stations in Bohemia and Moravia belonged to the Institute and a number of pea, faba bean, soybean, winter rape and flax varieties were bred and released. However, the most important change happened in 1993, when, based on a political decision of the Czech government, research institutes specialising in particular crops were transformed to limited liability companies (Ltd.) with the obligation to maintain their original activities, i.e. agrobiological research and plant breeding. Our institute was thus transformed to “AGRITEC, Research, Breeding and Services Ltd.” and officially registered in September 1993. Since 1994 it became fully active in its recent activities (<http://www.agritec.cz>). It should be mentioned that for the management and staff this was new and very unusual since private agricultural institutes were unknown in the Czech Republic and at least exceptional in the world. Nevertheless, in spite of all starting economic and personal difficulties the institute has survived, and it is now successfully performing. In 2002, a filial company AGRITEC Plant Research Ltd. was established as a private non-profit institution whose all potential profit must be completely reinvested to research.

The following persons took up the post of the institute's director: Prof. Dr. Ernst Schilling (1942–1945), Ing. Jaroslav Tobyáš (1945), Ing. Karel Kohout (1946–1950), Emil Voleský (1950–1958), Ing. Vladimír Vašák, CSc. (1958–1963), Ing. Josef Lahola, CSc. (1963–1986), Ing. Oldřich Zmeškal, CSc. (1986–1990), Ing. Alois Chalupa, CSc. (1990–1994), Ing. Miroslav Hochman (1994–until now).

Currently, AGRITEC performs complex agrobiological research and plant breeding of grain legumes (pea, faba bean, lupine), fibre crops (flax and linseed, hemp), oil crops (winter rape) and spice plants (caraway). It includes plant genetics and physiology, biochemistry and analytical chemistry (all disciplines mainly directed to plant breeding utilization), integrated plant protection (phytopathology, herbology, entomology) as well as growing and harvest technologies of the above-mentioned crops.

Here we discuss mainly genetics and breeding related research activities. An important long-term activity of AGRITEC is its national responsibility for maintaining genetic resources of flax/linseed (2056 accessions in 2007) and grain legumes (2726 accessions in 2007; mainly pea). The developed new technologies (molecular markers and image analysis) are used to characterize/describe these germplasm resources and to create core collections of particular crops. The classical plant breeding in pea, flax/linseed and winter rape is concentrated mainly on the improvement of quality traits and resistance to biotic factors (predominantly to all the important fungal pathogens). AGRITEC's breeders recently developed (as main breeders or co-authors in the breeding consortia) the following crop varieties that were registered in the Czech Republic: fibre flax Venica (2001), linseed Amon (2007), canning pea Cetrís (2007) and Dragon (2008), winter rape Oponent (2006), Opus (2007), Oksana (2007) and Aplaus (2007). The development of tissue culture techniques started in the early eighties and nowadays they are used to complement conventional plant breeding methods (doubled haploids in flax, winter rape and caraway; selection *in vitro* for fungal pathogen resistance in legumes and flax; somaclonal variation in legumes and flax). In the mid-nineties we started genetic transformation research of flax and pea and recently we have produced transgenic peas with resistance to PEMV and PSbMV based on the mechanisms of CPMR (Coat Protein Mediated Resistance) or PTGS (Post-Transcriptional Gene Silencing). The development of transgenic pea and flax with improved resistance to fungal pathogens and insect pests is under investigation. During the last decade, AGRITEC was deeply involved in the possibilities of utilization of fibre crops (flax, hemp) for phytoextraction of heavy metals (Cd, Pb, Zn) and radionuclides from contaminated soil (COST Action 837 and 859). The screening of flax and hemp gene pool from germplasm resources for ability to accumulate heavy metals in greenhouse and field conditions is recently complemented by the effort to produce transgenic flax with methalothioneine transgene to improve Cd tolerance and accumulation. The transgenic approach (in parallel with induced mutagenesis) is also used to change the content and proportions of saturated/unsaturated fatty acids in flax seed for human consumption.

In the late eighties, the electrophoretic techniques of protein (isozymes, seed proteins) analysis were introduced in the institute to characterize and describe legume and flax cultivars by these biochemical markers. Later, a large set of the molecular (DNA) markers was used for the study of pea and flax genome laying an emphasis on microsatellite and retrotransposone sequences. These molecular techniques, which were recently elaborated and verified, can be efficiently used for variety registration and breeders' rights protection. Besides, they can also be exploited for the management of breeding process. Especially in pea, due to dramatic progress in genome sequencing of taxonomically related species (*Medicago truncatula*, *Lotus japonicus*), it may be expected in the nearest future that Marker-Assisted Selection (MAS) will be vastly used for the introduction (pyramiding) of genes responsible for important agronomic traits.

Our traditional national partners in genetic and biotechnological research (including plant breeding) are the Institute of Experimental Botany in Prague and Olomouc, Institute of Organic Chemistry and Biochemistry in Prague, Institute of Plant Molecular Biology in České Budějovice (all belonging to the Czech Academy of Sciences), Crop Research Institute in Prague, breeding companies Selgen a.s. in Prague and SEMO a.s. in Smržice, Palacký University in Olomouc, and Mendel University of Agriculture and Forestry in Brno. Due to the long-lasting tradition of research on fibre crops and legumes, AGRITEC collaborates with a number of foreign research institutions. As the FAO Flax Database manager, AGRITEC has traditionally close contacts with European as well as overseas (USA, Canada)

flax gene banks. Recently, very fruitful collaborations have been established in pea biotechnology (INRA Dijon, France) and in pea molecular marker research (SCRI Dundee and JIC Norwich, UK; Helsinki University, Finland; Melbourne University, Australia; USDA Pullman, USA).

AGRITEC is accredited for GMO manipulation including GMO release into the environment, for pesticide testing (GEP) and is also a holder of Quality Management System ISO 9001–2000 for the activity “Research and development of new varieties and technologies in plant production”. AGRITEC provides various services and expertise for its clients from the area of plant breeding and plant production (e.g. biological tests of seeds, cultivar identification with biochemical/molecular markers, identification of transgenes in plants and plant derived products, phytopathological testing, pesticide testing, and a number of chemical/biochemical analyses – proteins, lipids, fatty acids, starch, amylose, antinutritional substances, mycotoxins, heavy metals). Besides the production and selling of the seed of its own varieties, AGRITEC represents a number of foreign breeding and seed companies (Poland, France, Netherlands, Hungary, Slovakia) in the Czech Republic in multiplying and selling the seed of their varieties (flax/linseed, hemp, lupine, faba bean).

It remains the future aim of the management and staff of AGRITEC to perform high-quality agrobiological research and plant breeding and to contribute by their results to the improvement of knowledge in the field of genetics, physiology, biotechnology and molecular biology of grain legumes and industrial crops.

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Participants in a scientific seminar with invited foreign speakers dedicated to the 65<sup>th</sup> anniversary of agricultural research and plant breeding at Šumperk (1942–2007), held in AGRITEC Šumperk on 19<sup>th</sup> September 2007 (photo: Dr. J. Horáček)