



The activities of the Czech Association for Biomass - CZ BIOM

Whilst the cultivation of industrial and energy plants was a traditional task of agriculture and forestry in the Czech Republic, in the second half of the 20th Century the major agricultural priority was to secure self-sufficiency in food production and growing plants for non-food purposes was minimised. At the beginning of the 1990's, the Czech Biomass Association CZ BIOM (www.biom.cz) was established and since that time has striven to expand non-food production in the Czech Republic.

In general, the production and use of renewable raw materials (RRM's) brings important benefits for ecology. The exploitation of non-food plants as a raw material can represent an important and generally long-term carbon sequestration and also contributes to the protection of exhaustible fossil resources. At present, there are 400,000 hectares of fallow agricultural land in the Czech Republic, which are either unused or quite ineffectively planted with trees or grass. According to existing experience the cultivation and use of industrial or energy plants significantly enriches the cultural landscape, promotes the generation and maintenance of jobs and contributes to the ecological stability of the countryside. Raw materials of plant origin enable the development of new products with exceptional properties which are unavailable while using petroleum-based materials. Currently, the production of RRM's is rather restrained in the Czech Republic due to limited state assistance (laws, tax relief, subsidies, etc.) for its exploitation.

CZ BIOM: seeks subsidies for non-food production; advertises the cultivation of technical and energy plants in specialised publications, conferences and courses, instructional and training films etc. and initiates or directly supports research into new cultivation methods and advanced technologies of non-food biomass processing.

CZ BIOM at present achieves marked success of biomass utilisation and production of solid and liquid biofuels. The production of industrial materials and

the energy use of biomass often proceed simultaneously e.g. in the treatment of hemp straw the fibre is processed for industrial purposes and the hemp hurds are utilised for energy. An action program of CZ BIOM in the sector of energy use of biomass comprises an increase of the current annual utilisation 30 PJ to approx. 95 PJ by 2010. This target value comprises production of motor phyto-fuels (9.2 PJ) and electric power from biomass combustion (1700 GWh). These values are in accordance with EU requirements to ensure a 6% share of renewable energy from total energy consumption by 2010.

In the Czech Republic mainly rape straw is used for preparing solid fuels (fuel cakes and green pellets for heating of family houses; giant bales of straw for municipal and industrial steam-boiler plants) as well as, partially, grain straw and biomass from 15 species of plants whose cultivation is supported through Government funding. Among these plants, energy grass - Reed Canary Grass (*Phalaris arudinacea* L.) is of great interest due to considerably high yields.



Reed Canary Grass (Phalaris arudinacea L.), used for energy production

Fibre Crops

Approximately one half of Czech textile industry requirements are covered by the production of domestic flax fibre. An increase of the contemporary harvesting area (5,700 ha) up to at least 12,000 hectares is anticipated. Flax is also grown as a raw material for oil production; the harvesting area of this crop is at present 2,500-3,000 ha. Both types of flax are subject to subsidy. Further increases in production are restricted by the risks in flax cultivation and the unavailability of reasonable harvesting machines. Members of CZ BIOM control approximately one quarter of the harvested flax area.

The involvement of CZ BIOM members - growers and processors - in hemp production is much higher (85%). The harvested areas of hemp, which in former times almost faded away entirely in the Czech Republic, is now increasing every year. In 2003 the total harvested area of hemp was around 700 ha. Along with the increase of sowing area, economically effective technologies are also being implemented. Former harvest technologies focussed on maximising fibre length for the textile industry and involved a lot of manual work. Present technologies make the evaluation of all parts of the hemp plant possible, including the hemp hurds. Technology modification also makes possible the processing of non-dew-retted hemp straw to obtain fibres of interesting technological quality. CZ BIOM initiates not only the cultivation of technical hemp, but also introduces some new harvesting technologies e.g. improvement of the stepped harvester, or composite harvest. In this case the reaping-thresher harvests the top part of the plant and threshes out the hemp grain; in the second phase the reaping crusher harvests the remaining stalks. With a high-grown stand (a result of good nutrition and sufficient rainfall) it is necessary to apply such cutting, which allows shortening of long hemp stalks. Barriers to faster expansion of cultivation are the poor capacity of hemp-mills in cultivation areas and a deficit of special hemp harvesters. The lack of hemp-mills is solved by the use of mobile hemp-mills, which saves transportation costs and makes it possible for hemp growers to utilise the energy from hurds. Hemp fibres are presently an attractive commodity not only for the textile industry but short fibers and hurds find many other uses - they can be used in upholstery, thermal insulation and sound proofing; in addition, they are applicable as an additive to various mortar mixtures, as infilling for the automotive industry and are suitable for the production of special paper (security paper, cigarette paper). Hemp oil has technical and pharmaceutical uses.



Products from short hemp fibres

Biomass for Fuels and Lubricants Production

"2nd generation" biodiesel has been produced in the Czech Republic for years. This product represents multicomponent fuel with at least 30% rape oil

methyl ester. The remaining part is from thoroughly desulfurized oil components, which are biologically degradable (more than 90% over 21 days). Rape for non-food exploitation, cultivated on around 76,000 ha, is a subject of Government subsidy. The total production of 230,000 t of rape grain represents 70,000 t of the annual methyl ester. Oil plant production of CZ BIOM members is exploited rather for the production of ecological biooils, primarily for loss-lubrication and hydraulic fluids. For technical purposes, besides winter rape, *Camelina sativa* is now also used. It is a crop with low requirements for agricultural engineering, suitable for extreme regions. Oils with an enhanced content of lower fatty acids are also used by the Czech chemical industry to produce surfactants, plastics, additives, etc.

The growth of non-food use of plant raw materials is expected as a consequence of the exploitation of bioethanol in fuel mixtures. Bioethanol will be applied particularly in the production of fuel oxygenate ETBE, which, as a replacement for the current MTBE from synthetic methanol, will constitute an ingredient of petrol mixtures with a rate up to 15%. The annual consumption of ETBE in the Czech Republic is expected to achieve 150,000 m³, which is equivalent to 250,000 m³ of bioethanol. Another opportunity for bioethanol utilisation in the Czech Republic is the certified technology of rape-oil methyl ester production, which is a component of the above mentioned 2nd generation biodiesel. A new system of bioethanol production which has been recently introduced is mainly focused on processing amylaceous varieties of wheat and triticale; the use of sugar beet is also considered. With regard to the foreseen subsidies for the cultivation of non-food alcohol crops and the building of new distilleries, it can be expected that up to 100,000 ha of agricultural land will be sown by 'alcohol' crops in the near future. It should be noted that the limiting factor for the production of bioethanol is its higher cost in comparison with that of synthetic ethanol.

CZ BIOM suggests to produce bioethanol from lignocellulose biomass, use inexpensive agricultural by-products or energy plants with high biomass production. Technology, which consists of acid hydrolysis of lignocellulose biomass under high temperature and pressure, was developed at the Research Institute of Crop Production in Prague-Ruzyně (a member of CZ BIOM). The pilot plant is shown over the page. This technology allows the utilisation of cheaper raw material than is exploited by agro-distilleries. Proceeds from 1 metric tonne of grain straw dry matter are up to 648 kg of hydrolysis sugars. This equals 202 kg of absolute ethanol, whose production costs are 75% in comparison with bioethanol from cereals. In addition, further valuable

products can be obtained: pulverous lignin, furfural and organic acids.



Bioethanol production from lignocellulose biomass - pilot plant

Non-food Evaluation of Starch

Natural or modified starch is used in the paper and textile industries, as a binder in the production of building slabs, in foundry moulds fabrication, in crude oil output etc. A new opportunity is the production of biodegradable plastics. Starch is used either as a filler in the plastics or as copolymer, with polyethylene or polypropylene. CZ BIOM supports the development of non-food uses of starch in the production of ecological biodegradable containers by means of two of its members. CZ BIOM also carries out R&D into a wide range of biodegradable materials.

Waste management is the main driver for biodegradable plastics in the Czech Republic. At present, granulated starch copolymers are imported from Italy; although domestic production is already prepared. Since 2000 the production area of starch plants intended for non-food purposes has constantly increased.

Schavnat or Sorrel of Uteush - A New Crop for Non-Food Utilisation

In order to employ 400,000 ha of fallow agricultural land along with 20,000 ha of anthropogenic soils (recultivated open-cast spoils) it was necessary to find crops, the cultivation of which would be effective both from economical and energy aspects. Among perennials the perennial spinach-sorrel hybrid *Rumex patientia* L. x *Rumex tianschanicus* A.Los, known in the Czech Republic as the Sorrel of Uteush, was found to be the most suited high-yielding energy crop. Branched stalks of this herb reach up to 2-2.5 m high.



Schavnat or the sorrel of Uteush - a new multipurpose crop for non-food production

This is a very adaptable crop with regard to the sowing period, agro-technical level, fertiliser requirements and soil conditions. The key advantage of this crop is low-cost production of biomass with good quality for use as biofuel. With only one annual harvest this crop offers, on average, almost 12-16 tonnes of dry aboveground biomass, which even exceeds the normal yield level of fast-growing woody plants. This herb is frost tolerant. It can be grown in both lowlands and uplands (with the exception of wet lands and heavy acidified soils). The lifetime of a schavnat plantation is up to 20 years. Schavnat also has low requirements for additional fertilisation. An advantage of the cultivation and harvesting of this crop is the high technological potential and the possibility to use ordinary agricultural cultivation methods. Moreover, schavnat has considerable potential for the production of high-quality forage, specialised food products and biologically active food and feed additives, because in a young stand it has a high content of raw protein and vitamins.

Although substantial progress in the breeding of this unconventional forage crop was achieved in the Ukraine by Prof. J.A. Uteush, breeding for non-food purposes was introduced in the Czech Republic by CZ BIOM. Members of CZ BIOM have exclusive rights to produce and deliver seeds of this right-protected crop both in the Czech Republic and in other European countries.

In the Czech Republic, the schavnat biomass is used for heating (compressed in briquettes and pellets, or bigger packs as fuel for boiler plants) and also for biogas production. Possible bioethanol production from the schavnat biomass by means of pressurised thermal hydrolysis was experimentally verified too. Schavnat is also a good source of phenolic compounds exhibiting beneficial health effects in humans. No specific agricultural mechanisation is needed for schavnat's cultivation. As a result of high interest in its cultivation among farmers, the area of its plantation consistently increases. Barriers for this cultivation are legal regulations in nature protection, which restrict and monitor the cultivation of plant hybrids in the Czech Republic.

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OCCI - Novel Model of Applied Research and Education in Alberta

Located in southern Alberta, Canada, the Olds College Centre for Innovation (OCCI - www.occ.ab.ca) is committed to developing Alberta's potential in agriculture through agri-food applied research and commercialisation.

In November 2001, the OCCI's facility - the Dr. Robert Turner Research Centre - was officially opened,

including more than 10,000 square feet of space which houses an analytical laboratory, plant stress physiology unit, microbiology laboratories, and a bioprocessing pilot plant. Other facilities include greenhouses, a natural fibres laboratory, a composting centre and 'incubator space' for industrial partners. OCCI is emerging as a key resource for small, medium and multinational companies interested in applied research in agriculture and food industries in Alberta.

OCCI focuses on new crops and products from existing crops for the nutraceutical industry and producers of functional food. Its expertise lies in the analysis of bioactive food and nutraceutical ingredients, extraction and separation technologies for natural products.

OCCI has completed over 100 industry and Government projects since its inception. Projects include research on antioxidants in oilseeds, isoflavones in agricultural crops, processing of anthocyanins from blackcurrant and Saskatoon berries, inulin from Jerusalem artichoke and extraction of bioactive ingredients from medicinal plants. A database of essential oils from Alberta aromatic plants and forestry by-product is being developed for food and non-food industries.



*Microprocessing Facility
- Herbal Extracts Processing*

Recently, OCCI was awarded start-up funding from the Canada Foundation for Innovation to construct a \$3.3 million bioprocessing, applied research and product development facility. The pilot plant for processing, extraction, separation and fermentation operations is under construction. Industrial partners and collaborators provide additional funding. OCCI has built a strong network of collaboration with universities and public research organisations including the Alberta Research Council, Alberta Agriculture, Food and Rural Development, and several international research networks.

The most recent development is the creation of the Institute for Food and Agricultural Science, Alberta (IFASA), where the major R&D providers in Alberta will link resources within the Alberta food and agricultural sector and work together for the collaborative management and delivery of

agriculture, agri-food and agri-industrial programs. Some of the expected outcomes of this program by 2010 include creating 125 new products/technologies and creating 70 new companies.

This program represents part of the Alberta Government's goal of expanding the value-added agriculture sector to \$20 billion by 2010. Reaching that goal will produce over 35,000 new jobs in the value-added agriculture production sector.

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Forthcoming Industrial Crops Events

4-5 November 2004

National Non-Food Crop Centre First Annual Conference - 'The Green Supply Chain'

York, UK

Contact: Lucy Hodsman (Tel: 0044 1904 435182

Email: enquiries@nnfcc.co.uk)

2-3 Feb 2005

Green-Tech® 2005: 4th International Conference and Trade Show on Sustainable and Renewable Raw Materials with 9th Symposium on Renewable Resources

Potsdam, Germany

Contact: Europoint b.v (Tel: 0031 30 6933 489 Email:

info@europoint-bv.com)

17-21 Sept 2005

International Conference on Industrial Crops and Rural Development

Murcia, Spain

** Abstracts Submission Deadline: 31st October 2004**

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For more details and events visit

www.ienica.net/eventsdiary.htm

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