

## **ANNEX 13**

Statistics for France

# FRANCE

**Lubricants** (other than 4-stroke engines) (source: Europalub 1995):

APPLICATIONS	FRENCH MARKET (T/YR)	EUROPEAN MARKET (T/YR)	PRODUCT TO BE REPLACED
<b>2-stroke engine oil</b>	11 500	75 000	mineral oils
<b>hydraulic fluids</b>	100 000	570 000	glycol polyalkylenes
<b>machining oils</b>	60 000	450 000	polyol esters
<b>non-recovered oils</b>	15 000	30 000	polyol esters, glycol polyalkylene
<b>oils for concrete casings and formwork</b>	9 000	40 000	
<b>grease</b>	30 000	100 000	glycol polyalkylene

## Drilling fluids:

APPLICATIONS	EUROPEAN MARKET (T/YR)	PRODUCT TO BE REPLACED
<b>Primary fluids</b>	80 000	diesel fuel mineral oils
<b>Emulsifier</b>		synthetic surfactants
<b>Viscosity enhancer</b>	- polyacrylamide 42 000 - xanthanes 110 000	water-soluble polymers: - polyacrylamides - xanthanes

Many companies are preparing for the likelihood that more stringent legislation will impose a tax on the use of environmentally toxic lubricants. Some examples are given below [16].

- NOVANCE uses a thousand tonnes of vegetable oil produced in metropolitan France to produce biolubricants.
- MOBIL is readying a production line for clean lubricants (AGRICE programme).
- A SNCF/SHELL/BP partnership is working on lubricants for greasing railway track (around 700 T/yr).
- The construction/public works sector is interested in oils for concrete casings that reduced worksite pollution and work-related illnesses (6000 T of oil applied to the inner surface of concrete moulds and forms. Vegetable ester formulations are already being marketed for these applications (for example, by supplier Pieri FINA).
- Vegetable-oil-based products are now used as cutting fluids in the aeronautic industry (smaller quantities required and better working conditions).

Major industrial groups such as ELF, FINA, TOTAL and SHELL, among others, are developing applications.

However, for the most part these applications involve tropical oils (palm-oil, copra, palm-nut oil). At the same time, the constant readjustment of agricultural policy and the risk of fluctuating quantities, quality and price of feedstocks worries industrialists, and hampers industrial exploitation of vegetable oils.

## ✓ Biodegradable plastics

Starch can be used in this type of material in three different ways:

- adjunct in conventional plastics (6% starch)

- blended with synthetic polymers (60 to 75% starch)
- as a thermoplastic starch itself (75 to 95% starch + other grain-derived compounds).

Materials derived from raw amylaceous matter

In France the AGRIPACK company produces packing material from maize starch. The beads obtained are spherical and calibrated at approximately 15 m in diameter. Between 10 and 12,000 m<sup>3</sup> of packing beads can be produced from 100 ha of irrigated maize (transport costs account for 30 to 40% of the sale price). A 20% share of this market could be supplied with industrial crops on 2,000 ha of set-aside lands.

Biopolymers

Biopolymers are produced by fermentation. The most common compounds are polyhydroxybutyrate (PHB) which fetches 150 to 170 FF<sup>1</sup>/kg for a world production of 5,000 T/yr, polylactic and polyglycolic acid (4,000 to 20,000 FF/kg), polylactones, and chitosan.

These compounds are not widely marketed in France. Their high price limits their applications to noble uses such as surgical materials that are biologically broken down, or "green" packaging for cosmetics. But lower production costs would allow industrialists to increase their production capacity and branch into new markets.

The products on the market are MATER-BI, NOVON, BIOPOL, ECO-PLA, produced respectively in Italy, the United States and the United Kingdom.

These biodegradable plastics are suitable only for short-life-cycle applications, i.e. 20% of the total market for plastics, along with a strategy for recycling synthetic plastics which have qualities that are indispensable for many applications.

Currently production of biodegradable plastics stands at a few tens of thousands of tonnes world-wide, but could reach one million tonnes by 2000 if new regulations governing the use of fossil carbon or non-biodegradable packaging are adopted.

✓ **Detergents**

The potential applications for starch or starch derivatives are particularly attractive in detergent manufacture, an industry with large-scale production. Studies have shown that 60 to 75% of washing powders could be replaced by biodegradable products.

Of roughly 1,700,000 tonnes of detergents consumed in France each year, 1,400,000 could be supplied by agriculture, after processing, broken down by product as follows (source: ITCF):

Compounds	% in washing powder	Tonnage/yr	Substitute product
Surfactants	8-14	350 000	Amphiphile derivatives of glucose
Alkaline agents	10-20		
Sequestering agents	20-30	900 000	<ul style="list-style-type: none"> <li>• Citric and gluconic acids</li> <li>• Modified starches</li> </ul>
Whiteners	10-20	50 000	Sugars and acetylated polyols that release hydrogen peroxide
Ancillaries	<ul style="list-style-type: none"> <li>• Enzymes : 0.3</li> <li>• Anti-deposit agents (CMC) : 1</li> <li>• Optical bluing agents : 0.2</li> </ul>		
Adjuncts	<ul style="list-style-type: none"> <li>• Scents</li> <li>• Colour dyes</li> <li>• Volume agents</li> </ul>		

In France the company HENKEL-SEPPIC produces **surfactants** from agricultural products (3,000 to 4,000 T/year), particularly glucose syrup for the hydrophilic head and copra oil for the hydrophobic tail. These are (ionic) alkylpolyglucosides, more

<sup>1</sup> 1 ECU = 6.60 FF

commonly known as APGs. These can be modified by cationisation, anionisation or esterification, according to the application. They can be used in the formulation of dishwashing liquids, detergents, liquid soaps and various other cleaning agents.

**Citric and gluconic acids** (complexing agents for ions in solution in wash water) are produced by fermentation of glucose derived from starch, and they are already used in some cases as substitutes for sequestering agents. Gluconic acid is used mostly in cleaning and anti-corrosion products, and citric acid in household detergents.

A factory with a nominal production capacity of 40,000 T was recently built in Alsace by the Austrian group Jungbunzlauer.

**Sugars and acetylated polyols** such as glucose pentacetyl are used as whiteners, and have a very high capacity for complexing heavy metals after decomposition, they contain no nitrogen and are entirely biodegradable.

All of the biodegradable compounds, can, when substituted for phosphates, limit eutrophication phenomena in bodies of water.

#### ✓ Other starch applications

The diverse characteristics of starch make it suitable for many applications, which have been more or less developed to date. They are relevant to the following sectors:

- **Adhesives and glues**, for manufacture of corrugated paperboard (90% of adhesive use in papermaking), paper bags, wallpaper...  
Various processes have been perfected by the CERESTAR company located in France: Stein-hall, No-carrier, Minocar. The ROQUETTE company is also a leader in this field in France.
- **Textiles**, for preparation of weaving production lines and printing of cloth. But this demand is falling off rapidly, in proportion to the growing use of synthetic fibres, and in 1993 consumption came to only 8,000 T in Europe, of which 1,500 T in France.
- **Chemicals industry**, as fermentation substrates (amino acids, antibiotics, vaccines, prosthetic devices...), as a direct substrate— excipient, binder, coating, active principal (sorbitol), tissue substitute (blood serum: starch ether).

Pathways for development in this domain involve cyclodextrines in particular, for their specific ring structure, and polylactic acids for the manufacture of biocompatible and bioresorbable prosthetic devices.

- **Building and construction**: amylaceous products are in common use as additives, to regulate drying (glucose syrup), as binders, anti-freeze and a retarding agent for concrete (gluconic acid).
- **Lubricants**, in association with basic vegetable oils for the manufacture of biolubricants.
- **Agrochemicals**, as binder in the make-up of fertilisers, modified starch allowing controlled release of phytosanitary products by encapsulation, seed coatings.
- **Super-absorbent products**: grafted starches that retain up to 1,000 times their weight in water, in disposable nappies, as a talc substitute, or root coating in semi-arid zones.  
The potential market is estimated to reach 100,000 T/yr in Europe in 2000.

#### i. Plant species

(Given the complex synthesis of a range of data, these figures are orders of magnitude.)

Two types of crops represent the most valuable production in France:

- Crops with low unit value, but extensively planted (lavandin, poppy).
- Crops that are picked or gathered in small quantities, with relatively high unit value (gentian, wild blueberries).

**Planted acreage of medicinal, aromatic and perfume plants in mainland France**  
(1995, [32]) :

CROP SPECIES PLANTED ON > 10,000 ha		
	Lavandin (13,300 ha)	
CROP SPECIES PLANTED ON > 5,000 et < 10,000 ha		
	Oil poppy (5,000 à 6,000 ha)	
CROP SPECIES PLANTED ON > 1,000 et < 5,000 ha		
Lavender (2,500 ha)		Clary (1,000 ha)
CROP SPECIES PLANTED ON > 100 et < 1,000 ha		
Tarragon	Thyme	Parsley
Bitter fennel	Hyssop	Psyllium
Ginkgo Biloba		
CROP SPECIES PLANTED ON > 10 et < 100ha		
Wormwood	Chervil	Peppermint
Dill	Chives	Passiflora
Angelica	Coriander	Woad
Green anise	Ergot	Horseradish
Artichoke	Sweet fennel	Rosemary
Burdock	Fenugreek	May rose
Basil	Gentian	Savory
Borage	Lovage	Officinal sage
Wild camomile	Melilot	Verbena
Roman camomile	Melissa	
Blackcurrant	Mint	
CROP SPECIES PLANTED ON < 10ha		
Artemisia	Hamamelis (witch hazel)	Meadowsweet
Bluet	Jasmine	Saffron
Calendula	Marjoram	Santolina
Cistus	Mallow	Saponaria (soapwort)
Escholtzia	Bitter orange	Valerian
Ginseng	Origanum (oregano)	Red creeper
Grindelia	Mouse-ear (hawkweed)	Violet
Marsh mallow	Dandelion	Others



## Annex 1

## Cropping patterns for agricultural products

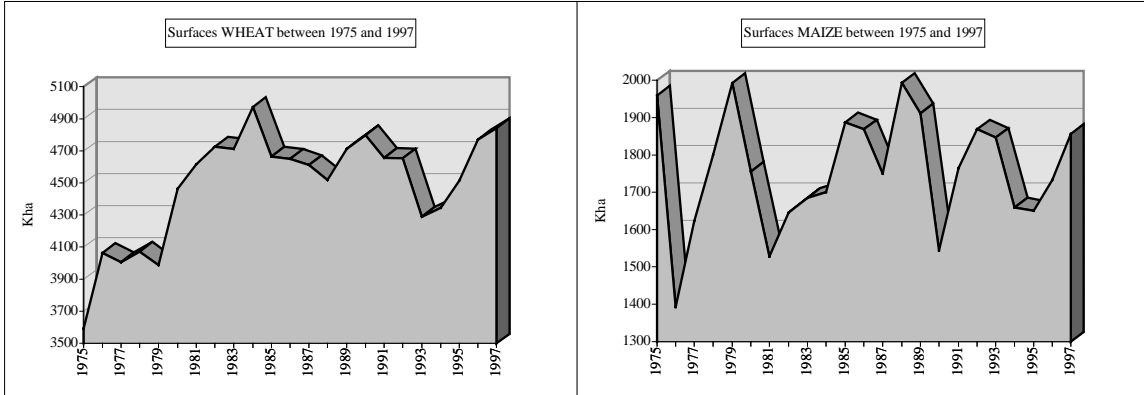
		1975	1980	1985	1990	1995	1996	1997
				<b>CEREALS</b>				
<b>WHEAT</b>								
Surfaces	(Kha)	3592.7	4465.9	4666.0	4799.0	4515.8	4770.1	4843.7
Average yield	(t/ha)	3.95	5.21	6.11	6.61	6.61	7.27	6.81
Production	(KT)	14199.3	23256.0	28503.0	31743.0	29852.5	34695.0	32970.8
<b>MAIZE</b>								
Surfaces	(Kha)	1960.0	1756.9	1888.7	1545.0	1650.3	1733.4	1857.6
Average yield	(t/ha)	4.18	5.33	6.59	5.82	7.72	8.38	9.06
Production	(KT)	8201.8	9358.0	12441.0	8996.0	12735.9	14529.7	16832.5
<b>BARLEY</b>								
Surfaces	(Kha)	2796.6	2649.9	2248.0	1761.0	1386.8	1534.3	1690.3
Average yield	(t/ha)	3.37	4.40	5.10	5.72	5.54	6.19	5.99
Production	(KT)	9343.5	11715.6	11470.0	10067.0	7685.6	9496.9	10126.3
<b>OATS</b>								
Surfaces	(Kha)	655.3	533.8	432.8	218.0	148.6	139.5	133.4
Average yield	(t/ha)	2.97	3.62	4.09	3.88	4.04	4.46	4.25
Production	(KT)	1947.9	1930.7	1770.0	146.0	600.6	621.9	567.2
<b>RYE</b>								
Surfaces	(Kha)	110.1	129.5	87.3	64.5	46.3	48.6	45.1
Average yield	(t/ha)	2.65	3.15	3.40	3.66	4.10	4.54	4.36
Production	(KT)	291.7	407.5	296.8	236.2	190.3	220.8	196.9
<b>SORGHO</b>								
Surfaces	(Kha)	81.6	147.4	44.0	66.6	45.8	54.8	68.7
Average yield	(t/ha)	3.30	4.74	4.68	3.97	5.65	6.26	6.62
Production	(KT)	269.2	349.2	206.2	264.4	258.5	343.2	454.2
				<b>OIL CROPS</b>				
<b>RAPE</b>								
Surfaces	(Kha)	281.7	780.5	473.7	677.4	838.8	870.0	974.9
Average yield	(t/ha)	1.80	2.80	2.99	2.91	3.23	3.32	3.54
Production	(KT)	507.3	2181.6	1418.6	1973.1	2706.7	2885.2	3449.2
<b>SUNFLOWER</b>								
Surfaces	(Kha)	75.7	102.8	638.5	1116.3	976.8	913.4	894.9
Average yield	(t/ha)	1.49	2.38	2.37	2.07	2.06	2.24	2.28
Production	(KT)	113.3	244.8	1513.3	2312.1	2015.5	2044.9	2041.1
<b>SOJA</b>								
Surfaces	(Kha)	1.6	7.8	27.4	118.2	101.8	85.9	97.9
Average yield	(t/ha)	1.97	2.12	2.10	2.20	2.60	2.70	2.70
Production	(KT)	3.3	16.5	56.4	255.6	261.3	229.6	268.6
<b>OIL FLAX</b>								
Surfaces	(Kha)	20.8	3.0	/	2.2	15.3	8.4	5.4
Average yield	(t/ha)	1.34	1.96	/	1.90	1.80	1.80	1.80
Production	(KT)	27.8	5.9	/	4.2	27.2	14.9	9.9
				<b>AUTRES</b>				
<b>SUGAR BEET</b>								
Surfaces	(Kha)	598.1	548.8	490.9	474.7	458.2	456.7	461.7
Average yield	(t/ha)	39.55	48.04	61.08	66.85	66.71	67.74	74.32
Production	(KT)	23655.7	26368.4	29990.7	31734.6	30571.0	30943.5	34311.4
<b>HEMP</b>								
Surfaces	(Kha)	7.5	6.6	6.1	3.3	6.0	7.6	10.6
Average yield	(t/ha)	5.85	6.83	6.05	6.37	6.20	5.10	7.10
Production	(KT)	44.1	45.1	37.0	20.9	37.0	38.9	75.2
<b>TEXTIL FLAX</b>								
Surfaces	(Kha)	43.2	46.3	58.8	58.7	54.0	44.1	45.0
Average yield	(t/ha)	5.61	6.36	6.82	6.22	6.10	6.40	6.90
Production	(KT)	242.4	294.6	401.8	365.1	327.5	283.9	312.6
<b>SPECIALTY USES CROPS (cf. part. IV)</b>								
Surfaces	(Kha)	32.1	29.5	/	21.9	26.8	27.9	29.1
<b>LAVANDIN</b>								
Surfaces	(Kha)	19.6	16.9	12.6	12.4	14.2	14.1	14.3
Average yield	(t/ha)	/	/	6.07	6.63	7.70	7.90	7.90
Production	(KT)	/	/	7.66	82.7	109.2	112.4	113.4

Annexe 1

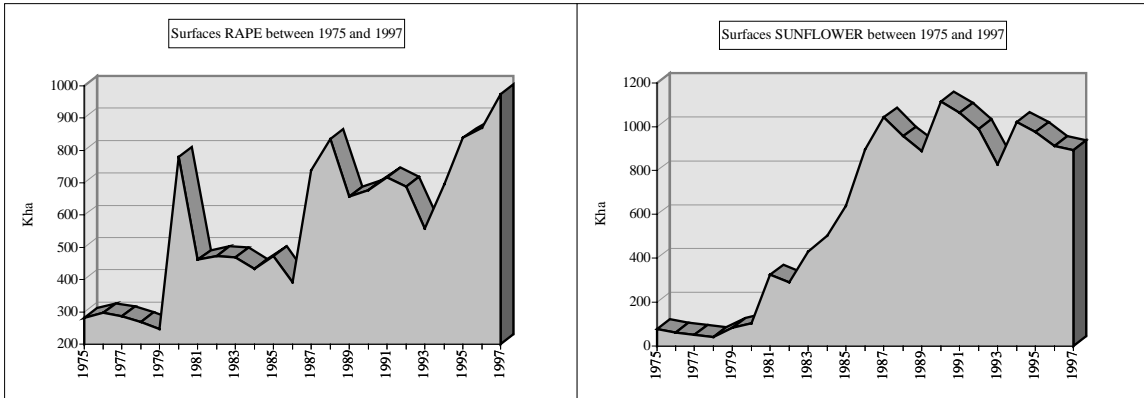
Surfaces (France) of main crops with industrial purposes

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
<b>WHEAT</b>																							
Kha	3592	4066	4008	4072	3987	4465	4619	4728	4713	4975	4666	4650	4613	4519	4712	4799	4658	4654	4292	4345	4515	4770	4843
<b>MAIZE</b>																							
Kha	1960	1393	1623	1801	1993	1756	1529	1646	1685	1701	1888	1869	1750	1994	1912	1545	1764	1869	1847	1660	1650	1733	1857
<b>RAPE</b>																							
Kha	281	297	287	269	248	780	461	473	469	433	473	392	737	835	657	677	716	687	558	694	838	870	974
<b>SUNFLOWER</b>																							
Kha	75.7	59.5	50.4	38.9	80.6	102.7	323.1	289.6	431.1	503.7	638.5	896.7	1043.7	957.1	889.9	1116.3	1065.3	990.8	826.9	1022	976.8	913.4	895
<b>SUGAR BEET</b>																							
Kha	598	613	581	556	545	548	632	561	490	525	490	448	445	432	430	474	457	460	441	437	458	456	461
<b>SORGHO</b>																							
Kha	85	81.6	99.9	93.6	83.9	147.4	68.6	56.1	53.7	56.6	44	45.1	35.8		71.4	66.6	71.5	101.7	82.9	47.7	45.7	54.7	68.6

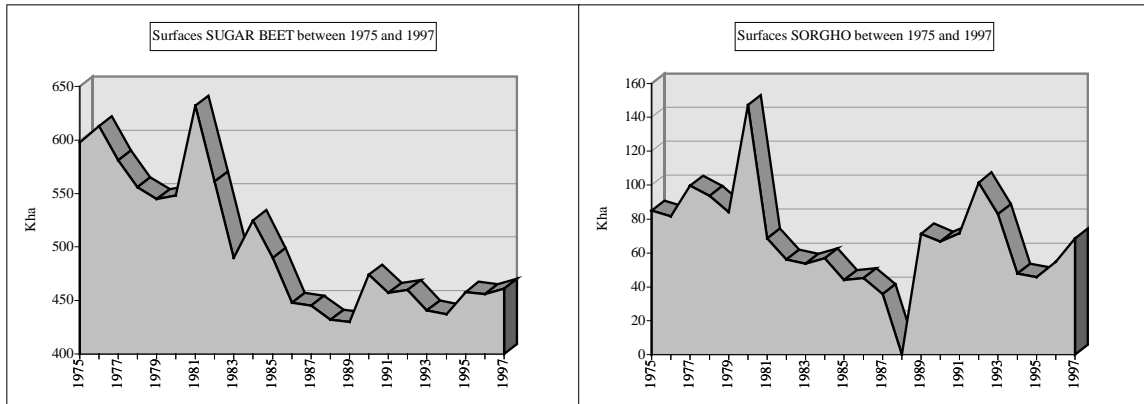
CEREALS



OIL CROPS



SUGAR BEET and SORGHO

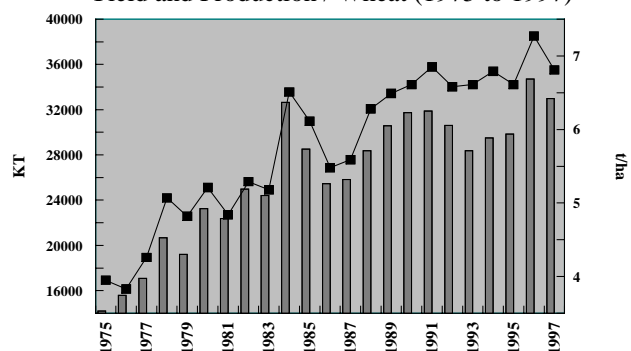


### Production of crops for industry purposes from 1975 to 1997

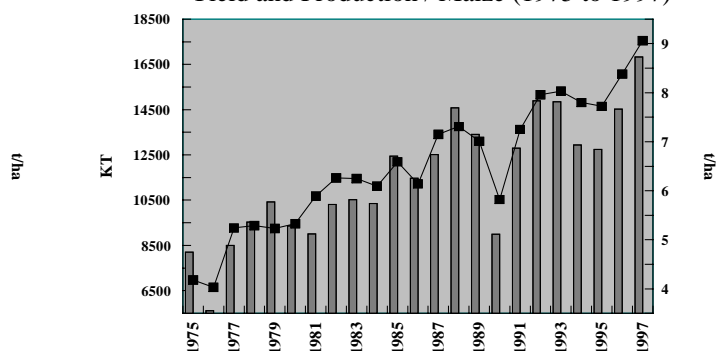
	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
<b>WHEAT</b>																							
t/ha	3.95	3.83	4.26	5.07	4.82	5.21	4.84	5.29	5.18	6.51	6.11	5.48	5.59	6.28	6.49	6.61	6.85	6.58	6.61	6.79	6.61	7.27	6.81
KT	1419	1558	1708	2066	1920	2325	2236	2498	2439	3265	2850	2546	2581	2837	3058	3174	3188	3061	2836	2950	2985	3469	3297
<b>MAIZE</b>																							
t/ha	4.18	4.03	5.24	5.29	5.23	5.33	5.89	6.26	6.25	6.09	6.59	6.14	7.15	7.31	7.01	5.82	7.25	7.96	8.03	7.80	7.72	8.38	9.06
KT	8201	5617	8504	9525	1042	9358	9002	1030	1052	1035	1244	1147	1251	1457	1341	8996	1279	1488	1484	1294	1273	1452	1683
<b>RAPE</b>																							
t/ha	1.80	1.94	1.46	2.33	2.04	2.80	2.18	2.50	2.06	3.14	2.99	2.66	3.62	2.82	2.86	2.91	3.19	2.70	2.84	2.64	3.23	3.32	3.54
KT	507.3	577.7	419.8	628.0	515.7	2182	1005	1184	966.8	1358	1418	1044	2670	2356	1881	1973	2289	1859	1587	1835	2706	2885	3449
<b>SUNFLOWER</b>																							
t/ha	1.49	1.28	1.82	2.12	2.06	2.38	2.53	2.24	1.95	1.94	2.37	2.08	2.54	2.60	2.31	2.07	2.44	2.16	2.09	2.08	2.06	2.24	2.28
KT	113.3	76.0	91.9	82.4	165.7	244.8	816.5	648.5	841.2	977.8	1513	1869	2650	2489	2054	2312	2600	2143	1728	2127	2015	2044	2041
<b>SUGAR BEET</b>																							
t/ha	39.55	37.28	46.63	43.68	47.81	48.04	57.57	57.53	53.70	54.69	61.08	57.63	57.75	66.03	64.32	66.85	64.56	68.76	72.06	66.44	66.71	67.74	74.30
KT	2365	2286	2713	2430	2605	2636	3642	3233	2631	2875	2999	2583	2573	2858	2769	3173	2952	3167	3180	2903	3057	3094	3431
<b>SORGHO</b>																							
t/ha	3.66	3.30	3.31	4.25	4.04	4.74	4.99	4.90	4.61	4.52	4.68	3.81	5.31		4.21	3.97	5.52	5.58	6.12	5.51	5.65	6.26	6.62
KT	311.3	269.2	330.5	397.7	338.5	349.2	342.5	276.3	247.9	255.8	206.2	171.8	190.3		300.6	264.4	394.6	568.1	507.1	263.2	258.5	343.2	454.7

### CEREALS

Yield and Production / Wheat (1975 to 1997)

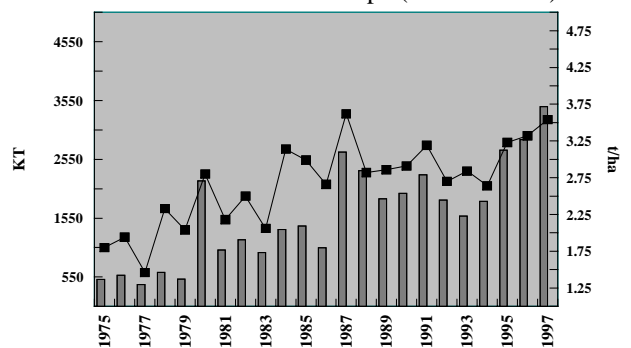


Yield and Production / Maize (1975 to 1997)

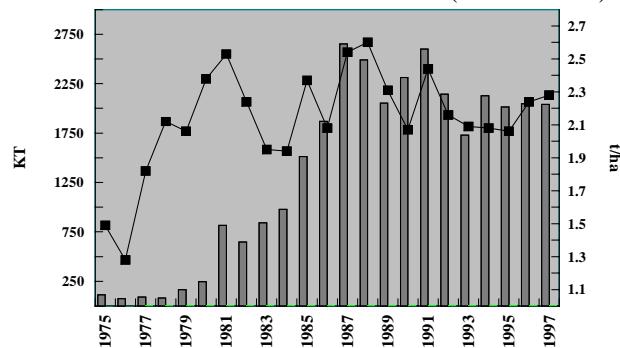


### OIL CROPS

Yield and Production / Rape (1975 to 1997)

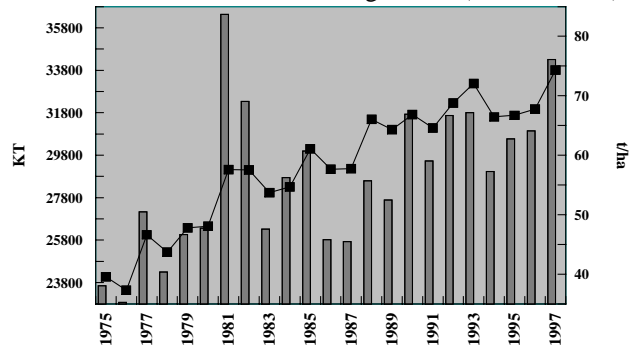


Yield and Production / Sunflower (1975 to 1997)

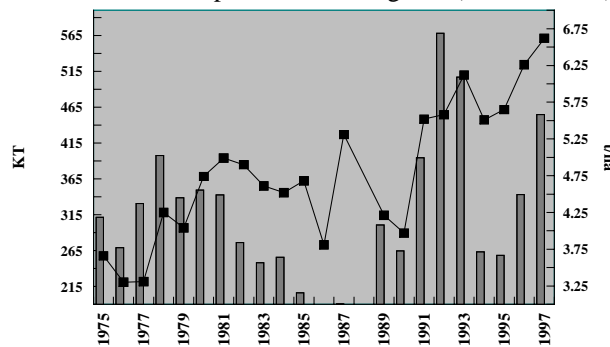


### SUGAR BEET AND SORGHO

Yield and Production / Sugar Beet (1975 to 1997)



Yield and production / Sorghum (1975 to 1997)



Legend  Production KT  
 Yield (t/ha)



**Main crops for non food purposes**

<b>Crops</b>	<b>Surface (1000 ha)</b>	<b>Set Aside surface</b>	<b>Average Yield</b>	<b>Production</b>
<b>OIL SEED CROPS [22]</b>				
<b>Rape</b>	970	162 where : RME 149 Erucic Chimical	3.5	3,400
<b>Sunflower</b>	895	41 dont : Oléic 2,6	2.3	2,100
<b>Soja</b>	97		2.9	280
<b>Oil Flax</b>	5		1.8	9
<b>SUGAR CROPS [30]</b>				
<b>Wheat</b>	5,000	10.4	7	33,055
<b>Maize</b>	1,700		9	15,451
<b>Barley</b>	1,500			10,146
<b>Others</b>	400			
<b>Sugar beet</b>	461	12.4	11 (T sucre/ha)	32,773
<b>Potatoes</b>				1,240
<b>FIBRES CROPS (estimate)</b>				
<b>Wheat Straw</b>			3.5	13400 T straw
<b>Barley straw</b>			3.5	4600 T straw
<b>Other straws</b>			3.5	2000 T straw
<b>Hemp</b>	1		7 à 9	90 T fibres
<b>SRC poplar, eucalyptus</b>	1		7 à 10	8,5 T wood
<b>SPECIFIC USE CROPS (Medical, Aromatic, essential Oils : see Chap. VI)</b>				

**production of raw material for industrial uses in France**

	<b>Industrial product</b>	<b>Tonnes (1000)</b>	<b>By-Products</b>	<b>Tonnes (1000)</b>
<b>Rape</b>	Oil	340	Cakes	436
<b>Sunflower</b>	Oil	585	Cakes	235
<b>Soja</b>	Oil	92	Cakes	3,344
<b>Wheat</b>	Starches	1,020	Issues Solubles Gluten	204 102 81.6
<b>Maize</b>	Starches	1,760	Drêches et solubles Oils Cakes Proteins	352 52.8 70.4 88
<b>Potatoes</b>	Starches	270		
<b>Sugar Beet</b>	Sugars		Pulps	1,630

**Annex 2**

**Environmental Impact of main crops raised in this report**

Supply Environmental Impact	Irrigation	Nitrogen supply	Phosphate supply	Potassium supply	Fertilisers supply	Phytosanitary products	Total/ Crop
WHEAT	~	**	*	*	~	*	4
	0	1	1	1	0	1	
MAIZE	**	***	**	**	~	*	7
	2	2	1	1	0	1	
RAPE	~	****	***	***	Sulphur	*	9
	0	3	2	2	1	1	
SUNFLOWER	~	***	**	**	Bore	*	6
	0	2	1	1	1	1	
SRC	-	-	-	-	-	-	0
	0	0	0	0	0	0	
SORGHO	~	**	-	-	-	~	1
	0	1	0	0	0	0	
HEMP	-	**	-	-	-	~	1
	0	1	0	0	0	0	

Key :

<b>Crops management</b>	-	:	Negligeable supply
	~	:	Possible supply
	*	:	Supply
	(* : low, ** : middle, *** : high, **** : very high)		

<b>Environnemental impact</b>	0, 1, 2, 3 :	Impact
	(2 et 3 : environmental impacts predicted to be injurious at middle term)	