

# IENICA

## **Interactive European Network for Industrial Crops and their Applications**

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XII of the European Commission**

## **REPORT FROM THE STATE OF GERMANY**

### **Update Report December 2003**



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## ACKNOWLEDGEMENT

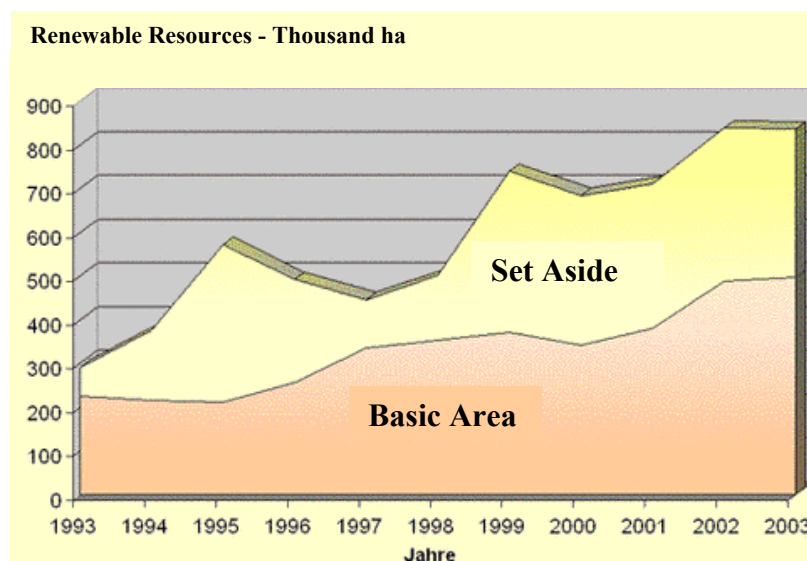
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## EXECUTIVE SUMMARY

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Renewable resources can be grown on set-aside or basic areas. The area of renewable resources has increased from 200,000 ha in 1992 to 846,606 hectares in 2003, 338,047 ha of which (approximately 40%) is on set-aside land (BMVEL). Compared with an agricultural area of 11,831,600 ha, renewable resources make a reasonable share of 8% of the arable land in Germany. This means that the area has tripled since the gathering of statistical data in 1993.



Source: FNR 2003

Wood is quantitatively the most important industrial raw material. Only 40 million m<sup>3</sup> of the 58 million m<sup>3</sup> growth is harvested. Rapeseed, though, is the most important agricultural crop. According to estimations approximately 650,000 ha of rapeseed is now used for the production of biodiesel, in the oleochemical industry and in the production of lubricants and hydraulic fluids. Further economically important materials are starch, sunflower and flax oil, sugar, fibres and remedies (FNR, 2002). The table below shows the full scale from 2001 to 2003.

Hectares	2001		2002		2003	
	Basic Area	Set Aside	Basic Area	Set Aside	Basic Area	Set Aside
Starch	125,000		125,000		125,000	
Sugar	7,000		7,000		7,000	
Rapeseed Oil	190,000	322,698	320,000	342,171	340,000	328,753
Sunflower Oil	20,000	4,874	20,000	3,983	15,000	3,185
Flax Oil	31,840	385	9,520	258	5,000	365
Fibre Plants	2,000	18	2,000		2,928	

Remedies	4,000	747	4,000	388	4,000	693
Others		2,765		3,960		5,051
Sum	379,840	331,488	487,520	350,760	497,500	338,047
<b>TOTAL</b>	<b>711,328</b>		<b>838,280</b>		<b>835,547</b>	

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Source: BMVEL 2003

There are several activities of the BMVEL to support and promote the application of products made of and from renewable resources. This includes funding for a wide range of research activities as well as market introduction programmes for plant oil and fibre products.

# OIL CROPS

## Crop Production

**Table 1 – Oil crop areas and oil yield - non-food only**

	<b>Basic Area (ha)</b>	<b>Set-Aside (ha)</b>	<b>Oil Yield (dt/ha)</b>
Rapeseed	340,000	328,753	28*
Sunflower Oil	15,000	3,185	22*
Flax Oil	5,000	365	14*

*Source: BMVEL 2003, \*BLE 2003*

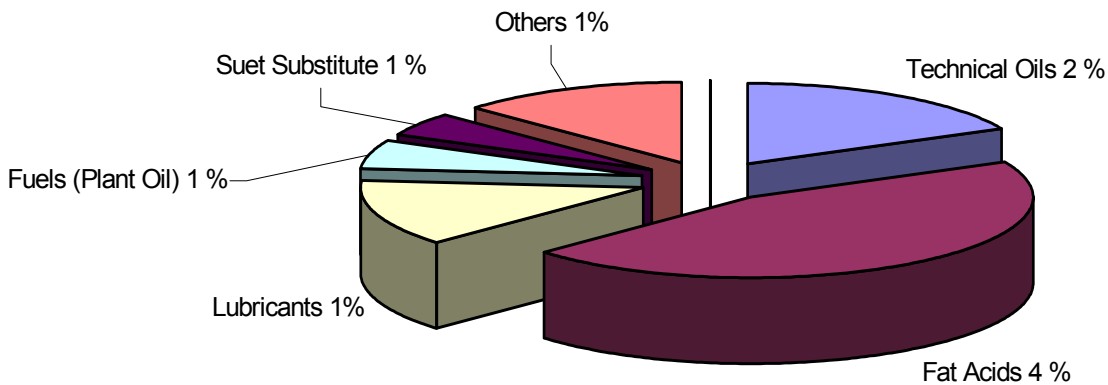
## Industrial Applications

Long-chain acid molecules offer a large number of applications for chemical-technical transformation. About 1.2 million tonnes of lubricants are used annually in Germany; 60% are industrial lubricants and 40% are used in automobiles (e.g. cars, agricultural and building machines). Machines in the forestry or landscaping sector have a high potential environmental impact due to leakages and torn hoses.

By means of the support from the BMVEL and the FNR, many research institutes and the oil processing industry work on the conversion of vegetable oil to high-grade lubricants to use them in these sensitive areas. More than 200 different lubricants such as chainsaw oils, hydraulic fluids and cooling lubricants are available on the market. In spite of many advantages, biolubricants are three to five times more expensive than mineral oils. This explains why the market share of the products of plant origin is only about 40,000 tonnes, which is 3.4% of the total use of lubricants and hydraulic fluids. To increase this percentage, a market introduction programme for users in environmentally sensitive areas was introduced in 2001. Today, nearly 2000 entrepreneurs have been supported to convert their machines.

Rapeseed is grown on 668,753 ha with 328,753 ha on set-aside land (approximately 49%). It is the most important oil plant in Germany. About 90% of the oil goes into the production of RME and 10% is used for other purposes, which are shown below.

## 10% of Rapeseed Oil, 2003

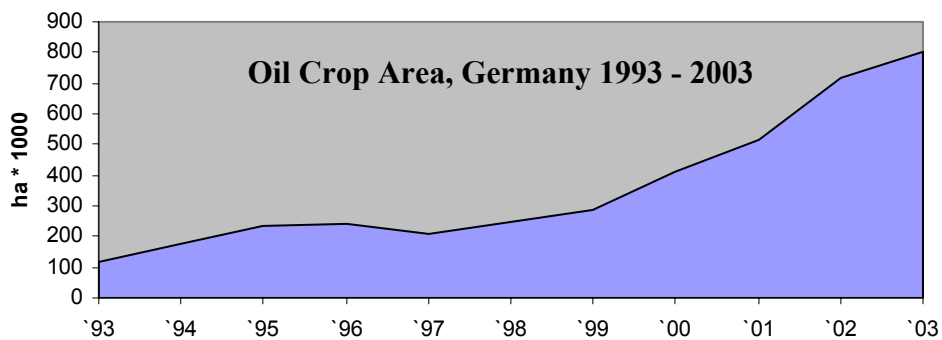


Source: BLE, 2003

In other words, 650,000 tonnes are used for biodiesel, 110,000 tonnes in oleochemistry and 45,000 tonnes for lubricants.

## Generic Issues

The graph below shows the development of the oil crop area from 1993 to 2003.



Source: FNR

The quality of oil can be influenced by the controlled growing of established plants; that makes it possible to meet the quality criteria for raw materials made by industry. In oil mills, oilseeds are pressed and extracted in order to gain vegetable crude oil. During the processing operations which follow, the crude oil is refined. Ultimately, the content of the existing oil crops in Germany are sufficient for the production of lubricants, hydraulic fluids, lacquers, paints, linoleum as well as additives and accessory materials.

# FIBRE CROPS

## Crop Production

**Table 2 – Fibre crop areas, production and fibre yield, 2003**

	<b>Area (ha)</b>	<b>Fibres (tonnes)</b>	<b>Straw Yield (t/ha)</b>	<b>Fibre Yield (t/ha)</b>
Flax	225	570	7.83*	2.53*
Hemp	2,700	8,830	9.6*	3.27*
Nettle	3	3.3	6.53*	1.12*

*Source: BMVEL, \*von Francken-Weltz; 2003*

## Industrial Applications

The application of fibres depends on their technical characteristics. Plant fibres are a safe substitute for glass, asbestos and plastic fibres. Building materials and moulded parts like the interior lining of cars as well as coatings, special paper (e.g. banknotes), fleeces, textiles, insulation material and filters are products which can be made with vegetable fibres. There are three favoured production lines for hemp and flax fibres in Germany.

## Natural Fibre Composites

This is a promising market for short fibres. Natural fibres combine high mechanical strength and stiffness with low weight and this makes them interesting for the automotive sector, which seeks to reduce vehicle weight without reducing the safety. A lot of research and development has been carried out in recent years and the materials have proved to be applicable in the automotive and building industries. 80% of natural fibres are used in the automotive industry. In 2003 about 50,000 tonnes of natural fibres had been used in this sector (Gassan, 2003). Potential figures, especially in the automotive sector, vary from 4 million up to 18 million tonnes per year.

## Insulation Materials

The market share of insulation material made of renewable resources is about 4% of the total size of the industry which is 29 million m<sup>3</sup> per year. Thermal and sound insulation has to meet the DIN standards (German Industry Norm), which includes fire safety and conductivity. To significantly increase the market size of these materials the Ministry of Consumer Protection set up a market introduction programme, running until 2004.

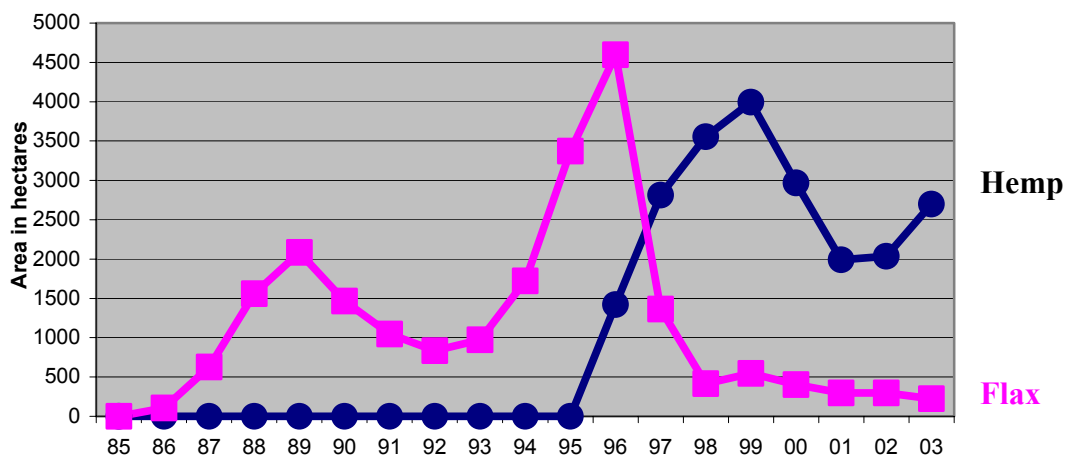
## Pulp Sector

This market will remain the most important for the traditional flax and hemp short fibre industry. In 2000 about 45% of the flax and 87% of the hemp short fibres in the EU were used in this sector.

## Generic Issues

Because of the climatic conditions, the growing of fibre plants is limited to flax, hemp and nettle. Until 1996 the drug law prohibited the cultivation of hemp and cultivation has started only recently. Flax is an old cultivated plant; flax production had its peak in 1996. One reason for the decline is probably the poorly developed processing industry. There is only one plant for long- and one for short-fibre processing. The following graph shows the development of fibre plant cultivation from 1985 to 2003. Most of the fibres are imported from Benelux and Eastern Europe.

**Flax and Hemp in Germany 1985 to 2003**  
Source: BMVEL/BLE 2003



Source: Nova Institute

# CARBOHYDRATE CROPS

## Crop Production

**Table 3 – Carbohydrate crop areas, production and starch yield, 2003**

	<b>Area (hectares)</b>	<b>Plant Yield (million tonnes)</b>	<b>Starch Yield (million tonnes)</b>
Potatoes	**	2.9	0.64
Maize	imported	0.6	0.38
Wheat	**	0.9	0.48
<b>TOTAL</b>	125,000	4.4	1.5

	<b>Area (hectares)</b>	<b>Plant Yield (t/ha)</b>	<b>Sugar Yield (t/ha)</b>
Sugar Beet*	7000	60	8.9

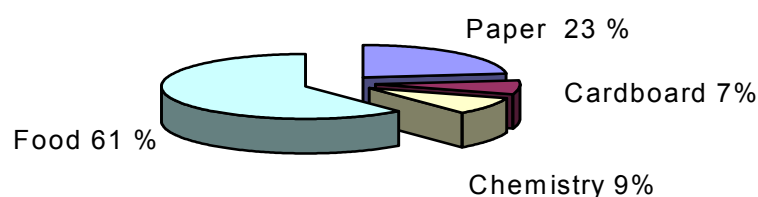
Source: Fachverband der Stärkeindustrie e.V. 2002 \*Source: BLE 2003

\*\*There are no specific figures for starch potatoes or starch wheat. The average yield for potatoes differs annually between 350 and 440 dt/ha, the starch yield between 65 and 80 dt/ha (Statistisches Jahrbuch für Ernährung, 2002). So an area for these crops can be roughly calculated.

## Industrial Applications

Starch is used in three applications. About 0.45 million tonnes (28%) are native starches, 0.3 million tonnes (19%) are modified starches and 0.85 million tonnes (53%) are used as different sugar products like glucose or dextrose.

The following graph shows the application in the industrial sectors



Source: Fachverband der Stärkeindustrie, 2002

The variety of non-food products based on sugar ranges from washing powder, biodegradable plastics and cosmetics to medicaments, alcohol as well as additives and accessory materials. Starch is used for the production of biodegradable materials and glue as well as additives and accessory materials. Additionally, the liquefaction and fermentation of starch for the production of alcohol (ethanol) plays an important part.

### **Generic Issues**

Starch in the EU is mainly made from maize, wheat and potatoes. Only wheat and potatoes are relevant in Germany. More than 20 million tonnes of starch plants are processed annually; 4.4 million tonnes in Germany. Currently, 8 companies with 15 production sites process 1.5 million tonnes of starch in Germany. About 100,000 tonnes of starch is imported. About 2,200 people work in the industry, which turned over €1.1 billion in 2001. (Fachverband der Stärkeindustrie e.V. 2002)

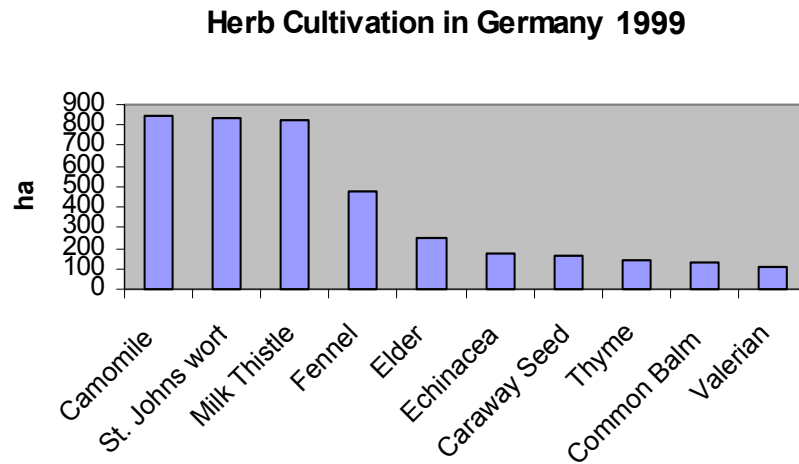
Sugar belongs to the group of carbohydrates. In Germany, exclusively sugar beet is used for the production of sugar. Most of it goes into the food industry. The processing of sugar beet is realised in sugar mills, where they are cleaned, washed and finally shredded.

Starch is one of the most important vegetable reserves. Once harvested, these plants are chopped up and grinded in starch mills. Finally, starch is achieved by the elutriation of the processed material.

# SPECIALITY CROPS

## Crop Production

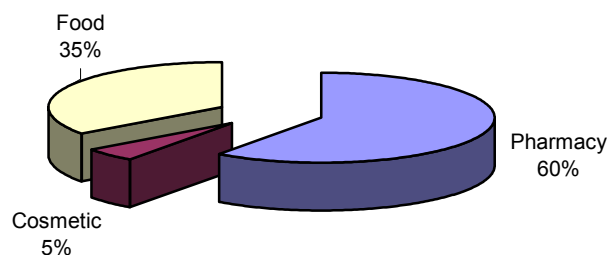
In general, statistics in this area pose segregation problems. Some studies include flax cultures for food applications; some involve fennel. The figures in the following graph apply to the graph below.



Source: FAH, 2002

## Industrial Applications

Germany covers only 5-10% of the demand through domestic cultivation (Kupke, 1999). Currently remedy and spice plants go into three sectors:



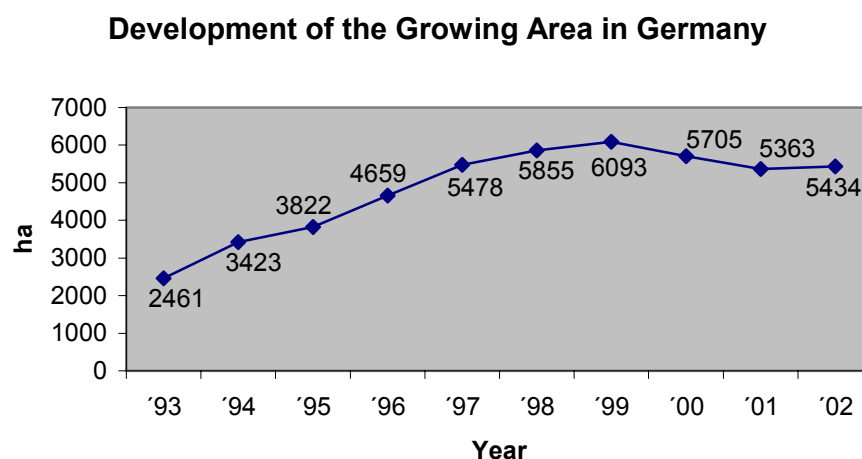
Source: FAH, 2002

## Generic Issues

Since the beginning of the 1990's the worldwide turnover of herbal medicines and food complements has increased from US \$12.4 billion in 1994 to US \$20.3 billion in 2003. Even

though the increase has slowed during recent years, it is still a growing market, which is due to a shift in health and nutrition awareness.

Europe and Germany hold the leading share with US \$7 billion and US \$2.6 billion respectively (Grünwald, 2003). About 30% of the prescription free remedies in Germany are herbal medicines (Galizia, 2003).



*Source: Statistisches Bundesamt Deutschland*

About 100 of the 400 species occurring in Europe can be found in Germany. According to FNR (2002), 15 species dominate 82% of the cultivation area.

The imported amounts of herbs and drugs has increased by a third since the 1970's. The major states of origin are India (spices), Egypt, the EU Countries, Hungary and Bulgaria. The market in Germany has been stable at a level of some 5,000 hectares. This is due to saturation, because too many similar products are on the market. The EU Traditional Herbal Medicine Guideline offers good chances to launch new herbal products and generate growth in the next 2–3 years (Galizia, 2003).

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