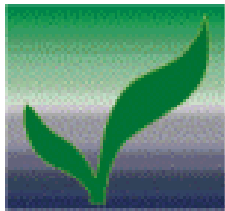


# IENICA

## Non Food Production and Research in Scandinavia

*IENICA is a project funded under the FAIR Programme by DG XII of the European Commission*



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## **Non-food production and research in Scandinavia.**

### General

Agriculture in the Nordic Countries differs very much both between the different countries and within the individual countries.

However the countries have in common a long tradition for efficient farming with good infrastructures and also for the production of added value products.

Scandinavia does also have efficient agroindustries that can process specialty crops.

The climatic conditions vary from arctic to temperate climate.

Although this report does not cover energy applications the development in the energy sector could serve as a bridge for the development of other non-food areas. All three countries have a long tradition in using bio-energy for heating purposes. The taxation of fossil fuels and tax exemption for renewable energy have been a driving force in this respect. There have been a lot of efforts in order to use crops grown on agriculture land or agricultural by-products for this purpose. In Sweden these efforts have mainly been oriented towards short rotation copies (Salix) and energy grass (Reed Canary grass) and in Denmark towards Miscanthus Salix and the utilisation of Straw.

Denmark is a major exporter of agricultural products, and agriculture is one of the main trades in Denmark. In Sweden and Finland agriculture plays a more modest role, and export is limited. In all three countries grass (for hay and silage) and cereals dominate, followed by oilseeds (mainly rapeseed) and potatoes. The farmers are skilled and well organised. The cultivation of wheat and rapeseed is restricted to the southern parts of Finland and the southern and central parts of Sweden. Sugar beets are grown in Denmark and the southern parts of Finland and Sweden. Barley, oats and potatoes can be grown also in the northern part of Sweden and Finland. In Denmark these crops can be produced in all areas.

### Oil crops

The growing of rapeseed has declined during recent years in all three countries. Linseed is grown mainly for demonstration purposes. In the non-food area rapeseed is used for commercial production of hydraulic oils, lubricants, printing inks and in surfactants (as well as a biopropellant (RME) in the energy sector).

Linseed oil has for many years been used for wood protection, especially in Sweden and Finland, and there seems to be a revival of interest for products from

linseed oil in all three countries. All three countries import oilseeds for use in food and non-food industries.

### Fibre crops

The farmers interest for growing flax is increasing mainly due to very favourable EU subsidies.

Small scale industries do exist, however the production is still very modest. The fibres are a. o. used for automotive interior application and production of specialty textiles (Finland and Sweden). Hemp growing is still very limited (in DK and F), and the commercial application is almost non-existing. Growing of hemp is not allowed in Sweden.

### Canary reed grass

Institutions in all three countries are involved in an EU project on reed canary grass. (1995-1998)

Reed canary grass grows well in a cool climate, and the research so far has shown that the fibres can be used for production of pulp and paper. They have the same quality as birch fibres and the yield pr. ha is twice that of birch.

There is a lack of hardwood fibres in Scandinavia, and birch wood is e.g. imported in large amounts from Russia.

### Carbohydrate crops

#### *Cereals*

The main crop in all three countries are cereals, however cereals are only to a limited extend used for non-food purposes in Sweden and Denmark. Neither Sweden nor Denmark produces cereal derived starch for non-food purposes. (Sweden produces 15.000 tons of starch per year from cereals for the food industry).

In Finland starch is produced from barley, which is rather extraordinary. The growth conditions in the northern part of Finland seem to be very well suited for barley, and very high starch contents can be obtained. More than 270.000 tons of barley is used for non-food purposes in Finland.

#### *Potatoes*

All three countries have potato starch factories, however the quota system for potato starch limits the production considerably. The potato starch (natural and

derivatives) is mainly used in the large paper industry in Sweden and Finland. Also a major part of the Danish produced potato starch is used in paper production.

### *Sugar beets*

Sugar beets are grown and processed in all three countries however the application for non-food purposes is very limited.

### Specialty crops

The cool Nordic climate seems to be favourable for some plants containing molecules with medicinal effects. In Finland thus medicinal plants and herbal seed spice species are grown on about 2.000 hectares. In Sweden major pharmaceutical industries are involved in specialty crop research. In Denmark the industrial interest still is limited.

### Arctic Farming

Parts of Finland, Sweden and Norway together with the Faroe Islands, Iceland and Greenland constitute the "Circumpolar areas".

The Circumpolar areas hold about 50% of the land in Sweden and Finland, but only approximately 15% of the population and a very limited area of agriculture land. The climate in these areas is severe and the weather unpredictable. Together with a short growing season this makes farming in these areas very difficult.

On the other hand there are also some advantages such as good light condition and an extremely long "daylight" during the summer period. To this can be added that plant diseases and pests are more rare in these areas than in warmer climates.

(The above is based on a proposal from the Nordic Joint Committee for Agricultural Research" on agricultural research in Circumpolar areas).

The slow growth might favour the formation of secondary plant metabolites (e.g. in lupins in Iceland) indicating that this climate might be suited for production of specialty crops with contents of biological active materials. It is well known that e.g. the aromatic quality of berries from these areas is superior to those from temperate climates.

### Nordic Research Cooperation

There is a long tradition for research cooperation between the Scandinavian countries.

NKJ (Nordic Joint Committee for agricultural) was created some 30 years ago and is a coordination unit for the Nordic Science Councils within agriculture.

NKJ can financially support specific research projects - including non-food research-creation of networks, exploratory research etc.

In 1996 NKJ organized a workshop on "Plant based specialty products". As a result of the conference was established two networks:

NORBASC (Nordic research on Biologically active Secondary compounds) and Nordic Starch network. (Holds a Nordic conference on starch once a year).

In 1995 the Nordic Forestry, Veterinary and Agricultural University (NOVA university) was established. It is a "university without walls" with participation from 7 Nordic universities. The general purpose of establishing NOVA is to increase range and quality of Nordic education and research by means of cooperation projects. Non-food research is included.

In 1996, "NKJ" issued a report on the non-food research in the Nordic Countries.

It was shown that the overall reasons for funding non-food research were the same in all three countries, namely:

- Agriculture political reasons - New income for farmers, decreased over-production.
- Environmental: production - product
- Development of rural areas.

In Finland and Sweden also employment and export consideration, were important.

The main research competence areas are distributed among the countries as listed below:

	DK	S	SF
Plant breeding	+	+	+
Bioenergy	+	+	
Industrial products from veg. oil	+	+	
Cellulose and paper		+	+
Building materials and textiles	+	+	
Biodiesel		+	+
Bioethanol		+	
Biopolymers	+	+	+

Phytochemicals		+	+
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In Denmark the major part of the non-food research is performed in research institutes and only a few of the large industrial companies are involved. In Finland and Sweden, however, a number of the larger companies are also involved in non-food research.

### Constraints

The cold and often wet climate in the Scandinavian countries limits the number of crops that can be grown, and especially the climate in the northern part of Sweden and Finland reduces the crop yield.

In all three countries many institutions are involved in non-food research, the work is not co-ordinated and thus the results are not utilised optimally.

An R&D co-ordination centre in renewable raw materials might be needed. Many attempts have been made to start up new non-food productions, but often they have not succeeded due to lack of scale of volume. Venture capital is very much needed.