IENICA

Interactive European Network for Industrial Crops and their Applications

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Non-food Crop Activity in the Baltic Sea Region

The Baltic Sea area covers 2.3 million square kilometres, with a population of 103 million. The land use of the area is unique, with 50% afforested and 20% arable land. Approximately 30% of the Baltic population live in the countryside.

The Baltic Sea countries

The area includes 9 countries. Four are currently members of the European Union and five will join within a few years; the difference between the countries is considerable and emphasises the fact that the region is not yet an homogenous entity. Although the importance of agriculture in the economies of these countries has reduced during recent decades, it is still considered a key sector, and stable, sustainable crop production is still of considerable political interest. The percentage of gross value added by agriculture varies from 2% in Sweden to 10% in Latvia. Today farmers and the few agro-businesses are mainly producing bulk products to commodity markets, where price is often determined by political decisions and not related to the actual costs of production. The farmers' influence on their own situation is therefore limited, and has been for many years, and dynamic development of rural societies is limited. The establishment of a few dynamic and highly innovative industries in individual regions could trigger development towards a more sustainable and dynamic society. Focus of these new establishments should be on differentiated products and services, which appeal to consumers because of their unique quality characteristics.

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Non-Food Activity

Denmark

Geographically, three Danish islands are part of the Baltic Sea area: Lolland and Falster and Bornholm. Both Danish regions have local agro-industrial research centres, which focus on both food and non-food research and make a large number of innovation tools and incentives available for entrepreneurs. Green Centre on Lolland/Falster performs experimental work on e.g. medicinal plants and Bioraf Denmark Foundation on Bornholm works with oil crops and cereals. The Danish state and local authorities have established a good public environment for a dynamic business climate, although so far with little success concerning the establishment of new companies and jobs. Both regions have an unemployment rate higher than the country average.

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Estonia

Agriculture is an important activity and source of income in Estonia. In 2001 the area of agricultural land was 1.4 million hectares (33% of the total area), of which the area of arable land was 1.1 million hectares. Biomass for energy is in an early experimental stage. Herbs are only grown on a few farms, and relatively few are grown - only about 20 different kinds of herbs and mixtures of herbs for teas. In recent years the cultivation of rapeseed has advanced due to a new rapeseed processor. The plant at AS Werol Tehased uses approximately 60,000 tonnes of rapeseed a year, mainly for cooking oil, with a limited amount for biodiesel. Initially these amounts are small and production is experimental; there are no large factories. Only flax is grown for fibre and the climate and soil in southern Estonia are favourable for its cultivation, although the area is now 80 hectares, compared to 44,000ha at the beginning of the 20th century. However, the Pärnu Linen Factory employs 650 people and is one of the largest in Europe, producing linen yarn and fabric using mainly imported flax fibre. Construction will start this year on a flax (long and short) fibre factory, which will be capable of processing 4,000 ha of flax stem.

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Finland

The most common crops in Finland are cereals and grass: about 83% of the total cultivated arable land (2.2 million ha). Interest among farmers and industry in non-food crops has increased during the last decade, although the proportion of these crops grown is still small. There are attempts to promote the cultivation of reed canary grass for energy production, although research has shown that it is also suitable for fibre production for the fine paper industry. The cultivation area, currently about 2,700 hectares, is mainly on bogs released from fuel peat production. The cultivation of crops producing long fibres such as flax, hemp and nettle is still small. Short fibres from Finnish grown linseed could be used as insulation products and in other non-food applications, but the short fibre used in Finland is currently mainly imported. About 70,000 tonnes of oilseeds, mainly spring turnip rape, are processed for food oils and about 5,300 tonnes of seeds for industrial oils. 15% of linseed seed is utilised for non-food purposes such as timber protective agents, and potentially for mucilage. The area of caraway has increased in recent years and is currently around 7,000ha; used as a spice and exported to Central Europe. Research on the non-food applications of caraway and numerous other herbs has taken place and a number of potential applications are currently being considered, including cosmetics. Barley, potato, and wheat are the three major starch crops. In 2002, about 34,000 tonnes of barley, 113,000 tonnes of potato and 80,000 tonnes of wheat were processed into starch, mainly for paper and other industrial purposes.

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Lithuania

Whilst there is increasing interest in the cultivation of non-food crops in Lithuania, there is limited experience of industrial applications and a significant improvement can be expected with investment and knowledge coming from the most advanced EU countries. The main arable crops in Lithuania are cereals, oilseed rape, potato, sugar beet, flax and fodder crops. The textile, starch, alcohol, sugar and pharmaceutical sectors are well established. Estimates show that 400,000 tonnes of straw could be used for energy production; the capacity of straw burning boilers has increased up to 7MW during the last few years. Miscanthus, hemp, bromegrass and other plants have been investigated, but neither grass nor rotation energy forest are grown on a large scale. Flax is a traditional crop in Lithuania, with 9,300 hectares grown in 2002. The annual demand for flax long fibre is about 6000-7000 tonnes and is used in a range of applications: clothing (55%); furniture upholstery (20%); household use (15%) and other technical uses (i.e. packaging materials). Hemp cultivation is forbidden due to the content of psychoactive compounds. Oilseed rape is the largest oil crop in Lithuania with an area of 60,000 hectares in 2002, for vegetable oil and exports. Only a few hundred tonnes were processed domestically for biodiesel, although in 2003 this activity started to develop rapidly and oilseed rape is considered to be an important potential source for non-food raw material. Linseed also has good prospects for development and castor, poppy, safflower, soya, garden cress and mustards have been investigated with positive results, but wider commercial use in the near future is doubtful. Mainly potato starch is produced in Lithuania. The starch industry, with an annual production capacity of 10,000 tonnes, is underused: 2,400 tonnes of dried starch was produced in 2000. More than half of starch production is used in non-food industries (mainly cardboard, paper and textile production). Caraway is a major crop with 4,800 hectares in 2002 and Valerian, Camomile, Calendula and other plant species occupy 250-350 hectares and are used in the pharmaceutical and cosmetics industries.

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BASAN Final Conference

The Baltic Sea Agri-Industrial Network (www.baltic-network.de) identifies ways to integrate tools and skills to set up small-scale production units in the Baltic Sea regions based on locally produced raw materials and other agricultural products. Approximately 60 participants attended the conference that was held on Bornholm in September. The audience was mixed, with national and EU parliamentarians, scientists, industrialists, businessmen and farmers, which led to very lively and engaged discussions over the two days. It became clear that whilst all the regions of the Baltic Sea area face many challenges, the area also has potential to become dynamic and prosperous, due to a surplus of agricultural land, plenty of natural resources and relatively easy access to large markets due to a well developed infrastructure. Biotechnology, IT, agricultural diversification and new uses for agricultural products are key to this, as are entrepreneurs. Together, the regions can fulfil their potential and provide a strong link between old and new Europe. The production of speciality crops and products, including pharmaceuticals, cosmetics, paints, fine chemicals etc., will become an important focus in the future, and solid and liquid biofuels offer great potential for the region.

A strategy for dynamic rural development in the Baltic Sea region

A strategy for initiating new activities in the region was presented, and this includes attracting new investors by making the advantages known (i.e. lower input and transport costs, access to specialised labour etc.) and developing a promotion scheme for the entire Baltic Sea area. This will be part of a '**virtual Baltic Sea agro-industrial campus**'; one entity for entrepreneurs to have their technical and market ideas, and business plans, tested, before contacting investment funds and banks. The campus will consist of four pillars: The "Baltic Sea Agro(bio)-industrial Research network" (a network of existing local Research and Development institutions); a training centre for entrepreneurs (language skills, IT, "entrepreneurial spirit thinking" etc.); a business and market study unit and a technology observatory (scout function).

Surfactants

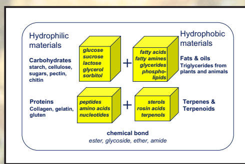
The word surfactant is short for surface active agent. One part of the surfactant molecule is hydrophilic (water loving) and one part is hydrophobic (water hating). The dual nature causes it to form aggregates in water solution and to adsorb to different types of interfaces, i.e. the interface between an oil droplet and water or between a leaf surface and water. The functions of surfactants make them abundant in hygiene products, cosmetics, pharmaceuticals, household and industrial detergents, the oil industry, and paper making. About 60% of the world production of surfactants is used for household detergents, personal care and industrial cleaning.

Natural surfactants

Truly natural surfactants are abundant in nature and are used in much the same way as in technical systems - to overcome solubility problems, act as emulsifiers etc - and they can offer improved surfactant properties, improved biodegradability, lower toxicity and renewability. However, the cost to extract and purify these surfactants usually exceeds the cost to obtain equivalent surfactants through chemical synthesis. There is currently considerable interest to develop fermentation processes with yeast or bacteria to increase the yield and thus decrease the cost of truly natural surfactants. The term natural surfactant is often more broadly used for surfactants where either the hydrophilic or hydrophobic, or both, parts of the surfactant are obtained from a natural source.

The European market in surfactants represents a volume of approximately 2.4 million tonnes, of which around 30% come from plants. The stakes are thus high for a renewable alternative in this sector, and could represent several thousand hectares of crops, as it takes around 60,000 hectares of land to produce 100,000 tonnes of vegetable surfactants. The hydrophilic part can come from co-products of the starch or sugar industries (e.g. sugar beets, derivatives of maize or other grain crops), carbohydrates from cellulose (pectin) or animals (chitin), or proteins (collagen, gelatin, gluten). Surfactants based on carbohydrates have been used for a long time. Surfactants that are produced on an industrial scale are sorbitan esters (®Span, ®Tween, approx. 10,000 tonnes/year), sugar esters (approx. 2,000 t/yr), alkyl polyglucosides (APGs, approx. 60,000 t/yr), and glucamides (approx. 20,000 t/yr). APGs have attracted considerable interest in recent years and show interesting properties such as mildness to the skin and eye and temperature insensitive crystalline phases. Glucamides are commercially important products, for example N-dodecanoyl-N-methylglucamine is used in large amounts for detergency. Amino acid based surfactants have been considered for use in pharmaceutical applications.

The hydrophobic part is most commonly obtained from triglycerides from vegetables or animals. Short C12-C14 hydrophobic alkyl chains are suited for detergent and wetting applications, whereas longer chains are more suitable as emulsifiers, softeners and lubricants. Typically, the hydrophobic part can for example come from oleo-chemical raw materials derived from rapeseed, sunflower, palm, or other plants. Possible raw materials from the wood industry are tall oil fatty acid, terpenes, sterols and rosin acids. A problem with EU-grown oil crops is that they cannot compete as a raw material for short chain surfactants (C12-14) with those derived from tropical oilseeds, e.g. coconut and palm kernel. Consequently, there is a need to find alternative niche markets for these products, such as pesticide adjuvants. The development of new crops such as high lauric rape varieties might increase the competitiveness of EU-grown oil crops.



Raw materials for surfactants

Examples of surfactant research in Europe

SNAP- Centre for Surfactants Based on Natural Products

A joint project between academia, industry and VINNOVA (Agency for Innovation Systems), SNAP aims to increase the understanding, and ultimately the commercial use, of surfactants based on natural products and compare them with commonly used surfactants such as ethoxylated fatty alcohols (http://www.surfchem.kth.se/yki/snap/)

GREENCHEM - Speciality Chemicals from Renewable Resources

Another Swedish joint industry-academia research programme, Greenchem started in summer 2003, financed by the Foundation for Strategic Environmental Research, to use biotechnology (enzyme catalysis) to produce environmentally friendly chemicals (e.g. biosurfactants and epoxides) from renewable resources. (http://www.greenchem.lu.se)

The French AGRICE surfactant R&D programmes
Most of the projects supported by AGRICE (AGRIculture for Chemicals and Energy) pertain to the synthesis of new molecules with improved surfactant properties using environmentally friendly chemical processes. Another portfolio of work supported by AGRICE focuses on the development, simplification and optimisation of chemical and microbiological synthesis of plant surfactants. This research work has led to several commercial developments, in cosmetics, plant protection formulas and drilling fluids for the oil industry. An example is the development of environmentally friendly plant-based emulsifiers for roadway works. The surfactants are designed to control the breakdown of the bitumen emulsion at the desired moment (under the effect of pH and/or temperature), and to improve biodegradability and user safety.

Estonian surfactant based on rape oil
A new, patented surfactant, ANROL has been derived from rape oil. It will be used for washing away graphite from walls, for the cleaning of crude oil cisterns and oil bores etc. A production plant will be built in the near future in Põlvamaa, Estonia. Its turnover is estimated to be 33 million EUR. The main customers are the Russian oil industry and the Saint Petersburgs town Government.

Amphiphilic polymers
Polymeric surfactants are likely to be more extensively used in the future. In many cases these have improved surfactant properties. Natural based amphiphilic polymers can be based on chemical modification of polysaccharides like dextran, cellulose and starch. Examples of research carried out in this field are the Swedish competence centre CAP (Centre for Amphiphilic Polymers, http://www.amphipol.lth.se/) and the Romanian Institute of Macromolecular Chemistry "Petru Poni" (http://www.ichpp.tuiasi.ro/~teia/).

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Eco-Friendly Resin Wins Top Enterprise Award

A pioneering project to develop a high performance eco-friendly adhesive resin has won maximum funding of £50,000 for manufacturer Cambridge Biopolymers in the HGCA Enterprise Award scheme. Derived from oilseed rape, the bioresin could be an alternative to the formaldehyde-based resins used in huge amounts in the building and furniture industries. The bioresin is as strong as high-performance chemical resins but with several ecological advantages: it creates no toxic emissions; the raw material is sustainable and renewable; it is cost effective and the raw materials are widely-grown; its products are recyclable and it is naturally water-resistant.

Dr. Colin Fitchett


Dr. Colin Fitchett with Tony Pike

Dr Colin Fitchett, who has been leading the development, says the Enterprise funding means they will be able to take the project beyond laboratory trials and set up a pilot scale production unit as a step towards full-scale manufacture. "We are already seeing a movement away from resins made with harmful chemicals, particularly in North America," he said. "Bioresins are the way forward, and we think our project will be ready for commercial scale production in time to ride the crest of the wave." Currently 145,000 tonnes of formaldehyde-based phenolic resins are used per year in Western Europe, with a similar amount used in the USA. The company is one of 11 winners of this year's HGCA Enterprise awards, which recognises the cream of the crop of British inventions using grain in new and exciting ways. There's still time for budding entrepreneurs to apply for funding in the next round of the scheme before the closing date for initial entries on December 31. Contact Charlotte Smethurst on 020 7520 3927 or apply online at www.hgca.com/enterprise

For Forthcoming Industrial Crop Events visit www.ienica.net/eventsdiary.htm

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