

IENICA

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

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REPORT FROM THE STATE OF POLAND



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METHODOLOGY

This report aims at gathering full information about non-food uses of agricultural crops in Poland. Up to now, the industrial crops and their non-food applications have not been monitored in the same good manner as food agricultural crops and products. It is important to underline that now the system of agricultural production as well as industrial exists in Poland including their effects and yields.

The market of agricultural raw materials and products in Poland is monitored by the Central Statistical Office (CSO)–GUS Główny Urząd Statystyczny in Warsaw, which edits the results of analysis in i.e. the Statistical Yearbook of the Republic of Poland.

The Agricultural Market Agency undertakes and elaborates the quarterly prognosis regarding the purchasing prices of cereals, milk and meat on relevant markets. Additionally, once a month, Agency publishes the bulletins, which contain the set of information about its activities, legislation and the situation on agricultural markets.

The results of monitoring and research are published in the special publications of the Institute of Agriculture and Food Economy — in reports, which describe the situation and perspectives of the basis markets (e.g. ‘The Potato market’; ‘The Sugar market’; ‘The Cereals market’; ‘The Oilseed Rape market’). The Ministry of Agriculture and Rural Development supervises both – the Agency and the Institute.

The following are the institutions, organisations and associations connected with the functioning of the industrial crops market in Poland:

- Ministry of Agriculture and Rural Development
- Ministry of Economy, Labour and Social Policy
- In scope of oil crops: Krajowe Zrzeszenie Producentów Rzepaku (Association of Oilseed Rape Producers), Opole.
- In the scope of fibre crops: Institute of Natural Fibres, Poznań, Polska Izba Lnu i Konopi (Polish Flax and Hemp Chamber), Zrzeszenie Producentów Krajowych Włókien Naturalnych (The Association of Natural Fibres Producers), Lublin

- In the scope of starch potatoes: Centralne Laboratorium Przemysłu Ziemniaczanego, Luboń (Starch and Potato Products Research Laboratory), Stowarzyszenie Producentów Skrobi Ziemniaczanej (The Association of Potato Starch Producers), Luboń near Poznań; Krajowy Związek Stowarzyszeń Producentów Ziemniaków Skrobiowych w Polsce, Luboń (Polish Union of the Associations of Starch Potato Producers in Poland), Luboń; Polska Grupa Producentów Skrobi Ziemniaczanej i Modyfikatorów, Lomża (Polish Group of Potato Starch and Producers and Modifiers in Lomża).
- In the scope of medicinal plants: The Research Institute of Medicinal Plants (IRiPZ), Poznań, Poland and the Polish Committee of Medicinal Plants, Office of the Main Board at the IRiPZ, Poznań
- In the scope of willow: Wielkopolskie Zrzeszenie Plantatorów Wikliny (The Association of the willow producers of Great Poland)
- Ośrodki Doradztwa Rolniczego — ODR system (Agriculture Advisory Centers) — farmers are advised and assisted by this system in comprehensive way (<http://www.odr.net.pl>)

Centralny Ośrodek Badania Odmian Roslin Uprawnych (Coboru — Research Centre For Cultivar Testing), Słupia Wielka (wielkopolskie district) (<http://www.coboru.pl>).

The COBORU is responsible for the complex elaboration and maintenance of official Register of Varieties (RO), enrolling the varieties into this Register, co-operating with domestic and foreign institutions involved in the registration and providing the variety authors rights protection, granting the breeders the exclusive rights for their varieties.

The Institute of Natural Fibres contacted and consulted the above mentioned institutions, organisations, research institutes, SME and processors involved in the industrial crops activities while preparing this report.

LEGISLATION

In connection with the accession of Poland to the European Union, the complex work has been conducted to adjust the Polish legislation to the juridical regulations and acts of the EU, regarding, among others, the issues connected in this report.

The major legislation acts and regulations in the scope of industrial crops and described agricultural markets, in force in Poland are as follows: (note: the regulations enforced in Poland appear in the official journal of acts, called: *Dziennik Ustaw* (Journal of Laws). The officially used title abbreviation of this register is: Dz.U.)

- Ustawa z dnia 24 listopada 1995 r. o nasiennictwie, tekst jednolity (Dz.U. z 2001 r., Nr 53, poz.563). Law of 24 November 1995 on seed production, consolidated text (Journal of Laws of 2001 No. 53, item 563)
- Zarządzenie nr 2 Dyrektora COBORU z dnia 10 marca 2002 r. w sprawie zgłaszania odmian do rejestru odmian roślin uprawnych lub o przyznanie wyłącznego prawa hodowcy do jego odmiany oraz urzędowego badania odmian (*Diariusz COBORU Nr 1a (47) 2002*). COBORU Director Decree No. 2 of 10 March 2002 on the submission of agricultural plants varieties to the register of varieties or on awarding the exclusive breeders' right to his variety and official examining varieties
- Ustawa z dnia 12 lipca 1995 r. o ochronie roślin uprawnych (Dz. U. z 2002 r. Nr 171, poz. 1398, z pozn. zm.). Law of 12 July 1995 on the protection of arable crops (Journal of Laws of 2002 No. 171, item 1398, with subsequent amendments)
- Ustawa z dnia 26 lipca 2000 r. o nawozach i nawożeniu (Dz. U. 89, poz.991). Law of 26 July 2000 on fertilisers and fertilisation (Journal of Laws of 2000 No. 89, item 991)
- Ustawa z dnia 20 grudnia 2002 r. o organizacji niektórych rynków rolnych (Dz. U. Nr 240, poz. 2059). Law of 20 December 2002 on the organisation of certain agricultural markets (Journal of Laws of 2002 No. 240, item 2059)

- Ustawa z dnia 18 grudnia 2003 r. o płatnościach bezpośrednich do gruntów ornych (Dz.U. Nr 6, poz. 40). Law of 18 December 2003 on direct payments to the arable land (Journal of Laws of 2004 No. 6, item 40)
- Ustawa z dnia 11 stycznia 2001 r. o regulacji rynku skrobi ziemniaczanej (Dz.U. Nr 11, poz. 83). Law of 11 January 2001 on the regulation of potato starch market (Journal of Laws of 2001 No. 11, item 83)
- Ustawa z dnia 11 marca 2004 r. o Agencji Rynku Rolnego i organizacji niektórych rynków rolnych (Dz. U. Nr 42, poz. 386). Law of 11 March 2004 on Agricultural Market Agency and organisation of certain agricultural markets (Journal of Laws of 2004 No. 42, item 386)
- Ustawa z dnia 2 października 2003 roku o biokomponentach stosowanych w paliwach ciekłych i biopaliwach ciekłych (Dz.U. Nr 199, poz.1934). Law of 2 October 2003 on biocomponents applicable in liquid fuels and liquid biofuels (Journal of Laws of 2003 No. 199, item 1934)
- Ustawa z dnia 23 stycznia 2004 r o systemie monitorowania i kontrolowania jakości paliw ciekłych i biopaliw ciekłych, weszła w życie 28 marca 2004 r. (Dz. U. Nr 34, poz. 293). Law of 23 January 2004 on the monitoring and controlling system of quality of liquid fuels and liquid biofuels, entered into force on 28 March 2004 (Journal of Laws of 2004 No. 34, item 293)
- Ustawa z dnia z 10 kwietnia 1997 r. Prawo energetyczne. Tekst jednolity z 2003 r. (Dz. U. Nr 153, poz. 1504). Law of 10 April 1997. Energy Law Act. Consolidated text: 2003. (Journal of Laws of 1997 No. 153, item 1504)
- Rozporządzenie Ministra Gospodarki z dnia 30 maja 2003 r. w sprawie szczegółowego zakresu obowiązku zakupu energii elektrycznej i ciepła z odnawialnych źródeł energii oraz energii elektrycznej wytwarzanej w skojarzeniu z wytwarzaniem ciepła. Economy Minister Regulation of 30 May 2003 on detailed scope of the acquisition of obligation of electrical energy and heat from renewable energy sources and electrical energy produced in conjunction with heat production

EXECUTIVE SUMMARY

This report is divided into four parts – oil crops, fibre crops, carbohydrate crops and crops for special uses.

I. Oil Crops

1. Oilseed rape

The main oil crop grown in Poland is oilseed rape (*Brassica napus L.*). The potential cultivation area of oilseed rape in Poland is approximately 2 million hectares. In 2001, the acreage of oilseed rape in Poland was 443,200 ha; in 2002 it was 439,040 ha and in 2003 about 426,000 ha (decreasing tendency). The cultivation of oilseed rape is carried out on about 30,000 of the 2 million farms in Poland. The average yields of oilseed rape seed in 2000 were 2.19 t/ha; in 2001 it was 2.40 t/ha; 2.17 t/ha in 2002 and about 1.86 t/ha in 2003. The total harvested amount of oilseed rape seed in 2000-2003 were 958,100 tonnes; 1,063,600 tonnes, 952,700 tonnes and about 793,000 tonnes, respectively (Annex 2, Table 10).

Since 1990 farmers have been growing only so called twice improved ("00") cultivars containing low amounts of erucic acid and glucosinolans. This makes the oil and the cake the fully usable food and fodder products. The quality requirements for twice improved cultivars of oilseed rape meet the EU standards and are even stricter regarding the content of glucosinolans, which reflects a high quality of Polish oilseed rape cake.

The non-food applications of oilseed rape currently are marginal and include production of biofuel (more in I.1.i Oilseed rape (*Brassica napus L.*). Some amounts of oilseed rape are mixed with linseed oil in production of alkyd resins.

2. Oil flax

Oil flax (*Linum ussitatissimum var. oleifera L.*) is a marginal crop in Poland. The total area of (oil flax) linseed in Poland in 2002 was 622 ha and 740 ha in 2003 [CSO]. The INF conducts research on the application of linseed in food and pharmacy. The results of this research are implemented in practice: the INF processes ca 600 tonnes of linseed per year into the following

products: 360 tonnes of cold pressed oil of which 50 tonnes are applied as pharmaceuticals (treatment of alimentary canal disorders), 36 tonnes for food applications and the rest as an additive for fodder. Additionally the linseed oil is used in production of paints and varnishes (a whole oil used for this purpose is imported)

II. Fibre Crops

Among fibre crops grown in industrial scale in Poland are two species: fibre flax (*Linum usitatissimum L.*) and hemp (*Cannabis sativa L.*). Once grown at a large scale in Poland today these raw materials face a strong competition from cheap cotton and man-made fibres and hence they lost their importance. Recently this situation has somewhat improved, especially for flax production. Hemp still remains a marginal crop in Poland used mainly for technical applications. Flax and hemp are mainly used in Poland in products applied in textile, construction and automotive industry.

Flax products:

- short fibre (tow and noils)
- long fibre
- flax sliver
- carded 100% and blended yarns
- combed dry- and wet-spun 100% linen yarns
- woven and knitted fabrics
- non-woven

Hemp products:

- blended cotton/hemp yarns from 50 to 120 tex, blended yarns with lycra, technical yarns (twine) and ropes
- woven and knitted clothing fabrics
- composite materials
- technical textiles
- non woven

The research conducted at the INF cover also application of essential oils contained in large amounts in hemp. The essential oils can be used in cosmetic industry (soap, lotion, cream, shampoo and perfume production) and in aromatherapy, also in wood and bibliographical resources protection.

III. Carbohydrate Crops

Among Polish crops, the major source of carbohydrates are potato, cereals and sugar beet. Those crops are utilised in food industry as well as for non-food purposes.

1. Potato

The potato cultivation area in 2001 was 1.19 million hectares, in 2002 803,000 ha, while in 2003 it decreased to 765,000 ha. The total production of potatoes (harvest) in 2001 was 19,379 million tonnes, 15,524 million tonnes in 2002 and in 2003 decreased to 13,493 million tonnes. 99% of Polish starch is obtained from potato. The production of starch and spirit in 2001/02 was 130,000 and 150,000 tonnes, respectively. The total sales of potatoes for industrial use (thousand t) was in 1999/00: 908; in 2000/01: 1,635; in 2001/02: 1,375 and in 2002/03: 1,830 tonnes [CSO].

The development of industrial uses of potato starch is supported by a special law of 11 January 2001 on the regulation of potato starch market (Journal of Laws of 2001 No. 11, item 83), which was enforced on March 1, 2001. This act introduced the system of production limits; the system of subsidies to starch potato and potato starch production; subsidies to companies which utilise starch for non-food purposes, as well as subsidies to starch export. The law regulations of starch market in Poland are based on the legislation of European Union.

There are two major areas of application of potato starch: ethyl alcohol production and the production of auxiliary substances useful in the following industries: pulp and paper, cardboard production, pharmaceutical, textile, foundry, drilling industry, glue production, starch used for packaging, lubricants, water absorbent, laundry starch applied in housekeeping to stiffen (starch) linen bedclothes, curtains etc.

2. Cereals

The industrial utilisation of cereals in 2000 was 948,000 tonnes, and in the season 2002/2003 increased to 1,161,000 tonnes. The structure of industrial utilisation of cereals is shown in the table below.

Table 1. The industrial utilisation of cereals in the season 2002/2003

Crop (application area)	Amount ('000 tonnes)
Rye (alcohol)	440
Barley (brewery)	500
Wheat (starch)	210

Source: Cereals Market, 2003

3. Sugar beet

The production of sugar beet in the season 2001/02 was carried out on 318,000 hectares, while in 2002 on 303,000 ha [CSO]. The non-food applications utilised about 45,000 tonnes of sugar, which cover the needs of pharmaceutical and chemical industries and sugar applied for fodder production.

IV. Crops for specialist uses

Medicinal plants are applied in Poland for the production of herbal medicinal products, herbal teas, condiments and cosmetics, also in aromatherapy and as active substances in natural plant protection products.

INTRODUCTION

The production of renewable raw materials has a long lasting tradition in agriculture. Beside food, such raw materials have been used for ages for craft and later for industry and energy production. In the 20th century, renewable raw materials lost some of their importance due to the use of fossil energy carriers and the production of petrochemical products. The renaissance of the interest in renewable raw materials is observed since last decade of XX century, due to: growing, strong impact of environmental consciousness, the possibility to extend the limited fossil resources. Renewable raw material eases surplus food markets and opens up production and income alternatives to the agriculture. The reveals of Institute of Natural Fibres prove that it is possible to remediate the land, polluted by heavy metals through the cultivation of industrial crops, such as flax or hemp.

The report includes information on industrial application of agricultural crops. Both industrial crops and non-food uses of food crops are included.

There was 13,666,000 ha of arable land in Poland in 2001, while in 2002 this area decreased to 13,067,000 ha. In 2001, 10,815,000 hectares were sown with major agricultural crops for food and industrial application, and a stronger tendency is observed in case of industrial crops. In 2002 industrial crops occupied 7.2% of that area, out of which almost 40% was sugar beet, major cereals 61.1% while potato 7.5 % [CSO]

The structure of sown crops is presented in the following table.

Table 2. Sown crops area in Poland ('000 ha)

Crops	1995	2000	2001	2002	1995	2000	2001	2002
	Total				of which private farms			
TOTAL	12892	12408	12386	10764	11220	11081	11118	9651
Cereals	8571	8814	8820	8294	7538	7905	7952	7523
basic cereals	7118	7122	7070	6574	6133	6307	6310	5907
wheat	2407	2635	2627	2414	1985	2178	2201	2040
winter	1843	1947	1994	1961	1472	1552	1608	1624
spring	564	688	633	453	513	626	593	416
rye	2452	2130	2002	1560	2219	2025	1904	1478
barley	1048	1096	1071	1051	857	962	955	937
winter	187	137	162	178	122	102	122	148
spring	861	959	909	873	735	860	833	789
oats	595	566	531	605	536	529	498	577
triticale	616	695	839	944	536	613	752	875
cereal mixed for grain	1366	1478	1471	1365	1338	1459	1458	1352
buckwheat and millet	39	62	55	36	38	57	51	34
maize for grain	48	152	224	319	29	82	133	230
Pulses	148	141	109	100	98	122	95	88
edible	48	49	46	45	38	43	41	42
feed	100	92	63	55	60	79	54	46
Potatoes	1522	1251	1194	803	1503	1233	1180	790
Industrial	1055	809	801	775	699	560	557	56
of which:								
-sugar beets	384	333	318	303	336	281	267	254
-oil-bearing	634	452	461	452	328	255	268	294
of which rape and agrimony	606	437	443	439	311	244	253	284
fibrous	14	4.2	5.4	5.2	13	3.8	5.1	5.0
of which flax	14	4.1	5.2	5.1	13	3.7	4.9	4.9
tobacco	19	14	13	10	18	14	13	10
hop	2.3	1.9	2.0	2.2	1.9	1.8	1.8	2.1
Feed	1087	913	898	492	918	805	796	402
of which:								
root plants	143	126	113	51	140	126	113	50
perennial legumes	441	328	318	69	394	299	290	50
maize for feeds	133	162	180	196	63	106	122	142
Other crops	509	480	564	300	464	456	538	281
of which field vegetables	279	248	240	171	269	242	234	166

Source: Statistical Yearbook of the Republic of Poland. CSO. 2003. Year LXIII. Warsaw. p. 221

I OIL CROPS

1 Opportunities

1.1 Science and Technology

1.1.i Oilseed rape (*Brassica napus L.*)

There is one major oil crop grown in Poland – oilseed rape (*Brassica napus L.*). Oilseed rape is grown mainly as winter crop. The spring form of oilseed rape is not popular due to higher water requirements and high competition from spring cereals and sugar beet. However, in northern and southern parts of Poland it is grown, especially when winter oilseed rape is destroyed by frosts.

In sowing seed production and cultivar registration – the Polish legislation – the act issued 24 November 1995 about sowing seed production – includes the guidelines of Directive 70/457. Following this act:

- The Centralny Ośrodek Badan Odmian Roslin Uprawnych (COBORU – Research Centre for Cultivar Testing) keeps the domestic catalogue called the Register of Varieties including annually verified and published list of cultivars of cultivated crops.
- The certified sowing material is produced and the evaluation and control of sowing materials is conducted (by Inspekcja Ochrony Roslin i Nasiennictwa – Crop Protection and Seed Management Inspection).

Only twice improved cultivars of winter and spring oilseed rape are grown in Poland. Polish requirements for the glucosinolans and erucic acid are far stricter from those in force in the EU. This is a result of the high importance of oilseed cake as a high-protein component of fodder in Poland.

The 2003 official COBORU list of oilseed rape cultivars grown in Poland included:

Winter oilseed rape: Batory, Bazyl, Gara, Kana, Kaszub, Lubusz, Marita, Mazur, Pomorzanie

Spring oilseed rape: Margo

The available cultivation and harvesting technologies are well adjusted and efficient.

Harvesting can be done by two methods: one- and two-stage. One-stage harvesting is especially suitable for the industrial crop – for oil production. In this technology the crop is harvested with a cereal harvester and initially cleaned. The farmer must clean and dry the seeds if they are to be purchased by an oil mill as first class quality.

Two-stage harvesting is used mainly on sowing seed plantations. The plants are mowed in the early maturity stage and left until the seeds reach full maturity. The crop is then ginned with a cereal harvester. There is some risk of losing seeds, due to opening of the oilseed rape capsules, when using this technology.

The production of oilseed rape in Poland generally depends on two factors: natural and economic. The natural factors having a crucial effect on the quality and quantity of yield are snowless winters during which the oilseed rape is destroyed by frosts and droughts in spring and early summer, which can decrease the yield dramatically. Economically the production of oilseed rape depends on prices for seeds paid to farmer. Polish farmers, until recently, have obtained no subsidies for their production (regarding all crops) and therefore suffered competition from subsidised oilseed rape from the EU and cheaper seed from other countries. The average yield of oilseed rape is 2.1 t/ha. Generally the whole crop is used in the food sector, mainly for vegetable oil and margarine.

Research into oilseed rape focuses mainly on winter hardiness of winter oilseed rape and breeding for yield increases. The over-production of food and increasing prices of mineral fuels has caused growing interest in the production of biofuel from oilseed rape.

The potential cultivation area in Poland is approximately 2 million hectares. In 2001 the oilseed rape in Poland was cultivated on 443,200 ha. In 2002 the acreage of oilseed rape in Poland was only 439,000 ha and in 2003, 426,000 ha (decreasing tendency). The cultivation of oilseed rape is carried out in about 30,000 of the 2 million farms in Poland. The average yields of oilseed rape seed in 2000 were 2.19 t/ha; in 2001, 2.40 t/ha, 2.17 t/ha in 2002 and 1.86 t/ha in 2003. The total harvested amounts of oilseed rape seed in 2000-2003 were 958,100 tonnes; 1,063,600 tonnes; 952,700 tonnes and about 793,000 tonnes respectively (Annex 2, Table 10). Thus there are reserves that might be used for cultivation of oilseed rape for fuel.

It is expected that in 2004 about 6,000 tonnes of esters will be utilised. It is equal to about 6,000 tonnes of oilseed rape oil, applied for fuel. This amount would be probably produced in the second half-year 2004.

As a result of the ordered research project the Polish oilseed rape fuel EPAL for diesel engines was developed at the beginning of the nineties.

As a result, few technologies have been developed; mainly low capacity technologies suitable for supplying big farms. One technology was developed at the Politechnika Radomska [technical university]. The technology was implemented in an agro-refinery at the Experimental Farm in Mochelek of the Akademia Rolniczo-Techniczna in Bydgoszcz [agricultural university]. The construction of the agro-refinery was sponsored by the State Committee for Scientific Research in Warsaw in the scope of research project.

The agro-refinery had a capacity of maximum 500 kg of seeds per hour and operated as a complete line covering processing from seeds to fuel. The fuel was obtained by transesterification of rapeseed oil. The by-product obtained was glycerine, which can find application in cosmetics. The efficiency of the process was about 33%. In 1998 the refinery was closed due to economical reasons.

Also an Instytut Budowy Maszyn Rolniczych in Poznań developed a small-scale technology for oilseed rape fuel production.

Several research centres in Poland, usually with positive results, tested the oilseed rape fuel. For instance: Institute of Aviation in Warsaw (171,000 km with a car on oilseed rape fuel and 1060 miles by yacht); High Military School in Wroclaw (tests with T-72 tank and a land troops transporter BWP-1). Important positive results were lower emissions of CO and HC – by 40%; SO₂; lower emission of solids – by 60% and carcinogenic compounds; no irritation effect of exhaust gases on respiratory tracts and a fuel itself on the skin; virtually total biodegradability after 21 days.

Oilseed rape fuel can be mixed in any proportion with a mineral oil. In Poland there are some companies, with production potential and know-how ready to start the bio-fuel production.

1.1.ii Oil flax (*Linum usitatissimum* var. *oleifera* L.)

A potentially interesting oil crop for non-food applications is oil flax (*Linum usitatissimum* var. *oleifera* L.)

The cultivation area of oil flax in 2002 was 622 ha and 740 ha in 2003. [CSO].

Linseed oil has numerous nutritional applications and can also be used, owing to specific its properties, for the production of paints and varnishes (as linseed oil is a fast-drying oil). The demand for this application is 15,000-18,000 tonnes a year of refined linseed oil. However, a strong obstacle is competitiveness of cheap linseed oil, imported mainly from Canada. All of the linseed oil used in the domestic paint industry is imported. Nevertheless, the INF has conducted a research program in co-operation with other research centres on the breeding new, highly efficient oil flax varieties, production of varnishes and oil varnish and new trends in linseed utilisation.

Another potential application of oil flax (and flax) is the use of certain substances obtained from seed capsules having positive immunological impact for transplantation surgery. However, this application is in the initial stage of research.

1.2 Industry

The Polish oilseed rape industry includes three major oil mills: in Kruszwica, Szamotuly and Brzeg. Each mill has the production capacity of ca 300,000 tonnes of oilseed rape per year. All are privatised mills owned by foreign capital, mainly French and German. There are also six smaller mills, each with a capacity of 30-60 thousand tonnes of seeds per year, located in Warsaw (Polish capital), Gdansk, Bielsko-Biala, Katowice-Szopienice, Bodaczow (state owned) and Burkatow. In addition there are a number of small-scale production private mills. In total the capacity of the Polish oil industry is about 1 million tonnes.

The production of oil involves two stages: pressing and extraction with naphtha ether. Almost the entire use of oil is for food production as edible vegetable oil and margarine. No data is available at the moment referring to the production of paints or technical oils. As for cereals,

there is a possibility of industrial utilisation of oilseed rape straw which can be utilised as a raw material for production of furfural (2 – formylfuran). This chemical can be used for the production of plastics and during oil refining. However, there has been no commercial development in this field.

1.3 Markets

The markets for oilseed rape products are mainly edible vegetable oil and margarine. The by-product obtained in the process of oil pressing is oilseed rape cake used as a high protein component of fodder for livestock.

The entire domestic production of oilseed rape will be utilised in Poland.

The decrease in domestic production results in increase of seed of import of oil bearing plants; among other import of oil rape seed in the amount of 7,500 tonnes.

The economical condition of Polish oil industry factories is good although the export of margarine was observed to decline from 43,200 tonnes in 1999 to 20,000 tonnes in 2002. The decline of export of oil from 24,800 tonnes to 2,100 tonnes occurred. In 2000 four oil plants were listed among the biggest 500 Polish enterprises. These four plants cover 60% of the oil production and 70% of margarine production.

Some of the rapeseed oil is used in a mixture with linseed oil in production of alkyd resin. Production of vegetable fats in the past decade is presented in Annex 2.

1.4 Environmental issues

There are no special environmental issues connected with the production of oilseed rape.

The emissions from all major and medium size oil mills comply with the relevant requirements.

2. Barriers to progress

The major obstacles towards the development of liquid biofuels are economic conditions.

The prices of such biofuels are still higher from those produced from petroleum.

It is the reason, that some reduction in excise duty and exemptions are applied in case of biofuels (the liquid biofuel, ethanol and methylated esters of rapeseed oil are waved from excise tax).

However, potential producers of biofuels, restrain from the production of fuels with additives of ethylated esters e.g. from rapeseed oil, due to the lack of long-term quarantine of decreased excise duty for such fuel.

The lack of proper adjustment of vehicles engines to utilise biofuels in the clean form (ethanol and methylated esters of rapeseed oil) result as additional obstacle.

The fuels standards allow for application of biofuels as additives, but in this case it is necessary to apply the exemption from excise tax, to allow for competition on the fuels' market. [9]

Additionally, there are two main barriers in the cultivation of oilseed rape: low winter resistance to frosts and shedding of seeds during harvest.

II FIBRE CROPS

1. Opportunities

1.1 Science and technology

The climatic conditions of Northern Europe allow for growing only two major fibre crops: flax (*Linum usitatissimum* L.) and hemp (*Cannabis sativa* L.). Both crops for centuries have been known and grown in Europe as fibre crops and were once the only source of vegetable textile fibre until first cotton and later man-made fibres were introduced.

1.1.i Flax (*Linum usitatissimum* L.)

Flax is one of the oldest grown crops in Europe and in Poland this plant has been known for more than 4 000 years, confirmed by archaeologists. The organised cultivation of flax in Poland is connected with the industrial processing which has been carried out for 150 years. Flax was a predominant fibre crop grown and utilised industrially in Europe and in Poland until World War II. Before WWII it also had to compete with much cheaper and more industrially feasible cotton fibre. After WWII this competition strengthened. In addition to cotton a rapid development of synthetic fibres contributed to the loss of importance of flax for the textile industry. Flax cultivation and the linen industry lost its importance in most West European countries by the 1970s. However, in Poland flax maintained its strong position both in agriculture and industry until the 1980s. In the same period, when flax growing and processing declined in countries such as Sweden, Germany and the UK, in Poland the largest cultivation area of flax (over 100,000 ha) was observed in the beginning of the 1970s. In that time the Polish linen industry was one of the worlds leading producers of the crop (about 6.6% of the world area of flax). Also, industrial production was impressive. The share of Poland as a producer of linen fabric was 8.3% (120 million m²). Poland had 31% of world export of linen and hemp fabric (ranking second in the world).

Until the end of the 1980s Poland maintained its position on the world market. A decline in this field began in the 1990s with a transformation of the Polish economy resulting in a considerable decrease of the production capacity of factories and raw material availability. The following were the key factors in that situation:

- Financial reforms of the state including changes in credit policies for factories
- Changes in industrial activity as a result of ownership restructuring
- Opening of the market to high quality raw material among others from the EU countries
- Changes in the structure of production and connected increase of demand for high quality fibre

As a result, the cultivation area of flax was considerably reduced from 34,300 ha in 1989 to 2,400 ha in 1998. Since then, the cultivated flax area of fibre flax has tended to increase, especially in south-eastern Poland. The total flax cultivation area was 5,200 ha in 2001 (CSO) and 5,100 ha in 2002 [CSO] (Annex 2, Table 11).

The necessity of restructuring of domestic raw material base for the linen industry in Poland has been reflected in the program, developed by the Ministry of Economy, Labour and Social Policy entitled “Strategia dla przemysłu lekkiego na lata 2000-2007” [A Strategy for textile industry in 2000-2007]. One of the tasks in this program is development of natural raw material base for textile industry. The Ministry of Agriculture and Rural Development subsidised the programme of flax and hemp breeding as well as collection and evaluation of hemp and flax cultivars and ecotypes.

Flax, together with wool and silk, is the main natural textile raw material and, together with hemp, is the only natural vegetable textile raw material that can be produced in Poland.

There are therefore a number of research projects conducted with the aim of generally increasing flax productivity and quality; more efficient processing technologies and different application areas of flax fibre and by-products. The leading research centre involved in research on flax and hemp is the Institute of Natural Fibres in Poznań (INF).

The research topics conducted at INF cover research and development activities, from molecular biology, biotechnology, breeding and cultivation, through processing till final application opportunities.

The following are the main research areas in flax conducted at the INF:

- Creative and maintenance breeding of fibrous flax – obtaining cultivars yielding high quality and quantity of fibre, and resistant to diseases. In 2003 the list of cultivated crop cultivars, which is the official list of cultivars enrolled on the Cultivar Register (State List), six (6) fibre flax cultivars were listed: Artemida, Nike, Wiko, Modran, Selena, Luna and Atena. The cultivars were included in Annex IInd of the Regulation of the Commission No. 206 (5th February 2004).
- Besides traditional breeding techniques, biotechnological methods are also used, allowing for considerable shortening of breeding process. Using the biotechnological methods (anther culture) the fibre flax cultivar Alba was improved in respect, among others, in resistance to Fusarium wilt. The obtained cultivar Klara has been in the stage of pre-registration trials since 2003. The Regulation of the European Commission No. 206/2004 of 05.02.2004 covers the Polish cultivars of fibre flax and hemp, which are eligible for EU subsidies. Among flax cultivars the following are eligible: Modran, Nike, Selena, Alba, Artemida and Luna. Among industrial hemp cultivars covered by this Regulation are Bialobrzeskie, Beniko and Silesia. The latter is limited to the area of Poland.
- Modern cultivation technology for obtaining high yields and quality of flax raw material, including optimisation of agro-technology treatments and sowing techniques, fertilisation, plant protection, and time of harvesting.
- Harvesting technologies and flax harvesting machines. The main focus in this field is full mechanisation of harvesting and post-harvesting handling of the crop, as well as harvest to obtain technical and sowing seed.
- Technologies of flax straw retting. The research aims at improving dew retting using auxiliary substances. Since 2000 a study is being conducted at the Institute of Natural Fibres on physico-chemical methods of fibre extraction based on osmosis phenomenon.

- Modification of fibre and spinning technologies allowing for spinning of flax fibre in blends with cotton, wool and man-made fibres by more efficient spinning systems normally used for those non-bast fibres.
- Weaving and knitting technologies allowing for increasing the efficiency of woven and knitted fabrics production, decreasing the number of errors and developing new construction of fabrics.
- New finishing technologies of linen and hemp products including enzymatic and liquid ammonia treatments allowing for improving the properties of final products.
- Production technologies of linen ready-made products with special properties:
 - fire retardant for safe transportation and public occupancies (such as interior furnishing, furniture, etc.)
 - decorative products
 - technical textiles for industrial applications
 - textiles for health prophylactics and medicine
- Pro-ecological utilisation of textile materials and by-products:
 - biocomposites for automotive, construction and packaging industry
 - lignocellulosic boards for construction and furniture industry
- Developing new pharmaceutical and nutrition products from linseed and hempseed
- Phytoremediation of degraded areas by fibrous plants and utilisation of obtained biomass as an industrial raw material for composites, pulp and paper and chemical industries etc.
- Research on physiological effect of bast fibres on human body and comfort of clothes.

Developed unique collections of linen and hemp apparels are the implementations of new technologies developed at INF. [1A]

1.1.ii Hemp (*Cannabis sativa* L.)

Hemp has been grown and utilised in Poland for some 1000 years, i.e. from the very beginning of the Polish State. After World War II, due to a growing problem of drug abuse, the cultivation of hemp was eliminated from the whole of Western Europe, except France, until the 1990s. It prevailed, however, in most East European Countries including Poland.

In 2003 the list of cultivated crops cultivars included three (3) fibre hemp cultivars: Beniko, Bialobrzeskie and Silesia. Polish hemp cultivars grown for fibre fully meet the requirements specified in the article 5a of the Regulation 1251/1999 issued by the EU for hemp grown in Europe.

In Polish regulations (The Counter Drug Addiction Act of 24.04.1997) only cultivars containing less than 0.2% delta-9-tetrahydrocannabinol in green dry matter can be grown.

Hemp can be cultivated on the specific area in selected regions only contracted and upon permission of the local government representative for the location of plantation.

The Polish cultivars Beniko, Bialobrzeskie and Silesia are listed in the Annex to the IInd Regulation of the Commission No. 206 of 5th February 2004.

The only research & development organisation in Poland involved in all aspect of hemp research is the Institute of Natural Fibres in Poznań. The creative and maintenance breeding of Polish monoaecious fibre hemp is now conducted in two of INF's Experimental Stations – Bialobrzezie and Wojciechow. Breeding research covers the following directions:

- Systematic increase of fibre yield per hectare through the increase of fibre content in stems.
- Increase of fibre quality preserving high yields of fibre.
- Increase of seed yield.
- Obtaining the chemotype of hemp containing traces of cannabinoids.
- Obtaining high degree of monoaeciousness in order to provide the industry with raw material homogeneous in respect of quality.
- Application of chemical control male sterility in hemp breeding.

In 1995 the research has begun to establish conditions for *in vitro* tissue culture growing. Polish cultivars of monoecious hemp are resistant to spring ground frosts, which enables early sowing – by the end of sowing time of spring small grains. Cultivation technology of hemp allows obtaining good yields and is still being improved at the INF. In Polish climatic conditions with good crop management practice there are no problems with weeds in hemp, it is also not infested considerably by diseases nor damaged by insects. Hence, usually there is no need for crop protection chemicals use in hemp.

Some problem in hemp cultivation is harvesting, especially where seed production is concerned. The only existing technology allowing for harvesting of both straw and seeds is Russian technology, involving low efficiency and low reliability machines as well as lots of manual operation. Therefore, there are several research programmes carried out at the INF aiming at improvement in this field. The most important research directions are:

- new system of stationary decortication of bast fibrous plants
- harvesting machines allowing for harvesting and separation of tops (seed and essential oils)

The growing interest in hemp in Western Europe, caused by tremendous versatility of this crop, resulted in the areas of research conducted at the INF focusing on following fields:

- Cultivation of hemp as a raw material base for textile, chemical and pulp and paper industries on heavy metal polluted soils.
- Production of lignocellulosic board for construction and furniture industry.
- Whole stem panels for construction industry (insulation and partition walls).
- Textile application of hemp fibre (weaving and knitting pure and blended yarns, woven and knitted fabrics and clothes).
- Geotextiles and non woven.

Production of energy from briquetted hemp hurds and animal bedding made of hemp hurds.

- Application of shives for composite materials production.
- Essential oils used in pharmaceutical and cosmetic industry.

One of the most promising potential applications of hemp is pulp and paper production. The annual hemp biomass production is 2.5 times higher than that of pine tree forest (in Central European conditions). Hemp pulp is a speciality, long fibre pulp suitable for the production of banknote, cartographic and photographic paper, cigarette tissue and long life document paper (due to stable whiteness of the hemp paper). This potential direction is very important in the context of increasing deforestation, increasing demand for paper in the world and the possibility of hemp cultivation on heavy metal polluted soils.

Recent research has shown that hemp and flax fibre contain natural absorbents, among which a special role is played by lignin able to absorb UV radiation. Therefore, there is a great potential for hemp fibre to be used to protect the human body against UV radiation.

Additionally, due to the high content of essential oils, hemp can be grown for the cosmetic industry (essential oils used as additive for production of soap lotions, creams, shampoos, perfumes and in aromatherapy). The two compounds found in hemp essential oils, limonene and α -pinene, show insect repelling properties and potentially can be used for plant protection products manufacture. Hemp essential oil also shows bacteriostatic properties to Gram+ bacteria (Staphylococcus and Streptococcus). This effect is comparable to thyme oil. [1A]

1.2 Industry

1.2.i Flax

Processing of flax straw is being carried out by the following organisations:

- The Association of Domestic Natural Fibres Producers in Lublin – groups farmers growing flax and producing flax fibre. The Association has four Etrich scutching drums and about 120 small size drums for long fibre production.
- Zakład Doswiadczalny LENKON in Steszew being the organisational unit of the INF. The mill has a scutching drum for long fibre of Depoortere; a tow-producing unit for short fibre; a fibre extraction unit for non-textile applications (decorticator); a unit for mechanical cottonisation of flax and hemp fibres, carding machines and spinning frames for technical yarn production, non woven unit, and edible mushroom cultivated on the base of shives.

- PPHU “CELINEN” Sp. z o.o. in Radwanice. The company has one Etrich scutching drum for long fibre production and a tow-producing unit for short fibre. The mill can process straw from an area of ca 600 ha.
- The Madex-Malbork – the company has Etrich drum unit for long fibre production.

Production of yarn and fabric is conducted in 6 mills:

- Zakłady Lniarskie “ORZEL” S.A. in Myslakowice. The company produces combing and carding linen yarns. The company has weaving and finishing divisions which allow for the production of high quality linen fabric that is mainly sold abroad. The demand for long flax fibre in 2002 was 1,460 tonnes. A part of the fibre, especially high quality is imported. “ORZEL” utilised 630 tonnes of short flax fibre in 2002.
- Fabryka Wyrobów Lnianych “SWIEBODZICE” Sp. Z o.o. in Swiebodzice. A spinning mill producing combed and carded linen yarns. The company processes about 700 tonnes of long flax fibre and about 550 tonnes of short fibres. In 2004 the new owner and the new name of the company EUROLEN occurred.
- Zakłady Lniarskie in Oldrzychowice. A mill can process long and short flax fibre into combed and carded yarns. At this moment the production is not active, due to the changes in the scope of ownership.
- Zakłady Lniarskie “MADEX” in Malbork. The company produces mainly carded yarns. Recently also a combed yarn production division was started. The annual demand for long and short flax fibre is 330 and 800 tonnes respectively.
- Spining Mill Safilin-Polska in Milakowo. The company produces wet-spun combed linen yarns and dry-spun carded yarns. The annual demand for fibre is 2960 tonnes of long and 2350 tonnes of short flax fibre (utilisation of domestic flax fibre: 400 tonnes and 300 tonnes respectively)
- Spinning Mill “LAMBRECHT” Sp. z o.o. Producer of carded yarns. Demand for short flax fibre per annum is estimated at 1,210 tonnes.

Fibre flax products in Poland are presented above — in II. Fibre Crops.

According to the information provided by the flax industry companies, the total utilisation of flax fibre by flax industry companies in Poland in 2002 was 5,650 t of long fibre and 5,840 t of short fibre (including imported fibre). In 2003 the companies processed 6,750 t of flax fibre. The actual potential capacity of Polish flax industry is much higher. [1A]

1.2.ii Hemp

Hemp cultivation area in Poland had its peak in 1960s when the area under cultivation reached 30 000 ha. The industrial application focused on technical yarns, fabrics (especially tarpaulin) and non-wovens. Within the following years the area under cultivation of hemp decreased systematically with considerable acceleration in the turn of 1980s and 1990s resulting from competition from man-made fibres on the industry side. Currently, hemp is rather a marginal crop grown on a small area (Annex 2, Table 11).

Production of hemp yarn and fabrics is conducted in the following mills:

- The Spinning Mill ZAMATEX Sp. z o.o. in Moszczenica — producer of blended cotton-hemp yarn.
- LENKON – the Experimental Plant located in Steszew (the unit of the INF in Poznań) — producer of technical hemp and linen-hemp yarns. The total amount of processed fibre is about 142 tonnes per year. No other hemp production is carried out currently. [1A]

1.3 Markets

1.3.i Flax

Markets for flax products cover long and short fibre, so called cottonised fibre for blends, pure and blended, dry and wet-spun yarns and woven and knitted fabrics. Production and markets for flax products are given in annex 2. [1A]

1.3.ii Hemp

Hemp products sold on domestic markets are: technical yarns (mainly a string), fabrics and non-woven, as well as certified sowing seeds sold to the EU (mainly Germany). In 2003 two factories manufactured hemp string

- “STRADOM” Company in Czestochowa
- LENKON – the Experimental Plant located in Steszew (the unit of the INF in Poznań)

The annual production of these two companies is about 400 tonnes.

Unfortunately in “STRADOM” Company the division producing hemp string was liquidated in the first quarter of 2004. [1A]

1.4 Environmental issues (Flax and hemp)

Environmental issues connected with fibre production are connected more with the work environment than natural environment. The main problems existing in Polish flax industry are:

- problems with sufficient dust removal during flax and hemp processing
- outdated machinery is the source of noise

Flax and hemp are ecological raw materials, that is why they could be stored on waste products storage place and/or could be composted without the threat to the environment. [1A]

2. Barriers to progress (flax and hemp)

The barriers described in this chapter are mainly economic and environmental.

- Significant fractionation and dispersion of fibre plant plantations.
- High price for certified sowing material.
- Outdated machinery in production and processing of these materials (high energy consumption, high level of noise emission, old processing technologies) and lack of funds for its modernisation (high price for modern equipment).
- Competition of subsidised fibres from the EU
- Competition of cheap chemical fibres

- Average quality of domestic fibre results in low profitability
- The industry processing natural fibres is highly capital consuming
- Lack of funds for purchase machinery for processing wastes resulting in fibre plant processing. [1A]

III CARBOHYDRATE CROPS

1. Opportunities

This section focuses mainly on potato starch, because the major volume of starch produced in Poland is obtained from potatoes.

1.1 Science and technology

1.1.i Potato

Cultivation of potato decreases. In 2002 the potato cultivation area in Poland was 1.19 million ha, while in 2003 decreased to 765,000 ha, what consists almost 55% of EU potato cultivation area. The total harvest of potatoes in 2002 amounted to 15.5 million tonnes (down by 20% from the year 2001). In Poland the consumption of potato is circa 120 kg per person per year. It means that amount of potatoes grown for consumption is about 4-5 million tonnes per year, including potato used for the production of chips, etc. The processing of potato for starch is 0.8 million to 0.9 million tonnes, while the potato processing for consumption purposes reaches 600-685 thous. tonnes. More statistical details are provided in the Annex 2.

The potato cultivars grown in Poland, included into the Polish National List of COBORU in 2003:

Aksamitka, Albatros, Albina, Alicja, Amora, Andromeda, Arkadia, Aster, Asterix, Augusta, Balbina, Bard, Bartek, Baszta, Beata, Bila, Bondeville, Bryza, Bzura, Cedron, Cekin, Clarissa, Cycloon, Cykada, Czapla, Danusia, Delikat, Denar, Ditta, Dorota, Drop, Felka, Fianna, Folva, Fregata Pomorska, Fresco, Gabi, Gandawa, Glada, Gloria, Gracja, Grot, Harpun, Hinga, Ibis, Ikar, Impala, Innovator, Irga, Irys, Jasia, Karatop, Karlena, Klepa, Koga, Kolia, Korona, Krasa, Kuba, Kuklik, Lady Claire, Lady Florina, Latona, Lawina, Lord, Maryna, Meduza, Molli, Monsun, Mors, Neptun, Nora, Oda, Orlik, Panda, Pasat, Pasja Pomorska, Perkoz, Pirol, Raja, Ramos, Redstar, Romula, Rosalind, Rudawa, Rumpel, Ruta, Salto, Sante, Satina, Saturna, Skawa, Sonda, Syrena, Sleza, Tajfun, Tara, Timate, Tokaj, Triada, Umiak, Ursus, Velox, Victoria, Vineta, Vitara, Wawrzyn, Wigry, Wiking, Wolfram, Zebra, Zeus, Zagiel. [COBORU]

Main varieties of potato for starch production:

- Medium early and medium late: Glada, Klepa, Lawina.
- Late: Bzura, Jasia, Hinga.

In Poland, the starch potato production is based on contracts with industry. The official agronomic guidelines are commonly accessible and applied in the scope of potato cultivation.

Table 3: The structure of potato consumption in 2001-2003

Specification	Amount	Amount	Amount
	('000 tonnes)	('000 tonnes)	('000 tonnes)
	2001/02	2002/03	2003/04 progn.
Harvest	19,379	15,524	13,493
Total amount for disposal	19,450	15,554	13,493
Utilisation at farms:	13,256	9,789	7,993
-for planting	2,064	1,900	1,850
-for fodder	8,592	5,289	3,563
-self supply	2,600	2,600	2,580
Total sell:	3,384	3,795	3,740
-for consumption	1,960	1,960	1,930
-for industry (total for food and non-food)*	1,405	1,695	1,720
Export	19	140	90
Import	71	30	40
Loses	2,810	1,850	1,800

Source: Rynek ziemniaka (Potato Market), November 2003. Based on CSO-GUS The Central Statistical Office. Warsaw

* potato utilised by industry, no matter for what purposes.

1.1.ii Cereals

The area of cereals grown in 2001 totalled 8,882,000 ha, while in 2002 was 8,295,000 hectares. The industrial application of wheat and rye mainly concerns the production of alcohol, but it is still mainly the alcohol used in the food sector (vodkas). The production of alcohol for non-food purposes is almost entirely based on cereals (96.4%). The industrial consumption (in brewery, starch and alcohol production) for this purpose in season 2002/2003 is estimated at 1,161 tonnes total for all cereals. This is approximately 4.2% of total consumption. Generally the alcohol in

Poland is produced mostly from cereals, due to higher costs of the production from potato. The important issue is the possibility to utilise the brewery decoction for fertilisers and fodder production. The example of non-food applications of cereal alcohol is addition to the production of bio-fuels in the form of direct addition to the fuel or as a product used form manufacture ethyl-tert-butiric ester.

Domestic production of cereals in 2002, including components of fodder, was 27,798,000 tonnes. Industrial utilisation of cereals is presented in Table 1.

The total production of alcohol from agricultural raw materials is shown in Table 4.

Table 4: Production of alcohol from agricultural raw materials (1994-2002) [m dm³]

Product	1994	1995	1996	1997	1998	1999	2000	2001	2002
Raw spirit	210	245	278	240.6	208	167.2	173.3	181	210
Ethanol-dehydrated spirit	27	63	100.9	110.6	99.8	88.5	51.5	69.4	82.8

Source: Ministry of Agriculture and Rural Development. Department of Land Economy and Rural Infrastructure (MRRW) 2003

The potential of industrial application of cereals however is much wider, especially for straw. The approximate ratio of grain to straw varies from 1.5-2.0; the annual production of straw in Poland is about 25 million tonnes [MRRW, 2003] as a waste product when growing cereals. The main use for the straw is animal bedding and feed and fertiliser (95%) [MRRW, 2003]. The straw may be used for heating, furfural production, animal bedding and manure etc. The straw harvested from 2 ha (2.5 t/ha) can provide enough energy to heat a house of 70 m². The overproduction of cereal straw could provide energy to meet 5% of the whole country's demand. Special, small size furnaces are available on the market for burning straw for farms. There are about 20 small boiler rooms and 4 big boiler houses based on cereals straw combustion operating.

There are about 10 producers and importers on Polish market offering boilers burning straw. However, the prices for such boilers are 1.5-2 times as expensive as boilers for wood [MRRW, 2003]. No more detailed information of utilisation of such units is available.

1.1.iii Sugar beet

The list of sugar beet cultivars grown in Poland (according to COBORU, 2003) includes the following cultivars:

Adeptus, Agathe, Alyssa, Andante, Arosa, Arthur, Atair, Atlas, Avalon, Canasta, Cartouche, Casino, Chorus, Chrobry, Compass, Cortina, Dojana, Elan, Electron, Esperanza, Georgina, Grys, Hawen, Henrietta, Henrike, Hetman, Isolda, Jackpot, Jamona, Janina, Jantar, Janus, Kassandra, Kawejana, Khazar, Korab, Kristall, Kujawska, Kutnowska, Leo, Lolita, Lubelska, Lupus, Lustro, Marathon, Nabucco, Nobel, Oktavia, Picasso, Poljana, Polonez, Prince, Rubin, Samuraj, Sandomierska, Saskia, Solist, Sonata, Texas, Tomba, Torino, Tristan, Ulla, Vectra, Vegas, Zawisza. [COBORU]

In 2001 sugar beet crops totalled 11.36 million tonnes, harvested from the area of 318,000 hectares. In 2002 the figures were 13,43 million tonnes and 303,000 ha respectively [CSO]. Despite slight decrease of cultivation area in comparison to 2001 (by about 14 000 ha) observed the yields were higher, among others, due to higher sugar concentration in sugar beets (16.4%). The production of sugar in season 2002/2003 was approximately 2,018 million tonnes – by 31% higher than a previous season. The yield of sugar beet in 2002 was 44.3 dt/ha as compared to 37.0 dt/ha average for the period 1997-2001. The 13.4 million tonnes of sugar beet was processed in 2002 by 75 mills (one did not operate due to bankruptcy process). 56 sugar mills including 22 grouped in the Domestic Sugar Company LTD and sugar mills owned by foreign capital carried out the sugar beet processing campaign.

Almost all sugar beet is processed for sugar, which is consumed in households and in the food industry, mainly for sweets, jams, juices, etc. In 2002 industry consumed 605,000 tonnes while households and public food sector – 915,000 tonnes. In 2001 domestic sugar consumption totalled 1,590,000 tonnes while in industry at 605,000 tonnes). The non-food applications utilised about 45,000 tonnes of sugar in 2002, which covered pharmaceutical, chemical industries, cosmetics, fodder as well as unidentified usage e.g. home production of wine, bees feeding etc. In the pharmaceutical industry sugar is used for the production of syrups and for sweetening some preparations. In the chemical industry a saponin made of sugar beet is used for the production of detergents as very good, natural surface active substance; sugar beet molasses (the by-product) is used for the production of potassium and sodium carbonate, alcohol, yeast,

citron acid and monosodium glutamate. Dried sugar beet pulp is applied for the production of ruminant fodder.

1.2. Industry

The industrial processing of potatoes includes two major products: starch and ethyl alcohol. The production of starch and spirit in 2001/02 was 130,000 tonnes, simultaneously 11,000,000 litres of 100% spirit. A decrease of the cultivated potato area in 1999 and 2001, and a significant increase in the production of starch and spirit means more intensive and efficient industrial processing. The potential demand for starch in Poland reaches about 200-250 thous. tonnes, while the average starch production totalled 180,000 tonnes (2003/2004).

1.2.i Starch

The domestic quota of potato starch production is 144,985 tonnes for the economic year 2004/2005, according to Accession Treaty. In 2003 processing of potatoes for starch was observed to increase up to 950,000 tonnes. Due to unfavourable price relation only 15,000–16,000 tonnes of starch used for non-food applications is obtained from domestic production. The rest - about 45,000 tonnes, is imported, mainly from the EU.

Starch is naturally biodegradable and a renewable biopolymer, present in several plants, but most of all in the potato bulb. Starch can also be obtained from wheat, maize, barley and rice. In Poland the main raw material is potato. The specific chemical and physical structure of the potato starch allows for its application as a raw material, compound or additive to several promising industrial applications.

The value of 1 tone was 1,500 PLN in 2002. The starch derived from cereals (circa 90-100,000 tonnes) is also present on Polish market, but it is imported, mainly from the EU.

In the season 2004/2005 the starch production is expected not to be higher than 149,985 thous. tonnes, in accordance with the contingents, the EU quotas (Accession Treaty of 13.12. 2002).

Industrial products made of starch are used in the following industries:

- 1) **Paper:** Modified starch is applied as an additive to paper pulp, for superficial sizing and coating of paper.
- 2) **Corrugated board production:** Starch is used to size of cartoon-paper layers in Stein-Hall carrier and No-Carrier systems.
- 3) **Textile industry:** The process of initial sizing (before spinning) of the cotton, polyester, wool yarns is supported by the application of modified starches such as oxidised, hydrolysed, estrificated and etherificated starches and the compositions of the above mentioned additives.
- 4) **Foundry:** Pyrodextrine of diversified level of degradations is applied as a bonding medium for foundry mass.
- 5) **Drilling industry:** modified starch is applied as a protective colloid in drilling washer, for acting as a drill cooling agent with simultaneous protection against water filtration in the bore-hole.
- 6) **Glue production:** The raw materials are modified starches as dextrine, oxidised, esterificated, etherificated, and hydrolysed starches. Modified starches are applied for the production of large range of biodegradable starch glues used for paper and corrugated board, paper coating, labels sticking and production of paper bags etc.
- 7) **Laundry:** starch applied in housekeeping to stiffen (starch) linen bedclothes, curtains etc.
- 8) **Pharmaceutical industry:** Starch is applied for the production of drugs to create appropriate hardness, appearance, and the constant quality during storage. The glucose obtained from potato starch is used in bio fermentation processes.
- 9) Starch used as an **additive** in the production of biodegradable lubricants, polymers, bioplastics and as water absorbent.
- 10) In the **food industry** starch is used to create appropriate texture, appearance and consistency during technological process and storage. In this application the natural ability of starch to form gels and the thickening of food products is used. Such ability concerns both natural and modified starches.

It is important to underline that all processes of starch modification are conducted according to the Good Manufacture Practices and the quality must fulfil the regulations of FAO/WHO. The chemical and microbiological purity of preparations must be according to the requirements of relevant standards elaborated for native starch.

1.2.ii Ethyl alcohol production from potato

The percentage of spirit production from potatoes in total alcohol production in 1999/2002 was 4 to 6%.

Ethanol is mostly applied for combustion in engines, as the additive to the petrol and as solvent. The constraints: high costs of production due to high costs of the raw material (70% of total production costs).

The addition of ethanol to gasoline started in 1992. The legislation referring to bio-fuels and bio-components is provided in the Regulation of October 2, 2003 (Dz.U. Nr 199, poz. 1934) about biocomponents applied in liquid fuels and about liquid bio-fuels).

The interest of distilleries in potato has decreased for several years. It is rather limited to processing of waste products of processing of another food goods or processing of potato, not utilised for planting. This tendency occurs due to high prices of potato and the increasing demands regarding environmental protection as well as decreased suitability of decoction for fodder.

The processing of potato for spirit in 2003 reached 120,000 tonnes and the share of potato spirit totalled 4% of total spirit (Potato Market, November 2003).

1.3 Markets

The costs of production at farm level are dependent on several factors, e.g. costs of: labour, fuel and energy, qualified seeds, machines, their conservation and amortisation, cost of insurance, taxes, fertilisers and pesticides, and costs of storage. At industry level costs result from the costs of: labour, fuel and energy, machines and devices — their purchase or conservation and amortisation, costs of equipment modernisation, cost of insurance, taxes, and costs of storage etc.

The market of potato in Poland is monitored by the Central Statistical Office CSO-GUS (Główny Urząd Statystyczny) in Warsaw, which edits the results of analysis in the Statistical Yearbook of Poland. Agencja Rynku Rolnego (Agricultural Market Agency) undertakes the

problems of: prognosis regarding expected harvest (crop), yields, the needs for particular crops, predicting market demand for industrial crops or their products, the demand and supply, which influences the prices etc. The Agency co-operates and co-finances the relevant reports and analysis together with the Institute of Agriculture and Food Economy. The output is presented in the special report: e.g. "The Potato market. Its condition and perspectives. Market reports". ISSN 1231–2762. The Ministry of Agriculture and Rural Development supervises both the Agency and the Institute.

The advantages of starch and starch derivative applications are: price competitiveness, non-toxicity, multi-functionality, and easy access.

Potato harvest in the year 2001 totalled 19.4 million tonnes, which was down by 20% from the previous year. Some reduction in potato cultivation area occurred as well.

The harvest of potato in 2002 according to CSO totalled around 15.5 million tonnes — about 20% less than harvest in 2001, while in 2003 year - 13,500 tonnes have been harvested from 765,000 hectares. The processing of potatoes for starch and dry potato mass increased in 2001 to over 1.3 million tonnes, in 2002 up to 1,695 million tonnes and in 2003 totalled 1,720 million tonnes.

Increasing tendency in potato processing for food products such as chips and crisps continued. In the season 2002/03 the potato market turnover increased to about 3.7 million tonnes. It is the result of increased potato processing by the industry by about 0.3 million tonnes (up to 1.7 million tonnes).

In the season 2002/2003 the increased sales of potato for consumption and for industrial purposes was observed. The tendency of increasing processing for other food production still remains; only the dynamics is not as high as in previous season.

The 2001/02 seasons brought an improvement in the balance of foreign trade in potatoes and potato products, mainly because of significant increases in the exports of potato products, which totalled close to 80 million USD (in 2002/03 was 97.4 million USD), while expenditure on their imports was almost 56 million USD.

Therefore, a positive balance of foreign trade in this sector totalled almost 24 million USD, where 7 million USD derived from the previous season's transactions. Despite lower potato crops, the situation in foreign trade should not deteriorate.

In the year 2002 the financial situation of potato industry was improved, mainly due to the support from the governmental budget. The valid Law of 11 January 2001 on the regulation of potato starch market (Journal of Laws of 2001 No. 11. item 83) regulates the subsidies to starch export, subsidies to starch potato and potato starch production; as well as subsidies to companies, which utilise starch for non-food purposes.

In 2003/04 the domestic quota of potato starch production (established in the law/regulation at 220,000 tonnes) will probably be not totally used. It is expected, that the starch production in the season 2004 will be around 180,000 t. and production of dry mass will be similar to the figures of 2002 (ca 15,000 tonnes).

The increase of processing of potatoes for French Fries and chips is expected. In the season 2002/03 the export of potatoes (ca 60,000 tonnes) increased due to lower price of raw material. The high export of potatoes and their products in 2002/03 reached 820,000 tonnes (in equivalent of fresh potatoes), and was of 17% more than in 2001/02.

Despite the lower harvest of potato, the level of country market prices in 2003/2004 is by about 20% lower than in the campaign 2001/2002. It is expected, that the average country markets price will be about 380 PLN (in previous season 481 PLN/t). The purchase prices will be lower, but the decrease will not be as significant as far as spot market prices are concerned.

In 2003 the significant reduction of potato-cultivated area appeared and was 765,000 ha (see table 3). The harvest in 2003 totalled 13,493 million tonnes; i.e. about 2 million tonnes less than in 2002.

The processing of potato for starch in 2001 to 2003 totalled respectively: 690,000 910,000 and 950,000 tonnes.

Polish potato producers (farmers) have got enough potential to secure, maintain and cover totally the potato production for starch purposes.

Generally there are no other reasons and indications of the decline of the potato production for starch purposes, but only the production limits (quotas) due to the accession of Poland to the European Union.

1.4 Environmental opportunities

The environmental aspect of starch and starch derivatives application is: non-toxicity, biodegradability. Potato is an annual plant, having very good agricultural conditions and practices and traditions contributing to successful cultivation in Poland.

2. Barriers to progress

2.1 Scientific

The research in the field of potato breeding, cultivation and processing is very well developed. Polish potato processing is recognised and supported by the Polish government and the relevant advantageous legislation contributes to the development of potato and starch market. However the significant decrease in the Polish economy will reflect the potato research. The future development of technical, non-food applications of potato derivatives is the main object of intensive work conducted by Centralne Laboratorium Przemysłu Ziemniaczanego (The Central Laboratory of the Potato Industry) in Lubon, close to Poznań.

Dissemination of research results: in Poland the net of ODR – the Extension Agronomy Centres, carries this out. Unfortunately, farmers do not take enough advantage from the potential of the Centres. Many of the farmers still do not have proper agricultural education and they sometimes rely on tradition and intuition. On the other hand the amount of well-educated farmers, who graduated from the agricultural universities grows constantly. Additionally, the process of adjusting the farmers to the needs of the potato market and the market for its products takes time.

2.2 Technical

Some of the potato-processing companies need equipment modernisation. The major limitations of the development are not enough financial means resulted from the low effectiveness of potato industry.

2.3 Environmental

The sewage of the potato industry is troublesome. More careful and restrictive regulations regarding the disposal of wastes create additional needs of investment in the development of sewage and waste management.

2.4 Legislative

There are no legislative constrains in the development of the processing of potato for non-food utilisation; just the opposite — Polish legislation contributed to the development of potato starch market (see Executive Summary). The relevant legislation: Law of 11 January 2001 on the regulation of potato starch market (Journal of Laws of 2001 No. 11, item 83) a with later amendments – The Law of 11 March 2004 on Agricultural Market Agency and organisation of certain agricultural markets (Journal of Laws of 2004 No. 42, item 386).

2.5 Economic

Potato cultivation and production in Poland features extreme fragmentation and relatively low levels of marketed production. The farms producing potatoes for their own needs often do not use qualified planting material; also, the level of mineral fertilising and chemical plant protection is still lower than in EU countries. Reflecting potato production on these farms at the country-scale shows a great degree variability.

As a result of this situation there has been a lack of significant improvement in the level of potato yields for many years.

Additionally the haulage costs are very high; the prices of petrol are similar to the prices in EU countries, but simultaneously the income of industrial companies and average income of Polish inhabitants are much lower than in the EU.

The high costs of implementing novel technologies for starch production for technical applications are the major barrier in quick and fruitful developments. The investment rate in the potato market has always been low, therefore the reproduction and modernisation of the fixed assets in potato industry is still not sufficient. The investment rate on potato market was only 0.62 in 2000, while in 2002 was 0.60. In the first half-year of 2003, investment rate decreased from 1.24 to 0.32 in comparison with data of 1997.

3. Prioritisation

The weather and soil conditions in Poland contribute to the very important and significant role of potato as one of the major crops in Poland.

The situation in the scope of potato industry should be improved by the realisation of the special government branch programme entitled: "The Branch Programme for the Restructuring of the Starch Potato Processing in Poland". One of the instruments of this programme is the system of an additional payment to the percentage of special, targeted preferential credits. The proper usage of these credits should allow the potato processing companies for conducting the necessary investments and modernisation procedures, to adjust their production level to EU demand, regulations and standards.

Generally, the economical and financial condition of the Polish potato processing companies is now better than in the last few years.

The new law of November 11, 2001, regarding the regulation of the potato starch market, is recognised by the Polish starch producers as a chance for the further, stable improvement in their financial results. The regulation of starch market of foresees the support to the starch sector: subsidies to starch potato and potato starch production; subsidies to companies, which utilise starch for non-food purposes, as well as subsidies to starch export. The introduction and execution of the above-mentioned law, elaborated on relevant EU regulations and laws,

contributed to the improvement of the economical condition of starch production and allowed for the stabilisation of that production in Poland.

According to the Law of 11 March 2004 on Agricultural Market Agency and organisation of certain agricultural markets (Journal of Laws of 2004 No. 42. item 386), the domestic quota for starch production for campaign 2004/2005 is 144,985 tonnes (further to decision of Accession Treaty). The quota had been established earlier on the basis of the rules of the Polish Law of 11 January 2001 on the regulation of potato starch market. However it has been changed after the negotiations and it created the necessity of introducing the changes in the rules and adjusting of the amount of domestic quota for the campaign 2004/2005.

IV SPECIALITY CROPS

1 Opportunities

This section focuses mainly on medicinal plants, as well as aromatic plants (broad sense), natural plant protection products and plants used for dyeing.

1.1. Science and technology

Medicinal plants are applied in Poland for the production of herbal medicinal products, herbal teas, condiments and cosmetics, also in aromatherapy and as active substances in natural plant protection products.

Processing of medicinal plants cultivated under special environmental conditions is well developed in Poland. The following is the list of top twelve herb species – medicinal plants grown in Poland and applied to the pharmaceutical industry:

Table 5: Major medicinal plants cultivated in Poland for the pharmaceutical industry

Species name of medicinal plant	Cultivated area, ha (estimated data from 2000-2002)
Milk Thistle (<i>Silybum marianum</i> Gaertn.)	1,500
Chamomile (<i>Chamomilla recutita</i> (L.) Rausch.)	1,000
Peppermint (<i>Mentha piperita</i>)	1,000
Caraway (<i>Carum carvi</i> L.)	700
St. Johns Wort (<i>Hypericum perforatum</i> L.)	400
Sage (<i>Salvia officinalis</i> L.)	300
Thyme (<i>Thymus vulgaris</i> L.)	300
Valerian (<i>Valeriana officinalis</i> L.)	250
Coriander (<i>Coriandrum sativum</i> L.)	200
Lemon balm (<i>Melissa officinalis</i> L.)	170
Purple coneflower (<i>Echinacea purpurea</i> Moench.)	100
Arnica (<i>Arnica chamissonis</i> Less.)	50

Source: Dr. Jerzy Jambor, PhytoPharm Kleka S.A., Kleka

The area of herbal crops cultivation in Poland is up to 35,000 ha, while the area of medicinal plants is up to 20,000 ha.

The agronomic guidelines for over 60 medicinal plants were elaborated at the Research Institute of Medicinal Plants in Poznań. 22 cultivars of medicinal plants were registered and widely introduced in cultivation.

1.2 Industry

1.2.i Medicinal plants

Medicinal plants are widely used in medicine as herbal medicinal products, herbal teas and in several therapy methods in the Polish market, as well as exported abroad.

Areas of application:

Herbal medicinal products: the basic herbal pharmaceutical preparations are those applied in preventing diseases, distemper of digestion system such as Sylimarol and Raphacholin. The leading domestic herbal medicine in geriatric treatment is Geriavit. In paediatrics, the preventive treatment has limited application – mainly immune-stimulating.

Aromatherapy: major essential oils applied in Poland in aromatherapy as well as in cosmetics are obtained from the following crops and medicinal plants: angelica, thyme, cumin, rosemary, mint, lavender, basil, coriander, fennel, marjoram, chamomile, lemon balm, salvia.

1.2.ii Cosmetics

Phytocosmetics, containing herbal substances are very popular in Poland. The herbs containing flavonoids, polyphenolic acids, anthocyanins, tannins, carotenoids, catechins, saponins, mucilage and polysaccharides are suitable for these products as raw material for phytocosmetics.

The water, glycol, ethanol, and oil extracts as well as essential oils are valuable source of active substances from herbal raw material, applied in cosmetics.

According to the statistical data for the last decade, the most important herbal species for cosmetics are:

Chamomile (*Chamomilla recutita*)
Marigold (*Calendula officinalis*)
Burdock (*Arctium lappa*)
Eyebright (*Euphrasia officinalis*)
Nettle (*Urtica dioica*)
Purple coneflower (*Echinacea purpurea*)
Lemon balm (*Melissa officinalis*)
St. Johns Wort (*Hypericum perforatum*)
Common birch (*Betula verrucosa*)
Arnica (*Arnika montana*)
Oak (*Quercus sp.*)
Sweet flag (*Acorus calamus*)
Ivy (*Hedera helix*)

The advantages of medicinal plants cultivation: large, homogeneous lots of raw material; the good quality of plant material; the possibility of obtaining appropriate raw material quality in the scope of: active components and chemical and microbiological purity; the possibility of controlling the series of herbal products starting from agricultural production

1.2.iii Aromatics and condiments (spices)

The market of aromatics and condiments is mainly linked to food industry applications. In Poland 32 species of herbs are grown for spices. From the total area (35,000 ha) of cultivated herbs, 2/3 consists of medicinal plants and herbs for pharmacy and cosmetics and 1/3 part represents herbs for condiments (spices). The major herbs cultivars applied in condiments in Poland are: Cumin (*Carum carvi*), Thyme (*Thymus vulgaris*), Coriander (*Coriandrum sativum*), Sage (*Salvia officinalis*), Mint (*Mentha piperita*), Garlic (*Allium sativum*), Angelica (*Archangelica officinalis*), Sweet Basil (*Ocimum basilicum*), Lovage (*Levisticum officinale*), Wild marjoran (*Origanum majorana*).

The commercial cultivation supplies approximately 7,000 tonnes of dry mass of these herbs per year.

1.2.iv Natural dyestuffs

The cultivation of plants for dye extraction could be a brand new and eco-friendly opportunity, because many artificial dyestuffs contain substances, which are aggressive and not human-friendly. Among the research carried out at the Institute of Natural Fibres in Poznań there is a natural dye programme. Research is based on the analysis of the traditional sources, the studying dye manuals and dyeing trials. The main research goal is application of vegetable dyestuffs in natural fabrics and development of a fashion collection dyed with these dyestuffs.

After the preliminary selection of plants showing dyeing properties a few species have been selected for cultivation.

There is a tremendous variability of plants showing dyeing properties. The dyestuffs can be found in fruits, shoots rhizomes, roots and bark, trees cores as well as excrescence and mosses.

Experiments are focused on achieving three primary colours – red, yellow and blue. The next step is a combination between all shades and tints of these colours to get a wide palette of hues for cellulose and animal fibres.

The Institute of Natural Fibres natural dyeing programme includes:

- The preparation of yarn for dyeing (linen, jute, hemp, cotton, wool and silk)
- Mordanting animal fibres – 8% alum (aluminium sulphate), 7% cream of tartar (potassium hydrogen)
- Mordanting vegetable fibres – tannin from oak galls, 20% alum and 6% washing soda
- Changing colours by using special modifiers.

The INF examined thirty natural dyestuffs to find the most economical and permanent colours. The involved methods use only natural mordants. The sources of tannin were found in tree bark – oak, willow, alder, as well as sumac and rhubarb leaves and oak galls. Tannin used as a premordant helps to improve the absorption of alum and copper. Modifiers used after dyeing, change the colours. The first industrial trials are performed on the base of the INF experience. In

Poland only the INF conducts the research in this field, the new herbs are checked but it is impossible to provide any figures regarding relevant production yet. There is project financed by the State Committee for Scientific Research, the results of which results are to be implemented. The INF invited recently the Institute of Dyestuffs in Zgierz near Lodz to co-operate.

1.2.v Natural products for crop protection

Some natural plant protection products (on the base on natural raw material) are manufactured in Poland and are implemented in horticulture practice (see Annex 4.3). Polish bio-products of production are based on active substances, contained in garlic, rapeseed oil and several other crops (including cereals). Some of products belong to the group of so-called adjuvants, which are most often applied.

A lot of species require better adaptation to modern agriculture and an improvement in product quality: for instance: in plant breeding, crop mechanization and post-harvest technology.

Through classical and/or new plant breeding techniques, advances could rapidly be obtained for several species, notably by including precise metabolites synthesis.

1.2.vi Osier (wicker) and willow

The cultivation area of osier is approximately 2,000 ha. There are special plantations of bush osier, where very good harvesting equipment is used. The species of osier and willow in Poland are: *Salix americana*, *Salix viminalis*, *Salix puprupea*, and *Salix amygdalina*. Recently the most popular is *Salix viminalis*. The weather and soil conditions in Poland are beneficial for osier and willow production. Production and processing in Poland is very traditional with a long history. The yield obtained annually can be estimated at 4,000 tonnes. The yield of bush osier *Salix americana* is up to 8 tonnes /ha (average yields vary from 5-8 t/ha in the south-east and between 10-15 t/ha in the western Poland). The production of osier provides a chance for rural areas, to reduce the unemployment.

Osier (wicker) is used mainly for production of different household goods, such as shopping and picnic baskets, traces, furniture (sofas, chairs, armchairs, chest of drawers, garden and furniture sets), lamp shades, table mats, flower stand, sticks, suitcases, trunks, fens etc. Additionally osier

is used for the production of cellulose and particle-boards. The trunk of *Salix* is a source of glycoside salicin (for pharmaceutical uses) and tannins. The important factor of osier cultivation is that it is often planted on set-aside land and can combat soil erosion.

The producers of osier products are SMEs, dispersed largely in Poland. Most of them serve the needs of German customers.

1.2.vii Crops for renewable energy

Different prognoses show the sources of renewable energy, including the biomass obtained from agricultural land will become more and more a part of energy market.

Dehydrated ethanol

Since 1993 the ethanol as an additive to fuel has been produced on the industrial scale in Poland. The maximum production for this purpose (110 million litres) was observed in 1997. From that time this production decreased to only 48.3 million litres in 2000.

In 2000 the production of dehydrated ethanol was conducted by 13 enterprises. The significant decrease in the production of ethanol for fuel is connected mainly with the limited demand of major fuel producers.

The government supports the production of liquid fuels with biocomponents' additives.

The Minister of Economy Regulation of December 22, 2002 (Journal of Laws No. 119, item 1259) said that the excise duty rate for the fuel containing 4.5-5% ethanol as well as addition of the below listed additives was decreased by 91 PLN/tonne.

- from 8% (V/V) of ethyl-tert-butiric ester (EETB) to lead fuel
- from 2% (V/V) ethyl-tert-butiric ester (EETB) to un-lead fuel

The application of dehydrated ethanol as well as EETB, allowed utilisation of about 67,7 million litres of dehydrated spirit. It increased the sale of ethanol for fuel.

Starting from January 1, 2004 — the system of tax/duty reduction, promoting the utilisation of bio-components (ethanol and esters) was modified.

Since January 1, 2004 the Minister of Economy Regulation of December 23, 2003 (Journal of Laws No. 221, item 2196) on the excise duty has been in force.

According to the § 10, point 16 of this regulation, the sale of liquid fuels containing 4.5-5% biocomponents is exempted from the excise duty in the amount of 1.5 PLN on each 1 litre of biocomponents added to this fuel and liquid fuels containing more than 5%-10% biocomponents in the amount of 1.80 PLN on each 1 litre of biocomponents added to this fuels and liquid fuels containing over 10% biocomponents – in the amount of 2.20 PLN on each 1 litre of biocomponents added to this fuels, however, the sum of exemption cannot be higher than the amount of excise duty due from the sale of these fuels.

The solution accepted in the resolution, subjecting the amount of exemption from the excise duty to the amount of added biocomponent, clearly and univocally prefers fuels with the highest addition of the biocomponents; for example esters which are autonomous fuels will be fully exempted from the excise duty.

Since 1st May 2004 a new ordinance Minister of Finance of 26 April 2004, *on exemptions from excise duty* has been in force. The principles of exempting from the excise duty due to application of biocomponents have not been changed.

Table 6. Utilisation of major agricultural raw materials applied for ethanol production ('000 tonnes)

Year	Rye		Potato		Molasses
	'000 tonnes	Share of total rye production [%]	'000 tonnes	Share of total potato production [%]	'000 tonnes
1995	664.8	10.6	649.0	2.6	0.0
1996	680.0	12.0	640.0	2.4	31.0
1997	630.5	11.9	370.6	1.8	50.0
1998	522.0	9.2	216.0	0.8	76.0
1999	378.0	7.3	112.0	0.6	107.0
2000	176.5	4.4	118.7	0.5	38.8

Source: Ministry of Agriculture and Rural Development, 2004

Introduced changes in the regulations should result in keeping sales potential for agricultural products used for manufacturing biocomponents for fuels.

Solid biofuel

The market of solid biofuel is not regulated and develops spontaneously, being competitive with another fuel markets.

A) Wood waste products

The wood waste products are mainly utilised as solid fuel.

B) Cereal straw

Recently the market of the cereal straw for heating purposes has been developing dynamically. The production of cereal straw in Poland exceeds 20 million tonnes per year. Most of this amount is utilised in agriculture, but about 10-20 % could be used for fuel purposes, without any harm for the soil quality [according to the opinion of some experts]. The project of the regulation does not include the control of this market in the version prepared in the spring 2004.

C) Bush willow (*Salix viminalis*)

The cultivation and production of bush willow for energy attracts growing interest in Poland. At the beginning of 2004, the scale of such production is still not big, but the relevant market will probably enlarge quickly.

One of the most important species of willow used for energy is (*Salix viminalis*). The selected forms in intensive cultivation yield annually 11-20 tons of dry wood. The willow wood can be harvested every year, every two years or every three years and can be burned directly or gasified in thermo- generators. Production of willow biomass is 4 times higher than annual growth of wood in forests.

The plantation can be used for 20-25 years and requires low input of fertilisers and cuttings are cheap which ensures low costs of establishing of plantation.

Utilisation of willow for energy production will result in reduction of emissions with beneficial impact to the natural environment. Utilisation of part of agricultural land for production of

biomass will improve the farm income, decrease the unemployment in rural areas, bring the stabilisation of agricultural markets and improve the energy safety of the state.

The factor limiting the willow cultivation is high water demand. High yields can be obtained on good soils, with temporary too high moisture content. Based on: [7], [9]

D) Grasses of Miscanthus genus and Sida hermaphrodita Rusby

Other species that can be used for production of renewable energy are grasses of large yield potential e.g. species of *Miscanthus* genus and *Sida hermaphrodita Rusby*.

Implementation of new species to farm production in Polish conditions requires also increasing some input on research and development work as well as implementation work. [7]

Perennial green lands

The area of green lands in Poland is currently 3561.3 thous. ha, which is 21 % of total arable land. In this figure, 71% is under perennial meadows and 29.0% - pastures (GUS-2002). This is the lowest, except Hungary factor in Europe. In The Netherlands and Great Britain, the area of green lands is 55-62% of total arable land. Increasing extensive use of green land, resigning from mowing and pasture fattening leads to degradation as a result of entering bushes and trees, which causes huge losses in green lands.

The above data show that unused areas of green lands can be used for other, less conventional applications, such as production of biomass for production of fuels or biogas manufactured by methane anaerobic bacteria.

Meadow plants, like other cultivated plants can also be used as a one of the components in biogas production as it is practised in other countries in methane fermentation of manure or as the only organic matter subjected to methane fermentation. It should be emphasised that this is equally valuable material and what is more – much cheaper because meadow plants do not require continuous planting (year after year) and treatment tillage. Grass can produce 0.6 nominal cubic meter (N/m³) biogas, which is as much as from other green farm wastes, potato, grain wastes, beet leaves, buttermilk, etc. It is possible to combine the meadow origin components with other material such as dung and manure. Using meadow plants for biogas production in a

larger scale will require specific studies adapting such material to mixed fermentation process combined with different materials.

The studies should allow for developing proper technology and its implementation. It will be necessary to analyse again opinions referring to applicability of cultivated crops only for a fodder and considering different use connected with biogas production. Also verification of opinions (in the same matter) regarding selection of meadow plant species and cultivars will be necessary.

Solving this problem can be very helpful both in the scale of the whole country, for which finding additional energy sources is a must and in the scale of regions, which are interested in maintaining biodiversity connected with meadow plants and landscape protection. Obtained solutions may allow for mowing and collecting yields from green lands without carrying animal production [8].

1.3 Markets

There are no official figures regarding size and value of the markets for cosmetics, natural dyestuff or natural products for crop protection. The producers treat such data as confidential.

1.3.i Medicinal plants

Data of *Herba Polonica* (2001, No 2, vol. XLVII) show that every year Poland about 20,000 tonnes of herbal raw material are purchased in Poland (about 3,000 — 5,000 tonnes – the harvest from natural sources, 15-17,000 tonnes — from cultivation).

The value of the Polish plant drug market, including over 2,500 (registered and approved products), is estimated to be 980 million PLN (225 million euro); 5 USD per capita and occupies almost 50 % of the middle and east European market.

The Polish market of herbal medicaments has got the similar position among the EEC countries, as the German market within the EU.

It is foreseen that the value of domestic market' sales of those medicaments will increase by 10-12 % per year (compared to EU markets where the increase is expected to be 8-10%). The major plant drugs on Polish pharmaceutical market in 2003 (taking into account the number of sold packages in million pieces): Raphacholin 5.4, Sylimarol 5.0, Alax 3.9, Plantex 3.7, Venescin 2.5, Calming down pills 2.4, Thyme and colt's foot 2.3, Urosept 1.9, Radirex 1.8, Amol 1.7.

The value of the plant drugs sold in 2003 in million PLN (million Euro): Sylimarol 23.7 (5.4), Amol 21.5 (4.9), Raphacholin 20.4 (4.6), Ginkofar 15.2 (3.5), Equisetum 12.5 (2.8), Tanakan 12.0 (2.7), Soyfem 11.0 (2.5), Aescin 10.9 (2.48), Urosept 10.5 (2.4), Thyme and colt's foot 10.0 (2.3). [PhytoPharm]

1.3.ii Cosmetics

There is a growing interest in the Polish society to use more natural and eco- and human-friendly cosmetics. This means an increased demand for phytocosmetics. Simultaneously, the volume and value of usage of phytocosmetics and natural essential oils increase significantly and it is a stable trend.

1.3.iii Natural dyestuffs

The application of natural dyestuffs in the textile industry could provide opportunities for Small and Medium Enterprises and creating new jobs. The INF is conducting a grant project involving special workshops in rural areas with high unemployment, aimed at training women in natural art handicraft and natural dyestuff extraction and application. The INF has noticed quite high demand for such production and activities.

1.3.iv Natural products for crop protection

The growing environmental consciousness in Polish society, among farmers and growers, has led to a tendency towards organic production, and increases the demand for natural products e.g. active substances extracted from crops.

1.3. v Osier (wicker)

The yield obtained annually can be estimated at 4,000 tonnes. The products obtained from osier (wicker) are exported to West European markets, mainly to Germany, where they are very popular.

1.3. vi Crops for renewable energy

The data regarding markets for crops for renewable energy in Poland are rather limited yet. Here are some descriptions available to the authors.

Dehydrated ethanol

In 2000 the production of dehydrated ethanol for fuel additive aim decreased to 48.3 million litres (110 million litres in 1997) and was conducted by 13 enterprises. The significant decrease in the production of ethanol for fuel is connected mainly by the limited demand of major fuel producers.

Cereal straw

Recently the market of the cereal straw devoted for heating purposes develops dynamically. The production of cereal straw in Poland exceeds 20 million tonnes per year.

1.4 Environmental issues

1.4.i Medicinal plants

The development of herbal/medicinal plants cultivation gives some advantages:

- Biodiversity: the cultivation of medicinal plants is the most efficient way to limit the excessive exploitation and harvest from the natural environment in order to protect natural resources.
- Decrease of pollution hazards: the regions of herbal plants cultivation are located in special, clean areas, and simultaneously, the environmental care in such regions is under special protection and control

- Implementation of Good Agricultural Practice (GAP) principles allows obtaining high quality raw material and protecting local environment
- Flora protection
- Cultivation of preserved (protected) species (*Convallaria maialis*, *Arnica montana*) enables protecting natural habitats of these species.

1.4.ii Cosmetics

There are some limitations and difficulties as well as barriers to progress in the scope of herbal raw material production and products. The diversity of species, small size of various markets, and their current organisation does not facilitate prioritisation. Also, efforts in research are dispersed.

2. Barriers to progress

There are some limitations and difficulties as well as barriers to progress in the scope of herbal raw material and products production. The diversity of species, the small dimension of the various markets, and their current organisation does not facilitate prioritisation. Also, efforts in research are dispersed.

2.1 Scientific

2.1.i Medicinal plants

The main issue limiting the development of research in the scope of medicinal plants is insufficient financial government support. Efficient support would allow:

- Elaboration of novel cultivation technology helping the introduction of new herbal species or modification of good agriculture practices for already cultivated species or cultivars with the new direction of application e.g. for the medicinal, nutrition, cosmetic needs
- Breeding new cultivars, which allows providing high quality raw material into medicinal plants processing (increase of cultivation profitability)
- Introduction of modern plant protection products
- Protection of Polish natural resources of domestic medicinal plants
- Implementation of novel methods for the dissemination of research results

2.2 Technical

2.2.i Medicinal plants

- Rather low level of applied agronomic practises
- Not many registered plant protection media
- Low level of mechanisation
- Not enough number of drying facilities

2.2.ii Cosmetics

The production of modern cosmetics requires novel technological systems, allowing high quality production according to the requirements of ISO standards and the requirements of the Polish regulations, which permit these products on the market. The requirements allowing for the registration certificate are on the European level.

2.3 Environmental

In the scope of herbal plants, natural products for plant protection and natural dyestuffs, no environmental barriers to progress are noticed. In fact, there are several potential benefits in that scope. Production of raw material from cultivation allows protecting natural resources of many species. There is a trend in Poland called “Close to nature” to use natural, eco–friendly food, medicaments, cosmetics, cloth etc. in larger scale.

2.4 Legislative

2.4.i Medicinal plants and herbal medicinal products

In Poland it is obligatory for all products, which deal with human health or care, to go through the detailed and demanding testing, according to relevant standards requirements. New herbal medicinal products are being tested in National Institute of Public Health and have to be approved by the Office for Registration of Medicinal Products, Medical Devices & Biocides in Warsaw.

The cultivation of several special species is regulated or forbidden: *Papaver somniferum*, *Digitalis* sp., and *Cannabis sativa*. Special, official permissions are required to cultivate those plants, provided by local authorities and the Ministry of Agriculture and Rural Development. Official approval for alternative medicines could increase the interest in some plant species. The general legislation regarding cultivation, plant protection as well as seed production is presented in the Methodology.

2.4.ii Cosmetics

All products, which could influence human health, must be tested, approved and certified (registration certificate). However, very restrictive processes of certification take a very long time and involve high costs for the producers, which limits significantly the fluency in the development of cosmetics production on the herbal basis.

2.4.iii Natural dyestuff and natural products for crop protection

All products, which could influence human health, etc., must be tested, approved and certified by the National Institute of Hygiene (Panstwowy Zaklad Higieny) in Warsaw. Legislation on the production and use of artificial colorants, perfumes and flavours, such as legislation limiting volatile organic compound emissions, could favour the development of various crops.

2.5 Economic issues

2.5.i Medicinal plants

The main problems limiting the development of medicinal plant production are:

- Not enough stabilised markets for herbal raw materials
- A significant dispersion of the herbal plants cultivation area (20,000 farms)
- The producers of herbal raw material are not associated in the powerful producers co-operatives (Polish Committee of Medicinal Plants gathers the producers' section, which represents unfortunately only a part of the producers').
- Low financial support for scientific research in that scope

2.5.ii Cosmetics

The application of domestic herbs and essential oils for cosmetics and aromatherapy is limited by the economic problems of many companies producing and processing herbs. A significant reduction of the earlier existing companies number is observed, as well as the reduction in the number of distilleries of essential oils. Therefore, the domestic production of essential oils is much lower than in the 1980s, replaced by import, which appeared cheaper. There is a strong competitiveness with artificial fragrances and essential oils. Marketing and advertising is expensive and it is a significant constraint in the development of SMEs producing herbal cosmetics.

2.5.iii Natural dyestuff

There is a strong competitiveness with artificial dyestuffs, and natural dyestuffs are more expensive than synthetic.

2.5.iv Natural product for crop protection

Produced mostly for horticulture purposes. Large amounts applied at a plantation scale would probably be too expensive, as prices are rather high. The registration process is long and the Ministry of Agriculture and Rural Development grants the relevant certificates. The effectiveness of the natural crop protection products is not as immediate as that of traditional pesticide, which also constrains large-scale applications.

Additionally, there are no taxes on synthetic pesticide; seldom up to 3 % - to facilitate the application of biocides on a large scale. There is a strong competition with chemical crop protection products.

3. Prioritisation

The medicinal plants are the most important crops for special uses in Poland. The climate, soil and low levels of pollution in entire country, especially in the east and north-east part of the country are some of the best in Europe for the cultivation of medicinal plants. Also, the high rate of unemployment and overpopulation in rural areas gives great chance for the production of herbal raw material. Additional beneficial factors are:

- tradition of cultivation and usage of herbal plants and herbal medicinal products
- common acceptance of the society
- about 100 years of research

CROPPING AND STOCKING PATTERNS FOR AGRICULTURE AND HORTICULTURE

Table 7. Harvest and production of major agriculture crops (harvest in thous. tonnes)

Specification	1996-2000	2000	2001	2002 Total
Cereals	25189	22341	26960	26877
– of which basic cereals including cereal mixed	20795	21344	25540	24876
wheat	8772	8503	9283	9304
rye	5160	4003	4864	3831
barley	3420	2783	3330	3370
oats	1437	1070	1305	1486
triticale	2006	1901	2698	3048
cereal mixed for grain	3779	3084	4060	3836
Maize for grain	557	923	1362	1962
Pulses for grain		264	211	135
– of which edible	100	93	88	95
– pulses for feed	182	171	123	134
Potatoes	23620	24232	19379	15524
Sugar beets	14920	13134	11364	13434
Oil-bearing	866	971	1082	968
– of which rape and agrimony	847	958	1064	953
Flax- straw	8.6	7.9	10.2	10.1
Tobacco	36	30	24	21
Hop	2.6	2.5	2.4	2.4
Feed root plants	4999	5057	4431	2140
Hay: total	19996	36739	55556	70801
Straw from basic cereals	21944	18387	21794	20979

Source: Statistical Yearbook of Poland 2003 and <http://www.stat.gov.pl/> (2003), °data not available by CSO yet

Table 8 Yields of major crops from 1 ha [dt]

Specification	1996-1999	2000	2001	2002	
				Total	Of which private farms
Cereals	28.6	25.3	30.6	32.4	31.1
Pulses	19.2	18.7	19.4	20.5	19.6
Potatoes	183	194	162	193	191
Sugar beets	377	394	358	443	439
Rape and agrimony	20.7	21.9	24.0	21.6	20.5
Feed root plants	408	400	390	419	423
Straw from basic cereals	30.3	25.8	30.8	31.9	30.9
Cereals, potatoes, and sugar beets (counted in cereals)	28.4	25.9	29.7	32.1	30.9

Source: Statistical Yearbook of Poland 2003

Table 9 Purchase of major crops in Poland

Specification	1991 – 1995	1995	1996-1999	2000	2001	2002	
						Total	In % of production
Cereals [thous. t]	4252	4604	5596	7089	6934	7940	29.5
wheat	2574	2651	3662	5206	4815	5439	28.0
rye	838	1132	876	677	805	872	22.8
barley	442	393	420	357	310	386	11.4
oats and cereal mixed	71	76	86	64	55	64	1.2
triticale	94	90	128	158	168	210	6.9
Pulses [thous. t]			4.9	4.9	2.9	4.5	4.7
Potatoes [thous.t]	1167	731	1165	1278	1138	1269	8.2
Sugar beets [m t]	12.6	13.3	14.9	13.1	11.3	13.4	99.9
Rape and agrimony industr. [thous. t]	724	1216	795	896	997	851	89.6

Source: Statistical Yearbook 2003

CURRENT INDUSTRIAL CROPS

2.1 Oil Crops

Rapeseed

Table 10. Area of cultivation, yields and harvest of rapeseed and agrimony

Year	Cultivation area [‘000 ha]	Yield [t/ha]	Harvest [‘000 t]
1990	500.4	2.41	1206.0
1991	467.8	2.23	1042.7
1992	417.1	1.82	758.2
1993	348.5	1.71	594.4
1994	370.3	2.04	755.7
1995	606.4	2.27	1376.6
1996	282.6	1.59	449.3
1997	317.4	1.87	594.9
1998	466.0	2.36	1099.1
1999	545.3	2.08	1131.9
2000	436.8	2.19	958.1
2001	443.2	2.40	1063.6
2002	439.0	2.17	952.7
2003	426.3	1.86	793.0

Source: Source: Statistical Yearbook 2003

2.2 Fibre Crops *Flax and hemp*

Table 11. Flax and hemp cultivation area [thous. ha]

Year	Flax	Hemp
1989	34.3	2.1
1990	29.6	0.7
1991	9.7	0.1
1992	5.5	0.0
1993	4.0	0.1
1994	8.1	0.4
1995	13.8	0.3
1996	5.9	0.2
1997	3.7	0.3
1998	2.4	0.1
1999	3.1	0.1
2000	4.1	0.1
2001	5.2	0.1
2002	5.1	0.1
2003	3.0	0,1

Source: CSO, Poland

2.3 Carbohydrate Crops

The major source of carbohydrates for industry in Poland is potatoes. In the year 2002; 15.5 million tonnes of potato were harvested.

Table 12 Cultivation area, yield and crop (harvest) of potatoes

Specification	1997	1998	1999	2000	2001	2002
Cultivated area [ha]	1.31	1.29	1.27	1.25	1.19	0.80
Change compare to the previous year [] *	-2.6	-0.9	-2.1	-1.3	-4.6	-27.7
Yield [t/ha]	15.9	20.0	15.7	19.4	16.2	19.3
*	-21.7	-25.8	-21.5	-14.9	-16.5	14.2-20.4
Crop (harvest) [Mio t]	20.8	25.9	19.9	24.2	19.4	15.5
*	-23.7	-24.9	-23.2	-21.4	-19.8	-13.2-17.8

Source [4]: Rynek ziemniaka (Potato Market), W. Dzwonkowski et al. IERiGZ, Warsaw. 2002. Based on data of Central Statistical Office (CSO), Warsaw

Table 13 Potato Balance Sheet

Item	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03
				0			
[000 tonnes]							
Crops-harvest	27217	20776	25949	19927	24232	19379	15 500-
Imports	35	66	24	131	39	71	30
Total supply	27252	20842	25973	20058	24271	19411	16070-16870
On-farm use:	18541	14496	18385	14638	17150	13256	9789
–seed	3100	2950	2950	2850	2850	2064	1900
–feed	12791	8896	12735	9158	11650	8592	5289
–self-consumption	2650	2650	2700	2630	2650	2630	2600
Total sales	4211	3356	3826	2969	3729	3384	3740
–for consumption	2352	2147	2089	2000	2000	1960	1960
–for industrial use*	2067	1140	1562	908	1655	1405	1695
–exports	72	69	175	61	84	19	140
Losses	4500	2990	3763	2451	3392	2810	1970

* industrial use irrespectively of the branch, Source: CSO. [4]

2.4 Crops with special uses

Medicinal plants and pharmaceutical preparations

The area of herbal crops in Poland equals up to 35,000 ha, while medicinal plants plantations area in Poland equals up to 20,000 ha. The detailed data regarding the cultivation area of particular medicinal plants are not available, due to the fact that there are approximately 20,000 plantations to approach.

The annual production of raw material obtained from such plantations is 15,000-17,000 tonnes. The annual demand for herbal raw material in Poland is 26,000 tonnes, while 17,000 tonnes are obtained from special plantations, 5,000 tonnes from natural environment and 4,000 tonnes from import.

The production of herbal raw material from plantations of herbs equals 17,000 tonnes of dry mass, which contains about 1/4 of production of countries of European Union. The dry mass of medicinal plants consumed by pharmaceutical industry is approx. 20,700 tonnes.

Table 14. The cultivation of herbal plants in Poland, purchase and production

Average year data for 1980 – 2002

Total area [ha]	Number of farms	Number of main cultivated species	Annual production of herbs [t]	Max buy up [tonnes]	Min buy up [tonnes]
30,000	20,000	70	17,000	In 1986: 24,000	In 1980: 8,500

Source: Dr. Jerzy Jambor, PhytoPharm Kleka S.A., Kleka

Table 15. Herbal raw material from natural environment, purchase and production.

Average year data for 1980 – 2002

Number of main cultivated species of medicinal plants	Annual harvest [tonnes]	Annual production of herbs	Max buy up [tonnes]	Min buy up [tonnes]
100	3,500-5,000	From 100 kg to 750 t	In 1978: 5,600	In 1980: 3,200

Source: Dr. Jerzy Jambor, PhytoPharm Kleka S.A., Kleka

ANNEX 3

INDUSTRIAL CROP PRODUCTS AND ESTIMATE TRENDS IN PRODUCTION FROM 1998 TO 2003 (AND IF POSSIBLE THEREAFTER)

3.1 Oil crops

Products based on rapeseed oil: edible plant oil, hard and soft margarine, methylated and ethylated esters of rapeseed oil, rapeseed cake for fodder

Table 16. The production of vegetable fats in past decade [‘000 tonnes]

Years	Vegetable edible fats total	Refined oils for sale	Margarine
1990	279.5	76.6	179.1
1991	289.0	70.0	194.0
1992	356.0	94.3	234.0
1993	422.8	124.1	276.3
1994	486.0	114.8	319.8
1995	550.0	149.1	373.6
1996	568.4	170.1	368.1
1997	642.0	207.0	394.5
1998	663.0	207.8	362.5
1999	704.8	246.7	367.3
2000	673.0	250.0	384.0
2001	699.0	220.4	380.2
2002	700.0	240.0	369.1
2003*	680-700	210.0	360.0
2004**	710.0	220.0	370.0

Source: Rynek rzepaku 2004 (Rapeseed Market), *Prognosis of IERiGZ, ** estimation of IERiGZ (Institute of Agriculture and Food Economy).

3.2 Fibre crops

Table 17: Production and markets of flax products

Item	1997	1998	1999	2000	2001	2002	2003
Dew retting [%]	100	100	100	100	100	100	100
Mill consumption of flax [t]	6288	5074.8	1882	2321	6123	6880	*6760
Yarn production [t]	3820	3024	889	1362	5950	6669	*740
Production of textiles [1000 m]	11298	7658	4607	4563	3953	4380	*4500
Export of linen textiles (fabrics) [1000 m]	7778	4875	4480	3241	2371	2550	*3100

Source: H. Smarzyński, Polish Flax Foundation, Institute of Natural Fibres, Poznań, Poland (1996-2000); * Institute of Natural Fibres estimations, Polish Flax and Hemp Chamber (2004)

Table 18: Data on export and import of fibre and linen products in Poland in 2003.

Specification	Export in thous. USD	Import in thous. USD
Scutched flax fibre	2,137	10,661
Linen tow and waste products	2,255	3,789
Linen yarn total	24,840	9,877
Linen fabrics total	21,302	31,552

Source: Ministry of Economy, Labour and Social Policy

The production of hemp goods is rather low, and it is difficult to gain the statistical data regarding the textile hemp production. Per year 20-30 tonnes of seeds are produced for reproduction, mainly for export. [1A]

3.3 Carbohydrate crops

Table 19. Industrial processing of potato

Direction of usage	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03*
['000 tonnes]							
For starch	940	470	806	335	815	690	910
For alcohol	847	212	223	83	215	100	100
For dry potato	97	212	233	140	175	85	100
For other food applications	183	246	317	350	450	530	600
Total processing	2067	1140	1579	908	1655	1500	1610

*Prognosis

Source: Data of "POLZIEM" Sp. z o.o., Ministry of Finances, CSO-Central Statistical Office, Warsaw, information from companies etc.

Industrial products obtained from starch in Poland are described in the Part III

3.4 Crops for special uses

Medicinal plants and pharmaceutical preparations

Table 20. Purchasing of herbal raw materials in Poland. Average year data for 1995 – 1999

Purchasing value	Raw Materials
over 1,000 tonnes	Matricariae flos, Menthae piperitae folium, Valerianae radix Carduri mariae fructus
500–1,000 tonnes	Hippocastani semen, Thymi herba, Hyperici herba, Oenotherae semen
200 – 500 tonnes	Tiliae flos, Mellisae folium, Boraginis semen
100 – 200 tonnes	Aroniae fructus, Frangulae cortex, Sambuci fructus, Betulae folium, Quercus cortex, Salicis cortex, Hippocastani cortex, Urticae folium, Cynarae herba, Visci albi herba
50 – 100 tonnes	Equiseti herba, Sambuci flos, Crataegi inflorescentia, Taraxaci radix, Salviae folium, Millefolii folium, Farfarae folium, Viola tricoloris herba
10 – 50 tonnes	Agropyri rhizoma, Calami rhizoma, Levistici radix, Calendulae anthodium, Chelidonii herba, Phaseoli pericarpium, Althaeae radix, Arnicae anthodium, Galegae herba, Origani herba, Angelicae radix
5 – 10 tonnes	Inulae radix, Euphrasiae herba, Cichorii radix, Meliloti herba, Cnici herba, Anthemidis anthodium, Convallariae herba, Malvae arboeae flos

Source: Dr. Jerzy Jambor, PhytoPharm Kleka S.A., Kleka

Table 21 The best sold herbal medicinal products in Poland

The annual value of the sale of each of the drug over 1 m USD

No	Name	Shape (form)	Producer	The components of plant origin
1	Geriavit	Capsules	PHARMATON (CH)	Ginseng extractum sic.
2	Amol	Liquid	ROLAND (D)	Oleum Citronellae, Oleum Myristicae, Oleum Caryophylli, Oleum Cinnamomii, Oleum Citri, Oleum Mentae, Oleum Lavandulae
3	Sylimarol	Pills	HERBAPOL POZNAŃ (PL)	Silybi mariani fructus extractum siccum
4	Raphacholin C	Pills	HERBAPOL WROCLAW (PL)	Raphani radix recens extractum sic., Cynarae herba extractum sic.

No	Name	Shape (form)	Producer	The components of plant origin
5	Bilobil	Capsules	KRKA (SLO)	Ginkgo bilobae extractum siccum
6	Wyciąg ze Skrzypu Polnego z Witaminami	Tablets	VITAMEX (S)	Equiseti extractum sic., Urticae extractum sic.
7	Urosept	Pills	HERBAPOL POZNAŃ (PL)	Extractum sic.: Petroselini radix, Phaseoli pericarpium, Betulae folium, Chamomilae anthodium, Vitis idaeae folium
8	Oeparol	Capsules	AGROPHARM (PL)	Oenothera paradoxa oleum
9	Tablets Uspokajające --	Tablets	LABOFARM (PL)	Melissae folium, Leonuri cardiacaе herba, Valerianae radix, Lupuli strobili, Menthae piperitae folium, Lavandulae, flos
10	Poldanen	Tablets coated	HERBAPOL POZNAŃ (PL)	Pygei africana cortex extractum sic.
11	Alax	Pills	HERBAPOL POZNAŃ (PL)	Alona, Glycyrrhizae radix, Frangulae cortex extr., Atropa radix
12	Sirupus Plantaginis	Syrup	HASCO-LEK (PL)	Plantaginis extractum fluidum
13	Tadenan 50	Capsules	DEBAT (Fournier Group) (F)	Pygei africana cortex extractum sic.
14	Cardiol C	Drops	HERBAPOL WROCLAW (PL)	Tinc. Convallariae titr., Tinc. Valerianae, Tinc. Crataegi, Colae extractum fluidum
15	Boldaloin	Tablets	HERBAPOL WROCLAW (PL)	Aloe extractum sic., Boldinum
16	Kalms	Tablets	G.R.LANE HEALTH PRODUCTS (GB)	Lupuli strob. pulvis, Valerianae extractum sic., Gentianae extractum sic
17	Esberitox N	Tablets	SCHAPER AND BRUMMER (D)	Thujae herba extractum sic., Echinaceae rad. extractum sic., Baptisiae extractum sic.
18	Echinacea	Tablets	RATIOPHARM (D)	Echinaceae angustifoliae radix extractum sic.
19	Pyrosal	Syrup	HERBAPOL WROCLAW (PL)	Extractum fluidum: Farfae folium, Sambuci flos, Tiliae inflorescentia, Salicis cortex; Fructus Ribis Concentratum
20	Melisana	Liquid	KLOSTERFRAU (D)	Extractum: Melissaе fol., Inulae rad., Angelicae rad., Zingiberis rhiz., Piperis nigri fruct., Gentianae rad., Myristicae sem., Phaseoli pericar., Cinchonae cort., Casiae flos, Cardamomi fruct.

Source: Dr. Jerzy Jambor, PhytoPharm Kleka S.A., Kleka

Despite a growing economic significance of herbal food and cosmetics, the greatest influence on the Polish herbal market in the present decade will have the manufacture of herbal

pharmaceutical preparations. The domestic market of herbal medicines with almost 3,000 authorised and implemented products is estimated to be about 200 million USD. This is about 10 % of the entire pharmaceutical market and almost 1/3 of the OTC medicine market. The forecast for the next years shows that the development of self-medication shall go together with an intensive development of the OTC (Over the Counter) medicines market, especially herbal medicines.

The general manufacture of herbal raw material in Poland is estimated to be about 20,000 tonnes per year, including 1/5 from natural resources and 4/5 from cultivation. There is an opinion that if farmers treat the herbal raw material as pharmaceutical raw material (with high quality) and the herbal processing is changed into a modern pharmaceutical industry, Poland may become an important manufacturer of raw material and processed herbs in the world.

Cosmetics and essential oils

The mass of herbal raw material used for the production of cosmetics is about 1300 tonnes per year.

The total use of essential oils for aromatherapy, including the usage for the fragrances and cosmetics is approx. 60 tonnes per year. In 2001 the purchase of cumin essential oil, produced in Poland equalled 10kg. The forecast predicts the constant growth of the herbs use for the production of cosmetics and essential oils.

Condiments (spices)

There is a commercial production of herbs for condiments uses. The herbal raw material applied exclusively for condiments (spices) is cultivated on 12,000 ha.

Natural products for plant protection, produced in Poland

Bioczos BR – Producer: PPH “HIMAL” Lodz

Based on extract from garlic (active substance allicin). Inhibits the growth and development of fungi (e.g. Phytophthora on flowering plants, Erysiphe on decorative plants) and bacteria of plant diseases.

Biosept 33 SL – Producer: Cintamani Poland – Piaseczno.

Based on the extract from grapefruit. Inhibits the growth and development of fungi (e.g. species *Phoma* on several plants from the *Ameryllidaceae* (*Hippeastrum*, *Narcissus*).

Polyversum – Producer: Biopartner S. C. Poznań.

Biologically active substance: oospores of fungus *Pythium oligandrum*. It is present in roots area of several crops (rape and all cereals). It is antagonist towards the following pathogenic fungi: *Fusarium*, *Phytophthora*, *Phoma*, *Alternaria*, *Perenoplasmopara*, *Botrytis*.

Adpros 850 SL – Producer- Varichem T. Ostrowski- Huta Zabikowo. Biologically active substance: fatty acids of rape oil.

Olejan 85 EC – Producer: Towarzystwo Chemiczne “ Danmar” Lodz. Biologically active substance: rape oil.

Two last preparations belong to so called adjuvants. It means that they support the biological efficiency of pesticides action (influence) and they have to be applied together with relevant pesticides.

Biochikol 020 PC - Firm Gumitex Poli-Farm sp.z o.o. Lynkowica str.59, 99 - 40 - Lowicz; Ph.: + 48 46830 00 40 Fax: +48 46830 00 40 41 e-mail: office@gumitex.pl

Bio product is biopolymer, derivative form chitin. Applied to fight with virus, bacterial and mushroom plant diseases.

Grevit 200 SL - Firm Avis Naturall Polska Sp.z o.o. Ph.:(022) 8892450, fax: (022) 8892451.

Bio product based on the extract from grapefruit. Applied to fight with bacterial and mushroom plant diseases.

KEY CONTACTS

4.1 Academic

Table 22. Key contacts in the scope of oil and fatty acids

Organisation	Address	Ph. No.+48/	Fax No +48/.	Products	Remarks
Poznań University of Agriculture	ul. Wojska Polskiego 71D 60-630 Poznań	(061) 848 75 16		University	Education and research
Instytut Hodowli i Aklimatyzacji Roslin	ul. Strzeszynska 36, 60-479 Poznań	(0-61) 823-32-51	(0-61) 823-38-71	Research Institute	Breeding of oil crops
Institute of Natural Fibres	ul. Wojska Polskiego 71b 60-630 Poznań	(061) 8455 829	(061) 8417 830	R&D	Breeding of oil flax, development of linseed and hempseed oil extraction technology and new products
Uniwersytet Warmińsko-Mazurski	ul. Oczapowskiego 2, 10-719 Olsztyn	(089) 524-03-10	(089) 524-04-08	University	Education and research
Wyzsza Szkoła Oficerska im. Tadeusza Kosciuszki	ul. Czajkowskiego 109 51-147 Wroclaw	(71)365816 2	(71)3658 162	Military University	Research on biodiesel
Instytut Lotnictwa	al. Krakowska 110/114 02 – 256 Warszawa	(22) 846-00-11	(22) 846-44-32	Research Institute (aviation)	Research on biodiesel
Przemysłowy Instytut Maszyn Rolniczych	ul. Starolecka 31 60-963 Poznań	(061) 87-12-200	(061) 879-32-62	Research Institute (agriculture machinery)	Producer of small scale unit for bio-diesel production

Table 23. Key contact in the scope of fibre crops

Organisation	Address	Ph. No. +48/	Fax No. +48/	Products	Remarks
Institute of Natural Fibres	ul. Wojska Polskiego 71b 60-630 Poznań	(061) 8480 061	(061) 841 78 30 E-mail: sekretar@inf.poznan.pl	Research Institute	Natural fibre science and research
Centralny Ośrodek Badawczo-Rozwojowy Maszyn Włokienniczych "POLMATEX-CENARO"	ul. Włokiennicza 55/59 90-608 Łódź	(042) 633 38 82	(042) 633 54 60	Research Centre	Textile machinery

Table 24. Key contacts in the scope of carbohydrate crops

Organisation and address	Ph./fax/E-mail	Profile of activity
Dr. Marian Maczynski Director Centralne Laboratorium Przemysłu Ziemniaczanego (CLPZ) Starch and Potato Products Research Laboratory ul. Armii Poznań 49 62-030 Luboń	Ph.:893 –46-05 Fax: 893 46 08 E-mail: clpz@man.poznan.pl	Research regarding: starch processing to obtain modified starch for the following industries: Food (thickening media, stabilisers), paper (preparations for superficial bonding of paper, cation starch, glue for corrugated cardboard etc.), textile (oxidised starch and acetylated starch, starch and synthetic blending), drilling (protective colloid in drilling washer), foundry industry (pyro-dextrin) as well as topics related to food purposes. CLPZ solves and assists the engineering of above-mentioned technological processes. The CLPZ assists the standardisation committee in scope of potato and starch products.
Instytut Hodowli i Aklimatyzacji Roslin Oddział Bonin 76-009 Bonin k/Koszalin	Ph.:+48/0-94/34 23 031 Fax: +48/0-94/34 27 028 E-mail: iziem@man.koszalin.pl	Potato research: breeding of new varieties, agricultural practices and storage
Prof. Dr. Hab. Jan Malkowski Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej ul. Świetokrzyska 20 00-959 Warszawa	Ph.:+48/0-22/826 50 31 Fax: +48/0-22/827 19 60 E-mail: ieridz@ierigz.waw.pl	Economy of agriculture and food

Source: [5]

Tables 25 –29 Key contacts in the scope of crops with special uses***Medicinal Plants***

Instytut Roslin i Przetworow Zielarskich Research Institute of Medicinal Plants ul. Libelta 27, 61-707 Poznań	Ph.:+48/61/852 40 03 Fax: +48/61/852 74 63 E-mail: iripz@iripz.pl
PhytoPharm Kleka S.A. Kleka 1, 63-040 Nowe Miasto nad Warta	Ph.:+48/0-61/ 2868000 Fax: +48/0-61/ 2874070 E-mail: jerzy.jambor@europlant.com.pl
President Dr. Jerzy Jambor Polish Committee of Medicinal Plants Office of the Main Board: ul. Libelta 27, 61-707 Poznań	Ph.:+48/0-61/ 2868505 Fax: +48/61/852 74 63 E-mail: jerzy.jambor@europlant.com.pl

Pharmaceutical preparations

Instytut Lekow Zaklad Lekow Pochodzenia Naturalnego The Drug Institute, Dept. Of Plant Material and Herbal Medicine ul. Chelmska 30/34 00-725 Warszawa	Ph.:+48/0-22/841 29 40 Fax: +48/0-22/8 41 06 52 E-mail: mch@il.waw.pl http://www. Il.waw.pl
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Note: Each major company, producing pharmaceutical preparations has got its own R&D department.

Cosmetics

Panstwowy Zaklad Higieny National Institute of Hygiene ul. Chocimska 24 00-791 Warszawa	Ph.:+48/0-22/ 54-21-400 Fax: +48/0-22/ 849-74-84 E-mail: tpoosiad@pzh.gov.pl
HERBA STUDIO ul. Długa 109 62-070 Zakrzewo	Ph./fax: +48/61/8 143-352 E-mail: herba@herbastudio.pl www.herbastudio.pl

Aromatherapy

FABRYKA SUBSTANCJI ZAPACHOWYCH "POLLENA-AROMA" Sp. z o.o. Fragrances & Flavours Co. Ltd. ul. Klasykow 10 03-115 Warszawa	Ph.:+48/0-22/811 42-21, +48/0-22/811-42-70 Fax: +48/0-22/811-92-28 E-mail: aroma@pollenaaroma.com.pl http://www.pollenaaroma.com.pl
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Natural Dyestuff

Instytut Wlokien Naturalnych Institute of Natural Fibres Ul. Wojska Polskiego 71b 60-630 Poznań	Ph.:+48/0-61/8 455-828 Fax: +48/0-61/8 417-830 E-mail: kasia@inf.poznan.pl
Panstwowy Zaklad Higieny National Institute of Hygiene ul. Chocimska 24 00-791 Warszawa	Ph.:+48/0-22/ 54-21-400 Fax: +48/0-22/ 849-74-84 E-mail: tpoosiad@pzh.gov.pl

4.2. Industry- both in fundamental research and industrial processing

Oil Crops

Table 30. Key contacts in the scope rapeseed processing industry

Organisation	Address	Ph. No.+48/	Fax No +48/	Products	Remarks
Wielkopolskie Zakłady Tłuszczowe ADM Szamotuly Sp. Z o.o.	ul. Dworcowa 39, 64-500 Szamotuly	(61)2921 405	(61)2921 451	Refined vegetable oils and fats	Private company; annual turnover: > 26 Mio Euro
Zakłady Tłuszczowe "BIELMAR" Sp. Z o.o.	ul. Sempolowskiej 63, 43-300 Bielsko-Biala	(33)8146 024	(33)8146 024	Margarine and similar fats	Private company; annual turnover: > 6.3 Mio Euro
Tłuszcze Roslinne "BOLMAR" S.A.	Bodaczow k. Zamoscia 22-425 Bodaczow	(84)6821 685	(84)6821 685	Margarines and vegetable oils	State owned
KAMA FOODS S.A.	ul. Ziemi Tarnowskiej 3, 49-300 Brzeg	(77)4162 053-58	(77)4162 059	Margarines and vegetable oils	State owned, annual turnover: > 140 mio Euro
Zakłady Przemysłu Tłuszczowego w Warszawie S.A.	ul. Radzimska 122/124 03-574 Warszawa	(22)6798 728	(22)6795 679	Margarines and vegetable oils	State owned, employment 785
Olvit Trade Sp. Z o.o.	ul. Indyjska 7 81-336 Gdynia	(58)6218 011	58)62107 65	Non-purified oils and fats	Private company, employment 100
Zakład Przetworstwa Nasion Oleistych Sp. Z o.o.	Lubachow k. Swidnicy Sl. 58-114 Lubachow	(74)8535 757-58	(74)8530 500	Refined vegetable oils and fats	Private company, annual turnover: – 6.0 mio Euro
Slaskie Zakłady Przemysłu Tłuszczowego "Van den Bergh Foods" Sp. Z o.o.	ul. Kolodziejska 2 40-386 Katowice	(32)2568 033	(32)2569 761	Margarines and vegetable oils, tee blends, beverages	Private company, annual turnover: – 122.8 mio Euro
ZAMPOL Sp. Z o.o. Rafineria Olejow Jadalnych	ul. Przemyslowa 3 05-100 Nowy Dwor Mazowiecki	(22)7759 246	(22)7759 246	Vegetable oil refinery	Private company

Organisation	Address	Ph. No.+48/	Fax No +48/.	Products	Remarks
Raisio Polska Foods Sp. Z o.o.	Jagodne 1 05-480 Karczew k. Otwocka	(22)7809 291	(22)7809 270	Margarines and vegetable oils, fodder	Private company, annual turnover: – 37.6 mio Euro
GODAGRO Ltd.	Zarzecze 8 18-220 Czyzew	(86)2755 555	(86)2755 016	Refined vegetable oils and fats	Private company, annual turnover: – 7.2 mio Euro
Polsko-Amerykanska Spolka "Raps" S.A.	Malczewo 14 62-242 Jarzabkowo	(61)8272 131	(61)8272 132	Refined vegetable oils and fats	Private company, annual turnover: – 203 thous. Euro
Office of Domestic Association of Rapeseed Producers (KZPR)	ul. Wspolna 30 r. 7 00-930 Warszawa	Ph.: +48/-22 623 26 05	Ph./fax+ 48-22 623 27 52, e-mail: biuro@kzpr.com.pl www.kzpr.com.pl		The organization unit of KZPR is Regional Association of Rapeseed Producers (OZPR).
Krajowe Zrzeszenie Producentow Rzepaku	ul. 1 Maja 6 45-068 Opole	(077)453 -07-91	(077)453 -07-91		Association of Rapes Producers

Table 31. Linseed processing

Institution	Address	Ph.: No	Fax No	Products	Remarks
J. Kozłowska, MSC Institute of Natural Fibres	ul. Wojska Polskiego 71b, 60-630 Poznan	+48/- 61/8 455- 829	+48-61/8 417-830	Linseed oil, edible and pharmaceutical, roasted linseed, flax preparation BIOFLAX	The products have got relevant certificates

Fibre Crops

Table 32. Flax and industrial hemp processing companies

Organisation	Address	Ph. No.	Fax No.	Products	Remarks
Instytut Włokien Naturalnych, Experimental Plant LENKON, Steszew	ul. Mosinska 8 62-060 Steszew	061 813 45 81	061 813 46 13	Short and long flax fibre, flax sliver, technical yarns	Company and also INF Experimental Factory; processes also hemp straw and fibre
ARMIX Grodki	ul. Grodki 92, 23-465 Turobin	084/683-53-48		flax fibre	
RAWEN-R. A.Batorski	ul. Grodki 26, 20-465 Turobin	084 683 42 44		flax fibre	
PPHU "CELINEN" Sp. Cywilna	ul. Włokiennicza 36/4 67-223 Radwanice	076 831 14 12	076 831 14 12	Flax fibre	
Zrzeszenie Producentow Krajowych Włokien Naturalnych, Lublin	ul. Inzynierska 8 20-484 Lublin	081 744 29 61	081 744 29 61	Growers of flax, producers of flax and hemp fibre and seeds	Association
Zakłady Przemysłu Lniarskiego "ORZEL" S.A. in Mysłakowice	ul. Daszynskiego 46 58-533 Mysłakowice	075 713 14 91	075 713 14 87	Flax woven fabrics, flax combed and carded yarns	
EUROLEN, former Fabryka Wyrobów Lnianych "SWIEBODZICE" Sp. Z o.o. in Swiebodzice	ul. Strzegomska 17 58-160 Swiebodzice	074 854 02 31	074 854 71 69	Carded and combed flax yarns	
Zakłady Lniarskie "MADEX" in Malbork	ul. Kosciuszki 10 82-200 Malbork	055 647 36 06	055 647 36 06	Carded and combed flax yarns	Processes the flax straw into fibre
Fabryka Wyrobów Lnianych "ZYRARDOW"	ul. Limanowskiego 44 96-300 Zyrardow	046 855 30 15	046 855 30 16	Woven fabrics and printing of fabrics	

Organisation	Address	Ph. No.	Fax No.	Products	Remarks
Zakłady Lniarskie "LEN"	ul. Nadodrzańska 1A 58-400 Kamienna Góra	075 744 25 05	075 744 25 05	Woven fabrics	
Safilin-Polska Sp. z o.o., Milakowo, oddz. Szczytno	ul. Gnieznińska 2, 12-100 Szczytno	089 758 74 75	089 758 70 08	Dew- and dry spun combed yarns and carded yarns	Foreign capital company
Spinning Mill "LAMBRECH T" Sp. Z o.o.	ul. Wodna 20A, 64-965 Okonek	067 266 95 70	067 266 95 71	Carded yarns	Foreign capital company
ZAMATEX Sp. z o.o.	Ul. Emerytalna 8/10 93-481 Łódź	044 616 95 68	044 616 95 68	linen-cotton and hemp-cotton yarns	Fabrics, knitting goods (including hemp) are produced in cooperation with other companies
ARMIX S.J.- M. Tluczek	Ul. Grodki 93-465 Turobin	084 683 53 48	084 683 53 48	flax and hemp fibre	
Ekotex Namysłów	Ul. Łączna 11 46-100 Namysłów	077 403 92 90		processing of linen wastes	

Carbohydrate Crops

Table 33. The list of potato industry companies

No	Organisation	Address	Ph. No. +48/	Fax No. +48/	Products
	Wielkopolskie Przedsiębiorstwo Przemysłu Ziemniaczanego S.A., Luboń Zakład Luboń and Staw	Ul. Armii Poznań 49, Luboń	(061) 813 05 81	(061)813 02 32	Potato starch, modified starch for: food, paper, textile, pharmaceutical industries, dextrin white and yellow, starch syrup, dextrin and casein glue, glue to PET packaging, potato protein
	Potato industry company NOWAMYŁ S.A.	Szosa Swidwiska 1 73-150 Lobeż	(091)3974 021	(091)3974 592	Potato starch, malto-dextrin, flocculent, bonding for wood cool briquetting, glue to corrugated cardboard
	Potato industry company S.A., Niechlow	Ul.Przemysłowa 8 56-215 Niechlow	(065)5435 626	(065)5435 605	Potato starch, pudding starch, wheat vital gluten, wheat starch, modified starch, potato protein
	Potato industry company ZETPEZET Pila Sp. Z o.o.	Ul.Walki Młodych 30 64-920 Pila	(067)2122 710	(067)2122 748	Potato starch, modified starch for technical and food purposes, starch syrup
	Potato industry company ZETPEZET Wronki Sp. z o.o.	Ul.Sierakowska 50 64-510 Wronki	(067)2540 841 (067) 2540457	(067)2540 885	Starch syrup, food carmel liquid and dry, painting starch glue, glue for paper and wall-paper, casein glue to wood, starch preparations for drilling
	Foo industry company "PEPEES" S.A.	ul.Poznańska 121 18-400Lomża	(086)2184 404	(086)2183 242	Potato starch, crystalline glucose, dehydrated glucose, malto-dextrin, modified starch oxidate, enzymatic syrup, beer, potato protein
10	Potato industry company LUBLIN Sp.z o.o.	Ul.Betonowa 9 20-402 Lublin	(081)5327 071	(081)5327 430	Starch syrup
11	"ELIPSA" Sp. z o.o.	ul. Fabryczna 1, 55-080 Katy Wrocławskie	0-71 316-60-75	0-71 316-66-71	Potato starch
12	Potato industry company Sp. z o.o. w Trzemesznie	ul. Przemysłowa 4, 62-240 Trzemeszno	0-52 315-43-50	0-52 315-43-52	Potato starch and protein
13	Potato industry company S.A. w Bronisławiu	88-320 Strzelno	0-52 318-93-90	0-52 318-93-91	Potato starch
14	Potato industry company S.A. w Ilawie	ul. Wojska Polskiego 33 14-200 Ilawa	0-89 648-22-31	0-89 648-23-59	Potato starch

No	Organisation	Address	Ph. No. +48/	Fax No. +48/	Products
15	Potato industry company "IKEDA" Sp. z o.o.	ul. Laczanska 24 46-100 Namyslow	0-77 4 106 135	0-77 4 104 592	Potato starch, maize starch dry potato
16	Potato processing company "BEST" S.j.	Przewloka 81 A 21-200 Parczew	0-83 354-30-69	0-83 354-30-69	Potato starch
17	Potato processing company Radomice	87-616 Lipno	0-54 28-79-583	0-54 28-79-583	Potato starch

Table 34. Potato and potato starch associations

Organisation and address	Ph./fax/E-mail	Profile of activity
Stowarzyszenie Producentow Skrobi Ziemniaczanej (The Association of Potato Starch Producers), Ul. Armii Poznań 49 62-00 Luboń	Ph.:(061) 893 47 00 Fax: (061) 893 46 76	Association of starch and derivative products' producers aims in protection of interests of starch producers in Poland. Supports co-operation, exchange of ideas and information, advising, conducts relevant training
Krajowy Związek Stowarzyszen Producentow Ziemniakow Skrobiowych w Polsce (Polish Union of the Associations of Starch Potato Producers) Siedziba Zarzadu Krajowego Ul. Armii Poznań 49 62-030 Luboń	Ph.:(061) 893 47 00	Union of the associations of potato producers in Poland
Polska Grupa Producentow Skrobi Ziemniaczanej i Modyfikatorow (Polish Group of Potato Starch and Producers and Modifiers in Lomza), 18-402, Lomza ul. Poznanska 121	Ph.:: (086) 473 – 44- 04 Fax: (086) 218-32-42	Producers' group, aiming in protecting the potato starch producers interests, providing opinion about legislation projects, connected with the sector, co-operation with the Ministry etc.

Source:[5]

Crops with Specialist Uses

Medicinal plants and pharmaceutical preparations

Table 35. Main companies producing herbs and pharmaceutical preparations

1. PhytoPharm Kleka S.A. Kleka 1, Nowe Miasto n/Warta	Ph.:+48/0-61/ 2868000 Fax: +48/0-61/ 2874070 E-mail: jerzy.jambor@europlant.com.pl www.europlant.com.pl
2. PZZ “Herbapol” S.A. Poznań ul. Towarowa 47/51 Poznań	Ph.:+48/0-61/866 62 51 Fax: (+48 61) 853 60 58 E-mail: herbapol.poznan@gmteuropa.com www.herbapol.poznan.pl
5. KZZ “Herbapol” S.A. ul. Chalupnika 14 Krakow	www.herbapol.krakow.pl
6. “Runo” Sp. z o.o. ul. Bialowieska 40 Hajnowka	Ph.:+48/0-85/682 21 95
7. PZZ “Herbapol” S.A. ul. Sw. Mikolaja 65/68, Wroclaw	Ph.:+48/0-71/344 66 39
7. Zaklad Chemiczno–Farmaceutyczny “Farmapol” Sp. z o.o. ul. Sw. Wojciecha 29	www.farmapol.pl
8. “Herbapol” Gdansk Sp.z o.o. Pruszcz Gdanski Ul. Zastawna 21	Ph.:+48/0-58/683 42 47
9. “Herbapol”Lublin ul. Diamentowa 25 20-954 Lublin	Ph.:+48/0-61/847-51-7, www.herbapol.com.pl
10. Instytut Wlokien Naturalnych (INF) Ul. Wojska Polskiego 71b 60-630 Poznań	Ph.:0-61/845-55-29 Fax: 0-61/8 417-830 E-mail: jkozlo@inf.poznan.pl
10. Curtis Healthcare Sp.z o.o. Ul. Zeromskiego 60-544 Poznań	
11. “Herbdor” (seed turnover) K. Pastuszewska ul. Wiejska 89 85-456 Bydgoszcz	Ph.:+48/0-52/321-24-04

Source:[1]

Table 36. Main cosmetics companies applying herbs

1) AVICENNA OIL – ul. Opolska 11/19 52-010 Wrocław Ph.: 81/ 341 69 51	9) Farmapol 61-749 Poznań ul. Świętego Wojciecha 10 Ph.. 61/ 852 63 53
2) HERBAPOL S. A. 31-464 Kraków ul. Chalupnika 14 Ph.. 12/411 78 44	10) Labofarm Ph.. 58/ 561 20 08 ul. Lubickowska 76 B 83-200 Starogard Gdański
3) HERBA STUDIO 62-069 Zakrzewo ul. Długa 109 Ph./fax: +48/61/814 33 68 E-mail: herba@herbastudio.pl www.herbastudio.pl	12) HASCO LEK Wrocław Ul. Zmigrodzka 242
4) HERBAPOL LUBLIN S. A. 20-954 Lublin ul. Diamentowa 25 81/ 744 12 21	13) A-Z MEDICA 81-106 Sopot ul. Czyżewskiego 6/1A Ph.. 58/ 342 23 12
5) HERBAPOL S.A. Poznańskie Zakłady Zielarskie 61-896 Poznań ul. Towarowa 47/51, Ph.. 61/ 866 62 51	14) FITOMED 01-445 Warszawa ul. Ciolka 13
6) HERBAPOL Warszawskie Zakłady Zielarskie 05-800 Pruszków, ul. Ołowkowa 54, Ph.. 22/ 758 88 44	15) FLOS LEK 02-981 Warszawa ul. Zawodzie 23, Ph.. 651 97 30
7) ZIOLOLEK Przedsiębiorstwo Farmaceutyczne 61-512 Poznań ul. Pamiatkowa 5 Ph.. 61/ 835 23 63	16) FEMI Laboratorium Farmaceutyczno-Kosmetyczne 80-275 Gdańsk ul. Karłowicza 7 Ph.. 58/ 341 46 12
8) FILOFARM 85-619 Bydgoszcz ul. Puławskiego 39	17) Pollena Aroma 03-115 Warszawa ul. Klasyków 10 Ph.. 22/ 811 42 21
10) Zakład Zielarski Kawon 63-800 Gostyn ul. Zielona 14	18) CHARMINE ROSE – POLYCRYST 03-828 Warszawa ul. Minska 65, Ph.. 22/ 871 10 00

Source: [6]

Table 37. Aromatherapy

FABRYKA SUBSTANCJI ZAPACHOWYCH "POLLENA-AROMA" Sp. z o.o. Fragrances & Flavours Co. Ltd. ul. Klasykow 10 03-115 Warszawa	Ph.:+48/0-22/811 42-21, +48/0-22/811-42-70 Fax: +48/0-22/811-92-28 E-mail: aroma@pollenaaroma.com.pl http://www.pollenaaroma.com.pl
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Table 38 Technology transfer groups

The Institution/address	Contact details
WCTT - Wroclawskie Centrum Transferu Technologii ul. Smoluchowskiego 48 50-372 Wroclaw (note: it act as Innovation Relay Centre as well)	Ph.: (+48 71) 320 39 12, 320 33 18 Fax: (+48 71) 320 39 48 E-mail: wctt@itma.pwr.wroc.pl http://www.wctt.wroc.pl
PPNT - Poznański Park Naukowo-Technologiczny Fundacja Uniwersytetu im. Adama Mickiewicza ul. Rubież 46 61-612 Poznań (note: it act as Innovation Relay Centre as well)	Ph.:(+48 61) 827 97 46 Fax: (+48 61) 827 97 41 E-mail: poznan@irc-westpoland.org.pl, ppnt@ppnt.poznan.pl http://www.ppnt.poznan.pl Dir. Jacek Gulinski e-mail: Jacek.Gulinski@irc-westpoland.org.pl
Centrum Transferu Technologii ul. Grunwaldzka 529 80-320 Gdansk (note: it act as Innovation Relay Centre as well)	Ph./fax: (058)552-1498, 0601 618 734 e-mail: ctt@post.pl http://www.ctt.gda.pl/
Politechnika Warszawska Centrum Transferu Technologii ul. Koszykowa 80 02-008 Warszawa	Ph.: (022) 660 71 66 fax: (022) 660 71 67 E-mail: ww@ctt.pw.edu.pl http://www.ctt.pw.edu.pl/
Uniwersytet Warszawski Uniwersytecki Osrodek Transferu Technologii ul. Pasteura 7 02-093 Warszawa	Ph.:+48/0-22/ 824 39 12 Fax: +48/0-22/ 824 38 94
Centrum Transferu Technologii Politechniki Krakowskiej ul. Warszawska 24 31-155 Krakow	E-mail: uott@uott.uw.edu.pl http://uott.uw.edu.pl/
Wydział Inżynierii Środowiska ul. Warszawska 24 31-155 Krakow (note: it act as Innovation Relay Centre as well)	Ph.:+48 (0-12) 628 28 45; Ph./fax: +48 (0-12) 632 47 95 e-mail: ctt@transfer.edu.pl http://www.transfer.edu.pl/ , http://imik.wip.pw.edu.pl/OTI/
Osrodek Transferu Innowacji Helena Korolewska Ms ul. Narbutta 86/12 02-524 Warszawa	Ph./Fax: (+48 22) 848 33 79, (+48 22) 6608609 E-mail: hm@wip.pw.edu.pl

Table 39. Innovation Relay Centres

IRC East Poland

Hi-Tech Sp. z o.o.
ul. Akademicka 3
02-038 Warszawa

Ph...: (+48 22) 823 42 52
Fax: (+48 22) 668 83 90
E-mail:
Malgorzata Skibska-Zielinska
E-mail: m.skib-ziel@hitech.com.pl
<http://www.hitech.com.pl>
Ph...: (+48 22) 825 58 19
Fax: (+48 22) 825 33 19
Krystyna Siwek
E-mail: ksiwek@opi.org.pl
<http://www.opi.org.pl>

OPI - Ośrodek Przetwarzania Informacji
Al. Niepodległości 188 b
00-950 Warszawa

IRC South Poland

IRC South Poland - Co-ordinator
Centrum Transferu Technologii
Politechnika Krakowska
ul. Warszawska 24
31-155 Krakow

Ph...: (+48 12) 628 28 45
Ph../fax: (+48 12) 632 47 95
E-mail: ircpk@transfer.edu.pl
<http://www.transfer.edu.pl>

Fundacja INKUBATOR
ul. Piotrkowska 143
90-434 Lodz

Ph...: (+48 42) 637 23 75
Fax: (+48 42) 637 23 15
E-mail: ctt@insite.pl
<http://www.inkubator.org.pl>

RARR - Rzeszowska Agencja Rozwoju
Regionalnego S.A.
ul. Szopena 51
35-959 Rzeszow

Ph...: (+48 17) 85 20 600 ext. 233, 234
Fax: (+48 17) 85 20 611
E-mail: irc_rz@telbank.pl
<http://www.rarr.dnet.pl>

IRC West Poland (see in Transfer of Technology list)

additionally:
CTT - OBROiUS Poznań
Innovation Rely Center
Poznański Park Naukowo-Technologiczny
Fundacji UAM
Ul. Rubież 46
611-612 Poznań

Ph.:8780-035 (7) w 108
Mobil: 0-607-990-690
Fax: 82 79 741
E-mail: poznan@irc-westpoland.org.pl
<http://www.obroi.us.poznan.pl/ctt>

4.3 Other interest groups

The committees, associations and unions regarding rape, fibre, potato, herbal plants are mentioned in connection with research organisations in each relevant group of crops.

4.4 Lists of names and addresses and interests of all people or organisations contacted

in the preparation of this report

Oil crops.

Rape

Poznań University of Agriculture Prof. Dr. Czeslaw Musnicki Dr. Piotr Tobola ul. Wojska Polskiego 71D Poznań	Ph.:+48(0-61) 848 75 16 Fax: +48(0-61) 848 73 98 E-mail: tobola@au.poznan.pl
Krajowe Zrzeszenie Producentow Rzepaku President Mariusz Olejnik Ewa Mysliwiec (Ph.: 0-22 623-26-05) ul. 1 Maja 6 45-068 Opole	Ph.:+48(077)453-07-91 Fax: +48(077)453-07-91

Bio-fuel

Optimal contact Ministerstwo Rolnictwa i Rozwoju Wsi Ministry of Agriculture Dep. Gospodarki Ziemia Ul. Wspolna 30 00-930 Warszawa	Ph.:0-22/623 16 24 Fax: 022/623 23 05
Przemyslowy Instytut Maszyn Rolniczych MSc. Eng. Stanislaw Jankowiak ul. Starolecka 3, 60-963 Poznań	Ph.:+48/(061) 87-12-200 Fax: +48 (061) 879-32-62 E-mail: stjankow@pimr.poznan.pl

Fibre Crops

In the scope of fibre crops, the authors used the information provided by the following institutions: Central Statistical Office, Ministry of Agriculture and Rural Development, Ministry of Economy, Labour and Social Policy (Krzysztof Zareba, Department of Industrial Policy, Plac Trzech Krzyzy 3/5, 00-507 Warszawa, E-mail: krzzar@mg.gov.pl), COBORU in Slupia Wielka, Instytut Wlokien Naturalnych (INF) in Poznan; Polska Izba Lnu i Konopi (Polish Flax and Hemp Chamber) at Institute of Natural Fibres, Poznan; Zrzeszenie Producentow Krajowych Wlokien Naturalnych (The Association of Natural Fibres Producers) in Lublin. The contacts has been made with the relevant farmers, linen mills and companies.

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Carbohydrate Crops

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Crops with specialist uses

Medicinal Plants

Doc. Dr. Habil. Przemyslaw Mrozikiewicz, Prof. Dr. habil. Piotr Gorecki Dr. Alina Mscisz, MSc Elzbieta Mielcarek Dr. Katarzyna Seidler-Lozykowska Instytut Roslin i Przetworow Zielarskich Research Institute of Medicinal Plants ul. Libelta 27, 61-707 Poznań	Ph.:+48/61/852 40 03, Fax: +48/61/852 74 63, E-mail: iripz@iripz.pl Ph.:+48/61/ 867-81-65
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Pharmaceutical preparations/ Drugs

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Natural Dyestuffs

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ANNEX 5

SOURCES OF INFORMATION (REFERENCES IN THE REPORT TEXT)

[1A] Publications and materials of the Institute of Natural Fibres, Poznań. Among others: EUROFAX Newsletter, Natural Fibres- Włókna Naturalne

[1] The publications and information of the Institute of Medicinal Plants, Poznań

[2] Dr. Jerzy Jambor, PhytoPharm Kleka S.A., Kleka

[3] Dr. Władysław S. Brud, POLLENA-AROMA, Warsaw

[4] Wiesław Dzwonkowski et al. Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej.

“Rynek Ziemniaka”. "The Potato market. Its condition and perspectives. Market reports". ISSN 1231-2762. No 22. November 2002

[5] publications and the and information of the (CLPZ)–Starch and Potato Products Research Laboratory, and Association of Potato Starch Producers, Luboń

[6] CENTRUM KOSMETOLOGICZNE Sp. z o. o., Warszawa

[7] Stefan Szczukowski, Univeristy of Warmia and Mazury, Olsztyn: “Evaluation of different plant species for energy production and their cultivation possibility in Warmia and Mazury regions”, “Implementation of new technologies for alternative plant production for energy production and herbal preparations”. Jan Kus “Utilisation of renewable energy resources in Poland”

[8] Prof. Dr. hab. Jan Zastawny, IMUZ Falenty

[9] Ministry of Agriculture and Rural Development of Poland

General sources of information

- Statistical Yearbook of the Republic of Poland, Warsaw
- Materials of the Ministry of Agriculture and Rural Development of Poland, 2003
- Register of varieties of agricultural plants (Lista odmian roślin rolniczych), COBORU, Słupia Wielka, Poland. ISSN 1231 –8299. 2003.
- Wiesław Dzwonkowski et al., Institute of Agriculture and Food Economy. 'The Potato market'; 'The Sugar market'; 'The Cereals market'; 'The Oilseed Rape market'. Its condition and perspectives. Market reports. ISSN 1231-2762. Warsaw
- Publications and materials of the Institute of Natural Fibres, Poznań. Among others: EUROFAX Newsletter, Natural Fibres- Włókna Naturalne
- The publications and information provided by the Institute of Medicinal Plants, Poznań
- Materials provided by Dr. Jerzy Jambor, PhytoPharm Kleka S.A., Kleka
- Publications and materials of Starch and Potato Products Research Laboratory, Luboń
(e.g. Marian Maczyński et al. The possibilities of starch utilisation and future trends in the potato starch production technologies)
- Materials provided by Dr. Władysław S. Brud, POLLENA-AROMA, Warsaw
- Information provided by the producers of natural crop protection preparations
- Information provided by of HERBA STUDIO, Zakrzewo
- Information provided by of the Drug Institute, Warsaw
- Information provided by the Polytechnic University of Lodz, Faculty of Food Chemistry and Biotechnology, Institute of Chemical Food Technology, Department of Sugar Industry
- Chotkowski et al. Plant Breeding and Acclimatization Institute (IHAR), Bonin, Poland: Production of potato. Technology–Economy–Marketing. 1997

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