JRC Scientific and Technical Reports

A Descriptive Analysis of Conventional, Organic and GM Crop and Certified Seed Production in the EU

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EUR 23443 EN - 2008

JRC
EUROPEAN COMMISSION

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JRC 45170

EUR 23443 EN
ISBN 978-92-79-09563-4
ISSN 1018-5593
DOI 10.2791/38071

Luxembourg: Office for Official Publications of the European Communities

Printed in Spain

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Executive Summary

Rationale of the study

1. Recently, the introduction of GM crops and GM seeds in agricultural production in the EU and elsewhere has raised the issue of adventitious presence of GM seeds in conventional seed lots. Article 21(2) of Directive 2001/18/EC provides that for products where adventitious or technically unavoidable traces of authorised GMOs cannot be excluded, a minimum threshold may be established below which the products shall not have to be labelled in accordance with the provisions of the Directive. In the absence of such thresholds, which is the current status of seed production, the legislation requires the labelling of conventional seed lots which contain any detectable adventitious traces of GM seeds (which have been authorised for cultivation under Community legislation) (Directive 2001/18/EC). The Commission is currently examining the possibility of establishing thresholds and the impact associated with the introduction of different threshold values, as regards to agronomic (technical) feasibility of production, to economic impacts for seed producers, farmers, food and feed producers, and to the necessary freedom of choice between genetically modified, conventional and organic crops. In this context, understanding the *current status and likely evolution of crop and seed production* in the EU is necessary as a basis to carry any further assessment of the effects of the regulation of adventitious GM presence in seeds.

Seed Industry: main facts and figures

2. The International Seed Federation (ISF) estimated the value of the global seed market in 2007 at 30 billion US$. This figure refers to revenues from commercial seed sales and therefore does not include farm-saved seeds. One review concluded that the value of the farm-saved seeds sector stands at around 30% of the commercial seeds sector. Industry estimates indicate that the world seed market will exceed 42 billion US$ by 2010. Europe (including Russia and other non-EU27 Countries) is the largest market for commercial seeds (around 32% of the world total in 2005), followed by the USA (around 21% of the world total in 2005) and Asia (around 17% of the world total in 2005). The most important segment of the seed sector is represented by cereal seeds (around 36% in 2005), followed by horticultural seeds (21% in 2005) and oilseeds (14% in 2005). However the most dynamic sectors are expected to be the vegetable seeds and the horticultural seeds sectors with an estimated annual growth rate of just below 5% during 2001-2010. The European seed market is projected to grow at an average annual rate of 4.26% between 2001-2010. In Europe, Russia is the largest single market for commercial seeds (21% of European market), while in the EU the largest markets are in France (15.7% in 2005) and Germany (11.7%

in 2005). Germany and France are also forecasted to be the most dynamic seed markets in Europe with annual growth rate of 5.21% and 5.13% respectively. Cereals still represent the largest segment in the European seed market (31% of the total in 2005) followed by horticultural seeds (26.7% of the total in 2005) and oilseeds (14% of the total in 2005). However, oilseeds are expected to be the most dynamic sector, with an annual growth rate of 5.39% over 2001-2010.

3. In 2005 the value of world seed exchange was estimated at around 4.5 billion US$. The largest part of the trade refers to agricultural seeds (63% in 2005) and the remaining to horticultural seeds (37% in 2005). The EU is a net exporter of seeds. During 2001-2005 seed imports increased from 450 million US$ to almost 580 million US$, and seed exports increased from 421 million US$ to 876 million US$. The increase in the volume of trade by the EU is mainly due to the increase in the shipment of vegetable seeds. Despite being a net exporter of seeds, the EU has a seed trade deficit with the US. The deficit ranged between 164 million US$ in 2002 and 82 million US$ in 2005. The reduction in the seed trade deficit between the EU and US is mainly due to the reduction in imports of maize seeds by France, mostly because of the adventitious presence of unapproved GM material. USA mainly exports vegetable seeds, oilseeds, and flower and tree seeds to the EU.

Soybeans grains and certified seeds production and trade in the EU

4. The EU is a major importer of soybeans (between 13-18 million tons yearly during the 2000-2005 period), and of soybean meal (between 17-22 million tons yearly in the same period). The combined amount of both products imported peaked in 2001-2002 and remains stable. However the trend observed during 2000-2005 is a decline in soybeans imports while soybean meal imports, especially from Argentina and Brazil, have increased. One reason for this is low crushing margins that have discouraged EU crushers from importing soybeans (EU-produced oilseed rape is competing with soybeans for crushing facilities in the EU). Also, the mandatory EU labelling requirements for oil derived from GM soybeans introduced in 2003-2004, together with relatively high oil prices, have led to a reduction in soybean oil use by the EU food industry. EU soybean oil production from imported beans declined from 3.1 to 2.4 million tons during 2001-2005. Direct soybean oil imports into the EU were not significant during this period but a rising trend is observed with 0.6 million tons of oil imported (mostly from Brazil) in 2005 due to demands from the biodiesel industry. With respect to the origin of EU imports, soybeans are mainly sourced from Brazil, followed by USA. The US share has declined in the period studied. Soybean meal imports are mostly sourced from Argentina and Brazil. Soybean crop area has rapidly increased in Brazil and Argentina since 2000 and both countries are predicted to surpass the USA as main producers in a few years. Conversely, a decline in area devoted to soybean cultivation in the USA is taking

place due to competition from maize production for bioethanol. Argentina's soybean crop area has increased from 11.6 million ha in the 2001/02 growing season to 15.3 million ha in 2005/06, while Brazil area increased from 13 million ha in 2001 to peak at 23 million ha in 2004/05. The GM soy adoption rate is over 90 % in Argentina, 85 % in the USA and above 50% and increasing in Brazil, but with very marked regional differences[1]. Some Brazilian states have GM soy adoption rates below 10 % (Southern states) while others have over 70 % adoption rate. All GM soybean cultivated in the world corresponds to a single transgenic event of herbicide-tolerant soybean ("Roundup Ready" soybean) that is authorized for import (but not for cultivation) into the EU since 1996. An application authorizing its cultivation in the EU (see below) is currently being reviewed. It is likely that a second generation version of this GM soybean will be released for cultivation in the USA in 2008/2009[2]. A request for authorizing its import into the EU has been submitted to EU regulatory bodies.

5. Production of soybean in the EU-25 is extremely small compared with imports and declined from 0.38 million ha in 2000 to 0.28 million ha in 2005 (equivalent to a mere 0.8 million tons production). Around 90% of the soybean crop area is in Italy, France, Hungary and Austria. The main reason for the decline is the reduction in the compensatory payments following the Agenda 2000 reform of the CAP. The area of organic soybean production is extremely limited. In 2005 the major producers of organic soybeans were Italy (0.007 million ha) and Austria (0.002 million ha). Within EU-27 Romania is by far the largest producer of soybean. The area devoted to soybean in Romania increased from 0.044 million ha in 2001 to 0.2 million ha in 2006, of which roughly 65% were cultivated with GM soybean (some 0.14 million ha). Since the withdrawal of GM varieties in 2007 the soybean area in Romania has halved (down to 0.1 million ha 2007). No GM soybean has yet been authorized for cultivation in the EU, so the area cultivated mainly refers to conventional varieties (except for a small area of organic soy).
6. The major soybean seed producers in the EU-27 are Italy and Romania. In Italy the area of soybean seed production has increased from 4,000 ha in 2000 to 9,000 ha in 2005. Such increase occurred despite the decline in the soybean grain production area, because of the necessity of Italian farmers to replace imported US soybean seeds (which could contain GM seeds that are not approved for cultivation) with domestically produced ones. Italy is a net importer of soybean seeds from Romania and France. In Romania the total area of soybean seed production has been declining from 7,500 ha in 2000 to just above 2,000 ha in 2005. Over the same period the area of GM soybean seed production ranged between 900 – 2,500 ha. The decline in the area of soybean seed production in Romania has been accompanied by an increase in the use of farm-saved seeds

[1] See http://www.pecad.fas.usda.gov/highlights/2007/03/brazil_soybean_30mar2007/
[2] See http://www.monsanto.com/monsanto/content/sci_tech/prod_pipeline/productPipeline.pdf

for soybean production in this country. Soybean seed trade volumes are small compared to domestic production in Romania. Serbia is the major provider of conventional soybean seeds (between 180 – 360 tons over 2000 – 2005). Romania exported conventional soybean seeds only to Italy (572 tons in 2005). Both in Italy and Romania the regions devoted to soybean seed production are also the regions growing soybean crops, so there is no regional segregation of crop and seed production.

7. The future developments of the soybean sector in the EU must be considered within the broader context of the entire oilseed sector. The main trend is the significant increase in demand of oilseeds for biodiesel production in the EU, resulting in projected increases of imported oilseeds to be crushed into EU facilities, as well as increased imports of processed oil. Regarding domestic EU production, analysts also predict an increase in oilseeds area, but the growth will be mostly due to increased Oilseed Rape (OSR) cultivation (see points 16-20 below). The predictions for soybean production in the EU suggest it will remain fairly stable. Another trend will be the authorization of GM soybeans for cultivation (re-authorization in the case of Romania) that will re-introduce the GM soybean cultivation in Romania.

Maize grains and certified seeds production and trade in the EU

8. Production of grain maize in the EU-25 ranged between 42-55 million tons during 2000-2005. However the area of grain maize production in the EU-25 has been relatively stable, ranging between 5.8 and 6.5 million ha in this period. The majority of the EU maize area (over 98 %) is planted with conventional maize varieties. Two GM maize events (both "Bt maize" types, resistant to corn borer pests) were approved for cultivation in the EU-25 during the 2000-2005 period. GM maize area in EU-25 ranged between 0.025 and 0.058 million ha during 2000-2005. Though this is a small proportion of total EU-25 maize area, production has been concentrated mostly in one Member State (Spain) where GM Bt maize now represents 21% of the total maize area (equivalent to 0.075 million ha in 2007). Moreover, regional distribution of GM maize in Spain is variable (following pest distribution) and some regions currently have reached 59 % of maize area planted with GM Bt varieties. GM maize production also occurred in South-Western France and in 2007 the area reached 0.02 million ha. Organic maize grain production in the EU-25 is very small and Italy has the largest area of organic maize grain cultivating 0.014 million ha in 2005 including the area under conversion, which represents around 1.25% of Italy's maize area.
9. The EU-25 imports of grain maize ranged between 2.9- 5 million tons per year over the 2000 – 2005 period, but the volume of imported grain is small compared to EU domestic production. In this period imported grain maize mainly originated from Argentina followed by Brazil. Since 2004 imports from Brazil have declined because of higher domestic production volumes in the EU,

strong appreciation of the Brazilian currency and increased domestic use by the Brazilian feed industry. In 2006 the EU imported significant quantities of maize from Serbia (around 1.2 million tons) and Ukraine. Total grain maize imports into the EU are expected to remain fairly stable or to increase moderately over the medium term. The import of USA grain maize declined sharply since 1996 (when it accounted for 70% of grain maize imported into the EU) to current figures of less than 5%. This was due mainly to the cultivation of GM maize varieties in the USA not yet authorized in the EU, an asynchrony that is still happening. Argentina also grows a high proportion of GM maize, but has adopted the policy of releasing only varieties approved for import into the EU. Brazil has just recently authorized the cultivation of GM maize. Serbia and Ukraine have not officially registered any GM maize varieties. The largest importer in the EU is Spain (3 – 4 million tons per annum, including intra-EU trade, during 2000 – 2005).

10. In the EU the major producers of maize seed are France and Hungary with France growing between 42,000 – 56,000 ha producing 142,000 – 160,000 tons during 2000 – 2005. Seed production mainly occurs in the South West, parts of Central France and in parts of Western France. Maize grain production occurs in the same regions, and in the South West production of conventional as well as GM varieties takes place. There is no regional segregation between seed and grain maize production in France. A significant part of France production is exported (between 51 – 68% of domestic production during 2000 – 2005). The main destinations for French maize seed are Germany, Italy and Spain. France also imports seed (around 47,000 tons in 2004) mainly from Hungary (13,000 tons in 2004), the USA (11,000 tons in 2004) and Chile (around 9,000 tons in 2004). However most of imports originating from the USA are of seed produced in Chile. France also produced GM Bt maize seed (374 ha in 2006), mainly in the South-West. Organic seed production ranged between 21 – 96 ha over 2001 – 2006. In the future the area of maize seed production in France is expected to remain stable. In Hungary the area for maize seed production ranged between 25,000 – 30,000 ha during 2000 – 2005. Seed is mainly grown in the great Hungarian Plains in the Southern and Eastern parts of the Country. No GM Bt maize varieties are produced in Hungary for grain or seed. Organic seed production in Hungary is extremely limited (i.e. 6 ha in 2006). Most of the Hungarian maize seed production is exported (around 40,000 tons equivalent to 60% of domestic production). The main destinations are the Netherlands, France, Germany and Italy. Hungarian seed imports are low compared to domestic production (around 5,000 tons in 2005) and mostly from the USA (around 1,200 tons in 2005), Romania (around 700 tons in 2005) and Chile (around 500 tons in 2005). Spain is also a major importer of maize seed in the EU (around 125,000 tons in 2005) with France the largest supplier of seed to Spain (108,000 tons in 2005).

11. Market studies suggest that EU demand for bioethanol will have a limited impact on maize production in the EU-25 at aggregate level and the area of grain maize should remain stable at around 6 million ha in the medium term. When Romania and Bulgaria are accounted for, the EU-27 grain maize area should stand at 9 million ha and stable over the medium term. Grain maize production is likely to increase by almost 6 million tons because of increasing yields in EU-25 in the medium term. The accession of Bulgaria and Romania increased EU maize production potential by 10 million tons. Regarding GM varieties, the main trend in the EU is the expansion of the area cultivated with GM Bt maize, particularly in France where it is estimated that in 2007 between 0.02 million ha of GM Bt maize have been planted (mainly in the South West). Currently over 0.5 million ha of maize in France are in areas affected by corn borer and the areas with infestations are spreading Northwards. It is expected that in 2008 the Bt maize area could reach 0.08 million ha in France.

Sugar beet and certified seeds beet production and trade in the EU

12. In the EU-25 France, Germany, Italy and Poland account for 60% of the sugar beet area. During 2000 – 2005 the total area of sugar beet cultivation declined from 2.4 million ha to 2.2 million ha. This decline in area cultivated is the consequence of the cut in the A and B sugar quota in 2002 and due to increases in sugar beet yields. At present no GM sugar beet varieties are authorized or in the pipeline for cultivation in the EU. Production of organic sugar beet is very small. The largest area is in Italy, where around 0.004 million ha were planted in 2003 (including the area under conversion) equivalent to 1% of the total Italian sugar beet area.
13. The EU mainly imports raw sugar for refining and exports refined sugar. Most of the imports into the EU come from ACP Countries either duty free or with reduced duty. Total sugar imports were between 1.9 – 2.3 million tons during 2000 – 2005, while sugar exports were between 4.5 – 7 million tons over the same period. The UK is the largest importer of sugar in the EU (around 2.1 million tons in 2005), mainly from Mauritius, Fiji, Jamaica and Guyana. France and Germany are the major exporters of sugar in the EU with Algeria, Syria, Israel, Switzerland and United Arab Emirates the main markets outside the EU.
14. Italy and France are the major sugar beet seed producers in the EU. The EU does not import significant quantities of sugar beet seeds from Third Countries. In Italy the area of sugar beet seed production ranged between 2,400 – 3,600 ha during 2000 – 2005. Almost the entire production (i.e. 99%) occurs in the North (in Emilia Romagna) while sugar beet crop production also occurs in other Italian regions. Italy is a net exporter of sugar beet seeds and annual exports were between 5,700 – 10,000 tons during 2000 – 2005. The main destinations for Italian seeds were Germany (around 4,300 tons in 2005), Belgium (around 2,000 tons in 2005) and Denmark (around 1,300

tons in 2005). Italian imports of sugar beet seed originated from other EU Countries (mainly Germany, the UK, Belgium and France). In France the annual area of sugar beet seed production was between 2,800 – 4,700 ha during 2000 – 2005. Seed production mainly occurs in the South-West, South-East, Centre and Western France, while crop production is essentially concentrated in the North. France is a net exporter of sugar beet seeds (around 8,800 tons in 2005), mainly to other EU Countries (e.g. Germany and the Netherlands). However significant quantities of French seeds are also exported to Russia (410 tons in 2004) and Maghreb (410 tons in 2004). Organic sugar beet seed production in France is very limited (i.e. 5 ha in 2003).

15. The main developments for sugar beet production concern the sugar reform, the production of bioethanol and the possibility of growing GM HT varieties. The sugar reform introduces a 36% price cut over four years starting from 2006. As a consequence a reduction in the sugar beet area is forecasted over the next years. The demand of sugar beet for bioethanol production is expected to positively affect domestic consumption of beet sugar and could in part alleviate the effect of the price cut. The introduction of GM HT varieties in the EU has been shown by different studies to have a positive economic on-farm impact, and therefore is of interest to growers, but it is unsure whether processors (i.e. sugar or bioethanol plants) would be willing to use GM varieties. In the US, where sugar from GM beet varieties does not require special labeling, the number of sugar processing plants that have begun to accept GM beets is increasing.

Rapeseed grains and certified seeds production and trade in the EU

16. In the EU-25 the area of Oilseed Rape (OSR) crop production has increased from 4 million ha in 2000 to 4.7 million ha in 2005. The change has been particularly strong after 2003, following the adoption of Directive 2003/30 on biofuels. The major producers of OSR in the EU are Germany (1.3 million ha in 2005), France (1.2 million ha in 2005), the UK (0.6 million ha in 2005), Poland (0.5 million ha in 2005) and Czech Republic (0.25 million ha in 2005). Currently no GM OSR varieties are authorized for cultivation in the EU, but two GM HT varieties have been approved for import for food and feed use in 2005. These GM Herbicide Tolerant (HT) OSR varieties are grown in Canada. Organic OSR crop production is extremely limited in the EU, and in 2003 was below 0.2%. The EU Countries with the largest share of organic OSR production are Italy (0.003 million ha in 2005, equivalent to 92% of domestic OSR area), Denmark (0.000989 million ha in 2005, equivalent to 0.88% of domestic OSR area) and the UK (0.001 ha in 2005, equivalent to 0.18% of domestic OSR area). Note that these figures also include organic area under conversion.
17. OSR grain trade in the EU is very small compared to domestic production. In 2005 OSR imports from Third Countries amounted to 0.1 million tons and exports to 0.2 million tons, while domestic production exceeded 15 million tons. Canada was the main supplier of OSR to the EU until

1996/97 and since then has been replaced by Australia. This is due the fact that Canada introduced GM HT OSR in 1996/97 and now the majority of Canadian OSR crop is GM. Australia however still keeps a moratorium on cultivation of GM OSR, although the situation is frequently re-visited by growers and regulators and several studies suggest that is possible that Australia will soon go ahead with the cultivation of GM OSR. Another development that could result in a re-start of Canadian imports of OSR into EU is the approval by the EU in 2005 of two varieties of HT OSR for import and processing. OSR trade within the EU is significant with Germany the main importer of OSR (1.4 million tons in 2004) mainly from France, the UK and Czech Republic. OSR meal and oil trade in the EU is also small compared to domestic production. In 2005 the EU produced over 8 million tons of OSR meal, imported 0.097 million tons and exported only 0.038 million tons. In the same year domestic OSR oil production amounted to almost 6 million tons while imports stood at 0.335 million tons and exports at just 0.075 tons. During 2000 – 2005 domestic OSR meal and oil production has increased (following the expansion in domestic OSR grains production), imports have also increased and exports have decreased because of higher domestic consumption in both the biofuel and food industry.

18. Germany and France are the major producers of OSR seed in the EU, with around 4,800 ha and 3,800 ha in 2005 respectively. In France the area of OSR seed production increased from just over 3,000 ha in 2000 to around 3,800 ha in 2005. Seed production is mainly taking place in the West and South-West of France. In Germany the area of OSR seed production increased from less than 3,000 ha in 2000 to 4,800 ha in 2005. Seed production mainly takes place in the West and North-West of Germany in areas where OSR crops are also grown. A trend in recent years both in France and Germany is the increase in the production of hybrid seeds (compared to open pollinating varieties) in order to limit the use of farm-saved seeds (currently around 35% of the OSR planted in France is farm-saved seed). At present no GM HT OSR seeds are being produced in the EU since no varieties have been authorized for cultivation. Organic OSR seed production is very small (e.g. Germany reported just 20 ha in 2006). OSR seed trade is mainly internal within the EU with very small quantities of seeds being imported from or exported to Third Countries. Germany is the main importer of OSR seeds in the EU, mainly from France (around 1,600 tons in 2005) and Hungary (around 1,000 tons in 2005).
19. For the future, the main trend is the large increase in demand for biodiesel in the EU. Studies show that this will result in a significant increase in OSR cultivated area in the EU up to 7.5 million ha in EU-27 in 2010. Imports of OSR for crushing in EU will also increase, and some GM HT varieties of OSR are now authorized for import. With respect to the cultivation of GM HT OSR by EU farmers, several economic studies in EU countries have shown the positive impact on competitiveness of the crop (i.e. reduction of production costs and simplification of weed

management). In terms of market and processors acceptability, adoption could be driven by increased demand of competitive feedstocks for biodiesel (biofuels derived from GM crops need no labelling under current legislation). However it is not clear if the EU food industry is likely to accept GM-derived OSR oil. Facilities for OSR crushing (for whatever use) would not find it easy to operate lines for both GM for diesel and non-GM for food. Finally, coexistence regulations will also have an effect on the level of adoption of GM HT varieties.

Cotton and certified cotton seeds production and trade in the EU

20. In the EU cotton is essentially produced in Greece and Spain (with a small quantity produced in Portugal). EU cotton production represents around 3% of the world production and is based on a quota system (0.782 million tons for Greece and 0.249 million tons for Spain) with a minimum guaranteed payment per ton of unginned cotton. When the production exceeds the quota the payment is reduced proportionally. In Greece the area of cotton decreased from 0.41 million ha in 2000 to 0.355 million ha in 2005. In Spain the area decreased from 0.09 million ha in 2000 to 0.086 million ha in 2005. The observed reduction in the area reflects the effort by Member States to keep the volume of production within the quotas. At present no GM cotton is authorized for cultivation in the EU, but there are several applications for GM Bt and HT varieties for import and food/feed use.
21. In the EU the main importers of cotton lint are Italy (0.15 million tons in 2005), Germany (0.07 million tons in 2005), Portugal (0.06 million tons in 2005) and France (0.04 million tons in 2005). The major exporters are Greece (0.25 million tons in 2005) and Spain (0.09 million tons in 2005). Cotton lint imports have been generally declining in the EU because of the slow down in the textile industry (i.e. relocation in Asian Countries). The EU is a net importer of cottonseed meal (used in animal feed compounds). Cotton seed meal imports declined from around 0.17 million tons in 2000 to 0.03 million tons in 2005, while domestic production remained almost constant between 0.2 – 0.23 million tons in the same period. Important suppliers of cotton seed meal to the EU are Benin (0.017 million tons in 2004), Brazil (0.013 million tons in 2004), Kazakhstan (0.012 million tons in 2004) and Togo (0.005 million tons in 2004). EU trade in cotton seed oil is small compared to domestic production (between 0.072 – 0.082 million tons over 2000 – 2005). Small quantities of cotton seed oil were imported in the EU (between 0.002 – 0.013 million tons over 2000 – 2005) mainly from Turkey. Greece is the only MS in the EU exporting cotton seed oil (around 0.007 million tons in 2005).
22. In the EU production of seed for propagation of cotton occurs in Greece (mainly in Thessaly and Macedonia-Tracia) and in Spain (in Andalucía). In Greece domestic production of seed decreased from 12,000 tons in 2001 to 1,300 tons in 2004 because of reduced plantings and increased

reliance on imported seed. In Spain the volume of cotton seed production also decreased from 2,700 tons in 2000 to 1,600 tons in 2005. Greece is a net exporter of cotton seed and in 2005 seed exports amounted to almost 11,000 tons while imports stood at 5,600 tons. Spain on the other hand is a net importer of cotton seed with 1,900 tons imported in 2005 and less than 800 tons exported in the same year. Before 2000 seeds were imported from the USA but the discovery of adventitious GM presence negatively affected US cotton seed exports to Greece, which have shown some recovery but are still far from pre-2000 levels. Cotton seeds imported by Greece and Spain from the USA declined from 6,500 tons in 2000 to 2,500 tons in 2005. At the same time Australia (2,200 tons in 2004) and Turkey (3,000 tons in 2005) have become important suppliers of cotton seeds to Greece and Spain. Australia cultivates GM cotton while Turkey does not. Cotton seed and crop production coexist in Spain and Greece.

23. There are currently no requests filed for authorization of GM cotton cultivation in the EU. The willingness of farmers to adopt GM Bt cotton (if authorized in the EU) has been estimated at 75% of the area cultivated with cotton in Spain by direct survey data. The main reasons are the savings in pesticide costs associated to Bt cotton cultivation and the expected increase in gross margins. A similar study from Greece is not available. The future for EU cotton production is related to the CAP reform of the sector, which partially decoupled payments and should have entered in force from 1st of January 2006. However the reform has been blocked by the European Court of Justice. The cotton area is expected to decrease in the EU. Over the period 2005-2007 cotton area in Spain and Greece has gone down further to 0.045 million ha and 0.3 million ha respectively.

Ware and certified seed potatoes production and trade in the EU

24. The major ware potato producers in the EU are Poland (0.6 million ha in 2005), Germany (0.28 million ha in 2005), the UK (0.14 million ha in 2005) the Netherlands (0.16 million ha in 2005) and France (0.16 million ha in 2005), accounting for over 60% of total potato area. The area of potato in the EU has decreased by almost 30% from 2.9 million ha in 2000 to just over 2 million ha in 2005. The reduction of the potato area in Poland (- 0.6 million ha in 5 years) accounts for most of this decrease. The production of organic potatoes in the EU is limited. Data from Italy, the Netherlands and the UK suggest that the organic potato area represented between 0.7-2.1% of the total crop area during 2000-2005.
25. EU potato trade is extremely limited because of the difficulty to transport and store potatoes and because of phytosanitary measures. In 2004 domestic potato production in the EU stood at almost 67 million tons, while imports amounted to 0.54 million tons and exports to 0.87 million tons. In the same year imports mainly originated from Israel, Egypt and Morocco, while exports were mainly destined to Algeria, Senegal, Russia, Egypt and Morocco.

26. In the EU the major producers of seed potatoes are the Netherlands and Germany. In the Netherlands the area of seed potato slightly decreased from 38,000 ha in 2000 to 36,000 ha in 2005. Seed production is mainly concentrated in the North and North-West of the Netherlands. Experts believe that in the Netherlands the area of organic seed potato stands at 1-3% of the total. In Germany the area of potato seed production has been slightly decreasing from 20,000 ha in 2000 to just above 16,000 ha in 2005. Production mainly takes place in the North (Niedersachsen, Mecklenburg-Vorpommen and Schleswig-Holstein) and in the South-Eastern Land of Bayern. In the future the area of seed potato production is likely to remain constant. Trade in seed potatoes is extremely limited and imports are almost non-existent. Small quantities of seed potatoes are exported to North African and Middle East Countries (e.g. Algeria, Tunisia, Egypt, Lebanon and Israel) for production of ware potatoes which are subsequently re-imported in the winter season.
27. The future trend is probably a slight decline in the area of potato cultivation in EU agriculture, estimated by experts at 0.6-1.2 % per year. The main reasons are lower consumption per capita and increased yields. GM potatoes are not yet authorized for cultivation in the EU, but one GM potato designed for the starch industry is in the final step of the EU authorization process for cultivation and could be released as early as next year. Starch potato production in the EU is regulated by a quota system (1.949 million tons). As such the area of starch potato is relatively stable. Germany and the Netherlands are two of the most important producers of starch potatoes in the EU with around 30,000 ha and 50,000 ha in 2005. In Germany starch potatoes are mainly produced in the Länder of Niedersachsen, Mecklenburg-Vorpommern, Bayern and Brandernburg, while in the Netherlands production mainly occurs in the North-East. Since the GM varieties are not designed to offer direct agronomic benefit to farmers, their adoption would be driven by the starch industry. Elsewhere, a variety of GM potatoes resistant to insects (Bt Potato or New Leaf) was cultivated in Romania before accession to the EU but this variety was withdrawn from the market and its authorization suspended in 2003 in Romania. There is no request for authorization of this GM Bt Potato in the EU, neither for import or for cultivation. The same GM Bt potato was once cultivated in the USA but was rejected by the food industry and its cultivation was discontinued.

The use of agricultural crops for biofuels production in the EU

28. Total production of biofuels in EU25 in 2005 was 3.2 million tons of biodiesel and 0.7 million tons of bioethanol, with the largest producers being Germany, France and Italy. Biodiesel production capacity in 2005 was estimated at 6 million tons, indicating a 50% utilization rate in the same year. For bioethanol, the production capacity has been estimated at over 1 million tons, suggesting a utilization rate of about 70%. There were 23 ethanol plants in EU25 in 2006 (of

which 6 in France, 5 in Germany and 3 in Spain), but current projections indicate that the number might increase to 47-63 by 2008. Oilseed rape for biodiesel production is the main EU grown feedstock at the moment. The use of EU grown OSR for biodiesel has passed from 4.5 million tons in 2004 to an estimated 8 million tons in 2006, suggesting that over 50% of EU domestic production is now used for biodiesel. On the other hand, in bioethanol production the use of EU grown cereals increased from 0.7 to 3 million tons over 2004-2006, representing just above 1% of the EU domestic production in 2006.

29. The recent decision to incorporate a minimum 10% of biofuels by 2020 has stimulated research looking at the implications for feedstocks production and consumption in the EU over the medium term (2014) and long term (2020). The projections indicate that by 2020 EU consumption of OSR could be at 32.8 million tons, of which 21 million tons for biodiesel, while domestic production could reach 20.6 million tons. By that time consumption of soybeans is forecasted to reach 21 million tons, of which 7.9 million tons for biodiesel, while domestic production is expected to remain low (around 3.5 million tons). Regarding bioethanol, cereals are projected to remain the main feedstocks. By 2020 total maize consumption in EU27 is expected to reach 70.2 million tons, of which 14.2 million tons for bioethanol, while domestic production could reach 69.2 million tons. Soft wheat consumption is forecasted to be at 138.95 million tons by 2020, of which up to 43 million tons for bioethanol, with domestic production at 156 million tons. Finally, sugar consumption is expected to reach 19 million tons by 2020, of which over 2 million tons for bioethanol production, while domestic production is expected to be at 16.95 million tons. To conclude, current figures and projections for the medium and longer term indicate that significant use of EU produced feedstock is currently taking place and will increase substantially for OSR, wheat and maize. On the other hand the use of sugar beet, soybeans and sunflower seeds is more limited and is expected to remain so also in the future.

30. Feedstock production costs are a crucial component to the competitiveness of biofuels and it is likely that increasing competition will generate higher pressure to further reduce costs at the farm and factory level. In this respect, the use of currently available GM crops could represent an opportunity for the biofuel industry. Currently, biofuels produced from GM crops need no specific labelling in the EU, so consumer acceptance might prove easier compared to food/feed uses. It is important to notice how different problems might arise for bioethanol and biodiesel production. Bioethanol plants in fact produce ethanol and by-products for feed, so they could easily operate with GM feedstocks for the fuel/feed markets. Crushing factories for oilseeds, on the other hand might find it more difficult to utilize GM feedstock if they are also serving the food market (a market that does not demand GM in the EU). Currently however, neither the EU bioethanol nor the EU biodiesel industry has, to our knowledge, taken a position in relation to the uptake of GM

crops. Therefore at this moment it is difficult to make a forecast on the potential adoption of EU GM feedstocks for biofuels production.

Introduction

Recently, the introduction of GM crops and GM seeds in agricultural production in the EU and elsewhere has raised the issue of adventitious presence of GM seeds in conventional seed lots. Article 21(2) of Directive 2001/18/EC provides that for products where adventitious or technically unavoidable traces of authorised GMOs cannot be excluded, a minimum threshold may be established below which the products shall not have to be labelled in accordance with the provisions of the Directive.

In the absence of such thresholds, which is the current status of seed production, the legislation requires the labelling of conventional seed lots which contain any detectable adventitious traces of GM seeds (which have been authorised for cultivation under Community legislation) (Directive 2001/18/EC). The legal requirement is not new and has been in place since labelling provisions were introduced under Directive 90/220/EEC and maintained under Directive 2001/18/EC (which replaced Directive 90/220/EEC). It remains illegal to place on the market conventional seed lots that contain GM seeds that have not been approved for cultivation. This has been the case since Directive 90/220/EEC entered into force in 1991.

The Commission is currently examining the possibility to establish thresholds for the maximum adventitious presence of GM material in certified seeds and is assessing the impact associated with the introduction of different threshold values, as regards to agronomic (technical) feasibility of production and to economic impacts for seed producers, farmers, food and feed producers, and the necessary freedom of choice between genetically modified, conventional and organic crops.

In this context, understanding the current status and likely evolution of crop and seed production in the EU is necessary as a basis to carry any further assessment of the effects of the regulation of adventitious GM presence in seeds. Understanding the likely distribution of GM commercial crop and GM seed production in the EU is also important when looking at the adventitious presence of GM material in conventional seeds. Data on the likely adoption and regional distribution of GM crops in the EU for short-medium term could be significant for this purpose.

The aim of this study is to gather basic information/data on the EU crop and seed production for a number of crops. The crops under considerations are maize, sugar beet/fodder beet, cotton, oilseed rape, soybean and potato. Data will refer to conventional, GM and organic varieties. With respect to seed production, in the present study (given the time constraint) the attention will be focused on

certified seeds. Also the study will focus on commercial seed production, therefore excluding farm saved seeds from the analysis. Given these premises, the study's objectives entail:

- Collection of data on volume, acreage and trade of crops in EU 25 and major trading partners (e.g. U.S.) and identification and analysis of main changes over time and analysis of future developments.
- Collection of data on volume, acreage and trade of certified seed production in relevant Member States, analysis of main changes over time and identification of main future developments in key MS.
- Identification of main seed producing regions in the EU and collection of information/data relative to the potential adoption by farmers of GM varieties of the above mentioned crops in these regions.

Chapter 1 Seed Industry: main facts and figures

1.1 The world seed industry: an overview

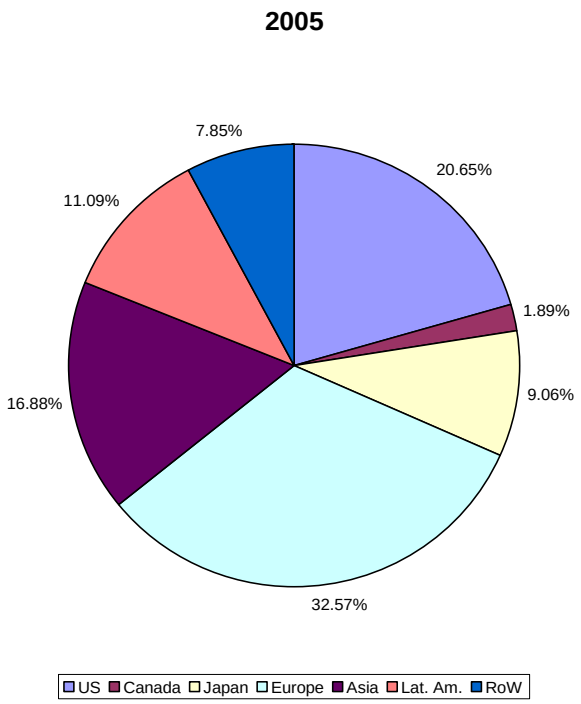
The International Seed Federation (ISF) estimated the value of the world (commercial) seed market in 2007 at about 30 billion US dollars. The data refer to revenues from commercial seed sales, and therefore do not include farm-saved seeds. However, the use of farm-saved seeds is not negligible. One review (Covent, 2003) estimated that in 2002 the world seed market was worth 35.5 billion US$ (including 1.3 billion US$ technology fee) and of this 12.1 billion US$ (around 34.2%) referred to 'proprietay seeds', 9.1 billion US$ (25.7%) referred to 'public' seeds and the remaining 13 billion US$ (around 36.4%) referred to farm-saved seeds. Industry estimates suggest that by the end of 2010 the commercial seed market will exceed 42 billion US dollars. The estimated annual (average) rate of growth for the period 2001-2010 is 4.27% (Table 1.1).

Table 1.1: Evolution of the World seed market by Region (US$ Million)

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*%Δ*
US	5955	6197	6451	6721	7008	7311	7630	7967	8323	8697	4.3
Canada	568	585	604	623	643	665	688	713	739	767	3.39
Japan	2606	2713	2827	2948	3076	3213	3358	3512	3675	3845	4.42
Europe	9435	9803	10194	10610	11055	11527	12027	12563	13132	13738	4.2
Asia	4787	5001	5229	5471	5730	6008	6308	6627	6969	7334	4.85
Lat. Am.	3200	3330	3466	3610	3764	3928	4104	4290	4488	4700	4.36
RoW	2419	2473	2531	2595	2665	2744	2830	2919	3012	3112	2.84
Total	**28970**	**30102**	**31302**	**32577**	**33941**	**35395**	**36944**	**38590**	**40337**	**42193**	**4.27**

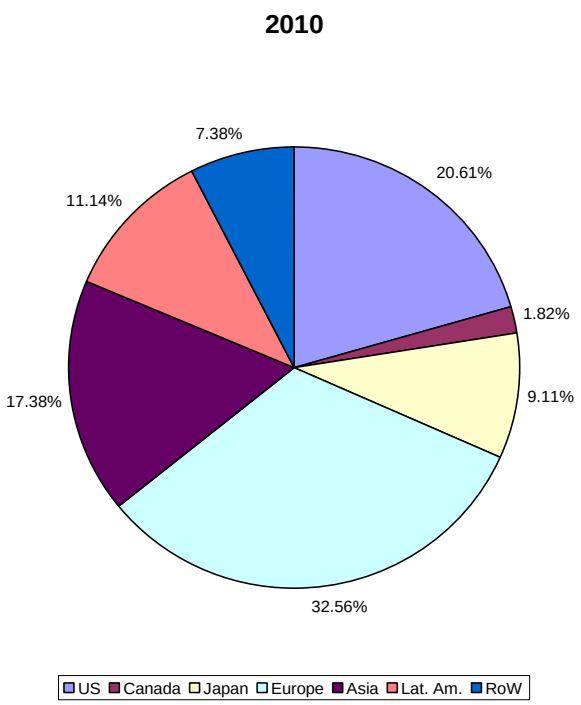
Source: Industry estimates

Table 1.1 illustrates the evolution of the world (commercial) seed market by region, over the period 2001-2010. The data were collected in 2004 and therefore the information referring to 2005-2010 is a forecast with a **10% error tolerance**. By comparing the figure for 2007 as presented in Table 1.1 (36,943 US$ Million ± 10%) with the ISF data reported above (30,000 US$ Million) it seems that Table 1.1 might slightly overestimate the growth of the global seed market. The data show that Europe (including Russia and other non-EU27 Countries) is the largest market for commercial seeds (around 32% of the world market in 2005), followed by the US (around 21% of the world market in 2005) and Asia (around 17% of the world market in 2005).



Source: Industry estimates

Figure 1.1: Shares of world commercial seed market by region in 2005



Source: Industry estimates

Figure 1.2: Shares of world commercial seed market by region in 2010

Figures 1.1 and 1.2 illustrate the share of total world seed market by region in 2005 and 2010 respectively (based on the data in Table 1.1). The situation will remain largely unchanged in terms of relative importance of the different world regions. The Asiatic region is expected to register the highest growth at a rate higher than the world average, followed by Japan and Latin America (see Table 1.1).

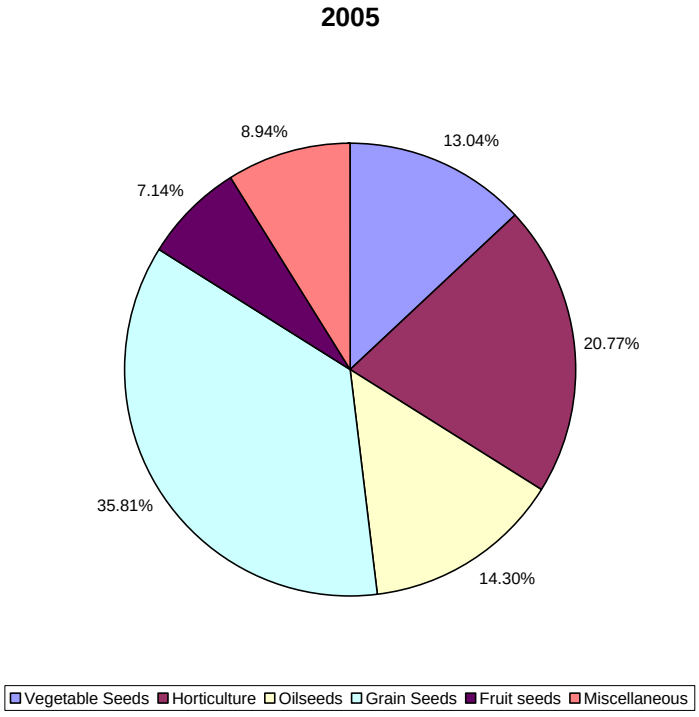
Table 1.2: World Commercial Seed Market by Segment (US$ Million)

	2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*Δ%*
Vegetable Seeds	3670	3841	4023	4216	4425	4647	4884	5135	5402	5688	4.99
Horticulture	5895	6158	6436	6732	7051	7389	7749	8131	8538	8971	4.78
Oilseeds	4072	4250	4438	4639	4853	5081	5326	5587	5865	6162	4.71
Grain Seeds	10495	10874	11274	11699	12153	12637	13153	13699	14276	14886	3.96
Fruit seeds	2144	2208	2276	2348	2425	2506	2592	2684	2782	2885	3.35
Miscellaneous	2694	2772	2855	2943	3035	3135	3241	3353	3474	3601	3.28
Total	**28970**	**30102**	**31302**	**32577**	**33941**	**35395**	**36944**	**38590**	**40337**	**42193**	**4.27**

V: Vegetable Seeds; H: Horticultural Seeds; O: Oilseeds; G: Grain Seeds; F: Fruit Seeds; M: Miscellaneous Seeds.

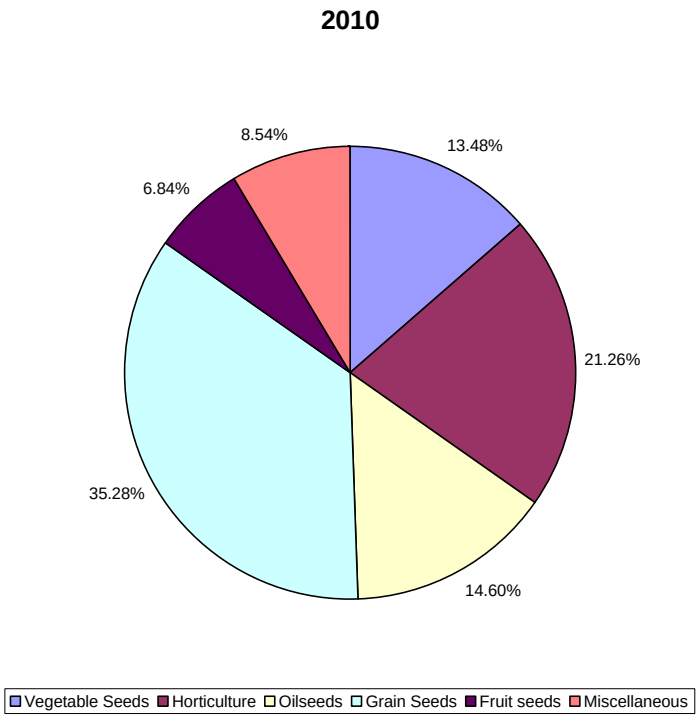
Source: Industry estimates

Table 1.2 illustrates the value of the commercial seed market by segment. Grain seeds refer to cereals; vegetable seeds include beans, cabbage, carrot, tomato and others; oilseeds refer to oil plants (e.g. sunflowers, rapeseed etc.), legumes (e.g. soybeans and peanuts) and fruits (e.g. olive, avocado, palm); horticultural seeds include flower seeds and grass seeds; fruit seeds refer to seeds of fruit plants (e.g. peaches and apples); miscellaneous refer to any other seeds not included above. Grain seeds represent the most important segment (almost 36% in 2005) in the World market, followed by horticultural seeds (around 21% in 2005) and oilseeds (around 14% in 2005). On the other hand the vegetable seeds segment is expected to be the most dynamic, with a forecasted growth rate of 4.99% p.a., followed by the horticultural seeds market with an estimated annual growth rate of 4.78%. Within the horticultural seeds market, the flower seeds segment is expected to lead the growth with an estimated annual growth rate of 5.2%, while the land and grass seeds market is expected to move more slowly with an expected annual growth rate of 4.1%. Given the relatively low growth rate (compared to the average for the whole seed sector), the share of grain seeds and fruit seeds is projected to decrease over the next years (compare Figures 1.3 and 1.4).



Source: Industry estimates

Figure 1.3: Shares of world commercial seed market by segment in 2005



Source: Industry estimates

Figure 1.4: Shares of world commercial seed market by segment in 2010

In general it appears that the world seed industry is becoming more similar to other agricultural inputs industry, by providing increasing support for the development and marketing of seeds worldwide. The industry primarily deals with two kinds of products: hybrids and open-pollinated varieties. The former offer higher returns on investment in proportion to the area planted. However the use of hybrids is not uniform in all crops (e.g. soybeans production relies on open-pollinated varieties). The development of genetically modified seeds has also affected the world seed industry by providing strong incentives for both vertical integration (i.e. acquisition of seed companies by agro-chemical companies) and horizontal consolidation (i.e. merger of different agri-business companies). Also the development of GM seeds has increased the value of the market through the premium for such varieties (on average around 40%) and the technology fees.

1.2 The European seed industry

Data from the European Seed Association (ESA) indicate that the European seed industry (for EU25) employed around 30,000 people in 2005 (of which 5,000 in R&D), had a turnover of 6.1 billion euros and spent around 12-15% of it in R&D (ESA, 2005). In 2006 the total production of certified seeds in the EU has been estimated at around 10 million tons (USDA). Data on the seed industry in different European Countries are difficult to retrieve, but some information is available through the national associations of seed producers.

The main organization representing the seed industry in France is the Groupement National Interprofessionnel des Semences et plants (www.gnis.fr). The French seed sector includes around 70 companies producing basic and pre-basic seeds, over 240 companies for the production of certified seeds, nearly 20,000 seed farmers (i.e. multipliers) and over 20,000 distribution companies. In 2004 more than 340,000 ha were dedicated to seed production in France for a value of almost 2,000 million euros (1,300 million in domestic sales and over 600 million in exports).

The main organization representing the German seed industry is the Bundesverband Deutscher Pflanzenzüchter (www.bdp-online.de). The organization represents more than 150 companies including both domestic and multinational companies. The total area of seed multiplication in Germany was over 200,000 ha in 2004.

The main organization of seed companies in Italy is the Italian Seed Association (www.sementi.it), which represents more than 170 seed companies, including cooperatives, individual companies and multinationals. However the number of seed companies operating in Italy is certainly higher (exceeding 400 companies). The area of seed production in Italy was around 175,000 ha in 2006 for a

production of over 500,000 tons and for a market value of over 600 million euros. The most important seed production activity in Italy concerns durum wheat (accounting for over 40% of the total seed multiplication area in 2006) followed by forage plants (around 20% in 2006).

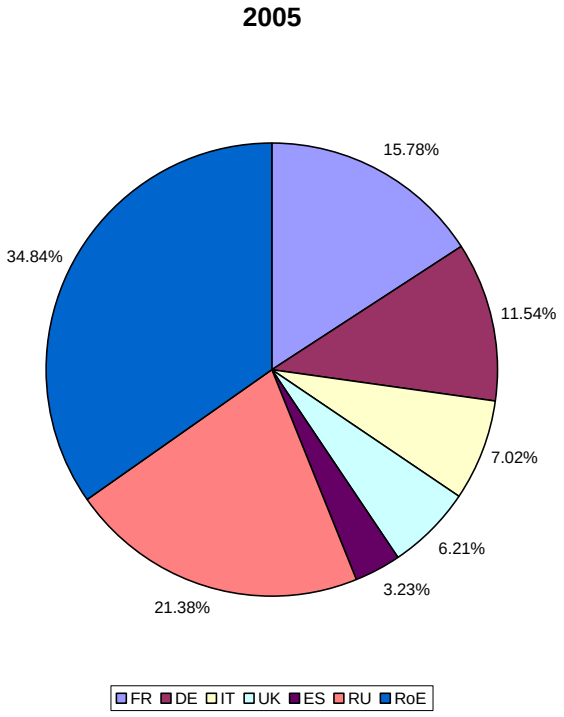
In Spain the main seed production organization is the Professional Association of Selected Seed Producing Companies (www.aprose.es), which represents 120 companies (90 domestic companies and 30 multinationals). The revenues of the seed companies associated to APROSE exceed 600 million euros per annum, with an investment in R&D of about 78 million euros p.a. (i.e. around 13%). Seed production in Spain amounted to over 380,000 tons in 2006.

As already mentioned in the previous section, the European seed market is forecast to reach almost 14 billion US$ by 2010, with an average annual growth rate of 4.27% over 2001-2010 (Table 1.3).

Table 1.3: Evolution of the European Seed Market (US$ Million)

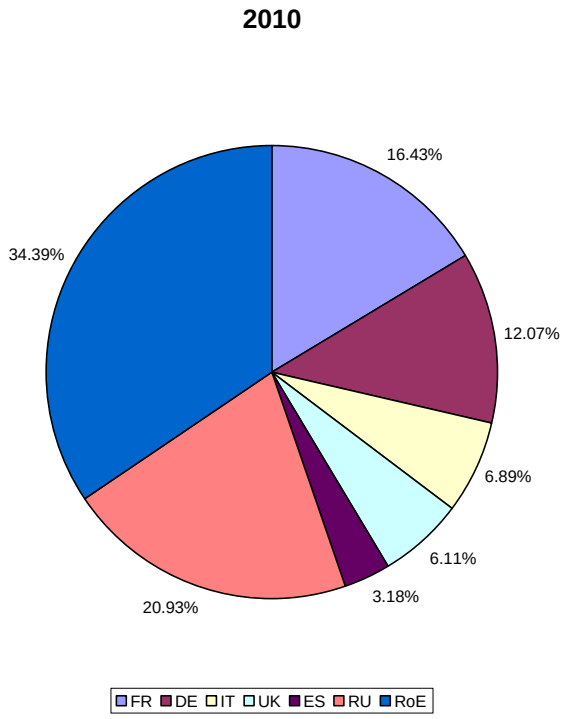
	2001	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***%Δ***
FR	1439	1508	1581	1660	1744	1835	1932	2034	2142	2257	5.13
DE	1050	1101	1155	1213	1276	1343	1414	1490	1571	1658	5.21
IT	675	698	723	748	776	807	839	873	909	947	3.83
UK	593	615	637	661	686	713	742	773	805	839	3.95
ES	309	320	331	344	357	371	386	402	419	437	3.94
RU	2054	2124	2200	2280	2363	2451	2546	2651	2760	2875	3.81
RoE	3316	3438	3567	3704	3851	4007	4167	4341	4527	4724	4.01
Total	**9436**	**9804**	**10194**	**10610**	**11053**	**11527**	**12026**	**12564**	**13133**	**13737**	**4.26**

Source: Industry estimates



Source: Industry estimates

Figure 1.5: Shares of the European seed market by region in 2005



Source: Industry estimates

Figure 1.6: Shares of the European seed market by region in 2010

Russia is the largest single market for commercial seeds in Europe, accounting for over 21% of the revenues in 2005. Due to the lower annual growth rate, it is estimated that by 2010 the Russian seed market will be relatively smaller (less than 21% of total European market in 2010).

In the EU, the largest seed markets are France, Germany and Italy. France and Germany alone are thought to account for about 50% of the EU25 certified seed market, with a turnover exceeding 3 billion euros in 2005. A more detailed analysis of the French and Germany seed market is presented in sections 1.2.1 and 1.2.2 respectively. Germany is forecasted to be the fastest growing seed market in the EU (at an average annual rate of 5.21%), followed by France (5.13% p.a.) and the Rest of Europe (4.01% p.a.). Because of this, the size of the German and French seed market will become relatively bigger, passing from 15.7% to 16.4% and 11.5% to over 12% of the European market respectively, over 2005-2010.

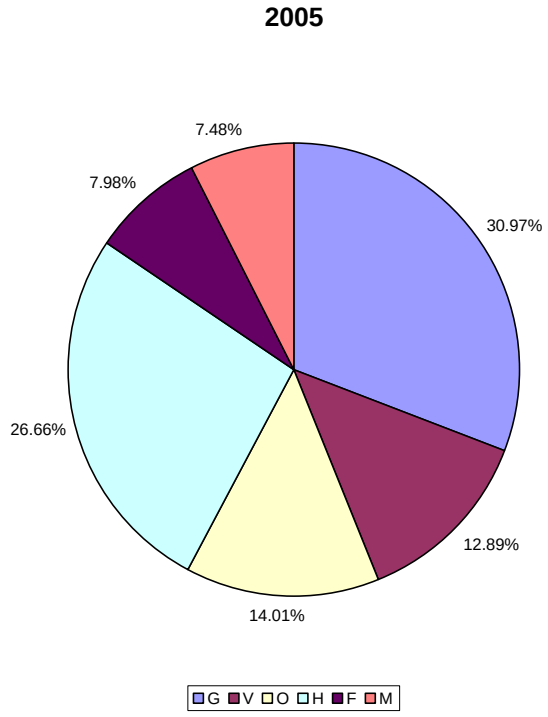
Table 1.4 shows that grain seeds still represent the largest sector in Europe (31% in 2005), followed by horticultural seeds (26.7% in 2005) and oilseeds (14% in 2005) (Figure 1.7). Oilseeds are the fastest growing sector in the European seed market, with an estimated annual growth rate of 5.39%. This is due to the expansion in oilseed areas for the production of biofuels and oils for the food industry (see Chapters 2, 4, 11 and 13). Vegetable seeds are also expected to grow quite fast (5.23% p.a.) together with horticultural seeds (4.80% p.a.). In particular, within the horticultural seeds segment, the flower seeds market is expected to grow faster (5.44% p.a.). Because of this, the horticultural, vegetable and oilseed sectors are expected to become relatively more important by 2010 (Figure 1.8).

Table 1.4: European seed market by segment (US$ Million)

	2001	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***%Δ***
G	3018	3111	3210	3313	3423	3540	3662	3793	3932	4078	3.40
V	1169	1267	1288	1354	1425	1499	1579	1664	1754	1851	5.23
O	1266	1330	1398	1472	1549	1633	1722	1818	1920	2030	5.39
H	2465	2574	2690	2814	2947	3089	3230	3401	3574	3758	4.80
F	782	805	830	855	882	911	942	975	1010	1047	3.29
M	735	756	778	802	827	854	882	911	942	975	3.19
Total	**9435**	**9843**	**10194**	**10610**	**11053**	**11526**	**12017**	**12562**	**13132**	**13739**	**4.26**

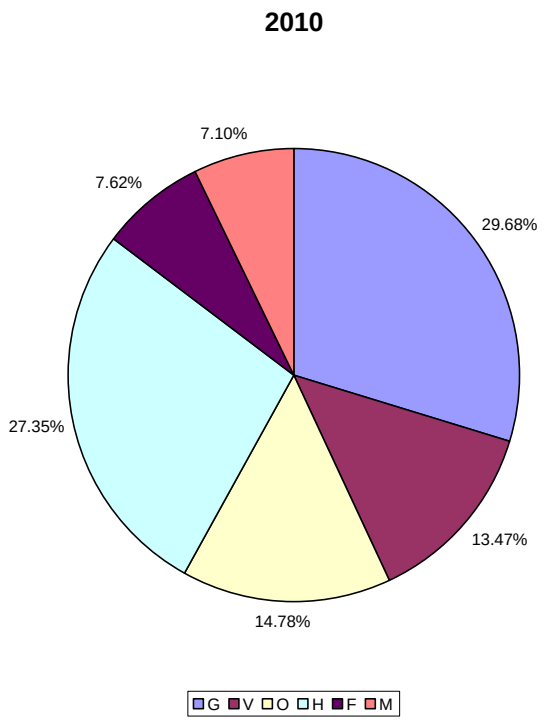
V: Vegetable Seeds; H: Horticultural Seeds; O: Oilseeds; G: Grain Seeds; F: Fruit Seeds; M: Miscellaneous Seeds.

Source: Industry estimates



Source: Industry estimates

Figure 1.7: Shares of the European seed market by segment in 2005



Source: Industry estimates

Figure 1.8: Shares of the European seed market by segment in 2010

1.2.1 France

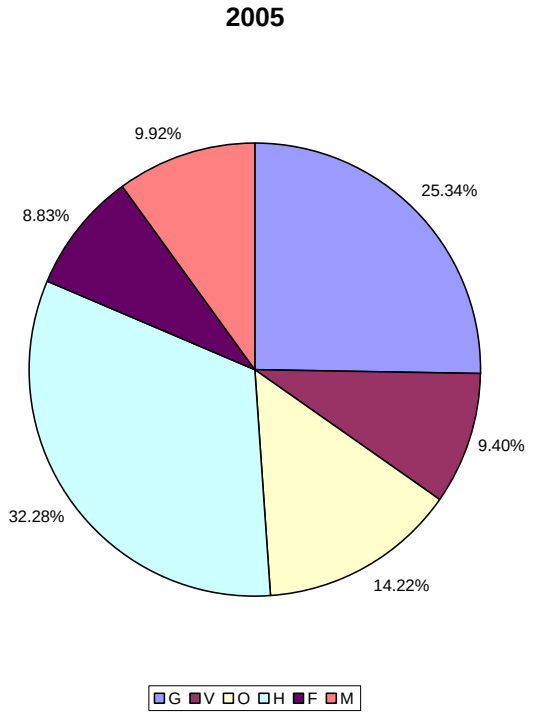
In France horticultural seeds and grain seeds represent the most important market segment accounting for 32% and 25% respectively of the total seed market in 2005 (Figure 1.9). The expected annual rate of growth of the French seed market as a whole over 2001-2010 is 5.13% (Table 1.5). However the fastest growing market segments are the horticultural seed sector (6.84% p.a.), the oilseeds sector (6.08% p.a.) and the vegetable seeds sector (5.54% p.a.). The fast growth of the oilseed sector is related to the expansion of the oilseed area in France (e.g. oilseed rape) for the production of biofuels. Within the horticultural sector, the growth of the flower seeds segment is particularly sustained (estimated at 7.20% p.a. over 2001-2010), while the lawn and grass seeds sector is expected to be less dynamic (estimated annual growth rate of 4.08%). Because of the higher than average growth rate, the oilseeds, horticultural seeds and vegetable seeds sectors are expected to become relatively more important by 2010 representing 14.84%, 34.87% and 9.57% of the total (Figure 1.10). On the contrary grain seeds sector is expected to become less important (22.77% of the total by 2010).

Table 1.5: Evolution of the French seed market (US$ Million)

	2001	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***%Δ***
G	397	407	418	430	442	455	469	483	498	514	2.92
V	133	140	147	155	164	173	183	193	204	216	5.54
O	197	208	221	234	248	263	279	296	315	335	6.08
H	434	463	494	527	563	602	644	689	736	787	6.84
F	131	136	141	148	154	160	167	174	182	189	4.12
M	147	154	160	166	173	182	190	199	207	216	4.39
Total	**1439**	**1508**	**1581**	**1660**	**1744**	**1835**	**1932**	**2034**	**2142**	**2257**	**5.13**

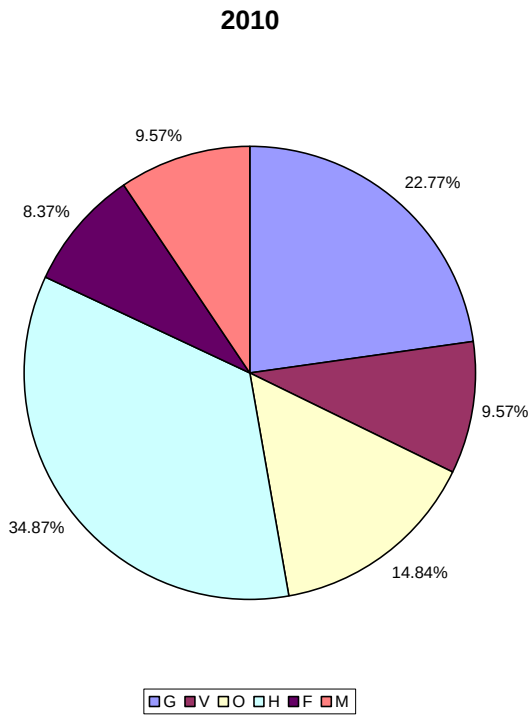
Source: Industry estimates

The major players in the French seed industry are Limagrain Group and Vilmorin & Cie (V&C). Limagrain is a cooperative and is the third largest seed company in the world. The group is the leading marketer in Europe for corn and wheat seeds, but is also present in the North American market through a joint venture with AgReliant. V&C is part of the Limagrain group and is the worldwide leader in breeding for the vegetable production and garden. V&C is the world's top supplier of vegetable and flower seeds for home gardens and stands third in the professional vegetable seeds market. It is also leader in Europe for the home garden lawn seeds segment.



Source: Industry estimates

Figure 1.9: Shares of the French seed market by segment in 2005



Source: Industry estimates

Figure 1.10: Shares of the French seed market by segment in 2010

1.2.2 Germany

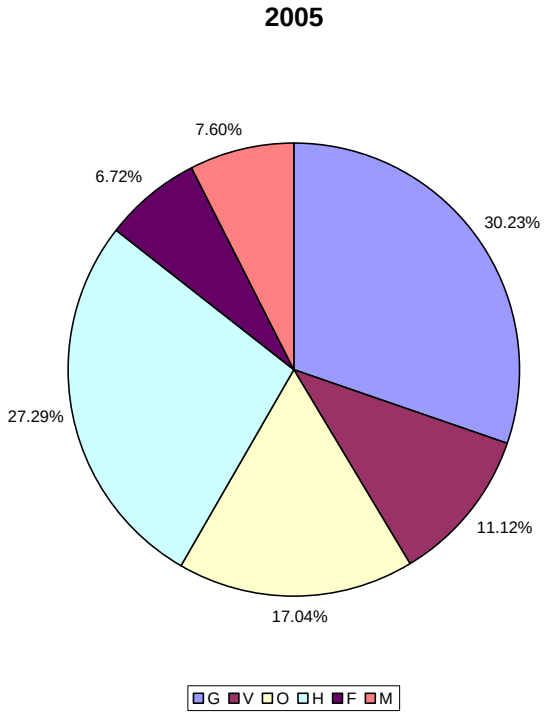
In Germany the grain seeds and the horticultural seeds represent the largest market segment, accounting for about 30% and 27% of the total in 2005 (Figure 1.11). The estimated annual rate of growth for the German seed market over 2001-2010 is 5.21%. However there is heterogeneity among different segments of the market (Table 1.6). The oilseeds sector is the most dynamic sector, with an estimated annual growth rate of 7.53% over 2001-2010, followed by the horticultural seed sector (flowers and lawn/grass) (6.1% p.a.) and the vegetable seeds sector (5.83% p.a.). The dynamics of the oilseed sector in Germany are related to the expansion of oilseed crops (especially oilseed rape) for the production of biofuels. The horticultural sector is also growing very fast (an estimated 6.1% p.a.), particularly because of the pull of the flower seeds sector. The grain seeds sector is the slowest growing sector with an estimated annual rate of 3.2%. As a result of such dynamics by 2010 the grain seed sector will be relatively less important (accounting for about 27% of the total German seed market), while the horticultural seeds, oilseeds and vegetable seeds will become relatively more important, accounting for 28.44%, 18.91% and 11.40% of the total respectively (Figure 1.12).

Table 1.6: Evolution of the German seed market (US$ Million)

	2001	***2002***	***2003***	***2004***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***%Δ***
G	342	352	363	374	386	398	411	425	439	454	3.2
V	114	120	127	134	142	150	159	168	178	189	5.83
O	163	175	188	202	217	234	251	271	291	314	7.53
H	277	293	310	328	348	370	393	417	443	472	6.1
F	74	77	79	82	86	89	93	97	11	105	4.03
M	81	85	88	93	97	102	107	112	118	125	4.93
Total	**1050**	**1101**	**1155**	**1213**	**1276**	**1343**	**1414**	**1490**	**1481**	**1658**	**5.21**

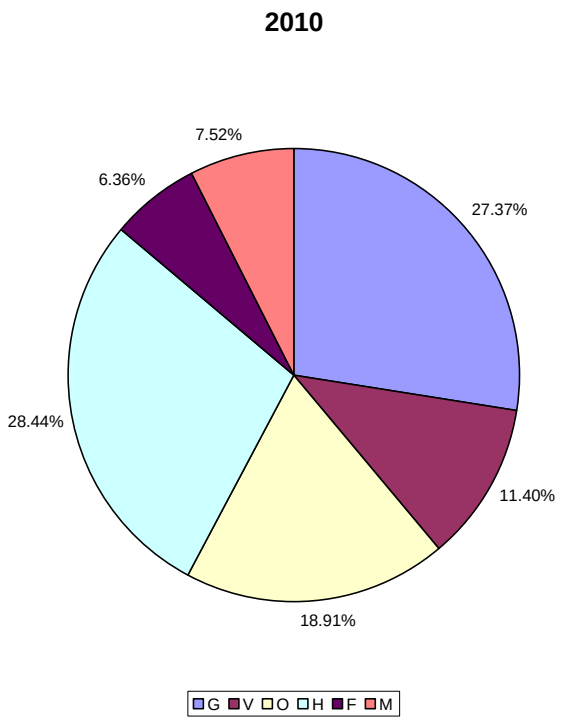
Source: Industry estimates

The major players in the German seed industry are Bayer CropScience and KWS SAAT. Bayer Crop Science is one of the world leaders in the area of crop protection, seeds, biotechnology and non-agricultural pest control. It is one of the largest seeds suppliers in the world and operates in 122 Countries. KWS is a leading plant breeding company in the world and is particularly active in the supply of sugar beet, corn, oilseeds and fodder crops seeds. The company operates in 65 Countries.



Source: Industry estimates

Figure 1.11: Shares of the German seed market by segment in 2005

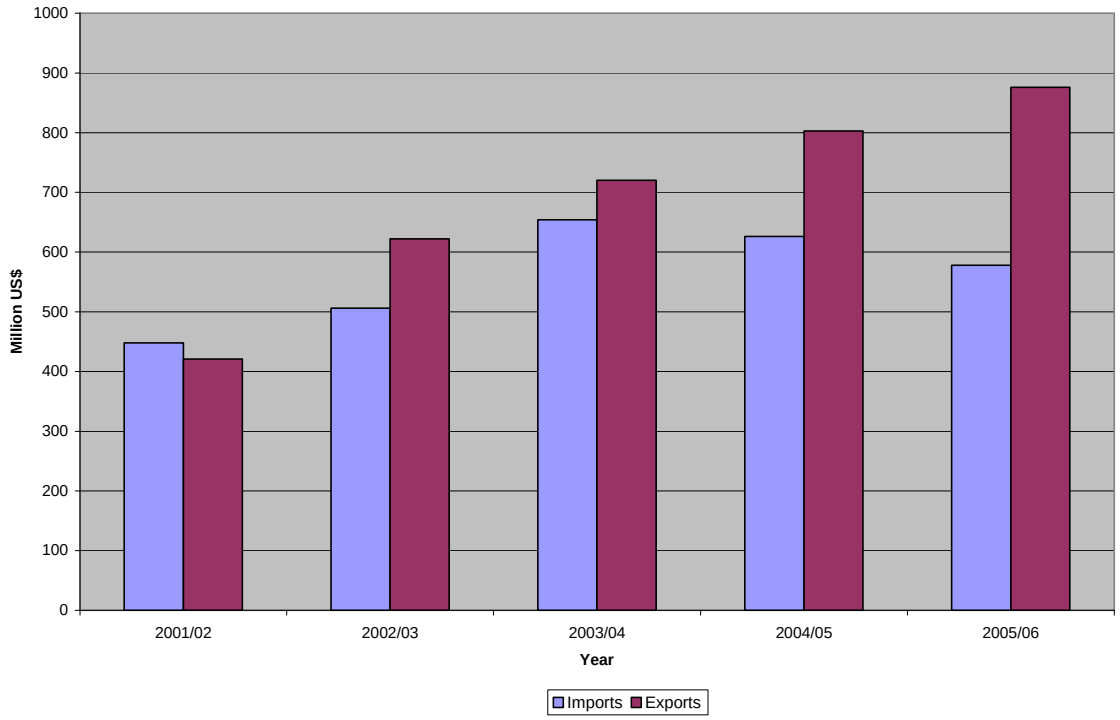


Source: Industry estimates

Figure 1.12: Shares of the German seed market by segment in 2010

1.3 EU seed trade

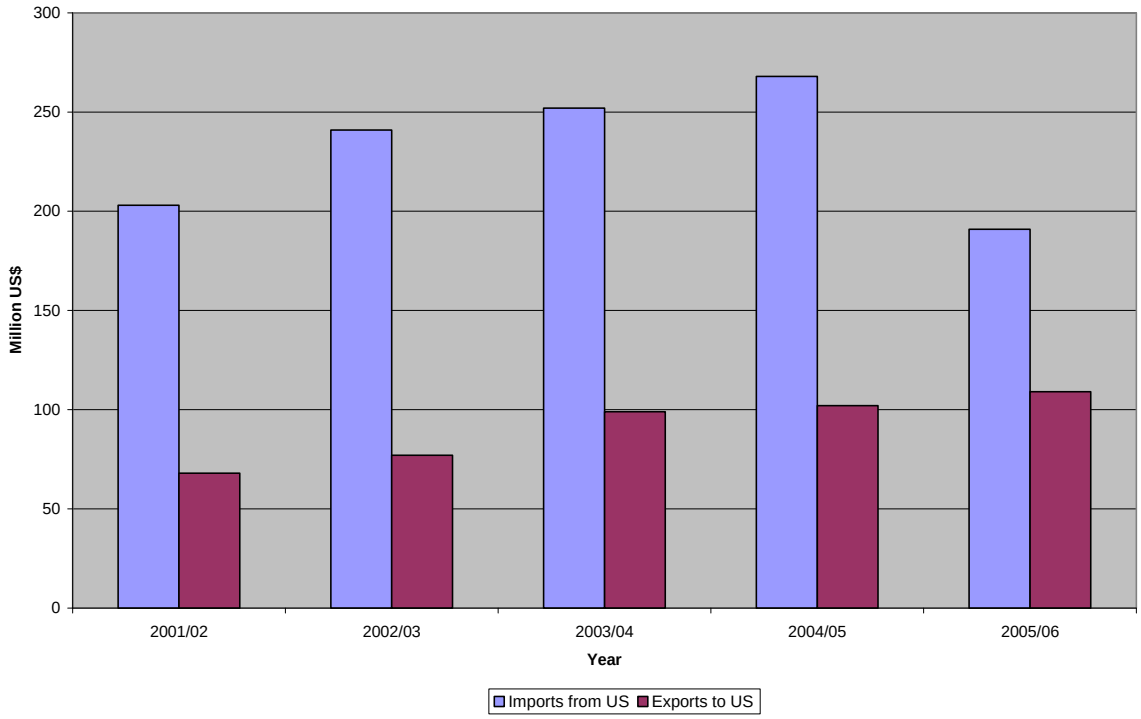
In 2005 the total value of seed imports (or equivalently seed exports) represented around 15% of the global seed market with a value of about 4.5 billion US$. Of this, the greatest part (63%) was related to trade of agricultural seeds while the remaining (37%) concerned horticultural seeds. In the EU seed imports increased from 450 million US$ to almost 580 million US$ (Figure 1.13) over 2000-2005. In the same period seed exports increased from 421 million US$ to 876 million US$. The increase in exports and imports of seeds in Europe is mainly due to the strong increase in shipment of vegetable seeds.



Source: USDA

Figure 1.13: Value of commercial seed trade in the EU

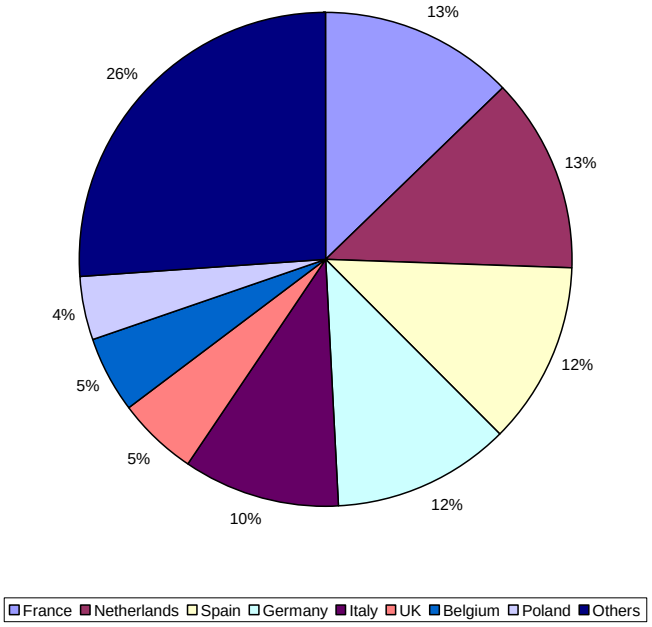
Despite being a net exporter of seeds, the EU has got a seed trade deficit with the US (Figure 1.14). The deficit ranged between 164 million US$ in 2002 to 82 million US$ in 2005. The main reason for the reduction in the trade deficit is the decline in imports of maize seeds by France, due to the fear of adventitious presence of unapproved GM material. The main planting seeds exported by the US to the EU are vegetables, oilseeds and flowers and trees.



Source: USDA

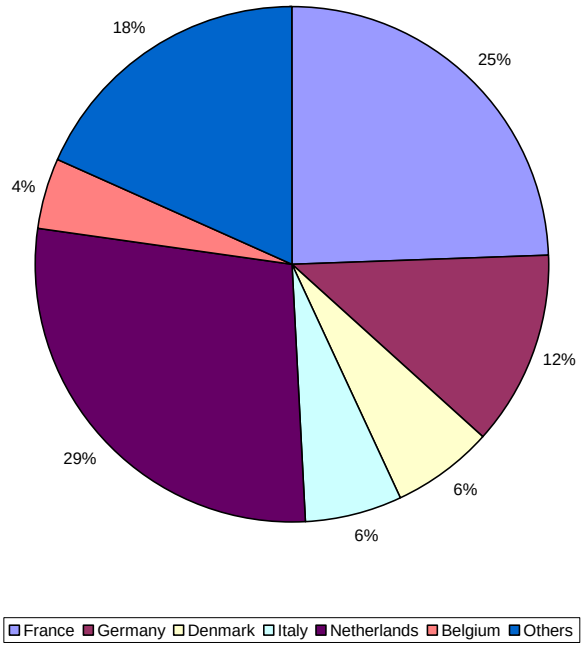
Figure 1.14: EU seed trade with USA

Figures 1.15 and 1.16 illustrate the distribution of seeds imports and exports by some major Countries in Europe. Notice that the data reported refer to total imports and exports, including trade with other EU Member States. As such these figures cannot be directly compared with the ones reported in Figure 1.13. France and Germany are mainly oriented towards importing agricultural seeds, while Spain and the Netherlands import significant quantities of horticultural seeds (around 50% of their seed imports). With respect to seed exports, the Netherlands and France are by large the major exporters, accounting for 29% and 25% (i.e. around 780 and 670 million US$) of European seed exports respectively, followed by Germany (around 330 million US$) and Denmark and Italy (around 206-220 million US$). The Netherlands mainly exports seeds for the horticultural market (around 71% of its exports, equivalent to 547 million US$), while France, Germany, Denmark and Italy mainly export agricultural seeds (between 67% and 92%, depending on the Country).



Source: ISF

Figure 1.15: Distribution of European seed imports by Country



Source: ISF

Figure 1.16: Distribution of European seed exports by Country

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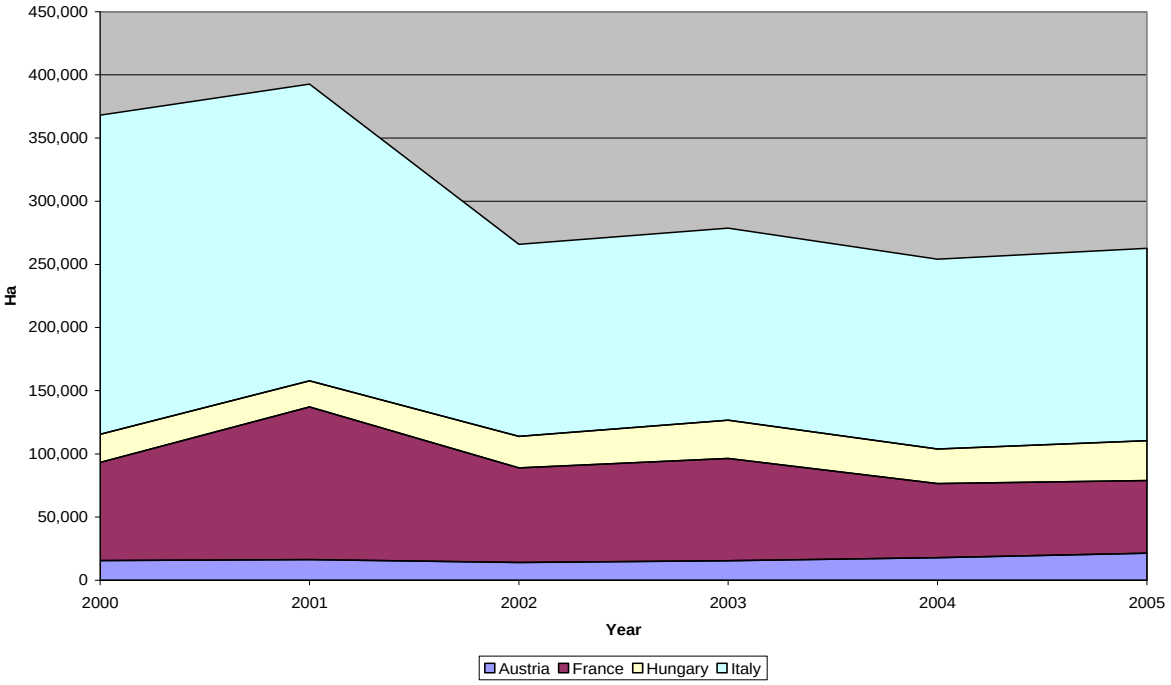
http://worldseed.org

Chapter 2 Production of Soybeans in the EU

2.1 Conventional grain Soybean

Overall it is important to note how domestic soybean production is marginal in the EU compared to trade[3]. Indeed the EU 25 is the world's largest importer of soymeal. In most recent years import of soymeal has been preferred to imports of soybeans because of the low margins to crushers. On one hand Southern American crushers are much more competitive. On the other hand the increased availability of rapeseed (because of its increased use in biofuels) is causing EU crushers to switch from soybeans to rapeseed. The aspects related to trade are treated in Chapter 3. Over the period 2000-2005 soybeans area in the EU 25 declined 25% from 0.38 million ha to 0.28 million ha (see Figure 2.1). The four largest producers in 2005 were Italy (0.15 million ha), France (0.057 million ha), Hungary (0.031 million ha) and Austria (0.021 million ha). These four countries accounted for over 90% of EU 25 production in the same year.



Source: FAOSTAT

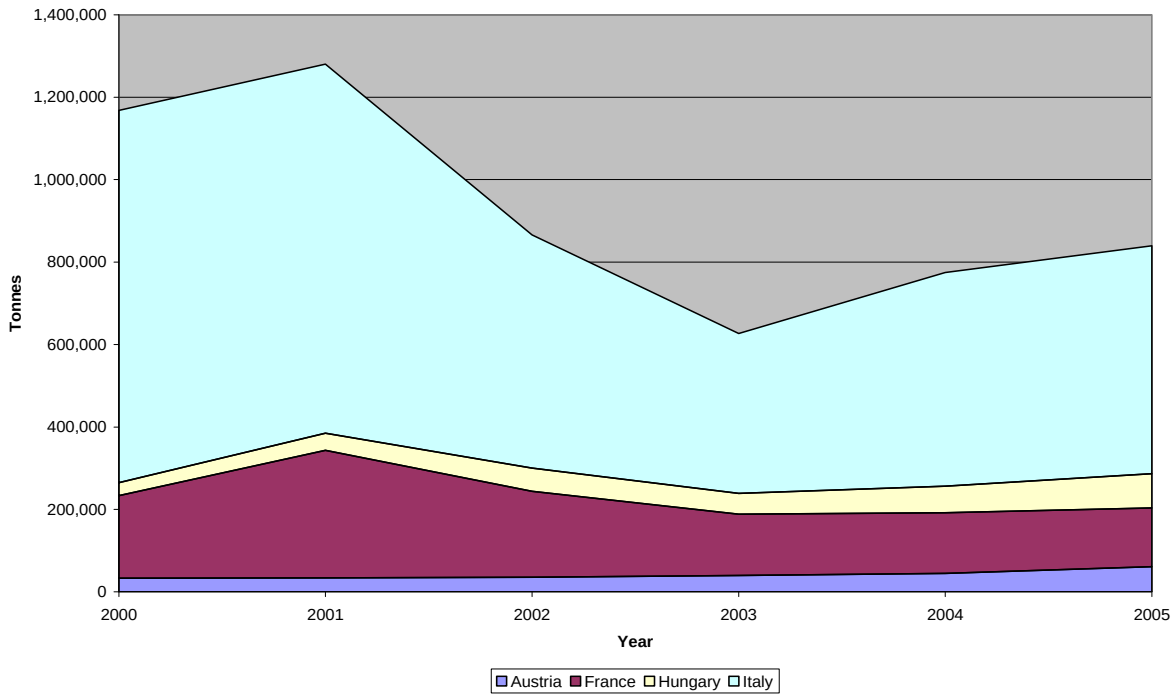
Figure 2.1: Soybeans area in the 4 largest EU producing countries

EU soybean area increased in 2001 from 0.381 million ha to 0.406 million ha. Such an increase was mainly due to an expansion of the soybean area in France. This expansion occurred despite the

[3] EU lacks enough land with suitable climate to produce soybeans. Soybeans cultivation is successful in climates with hot summers, with optimum growing conditions in mean temperatures of 20 °C to 30 °C (68°F to 86°F); temperatures of below 20 °C and over 40 °C retard growth significantly. The deficit of proteins for animal feed has been covered for decades by importing soybeans.

reduction in compensation payments (i.e. Agenda 2000). Over the previous 3 years an increasing number of French soybean producers have registered under the 'Soja de Pays' program. By holding to strict quality criteria throughout the whole production chain, soybeans of 'Soja de Pays' received a higher price than conventional soybeans. The reduction of the premium offered to non-GM certified soybeans (i.e. Soja de Pays) in the following years explains the decline in French soybean area.

In Italy soybeans plantings declined over the period 2000-2005 from over 0.25 million ha to just over 0.15 million ha. Causes for the decline include the reduction in compensation payments (from the implementation of Agenda 2000) and partially farmer's fears about adventitious GM presence in seeds shipments from US. The effects of the Agenda 2000 reform on soybeans have become fully evident in 2002, when producers in Northern Italy switched to soft wheat.

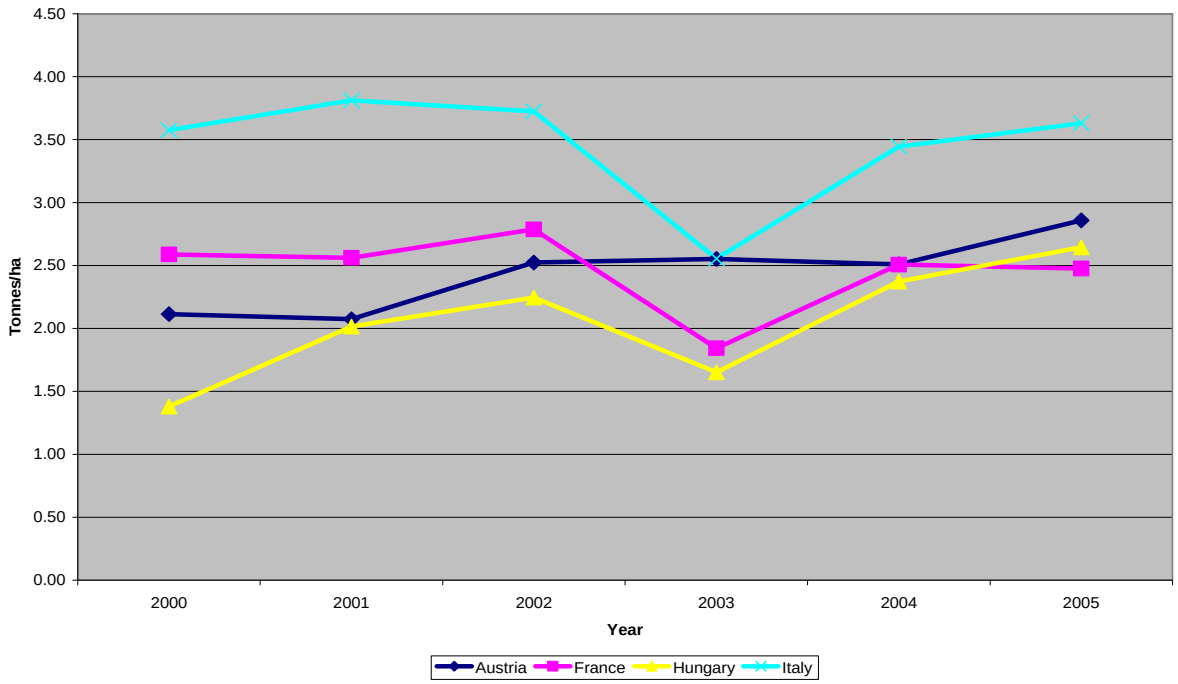


Source: FAOSTAT

Figure 2.2: Soybean Production Volume in the 4 largest EU producing Countries

In Hungary soybean production is marginal and confined to micro-climatic regions in the Danube basin. The crop years 2000 and 2003 were characterized by low yields because of drought. However, the crop area increased from 0.02 million ha to 0.031 million ha over 2000-2005. In Austria, soybeans are mainly grown under contract because of the high demand for non-GM produce by food processors and organic livestock producers. Due to rains in the harvesting period in 2001 the crop was heavily infested with fungi and therefore not fit for food use. The lower price of soybeans for feed discouraged plantings in 2002, which recovered in the following years. In general crop area increased from 0.015

million ha to 0.021 million ha over 2000-2005. The changes in crop area explain the observed changes in production volumes in the EU. Figure 2.2 illustrates the situation for the four largest producing countries, namely Italy, France, Hungary and Austria. Over 2000-2005, production declined by 25% from 1.2 million tons to less than 0.9 million tons. The decline was particularly evident in Italy (from 0.9 million tons to 0.388 million tons over 2000-2003 and then up to 0.553 million tons in 2005). On the other hand production increased in Austria (from 0.032 million tons to 0.061 million tons over 2000-2005) and Hungary (from 0.031 million tons to 0.083 million tons over 2000-2005), faster than the observed increase in area. An analysis of yields (Figure 2.3) can therefore provide further understanding of the observed changes in production.



Source: FAOSTAT

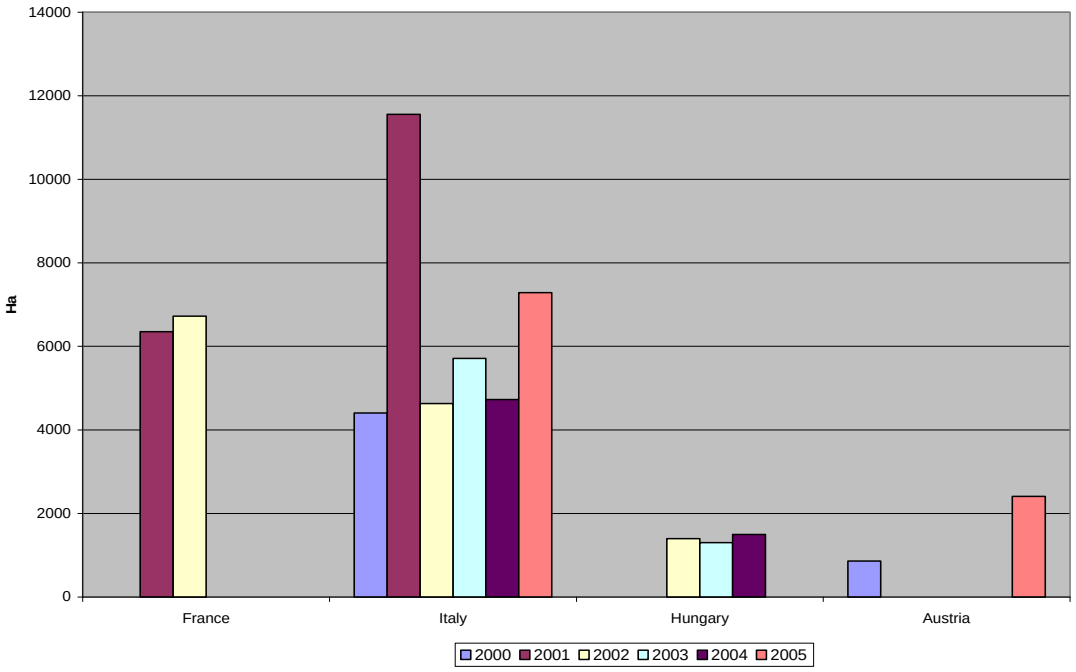
Figure 2.3: Soybeans yield in the 4 largest EU producing Countries

Figure 2.3 illustrates how the best yields for soybeans are recorded in Italy (3.6 t/ha in 2005). For all the countries in Figure 2.3, with the exception of Austria, 2003 was a bad year. Severe hot and dry conditions prevailed across the EU in 2003 and caused severe yield losses to most crops, including soybeans. If one excludes 2003, it appears that yields have been fairly stable in Italy and France, while they have been increasing in Hungary and Austria.

2.2 GM and organic grain soybeans

At present no GM soybeans are being grown in the EU25. However a variety of HT (Roundup Ready) soybean is being evaluated by EFSA for cultivation.

Figure 2.4 illustrates data on organic soybeans area in the four largest EU producers, namely Italy, France, Hungary and Austria over the period 2000-2005. The dataset is incomplete, but at least it provides a reference point in order to understand the dimension of organic soybeans production in the EU.



Source: EUROSTAT

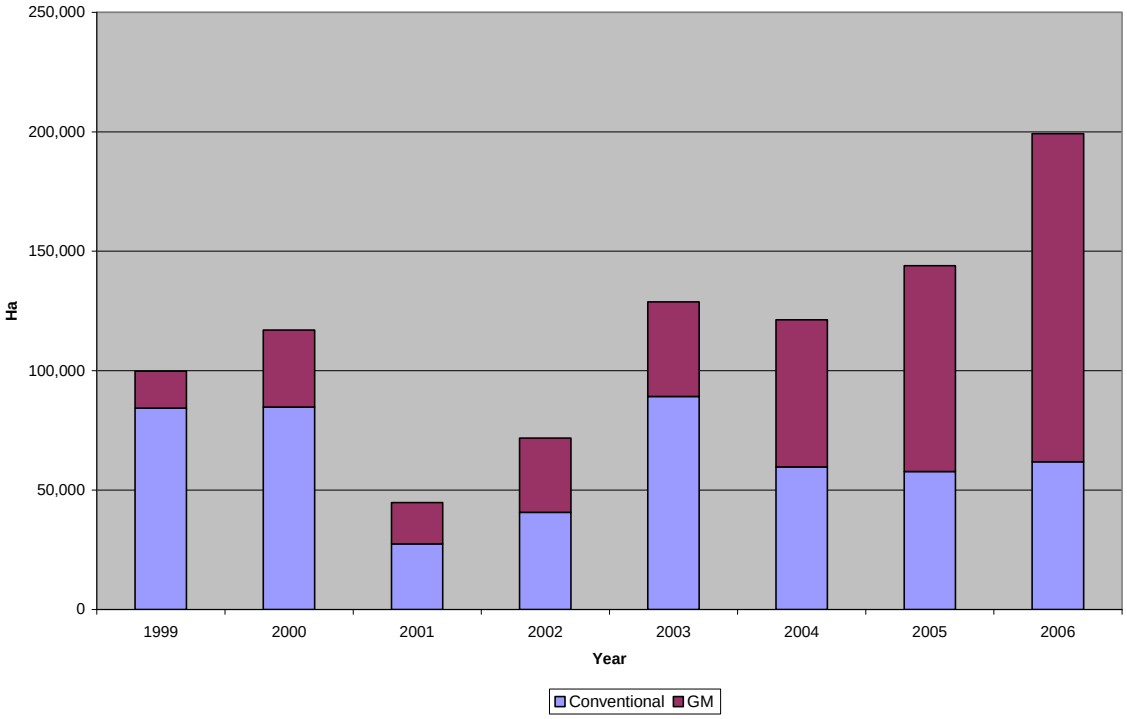
Figure 2.4: Organic soybeans area in the 4 largest EU Producers

Italy is by far the largest producer of organic soybeans in the EU with an area that ranged between 0.004 and 0.011 million ha over the considered period. First, it is important to notice how a consistent part of the area reported in Figure 2.4 refers to the area under conversion (between 14% and 51%, depending on the year considered). Second, organic soybeans account for only a small fraction of Italian soybean area, between 1.7% and 4.9% depending on the year. In France available data indicate a small increase in organic soybeans area over the period 2000/2001. Even in this case, organic production remains small, accounting for 5% and 8% of total soybeans production. When considering figures of organic production, it is necessary to compare them not only with domestic conventional production, but also with actual soybeans consumption. The EU is largely an importer of soybeans. So for example, EU 25 imported 14.5 million tons of soybeans in 2005, mainly from Brazil and the US. In the same year domestic production amounted to 0.883 million tons (roughly 6%) of which less than 10% is organic. Therefore organic soybeans production can be considered essentially marginal in the EU.

2.3 Case study: grain soybean production in Romania

Romania is a major producer of soybeans in Europe[4]. Over the period 1999-2006 the harvested area of soybeans ranged between 0.1-0.2 million ha (Figure 2.5). Romania has also been growing genetically modified herbicide tolerant (GM HT) soybeans (Roundup Ready soybean, authorized for import and processing in the EU25 but not for cultivation) over 1999-2006. Following the accession into the EU in 2007 all the Roundup Ready (RR) soybeans varieties have been withdrawn from the list of registered varieties. The company producing RR soybeans has currently applied for authorization for cultivation. Figure 2.5 illustrates a steady increase in the area planted with soybeans up to 2006, with low plantings in 2001. Unfavorable weather severely affected plantings in 2000 and resulted in extremely low yields (Figure 2.5). Drought during the growing season, lack of irrigation and low agricultural input uses (because of their high prices) depressed yields down to 0.6 tons/ha.

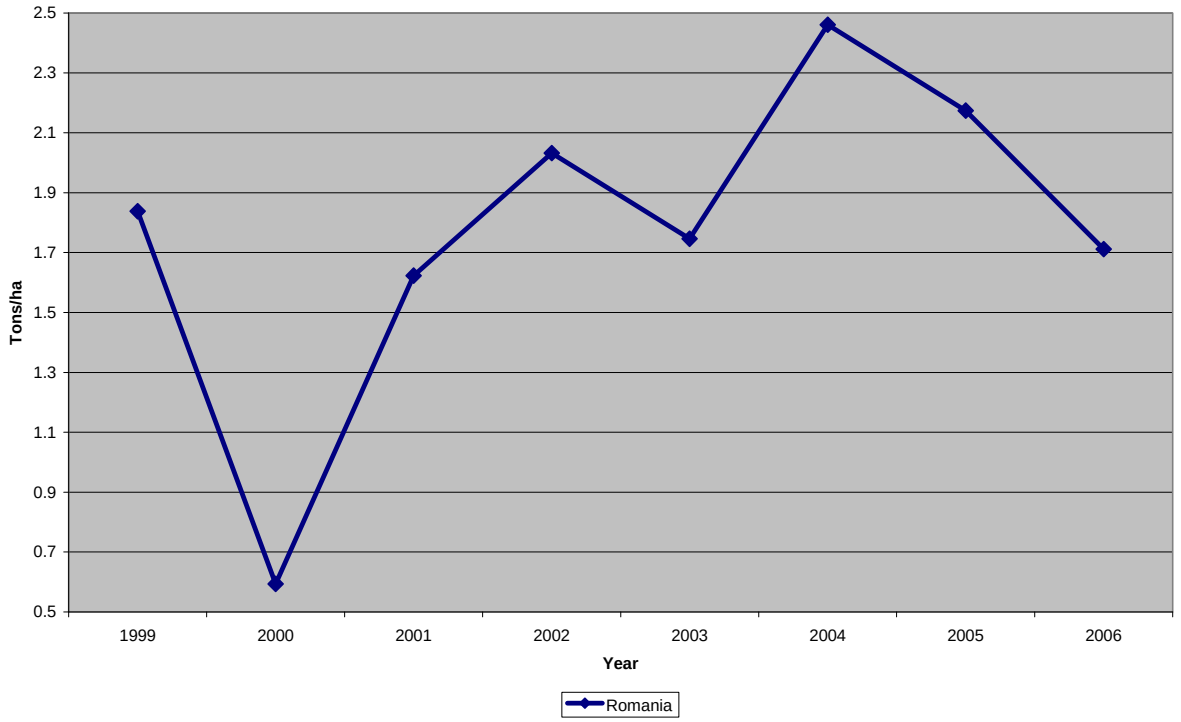
In order to sustain the oilseed sector and to favor diversification the Government launched a support program over 2001-2004 in order to provide direct support to soybeans growers. Direct payments of 7.6$/ton for soybeans delivered to processors were available to producers up to a total of 0.3 million tons. Also subsidies for irrigation, soil erosion control, plant protection and phytosanitary measures were introduced in order to help soybean farmers. Despite the Government support, plantings were extremely low in 2001 (just 0.045 million ha). Unfavorable weather at planting time and the very low yields recorded in the previous year discouraged farmers. However, total production remained unchanged (Figure 2.7) thanks to improved yields (Figure 2.6).



[4] Romania's soybeans grain and certified seed production has been included in the analysis because of its importance, even if Romania itself was not part of EU25.

Source: Romania Ministry of Agriculture and Rural Development (MARD)

Figure 2.5: Soybeans area in Romania



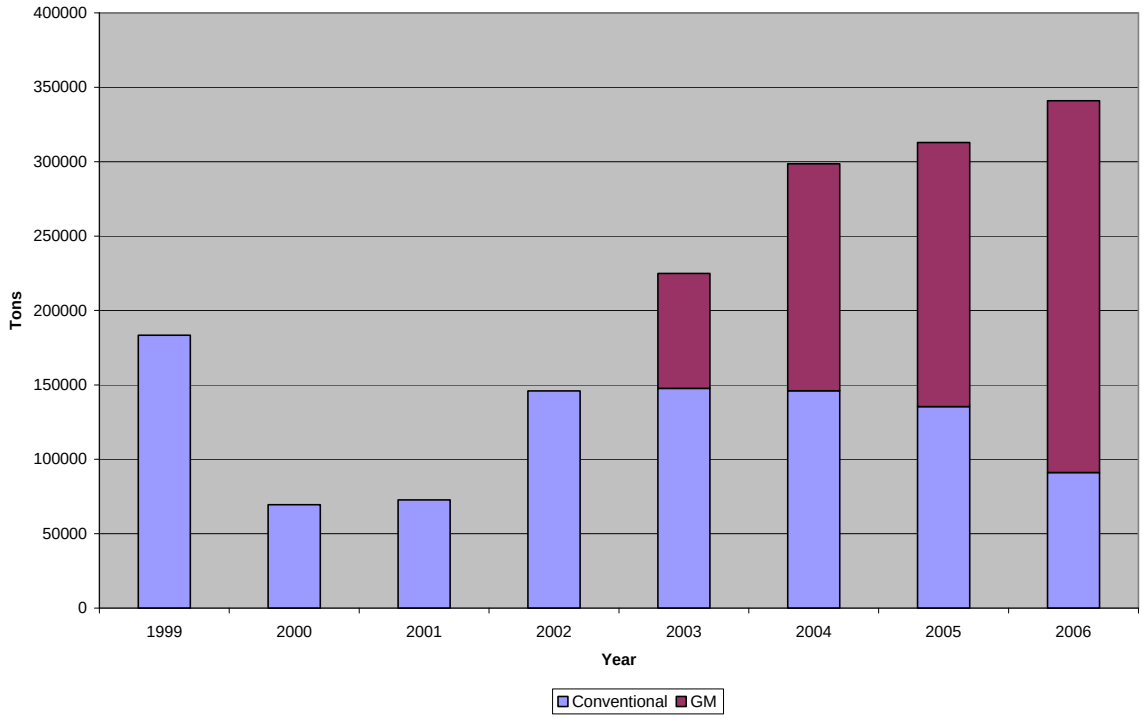
Source: Elaborated on the basis of MARD data

Figure 2.6: Soybeans yield in Romania

In 2002 and 2003 soybean area expanded as a result of the Government policies above mentioned and because of increasing demand from the crushing industry. Following increased use of soybean oil in animal feed and to a smaller extent for human consumption as margarine, the crushing industry has invested in new crushing capacity. Also in 2003 a large amount of land was available for planting in the spring, following the high degree of winter kill recorded in cereal crops. As a result soybeans area has gone up.

In 2004 and 2005 exceptionally good yields were recorded which are reflected also in total production (Figure 2.6 and 2.7). This was because of good weather conditions and better access to irrigation (at least by large farmers).

Consultation with the MARD (Romanian Ministry of Agriculture) indicates that in 2007, following the withdrawal of GM HT varieties from the market, the area planted with soybeans has gone down to less than 0.1 million ha.



Source: MARD

Figure 2.7: Soybeans production in Romania (tons)[5]

The Romanian Government has had a very positive attitude towards GM soybeans and in 2006 it is reported that 0.137 million ha out of 0.199 million ha were planted with GM HT varieties (see Figure 2.5). In the same year 0.25 million tons out of a total 0.34 million tons were GM HT soybeans (MARD). Adoption has been particularly strong among large commercial farmers who were able to combine the GM varieties with better irrigation facilities. The main reason behind the adoption of GM HT soybeans is the simplification of weed control practices which allows farmers to save time and money in the management of the crop (e.g. Brookes, 2003). Adoption of GM HT soybeans in Romania has been facilitated also by its effects on farmers' access to herbicides, since GM HT seeds and Glyphosate herbicides were sold in a single package.

2.4 Future developments

The future developments of the soybean sector in the EU must be considered within the broader context of the entire oilseed sector. As such further reference is made to section 3 of Chapter 11 (i.e. oilseed rape production). Here we present the expectations for soybeans production in two major producing Countries like Italy and Romania. The two principal developments in the oilseed sector concern the large-scale production of biofuels and the possible introduction of GM HT varieties. The

[5] Data on GM soybean production were not available for 1999-2001.

Italian industry is uncertain about the role that Italian oilseed crops might play in the production of biodiesel. In particular the industry feels that the production of biodiesel feedstocks would require large areas of production that Italy naturally lacks. As such the perception is to orientate the Italian production towards the supply of high quality products for the food market. In Romania, the main expectations for the future concern the possibility of reintroducing (at some point) the GM HT soybeans varieties. Following the withdrawal of such varieties in 2007, the area of soybeans has gone down by 50% (from around 0.2 million ha in 2006 to less than 0.1 million ha in 2007). At present the dossier on GM HT soybeans is under consideration by EFSA. The production of biofuels is likely to have a minor impact on soybeans production in Romania. There have been investments to build up 4 biodiesel plants in Romania, but the main target is OSR. The main use of soybeans production is in animal feedings, because of its high protein contents, rather than in oil production (i.e. soybeans oil yields are not comparable to OSR). In general, we can conclude that the production of soybeans in the EU will remain minor.

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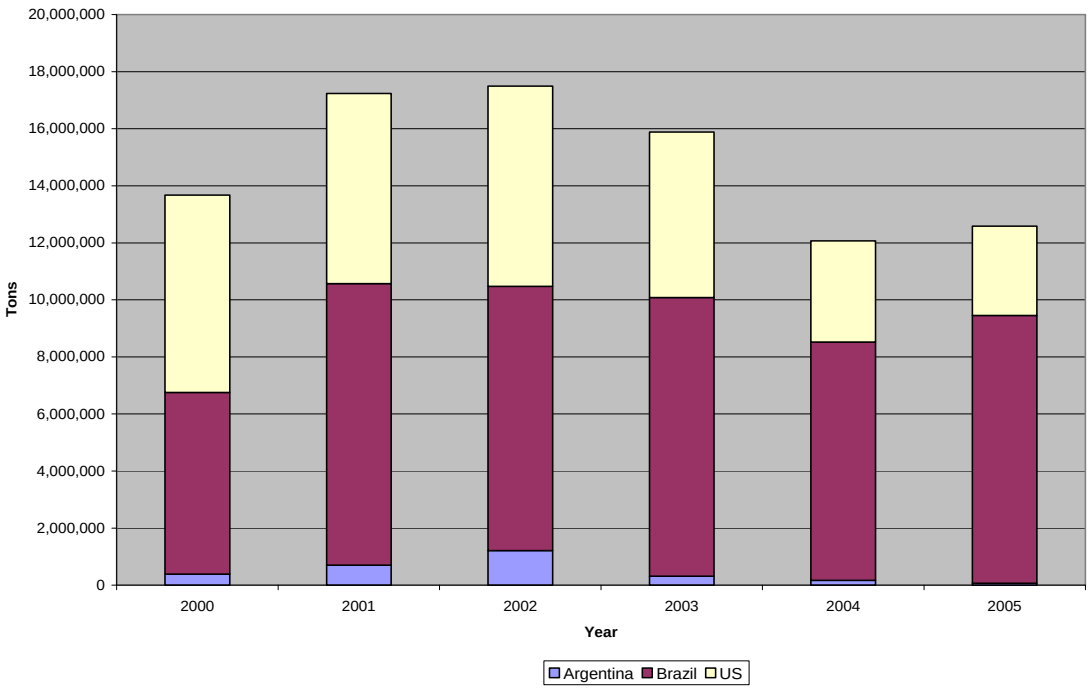
http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL

Chapter 3 Soybeans Trade in EU

3.1 Soybean grains trade

When looking at the soybeans sector in the EU, it is necessary to consider trade movements in beans, meal and oil. Given the negligible volume of soybeans production in EU25, imports are necessary to provide raw materials to crushers. Figure 3.1 illustrates EU25 imports of soybeans from the 3 most important suppliers, namely Argentina, Brazil and US. The main importers in the EU are the Netherlands and Germany. The Netherlands import mainly from US and Brazil. Up to 2001 imports were almost equally split between Brazil and US. However, after 2001 the Netherlands have been switching to Brazil as main source of imports, because of better access to non-GM varieties. Germany, on the other hand mainly imports from the Netherlands, Brazil and US. After 2000 American imports have declined in favor of Brazilian ones. The latter is today the main exporter to Germany.

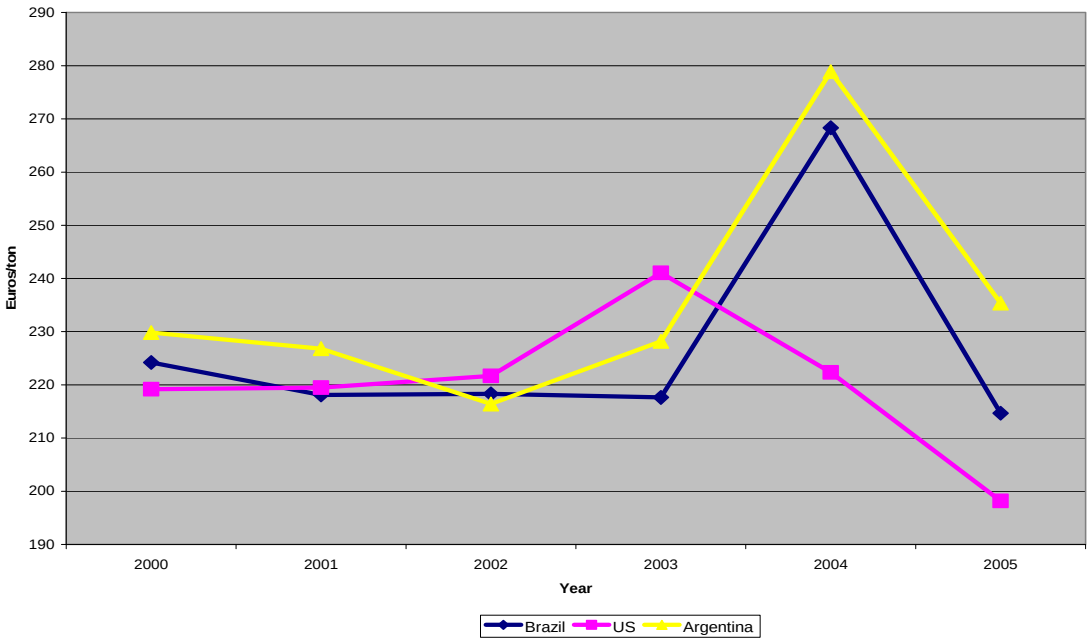


Source: COMEXT

Figure 3.1: Imports of soybeans in EU25

Figure 3.1 clearly illustrates how soybeans imports were particularly high in 2001 and 2002, and gradually decreased over the period 2003-2005. The reason for the 2001-2002 increase has been the improved profitability of crushing following the meat and bone meal ban in the EU. The ban was implemented as a response to the BSE crisis. The ban has increased the demand for oilmeals as a source of proteins for livestock sustaining oilmeals prices and therefore improving crushing margins. Given the large deficit of soybeans production in the EU, increasing imports was the only way to

supply an increasing crushers' demand. Figure 3.1 also shows how since 2001 the largest part of soybeans imports come from Brazil (up to 2000 the US was the main exporter of soybeans to EU25). This is the consequence of the EU preference for non-GM produce. The reduction in soybeans imports recorded in 2003-2005 is due to different factors. First, crushers' profitability has been reduced due to relatively high soybeans prices. Figure 3.2 illustrates average prices in euros/ton for Argentinean, Brazilian and US imports. Notice that these data are indicative, since they have been obtained dividing the value of imports by the volume.



Source: Elaborated from COMEXT data

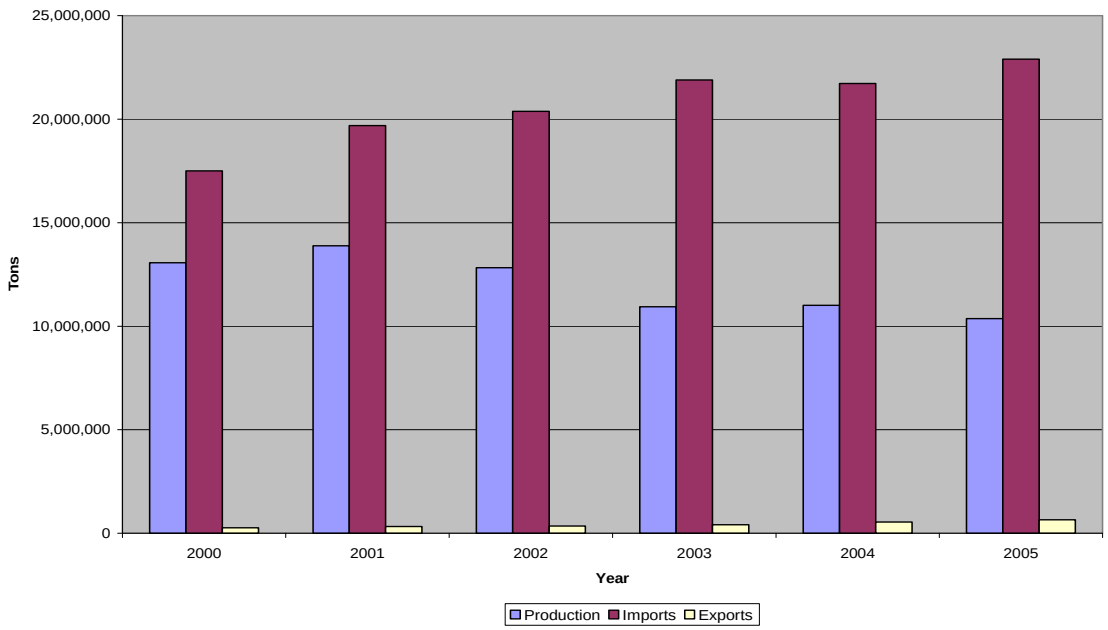
Figure 3.2: Average soybeans import prices (euros/ton) for US and Brazil

The figure shows how prices have generally been increasing up to 2004. The sharp increase in 2004 is the result of a drought in South America. Similarly the US import prices reflect changes in supply (i.e. low production in 2003 and subsequent expansion in following years).

Importing soybeans meal from Brazil turned out to be more profitable, because of the low crushing costs in this Country (see section on meal). Second, a bad market for soy oil due to the labelling and traceability requirements set by EU Regulations 1829/2003 and 1830/2003, has contributed to reduce the crushers' interest in soybeans. Finally, increased production of rapeseed and availability of rape meal and other grains have also had a negative effect on soymeal incorporation in animal feed. In the future, the possibility to use soybean oil in biodiesel production (at present its use is limited because of the CEN standards) might lead to a recover of soybeans imports. The EU is a net importer of soybeans. Exports outside the EU are negligible.

3.2 Soybean meal trade

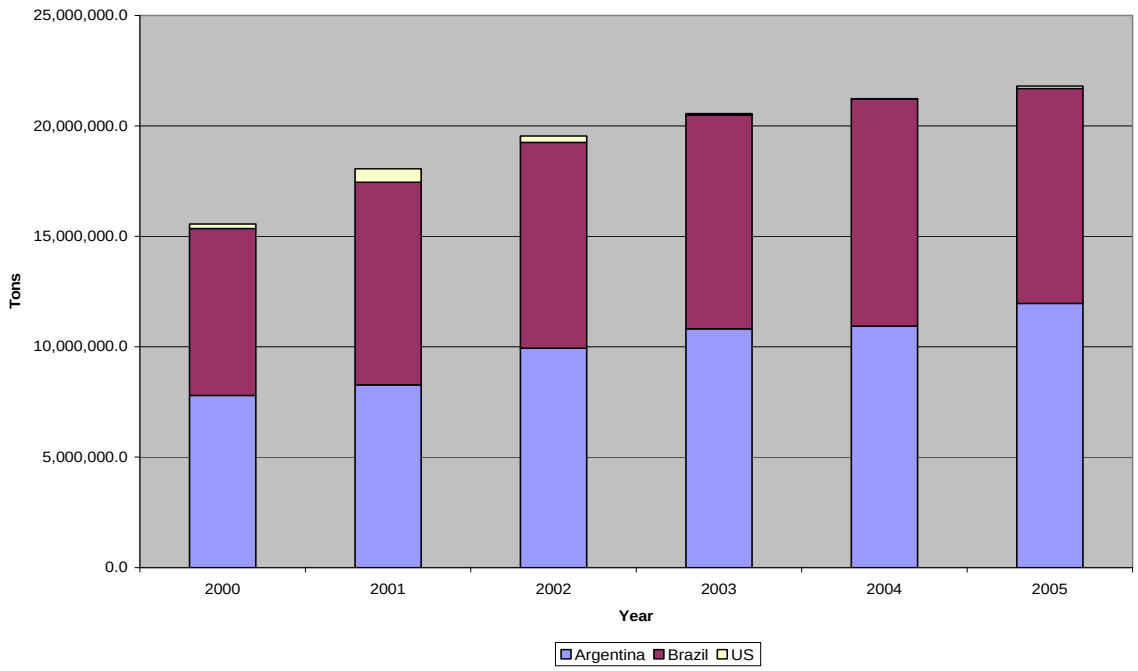
The EU25 is a significant producer and importer of soybean meal. Over the period 2000-2005 soybean meal production (obtained by crushing mainly imported soybeans) ranged between 10-14 million tons, while imports ranged between 17-22 million tons (Figure 3.3).



Source: USDA FAS/PSD

Figure 3.3: Soybean meal production and trade in EU25

Figure 3.3 illustrates how production of soybean meal declined from 2003, while soybean meal imports have gone up. This is in line with the decline in soybeans imports previously described (Figure 3.1). There are different reasons for this. At first, low crushing margins (because of high soybean prices) have discouraged crushers from importing soybeans. At the same time, the mandatory labelling requirements (for oil produced from GM soybean) introduced in 2004 and high soybean oil prices have led to a reduction in soybean oil use by the EU food industry (USDA, 2005). Under these circumstances importing soybeans meal from South America (mainly Argentina and Brazil) has proved to be more cost-effective (see Figure 3.4).

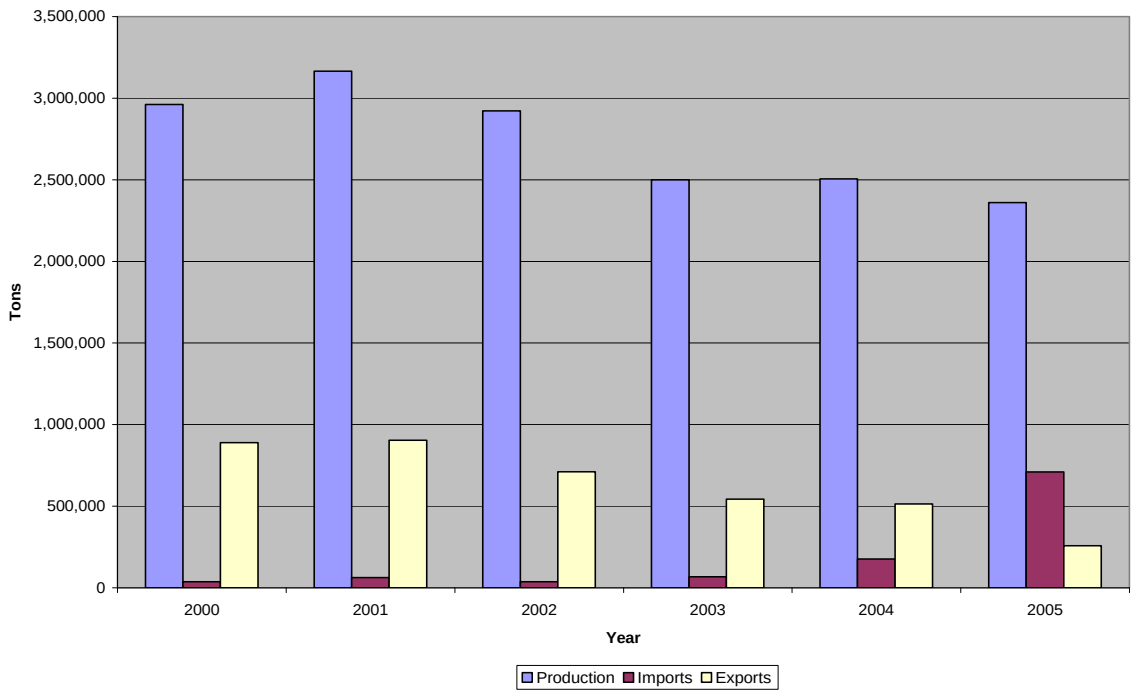


Source: COMEXT

Figure 3.4: Soybeans meal imports by Country of origin

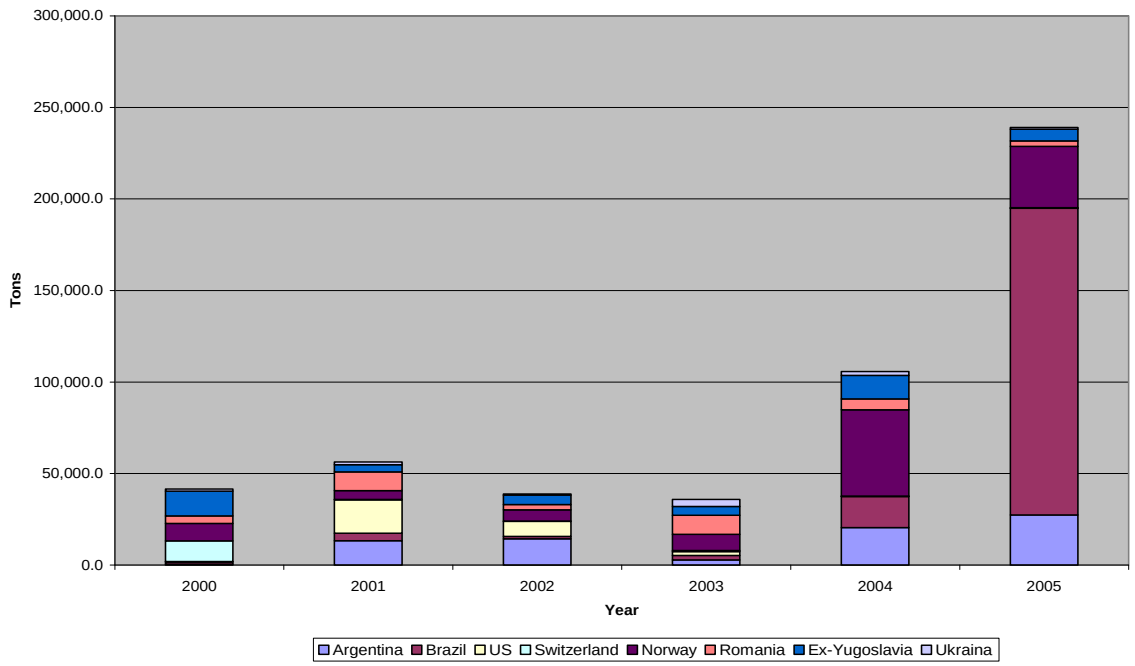
3.3 Soybean oil trade

Figure 3.5 illustrates how soybean oil production has been declining over the period 2000-2005 in EU25. This is the result of the decline in crushing and is therefore linked to the reduction in soybean imports and to the increase in soybean meal imports. Imports of soybean oil have been relatively small until 2003. However, in 2004 and 2005 increased use in biodiesel production and relatively low prices have led to an increase in imports and a corresponding reduction in exports. The use of soybean oil in biodiesel production has been particularly significant in Spain, because of the different standard adopted there. Given the low crushing costs, Brazil is the main source for soybean oil (Figure 3.6). The difference between the values reported in Figure 3.6 and Figure 3.5 (with respect to imports) is at least partially due to the fact that in the former case data refer to the calendar year (i.e. Jan-Dec), while in the second case data refer to the marketing year (i.e. Oct-Sept).



Source: USDA FAS/PSD

Figure 3.5: Soybean oil production and trade in EU25

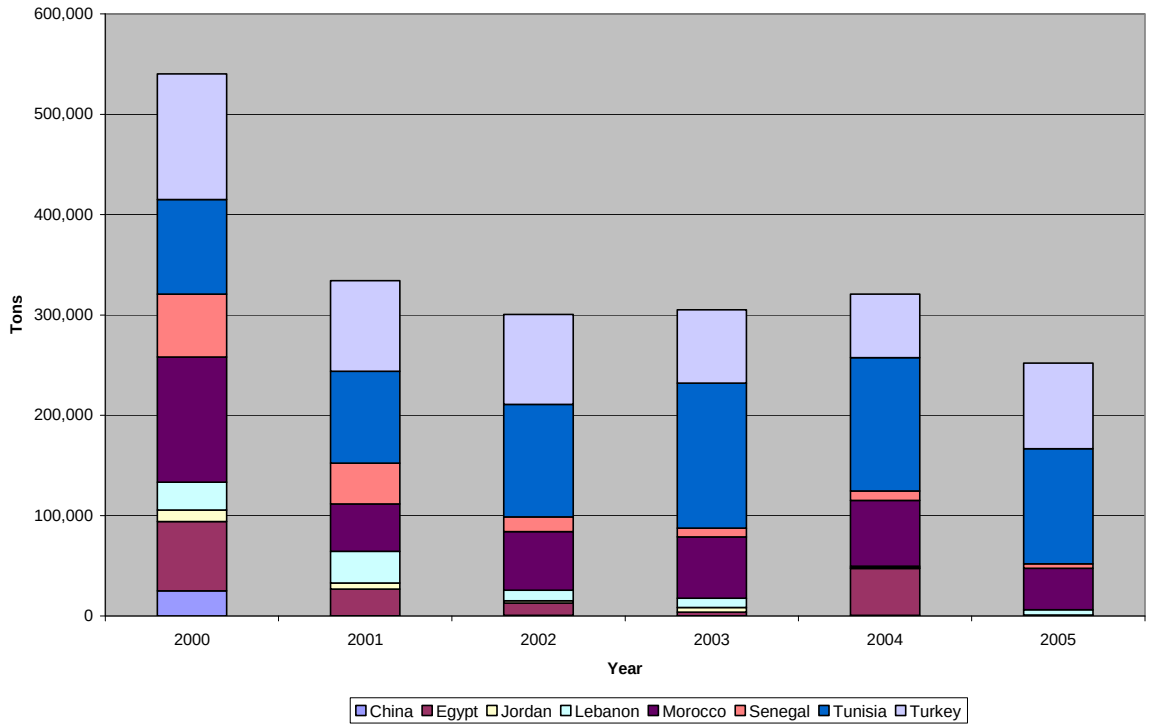


Source: Elaborated on COMEXT data

Figure 3.6: Soybean oil imports by Country of origin

With respect to exports, traditional destinations for EU25 soybean oil include Middle East and North African Countries like Egypt, Tunisia, Jordan, Turkey, Morocco, Lebanon and Senegal. In 2000 some

exports to China were also recorded (Figure 3.7). In general it is evident how soybean exports have been declining over 2000-2005. On one hand this is due to the reduction in soybean oil production in the EU25. On the other hand some Countries (e.g. China, Egypt, Jordan, Lebanon, Morocco, Senegal and Turkey) have increased their crushing capacity and have therefore switched to import soybean seeds instead of oil. Finally, the demand for soybeans oil by the biodiesel industry in EU25 has contributed to reduce exports.



Source: Elaborated on COMEXT data

Figure 3.7: Soybean oil exports by main destination

To sum up it is possible to draw some interesting conclusions with respect to trade in the soybean sector. Over 2000-2005 the EU25 has partially switched from importing soybeans to importing soybean meals and more recently soybeans oil. The reduced profitability of crushing soybeans (compared to other oilseeds like oilseed rape) has been an important factor in this respect. Also, the introduction of labelling and traceability requirements for GM food and feed has certainly affected oilseeds trade in the EU. With respect to the origin of EU imports, soybeans grains are mainly sourced from Brazil, followed by USA. The share of USA has declined in the period studied. Soybean meal imports are mostly sourced from Argentina and Brazil. Soybean crop area has remarkably increased in Brazil and Argentina since 2000 and both countries are predicted to surpass the USA as main producers in few years. Conversely, a decline in area devoted to soybean cultivation in the USA is taking place due to competition with maize production for bioethanol. Argentina's soybean crop area

has increased from 11.6 million ha in the 2001/02 growing season to 15.3 million ha in 2005/06, while Brazil area increased from 14 million ha in 2001 to peak at 23 million ha in 2004/05. The GM soy adoption rate is over 85 % in the USA and above 50% and increasing in Brazil, but with very marked regional differences[6]. Some Brazilian states have GM soy adoption rates below 10 % (Southern states) while others have over 70 % adoption rate. All GM soybean cultivated in the world corresponds to a single transgenic event of herbicide-tolerant soybean ("Roundup Ready" soybean) that is authorized for import (but not for cultivation) into the EU since 1996. The process for authorizing its cultivation in the EU (see below) is on-going. It is likely that a second generation version of this GM soybean will be released for cultivation in the USA in 2008/2009[7]. A request for authorizing its import into the EU has been filed to EU regulatory bodies.

The labelling requirements, together with the high price of soybean oil, have negatively affected the food industry demand for soybean oil. More recently, the possibility of using soybeans oil in biodiesel production and the reduction in soybean oil price had a positive effect on soybean oil imports in the EU (while reducing the amount of oil exported). On the other hand, animal products derived from GM fed livestock do not require labelling. Therefore, despite some pressure by retailers to establish a chain for meat products derived from livestock fed on GM free feed, the effect on soybean meal imports has been limited.

Consulted documents

USDA FAS, 2006. GAIN Report E36092. EU25 – Oilseeds and Products: Annual.

USDA FAS, 2005. GAIN Report E35118. EU25 – Oilseeds and Products: Annual.

USDA FAS, 2004. GAIN Report E34040. EU25 – Oilseeds and Products: Annual.

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USDA FAS, 2000. GAIN Report E20087. EU15 – Oilseeds and Products: the EU oilseeds market in 2000.

Consulted websites

http://www.fao.org

http://www.fas.usda.gov/psdonline/psdquery.aspx

http://www.fas.usda.gov/scriptsw/attacherep/

http://fd.comext.eurostat.cec.eu.int/xtweb/

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[6] See http://www.pecad.fas.usda.gov/highlights/2007/03/brazil_soybean_30mar2007/

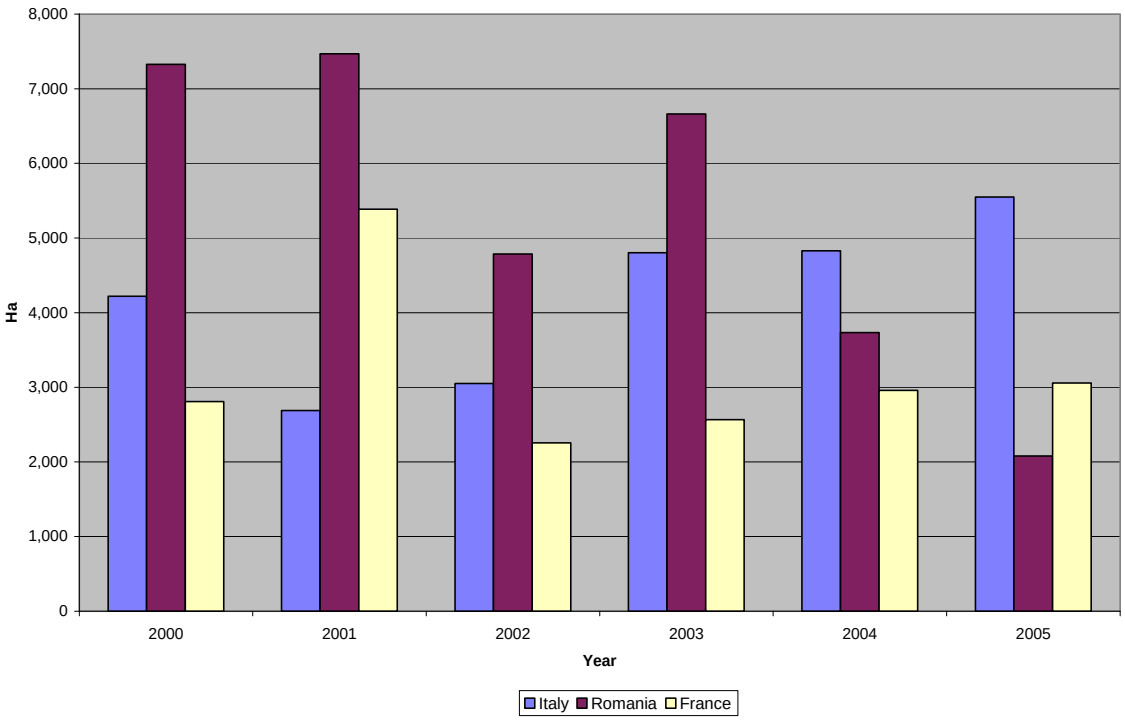
[7] See http://www.monsanto.com/monsanto/content/sci_tech/prod_pipeline/productPipeline.pdf

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL

Chapter 4 Soybeans Seed Production and Trade in the EU

4.1 Soybean seeds production

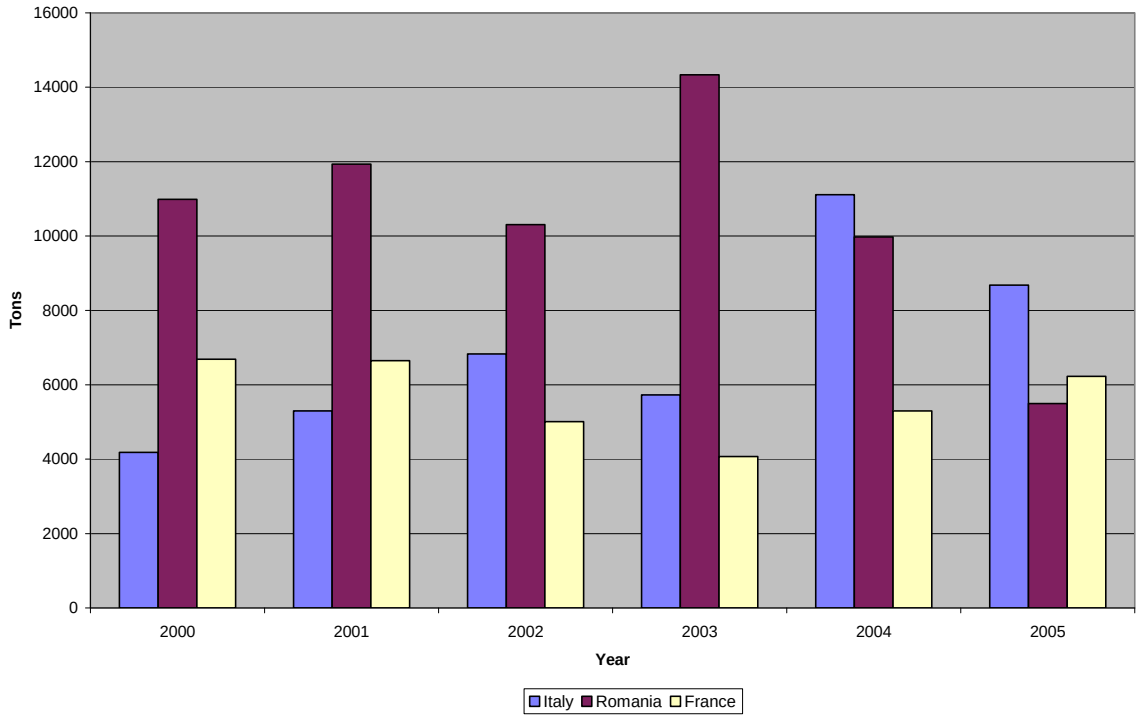
Soybeans seed production in the EU mainly takes place in Italy and Romania and to a smaller extent in France. Figures 4.1 and 4.2 illustrate data on area and volume production in Italy, France and Romania over 2000-2005. Notice that for Romania the data include both conventional and GM HT soybean seeds



Source: ENSE and ESCAA

Figure 4.1: Soybeans seed area in Italy and Romania

In Romania there has been a decline in the area of certified seed production, especially in 2004 and 2005. The decline in total seed production is mainly due to the large use of farm-saved seeds, especially for conventional varieties. On the other hand the area of soybean production in Romania has ranged between 0.12-0.13 million ha over 2003-2005 and has reached 0.2 million ha in 2006 (see Chapter 2). The decline in the area of certified soybeans seed production in Romania is reflected in the reduction in the volume of certified seeds especially over 2003-2005. A more detailed analysis of soybeans seed production in Romania will be presented in section 4.3.



Source: ENSE and ESCAA

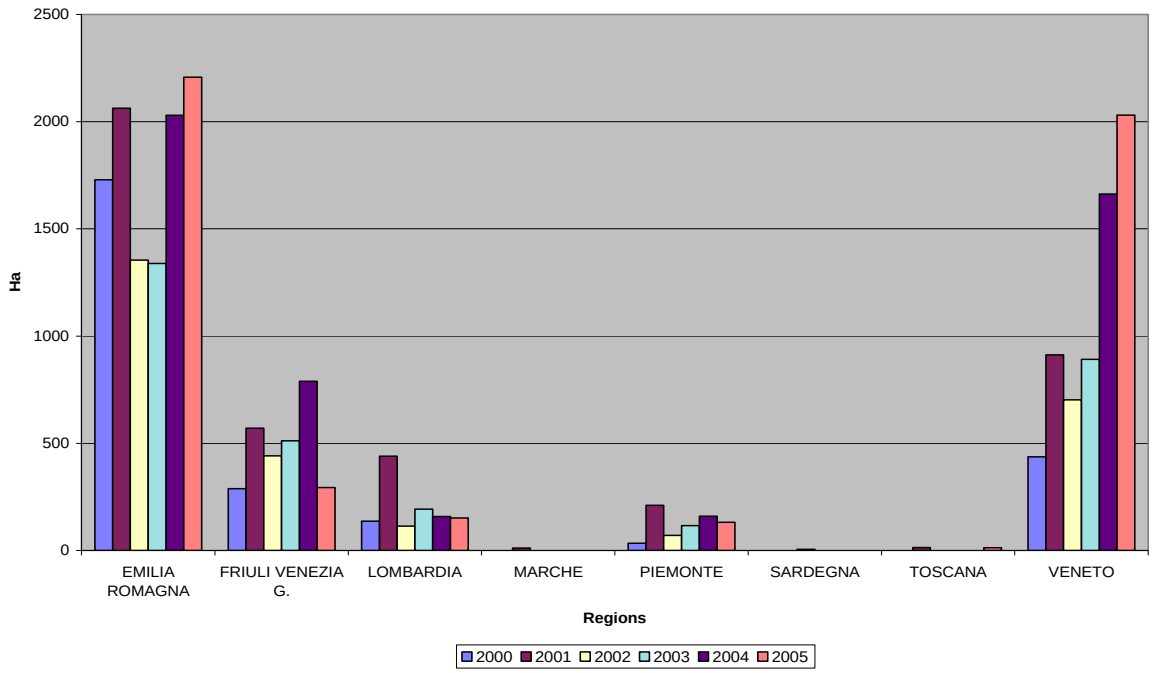
Figure 4.2: Soybean seed production volume in Italy and Romania

In France the area of soybean seed production has been relatively stable at around 3,000 ha, with the exception of 2001, when it exceeded 5,000 ha. The increase in the area was due to the expectation of increased soybean plantings in France in 2001 (see Chapter 2). When looking at volumes of soybean seed production though, it is clear that the amount of certified seeds has been relatively stable with a small decrease in 2002 and 2003 because of the corresponding decline in the planted area of grain soybeans.

The area of soybean seed production in Italy has generally increased over the years (with the exception of 2003). In general soybean seed production was not traditionally carried out in Italy, but it has been introduced from North America during the 1980s. Over the years it established itself in the Northern regions of Italy. The increase in seed area observed (especially after 2003) despite the decline in the area of soybeans for grains, is due to the necessity for Italy to produce its own seeds after the large-scale adoption of GM varieties in the US and Canada that traditionally supplied the Italian market. The volume of soybeans seed production in Italy (Figure 4.2) partially reflects the dynamics of the certified area (Figure 4.1). However, the volume of seeds certified in any year also includes seeds stored from previous years and/or seeds produced abroad. Other factors that affect the volume of certified seeds are growing conditions. So for example, the decline in the volume of seeds certified in 2003 despite the increase in the certified area reflects the bad growing conditions due to the draught. The data in

Figures 4.1 and 4.2 also include basic and pre-basic seeds[8]. With respect to the area, in 2005 pre-basic and basic seeds in Italy accounted for over 50% of the certified area with 2,635 ha. In terms of volume though, basic and pre-basic in Italy only accounted for 13% of certified seeds with 1,361 tons in 2005.

In Italy the increase in the area and volume of certified seed production has been also accompanied by a decline in the use of farm-saved seeds. Before 2000 farm-saved seeds accounted for up to 20-30% of seeds used by farmers, while today they represent less than 5%. In part this shift follows from the diffusion of GM varieties in North America and the will of Italian farmers to avoid adventitious presence of GM material by using certified conventional seeds. On the other hand after 2003 the Italian Government has introduced a subsidy of 50 euros/ha for growers using certified seeds. Notice that the breeding material for the production of certified seeds (i.e. pre-basic seeds) entirely originates from the US. Italian seed companies then produce the seeds through annual contracts with specialized farmers (multipliers).



Source: ENSE

Figure 4.3: Regional distribution of soybeans seed production in Italy

With respect to the regional distribution, the production is concentrated in the North of Italy, in Emilia Romagna and Veneto in particular (Figure 4.3). These two regions accounted for over 90% of the certified soybeans seed area in 2005. The location of soybeans seed production is affected by climatic conditions and by organizational reasons. In particular production takes place in regions where seed

[8] Pre-basic seeds refer to the generations of seeds that precede basic seeds. Basic seeds are used for the production of certified seeds.

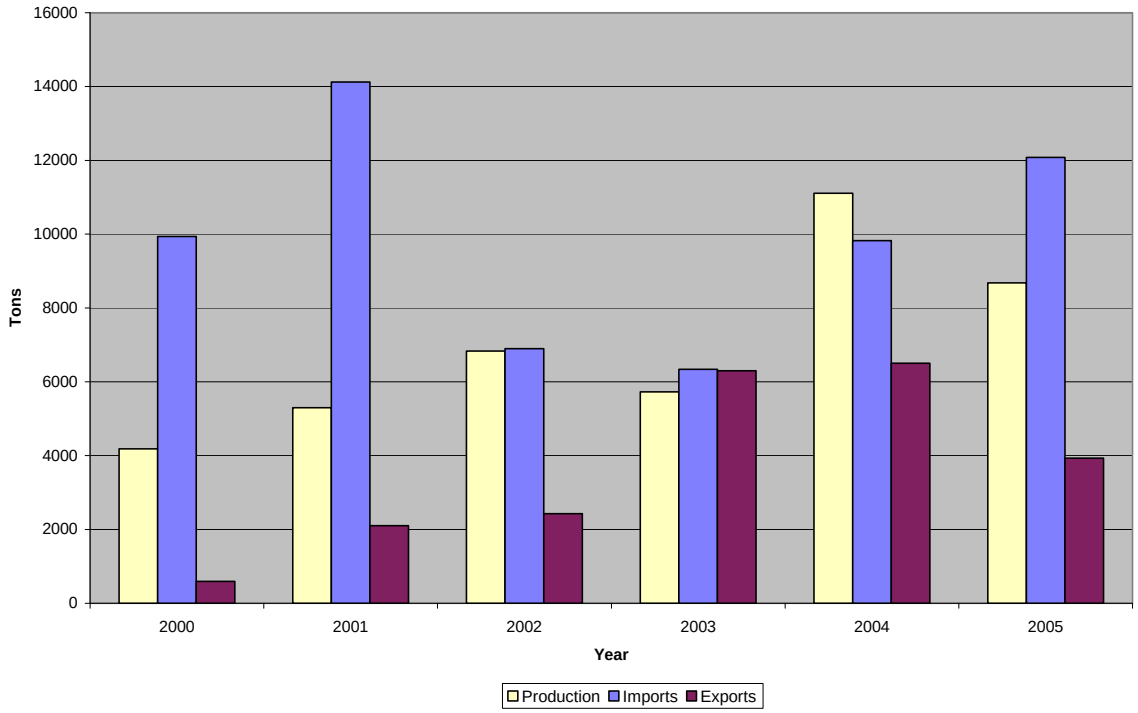
selection and treatment plants are present. In Emilia Romagna, the presence of companies and farmers specialized in seed production also explains the localization of soybeans seeds in the region.
Soybeans grain production is also concentrated in the North of Italy, with Veneto being the major producer followed by Lombardia and Friuli. This implies that to a certain extent seed and grain soybeans production take place in the same regions.

With respect to GM soybeans, no authorization for soybeans cultivation and for experimental reasons has been granted in Italy in the past years. When looking at possible adoption of GM HT soybeans varieties, it is very difficult to make predictions. Since the entire soybeans production is treated with herbicides to control weeds, it is clear that GM HT varieties are potentially appealing to all soybeans producers. However, the actual level of adoption (if GM HT varieties were to be authorized) will also depend on the coexistence measure that will be introduced and consumers' attitudes.

With respect to organic soybeans seeds, at present no production is taking place in Italy. Organic soybeans growers are currently relying on conventional seeds.

4.2 Soybean seed trade

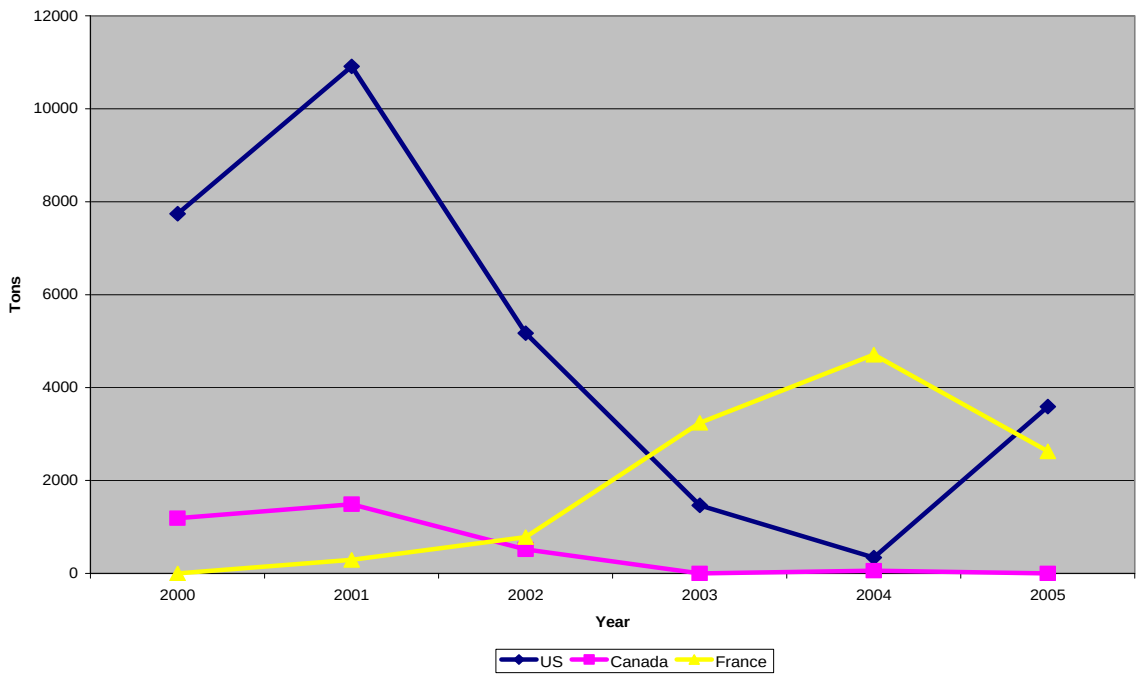
Figures 4.4 illustrates imports and exports of soybean seeds for Italy over 2000-2005. Italy is essentially a net importer of soybean seeds. However, over time the trade balance improved because of a gradual reduction in seed imports and an increase in domestic seed production. With respect to soybean seeds imports, the analysis of COMEXT data indicates how prior to 2003 the US and Canada were the major suppliers accounting between 75-77% of total soybeans seed imports between 2000-2002. However starting from 2003 imports of soybean seeds originate mainly from other EU countries. France turns out to be the most important supplier of soybean seeds for Italy at the moment (around 4,700 tons in 2004 and around 2,600 tons in 2005).



Source: COMEXT and ENSE

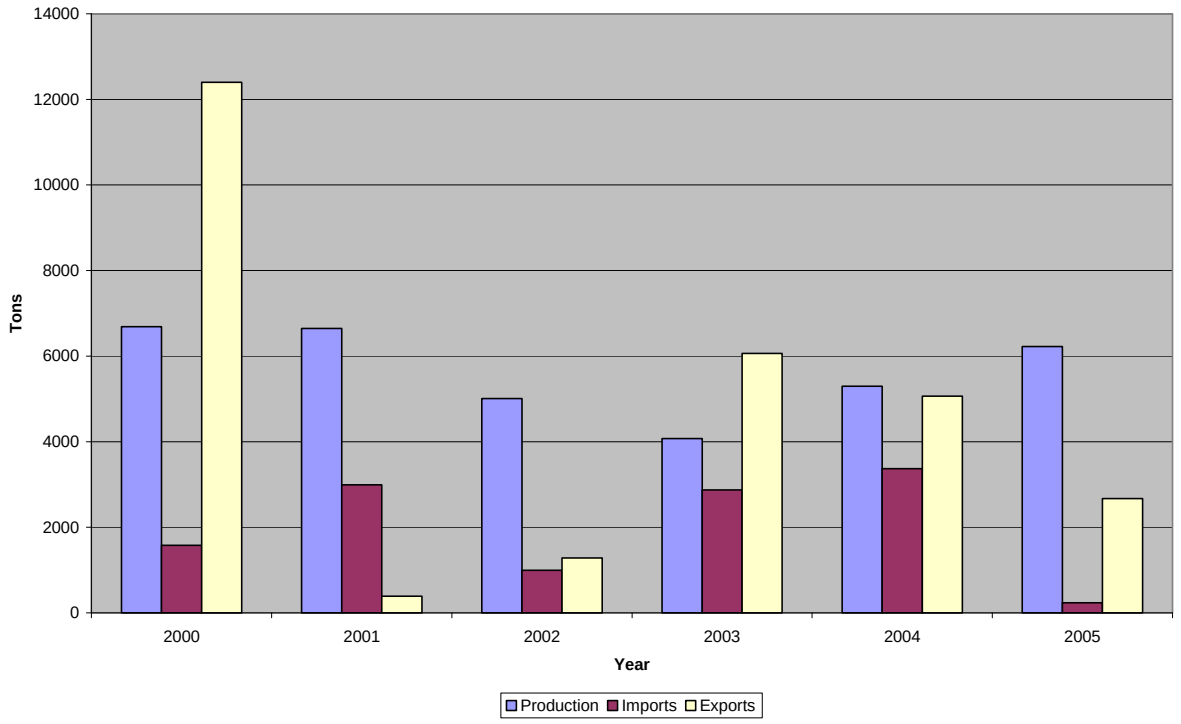
Figure 4.4: Soybeans seed trade for Italy

The COMEXT data also suggest that the UK (around 4,300 tons in 2005) and Romania (around 1,300 tons in 2005) are important sources of soybeans seeds for Italy. However, discussion with Italian experts suggests that the data referring to the UK are not correct and overestimate the volume of soybean seeds imported from this Country (i.e. production of soybean seeds in the UK has been discontinued in 2004). A more careful analysis of ISTAT data indicates that the correct volume for 2005 could be around 1,200 tons of soybeans imported from the UK. It is also clear that the seeds imported from the UK must have been produced somewhere else. Finally it is interesting to notice the surge in the imports of soybeans seeds from the US in 2005. With respect to exports, the main destinations of Italian seeds are other EU Countries like Germany (around 400 tons in 2005), Denmark (around 400 tons in 2005), France (around 160 tons in 2005) and the UK (reported around 2,600 tons in 2005). However, even in this case the data must be interpreted cautiously. In particular, it is difficult to understand the large volume of seed exports to the UK, where no soybeans are being grown.



Source: COMEXT

Figure 4.5: Italian soybeans seed imports originating from US, Canada and France



Source: COMEXT

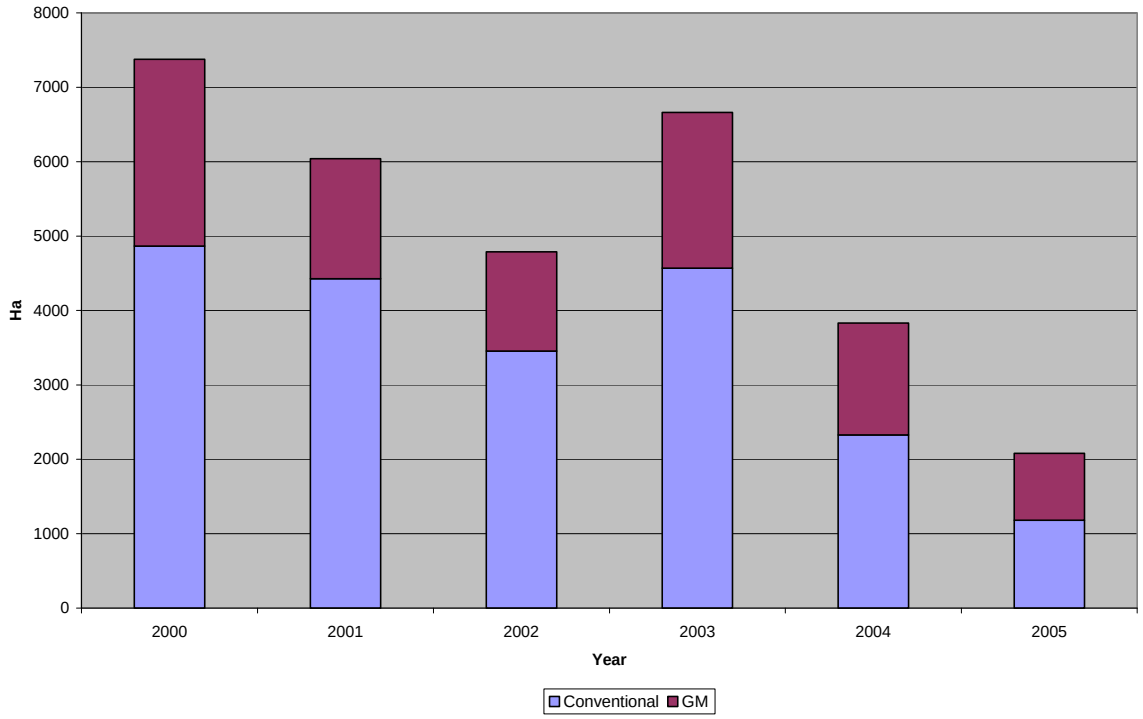
Figure 4.6: Production and trade of soybeans seeds in France

Figure 4.6 illustrates data on production and trade of soybeans seeds in France during 2000-2005. Up to 2004 most of the French soybeans seeds imports originated in the US (2,950 tons out of a total of 3,400) and Canada (243 tons in 2004). In 2005 there has been a sharp decline in soybeans certified seeds import in general, including seeds from North America . During 2001-2005 French soybeans seeds exports have increased. French seeds are exported to other EU countries, in particular Italy (1,300 tons in 2005) and Spain (1,100 tons in 2005). The extremely high export figure reported for 2000 is due to a very high quantity of seeds exported to Germany (over 5,000 tons). This figure is very suspicious, since the German soybean area is quite small (500 ha in 2000), and therefore could be due to a mistake in the process of data collation.

4.3 Case study: soybean seed production in Romania

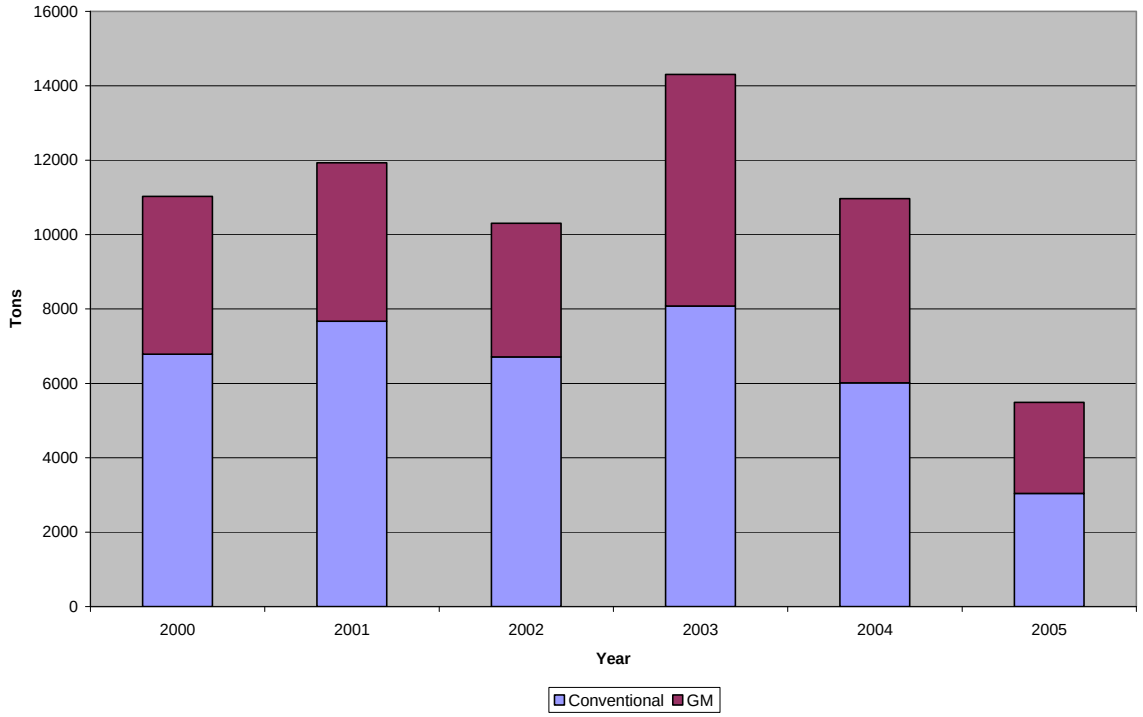
4.3.1 Production and trade of conventional and GM soybean seed varieties

Figures 4.7 and 4.8 show that over the period 2000-2005 there has been an increase in the importance of GM seed production both in terms of area (from 34% to 43%) and volume (from 38% to 45%). This is due to the fact that in the same period GM soybean area passed from 27% to 59% of total soybean area in Romania (see chapter 2 on Soybeans grain production in Romania). Figures 4.6 and 4.7 illustrate very clearly how there has been a decline in the production of soybean seeds, especially in 2004 and 2005. In part the decline is due to the large use of farm-saved seeds for conventional varieties. It has been estimated that over 2003-2007 the use of farm-saved seeds has gone from 16% to 70%. Also it is important to notice how the data in Figures 4.7 and 4.8 also include a small fraction (around 5-10%) of pre-basic and basic seeds.



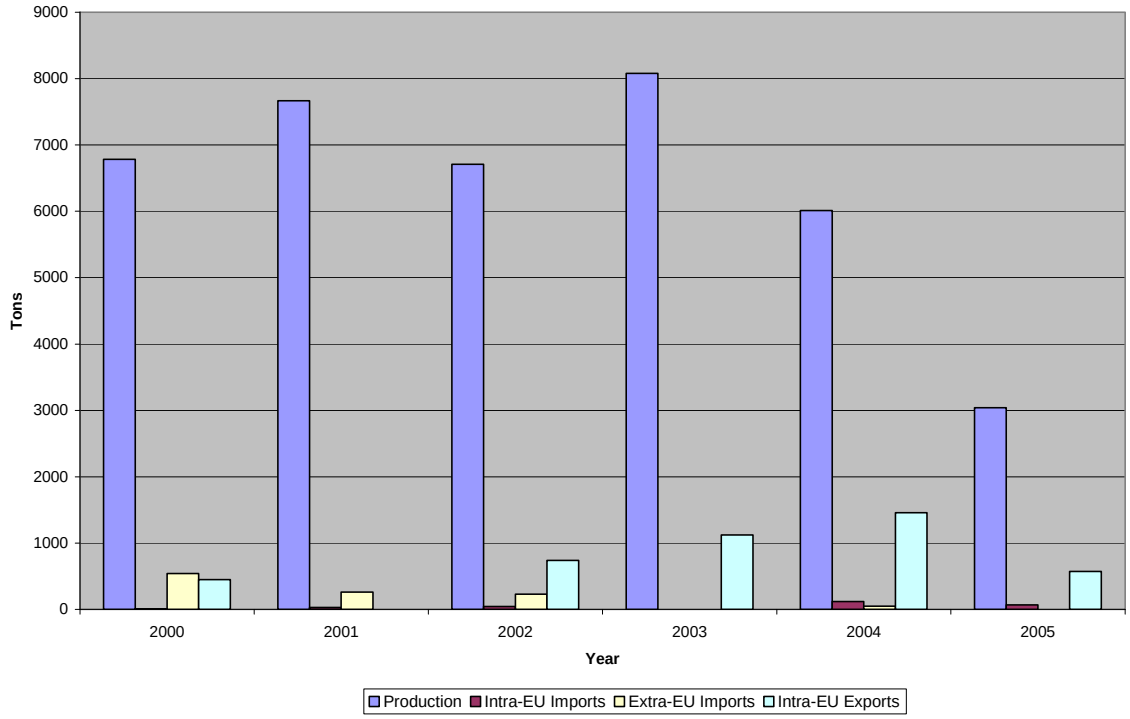
Source: ISTIS and MARD

Figure 4.7: Area of certified conventional and GM soybean seed production in Romania



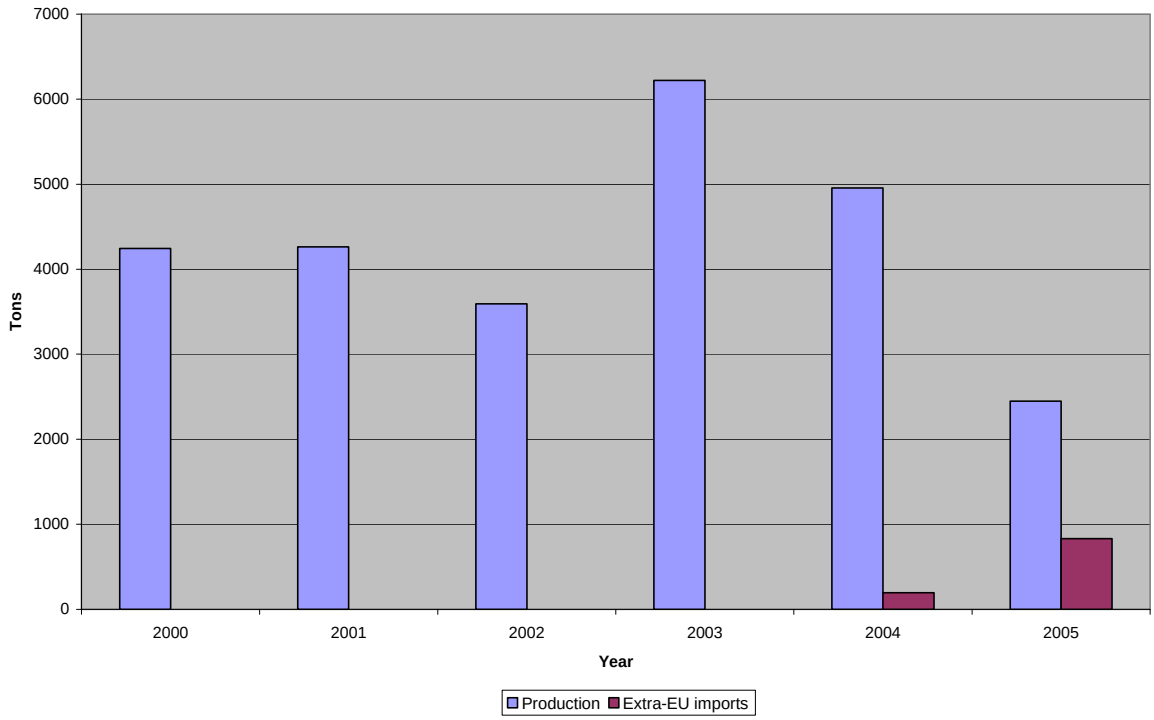
Source: ISTIS and MARD

Figure 4.8: Volume of certified conventional and GM soybean seed production in Romania



Source: ISTIS and MARD

Figure 4.9: Production and trade of conventional soybeans seeds in Romania



Source: ISTIS and MARD

Figure 4.10: Production and trade of GM soybean seeds in Romania

Figures 4.9 and 4.10 illustrate trade figures on certified conventional and GM soybean seeds in Romania (jointly with volumes of production, for better reference). Concerning conventional soybean

seeds, it is evident how the volume of trade is very small compared to domestic seed production. Over the period 2000-2002, Serbia turned out to be the main exporter of conventional soybean seeds to Romania, with quantities that ranged from 180-360 tons. Serbia has traditionally been very active in the development of soybean varieties. The other main exporter of conventional seeds to Romania, over 2000-2002, turns out to be the US with 51-80 tons per annum. Over 2004-2005 (no data were available for 2003) soybean seeds import from third Countries into Romania have been relatively low (30 tons from Serbia and 19 from the US in 2004 and 0 in 2005). Conventional soybean seed imports from other EU Countries have always been low. However it is interesting to register how in 2004 62 tons of conventional soybeans seeds were imported from France and 58 tons were imported from Hungary. With respect to the export of conventional soybean seeds, Romania has been exporting only to Italy (572 tons in 2005). Romania has increasingly become an important supplier of soybean seeds to Italy, and has replaced traditional suppliers like Canada and the US. This is due to the difficulty to source conventional seeds in North America.

When looking at GM soybeans trade, it is immediately evident how even in this case imports are negligible compared to domestic production. Data from ISTIS reveal how GM varieties were imported only in 2004 and 2005 and exclusively from the US.

4.3.2 Organization of production

Certified seed production is organized between breeders (who provide the genetic material) and multipliers (who materially manage seed production). For conventional varieties the genetic material is mainly domestic or derived from the one developed in Serbia. In this respect the activity of two public breeding institution in Romania (National Institute for Agricultural Research and Development FUNDULEA and Agricultural Research and Development Station TURDA) is very important. However, also private companies are involved in the development of conventional varieties (e.g. Monsanto). On the other hand, the genetic material for GM seeds was mainly US derived and the development of varieties was mostly in the hands of private companies (e.g. Monsanto).

The production of seeds is carried out by multipliers who are either individual farmers or companies. There is a network of specialized farmers (who are authorized to produce seeds) on which seed companies rely (it is estimated that there are around 200 of such farmers). It is important to notice that all seed production is irrigated. Seed production is managed through annual contracts between the seed companies and the multipliers (represented by an organization).

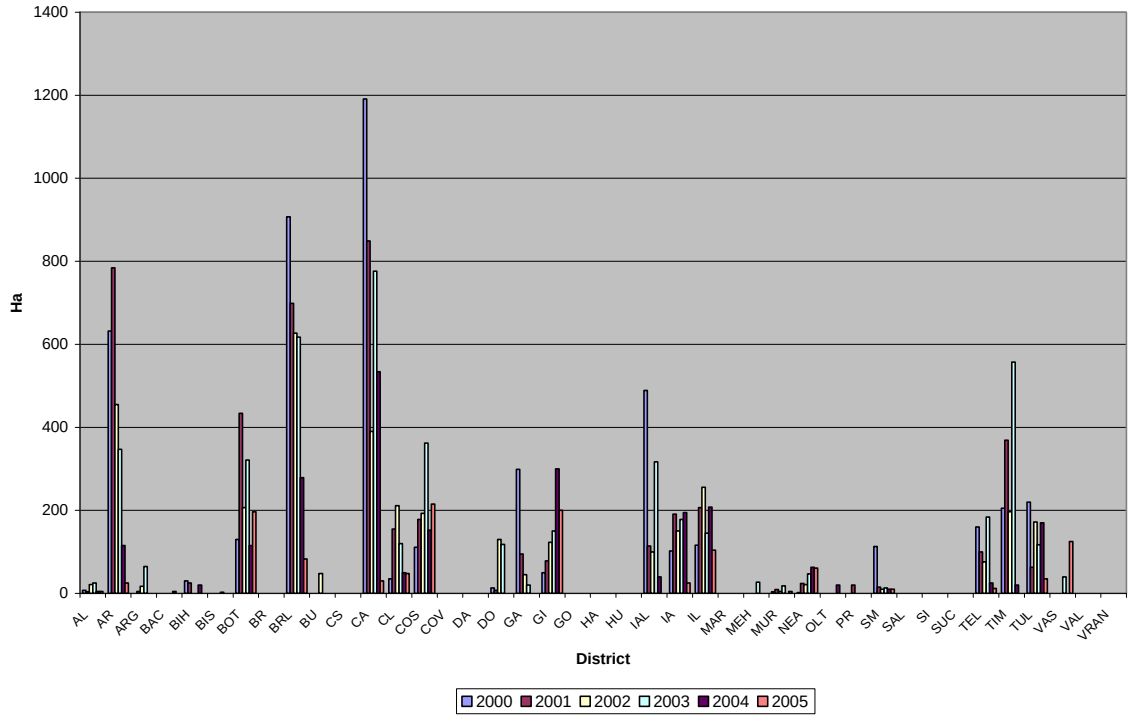
4.3.3 Regional analysis

Figure 4.11 shows how, with the exception of the mountainous regions in the middle, seed multiplication is taking place in almost every department in Romania.

Source: ISTIS and MARD

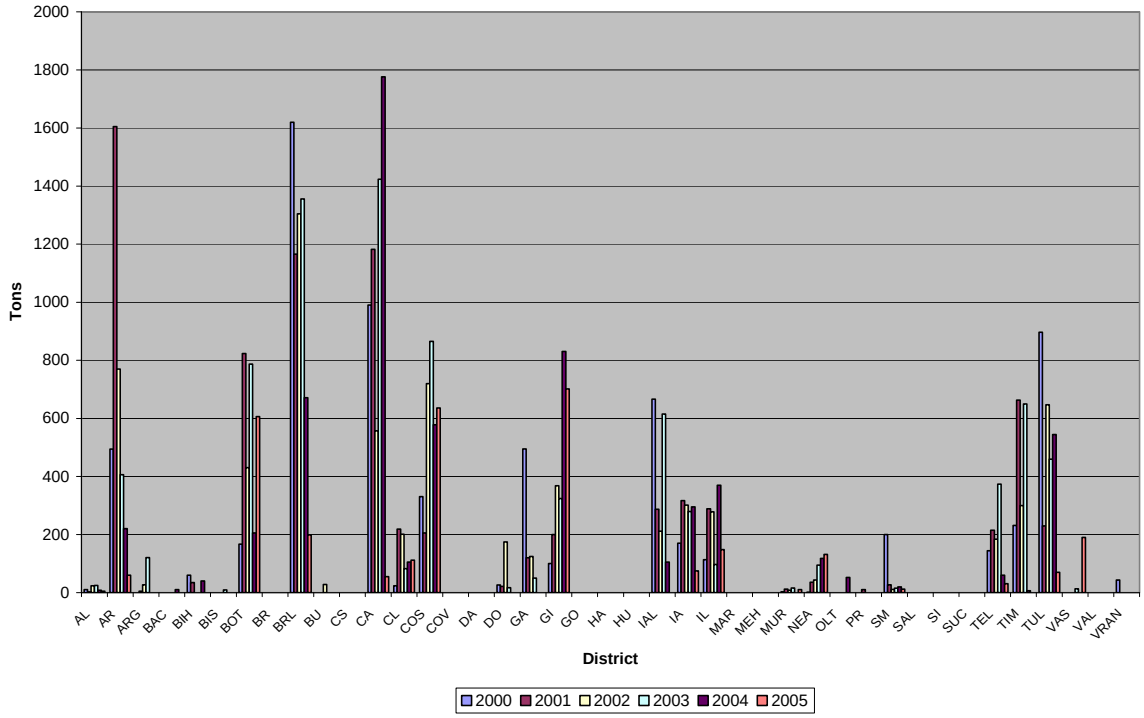
Figure 4.11: Departments with soybean seeds multiplication in Romania

However at a closer inspection it appears that the most important seed producing regions are located in the South-East. Figures 4.12 and 4.13 illustrate the regional distribution of area and volume of certified conventional seed production in Romania over 2000-2005. In this respect the main producing regions turn out to be Calarasi (CA), Braila (BRL) and Giurgiu (GI) in the South-East and Botosani (BOT) in the North-East. The location of seed production in these Departments reflects the good growing conditions but also the availability of irrigation.



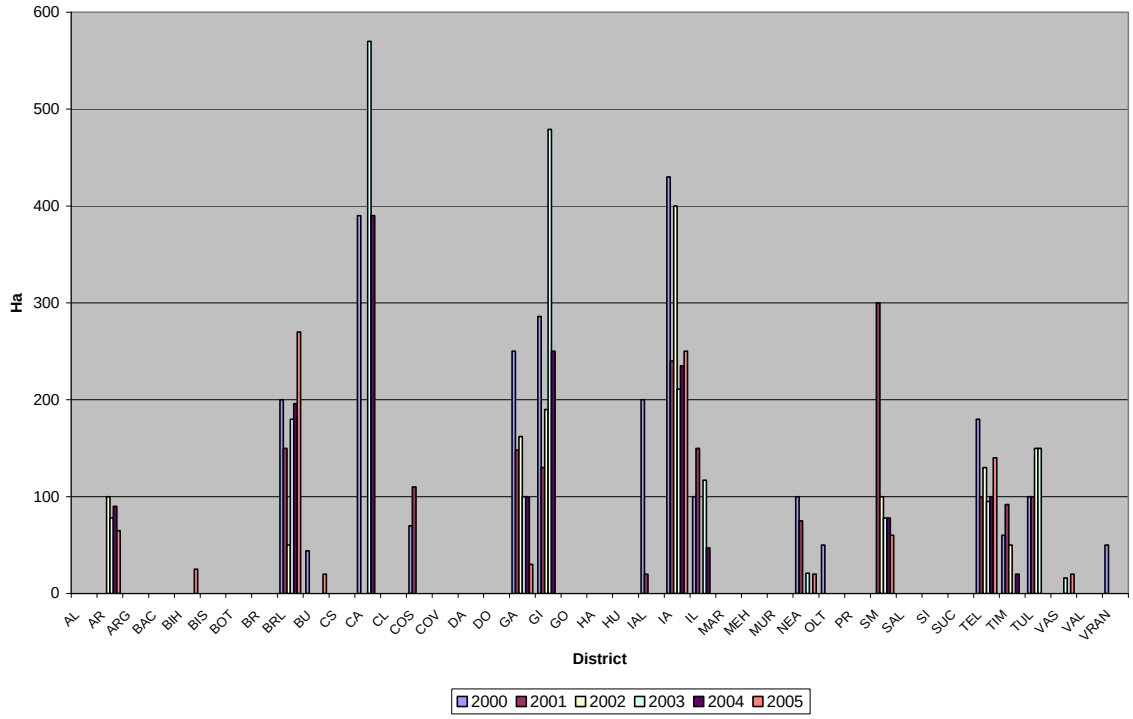
Source: ISTIS and MARD

Figure 4.12: Distribution of area of conventional certified soybean seeds in Romania



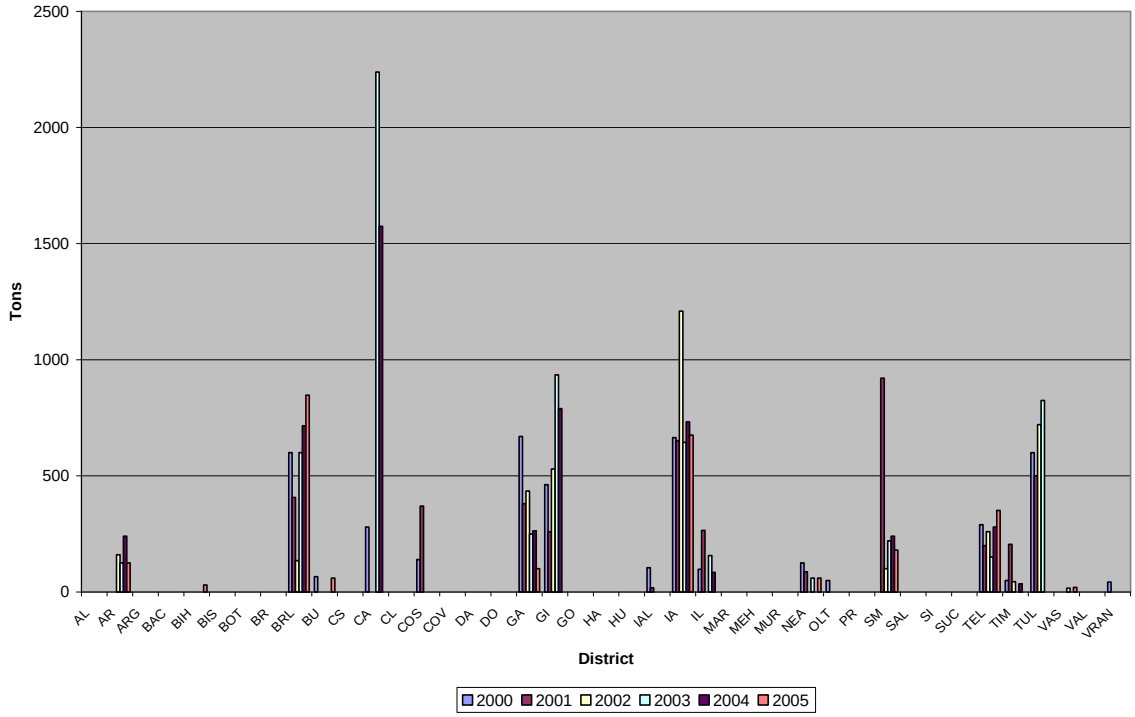
Source: ISTIS and MARD

Figure 4.13: Distribution of volume of conventional certified soybean seeds in Romania



Source: ISTIS and MARD

Figure 4.14: Distribution of area of GM soybean seeds in Romania



Source: ISTIS and MARD

Figure 4.15: Distribution of volume of GM soybean seeds in Romania

With respect to GM seed production it appears that again the South-Eastern regions were the most important. Figures 4.14 and 4.15 clearly illustrate how Braila (BRL), Calarasi (CA), Tulcea (TUL) and Giurgiu (GI) in the South-East, Galati (GA) in the East and Teleorman (TEL) in the South, were the most important regions of GM seed production.

Soybeans grain production is also widespread in Romania, except in the central mountainous regions. However, most of the production occurs in the South-East part of the Country close to the Black Sea and in the Timis (TIM) Department. It is clear that grain and seed production (both conventional and GM) has been coexisting in Romania over the period 2000-2006.

4.3.4 GM and Organic seeds

At present no organic production of soybeans seeds or grain is taking place in Romania. With respect to GM, no commercial seed production is authorized since 2007. However there are several official trials for research purposes. In 2007 Monsanto only has 16 official trials. The trials are being carried out at the ISTIS research stations. The event under investigation is the same that was previously authorized in Romania. The trials are carried on plots of 60 m^2 and all the harvested material is destroyed (burned).

Acknowledgements

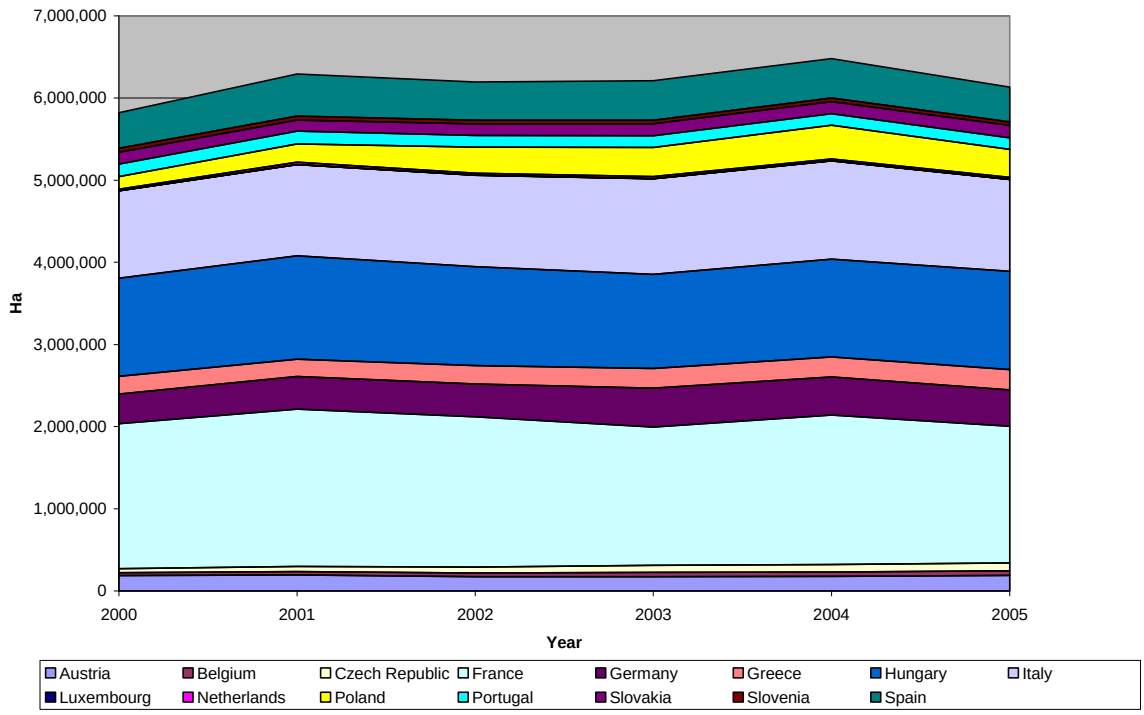
For the information concerning soybeans seed production in Italy, we would like to thank the participants to the meeting held at the Italian Ministry of Agriculture (MIPAAF) in Rome on 15th May 2007, Mr. M. Vilardi (MIPAAF), Mr. M. Desantis (MIPAAF), Mr. A. Manzo (MIPAAF), Mr. M. Nardi (Italian Seed Association, AIS), Ms. Elena Perri (ENSE), Mr. F. Golinelli (ENSE) and Mr. D. Strazzulla (MIPAAF).

For the information concerning soybeans seed production in Romania, we would like to thank the participants to the meeting held at the ISTIS in Bucharest on 23rd May 2007, Mr. G. Hedesan (Director of INCS, Romanian Ministry of Agriculture, Direction of Varieties Selection and National Inspection for Quality of Seeds), Dr. A. Badiu (Romanian Minstry of Agriculture, National Inspection for Quality of Seeds), Ms. T. Preda (Romanian Ministry of Agriculture), Mr. C. Radu (Pioneer, Romania), Ms. M. Cirja (Pioneer, Romania) and Dr. I. Sabau (Monsanto, Romania), Dr. C. Popescu (ISTIS), Ms. G. Grigore (ISTIS) and Mr. I. Trifu (ISTIS).

Chapter 5 Production of maize in EU

5.1 Conventional grain maize production

Maize is grown in several forms in Europe for different end uses and markets. Grain maize of various types for human and animal feed is grown mostly in central and Southern Europe, whereas forage maize, harvested as a whole crop for animal feed, is grown predominantly in central and some northern parts of Europe though not so much in Scandinavia and the Baltic states because of short summers. Grain maize has a number of types which are used for specific end uses such a high starch, waxy and sweet maize (sweet corn) in food, feed and industrial products.



Source: FAOSTAT

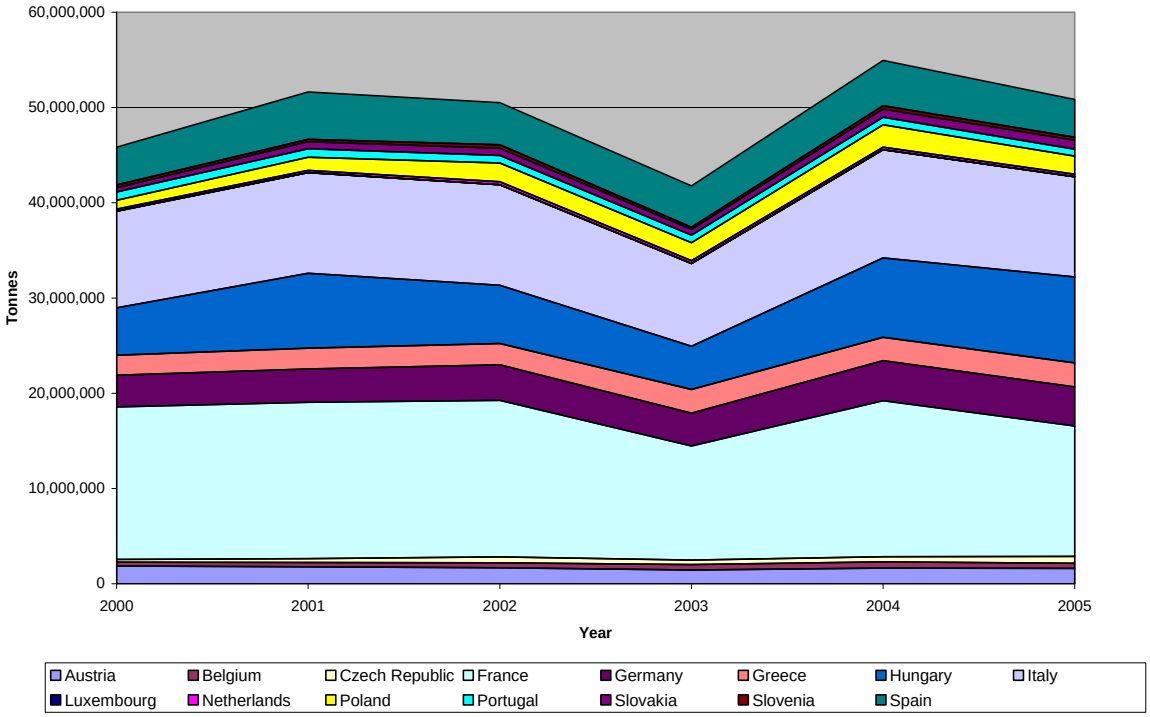
Figure 5.1: Maize area in EU 25

Over the period 2000-2005 the grain maize area in the EU25 has been quite stable and ranged between 5.8 and 6.5 million hectares (Figure 5.1). Production is mainly concentrated in four countries: France (1.6-1.9 million ha), Italy (1-1.2 million ha), Hungary (around 1.2 million ha) and Spain (0.4-0.5 million ha). These four countries account for roughly 2/3 of EU25 maize area. Significant areas of maize are also grown in Germany (around 0.4 million ha) and more recently in Poland (0.3 million ha in 2005). Poland saw an expansion of maize area over the period 2000-2005 from 0.15 million ha to 0.343 million ha, with a peak of 0.411 million ha in 2004. Production possibilities for maize in Poland

(and other North European Countries) are limited by its short growing seasons. However, attractive maize prices and the introduction of new varieties with shorter growing season have favoured the expansion of the crop area over time. Figure 5.1 illustrates a peak in maize area in 2001. This was a consequence of a switch from wheat to maize and oilseeds, partially because of the poor autumn planting conditions for winter wheat in 2000. Specifically, in Spain, the switch was favoured by: a) rise in water levels due to the previous winter abundant rains and b) lower direct payments for sunflower seeds production in irrigated areas. In France, on the other hand, the heavy autumn rains did not allow many farmers to finish winter sowing and they switched to spring plantings, mainly maize. By contrast, the reduction in area in 2002 was the result of a switch by farmers (especially in Italy, France and Spain) from oilseeds, sunflower and maize into wheat due to the equalization of compensation payments and expectations of higher yield and steady prices for wheat. In Spain, low water levels in reservoirs located in the Northern regions also contributed to the reduction in maize sowing. The other peak in area observed in 2004 is the result of the lowering of the set-aside requirements from 10% to 5% in EU 15 and higher maize prices. These effects were particularly evident in Italy and Spain.

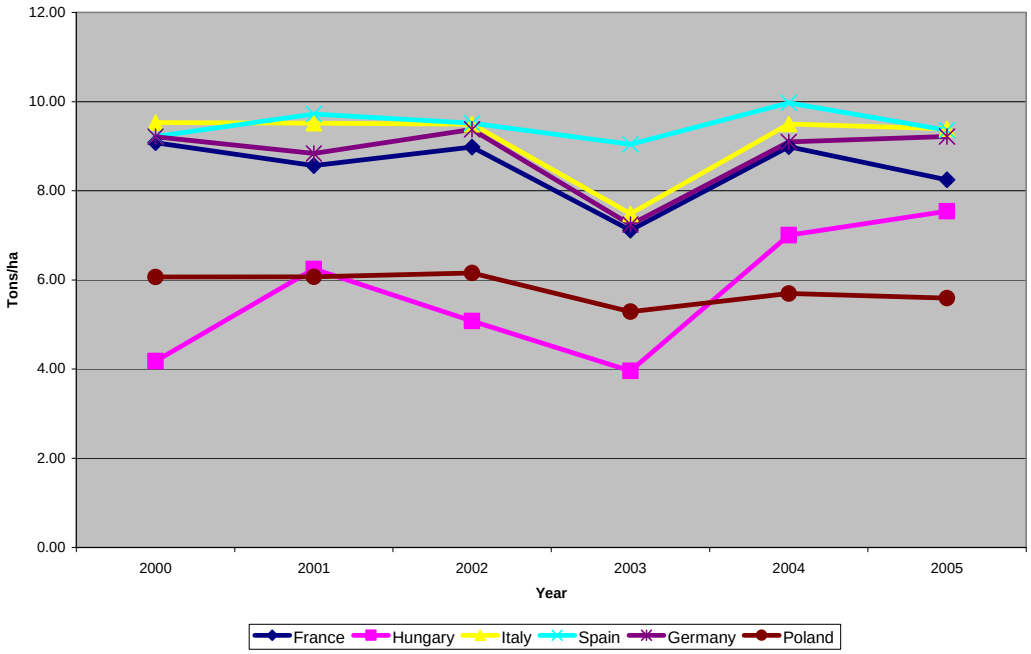
The reduction of area registered in 2005 is mainly due to lower prices (as a consequence of the high levels of production in the previous year). In Italy the increase in set-aside (back to 10%), the partial shift to sugar beets and soybeans, the need for more significant rotations (to prevent rootworm attacks) and the full decoupling in the regions where there was still a specific aid per hectare for maize, contributed further to the decline in maize area.

Over the considered period, the volume of production ranged between 42-55 million tons (Figure 5.2). Given the relative stability of area, the variability of production volumes is mainly due to yield variability (Figure 5.3).



Source: FAOSTAT

Figure 5.2: Maize Production Volume in EU 25



Source: FAOSTAT

Figure 5.3: Maize Yield (Tons/ha) in EU 25

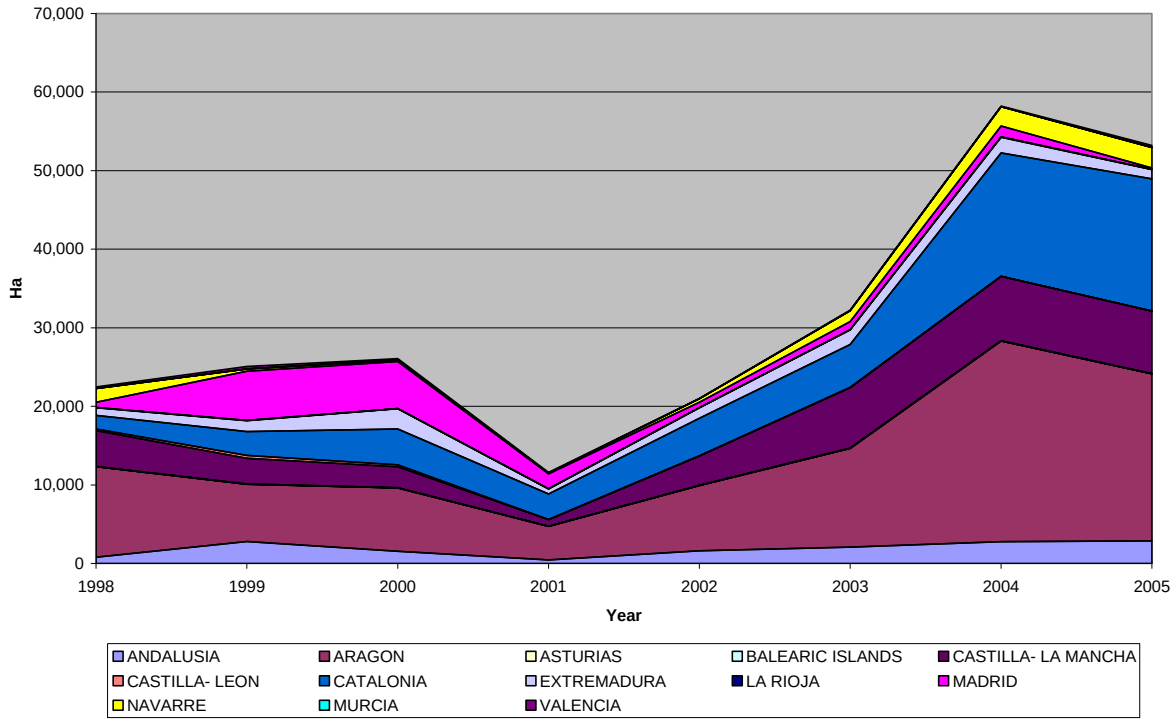
In Figure 5.3 the yield for the six main European producing countries (i.e. France, Hungary, Italy, Poland, Germany and Spain) are reported. In 2003, a drop in yield was recorded in each of these countries. This was due to the unfavourable weather, characterised by dry conditions and heat stress in all the main producing countries. The effect of heat stress has been particularly strong in Italy, France and Germany, where yield dropped between 20-30%. On the contrary, good weather conditions boosted the yield in 2004. In the 2005 cropping season, again limited precipitation in South-western Europe had a negative effect on maize yield, especially in France and Spain, with a depressive effect on the volume of production (see Figures 5.2 and 5.3). On the contrary, 2005 was a record year for Hungary (following a very good 2004) because of a favourable wet summer.

5.2 GM grain maize (Bt maize)

Bt maize is the common name given to genetically modified varieties of maize expressing the insecticidal toxins from the soil bacterium *Bacillus thuringiensis* (Bt). These toxins have activity against a range of insect pests which consume Bt maize plants. Currently in the EU Bt maize types cultivated express Bt toxins with activity against European corn borer which can severely damage unprotected plants and reduce the yield. The process of commercial release and adoption by farmers of Bt maize varieties in Europe has been influenced by regulatory and political developments. On February 1997, the European Union authorised for the first time the cultivation of Bt maize (transgenic event Bt-176 of the company Syngenta).

Within the EU, Bt maize is significantly grown only in Spain and more recently in France. Other countries who have reported area of GM Bt maize over 2000-2005 are Portugal, Germany and Czech Republic, however the area has been very low (i.e. less than 0.01 million ha).

In Spain, following consent from the EU in 1997, two commercial varieties derived from Bt-176 were listed in the Spanish Register of Commercial Varieties in 1998. The first plantings in took place in the same year. Syngenta placed in the market enough seed to sow 0.02 million ha hectares of Bt maize in 1998 (i.e. roughly 5% of the surface of maize in Spain). During the period 1998-2002 there were no additional authorisations of novel GM maize events (or any other GM crop) for cultivation in the EU, following an agreement of several Member States in their Council voting. During this period, Syngenta limited voluntarily the amount of Bt-176 maize seed sold in Spain, and the surface planted with Bt maize in Spain remained fairly stable. In 2003 the EU approved a new Bt maize variety (transgenic event MON-810 of the company Monsanto) for cultivation. By 2005 there were over 30 Bt maize commercial varieties available for Spanish farmers, mostly containing the GM event MON-810. The seed was produced and commercialized by more than 10 local and multinational seed companies.



Source: MAPA (2005)

Figure 5.4: Distribution of GM (Bt) maize area in Spain

Within Spain, three regions accounted for about 87% of the total area under Bt maize in 2005 (averaging 75% for the 1998-2005 period). These regions are Aragon (0.021 million ha of Bt maize in 2005), Catalonia (0.016 million ha) and Castilla-La Mancha (0.007 million ha) (Figure 5.4). The observed decrease in Bt maize area in 2005 reflects lack of water in that year. In 2007 the area of Bt maize in Spain reached 0.075 million ha, representing around 21% of the total domestic grain maize area, but reaching up to 59% of the maize area in regions with high infestations of European Corn Borer. Over the period under consideration one can observe a drop in Bt maize area in 2001 and a peak in 2004. The first was due to the lack of certified seeds available for planting (due to production problems from the company producing the seeds). It has been estimated that if enough seeds were available Bt corn area would have reached around 60,000 ha. On the other hand, the peak recorded in 2004 reflects the approval of nine new varieties in that year.

Over 2000-2005 Bt maize plantings in France have been virtually nil. In 2005, however, French farmers planted between 0.0005-0.001 million ha of Bt maize (MON-810) and in 2007 the area reached 0.02 million ha. This was entirely exported to Spain as animal feed.

In 2005, Czech farmers were allowed to plant Bt corn (MON-810) and as a result 60 farmers planted a total area of 0.0003 ha. In 2006 Bt maize area was reported to be 0.0013 million ha.

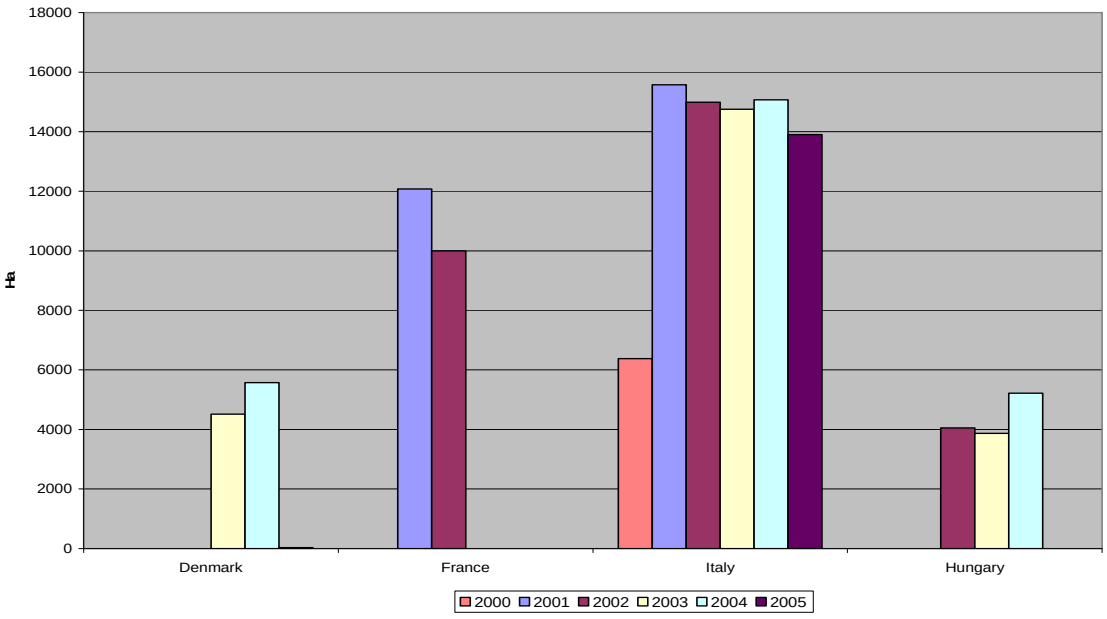
In Portugal, farmers increased the area sown with Bt maize from 0.0014 million ha in 2006 to 0.0043 million ha in 2007.

Since 1998, German farmers have been planting around 300-500 hectares of Bt maize per year. Until 2005 the main constraint was the inability to have Bt varieties registered for unlimited planting. Instead a temporary special permit (lasting one year) was necessary. Seed companies could market only a limited amount of seeds (up to 0.1% of the total amount of corn seeds planted in Germany). Since 2005, however, five Bt maize varieties have been registered with the German Federal Seeds Register and may be planted to an unlimited area. In 2006 0.00098 million ha of Bt maize were planted, mainly in the eastern regions.

5.3 Organic grain maize

The EU countries with the largest area devoted to organic production are Italy (over 1 million ha), Germany (around 0.8 million ha), Spain (around 0.8 million ha) and France (over 0.5 million ha). The main organic crops in the EU25 are grass as fodder and cereals. Data on organic maize are scattered. We report data for total organic maize (i.e. under conversion and fully converted) for France (around 0.01 million ha in 2002), Italy (around 0.014 million ha in 2005), Hungary (around 0.005 million ha in 2004) and Denmark (around 0.005 million ha in 2004) for the period 2000-2005 (Figure 5.5).

With respect to Italy, a large increase in the area planted with organic maize is registered in 2001 (from about 0.007 million ha to about 0.015 million ha). In this year both the fully converted area and the area in conversion have increased. This is the result of the consolidation of the EU support to organic farming introduced as an accessory measure of the CAP in 1992 (EC Regulation 2078/92) and subsequently framed within the Rural Development measures in 1999 (EC Regulation 1257/99). Despite this, organic maize production remains marginal and total organic maize area (i.e. fully converted and under conversion areas) represented between 0.6-1.4% of total maize production in Italy.



Source: EUROSTAT and SINAB

Figure 5.5: Organic Maize Area (including area under conversion) for Selected MS

5.4 Future developments

Worldwide, production and trade in maize is expected to increase with US and Argentina as major exporters. In the EU25, according to the forecast of DG AGRI (European Commission 2006 and 2007) the area of grain maize should remain stable at 6 million ha in the medium term. When Romania and Bulgaria are accounted for, the maize grain area in EU27 should stand at around 9 million ha and stable over the next 5 years. Nominal prices have risen because of the current supply and demand issues in North America and are generally expected to increase between 10-20% by 2011. An important factor that could affect the maize sector in EU25 in the future is bioethanol production. The USA is currently providing financial incentives to farmers supplying maize for bioethanol production. This has effectively removed a proportion of grain maize from the food/feed market, leading to a reduction in supplies and hence an increase in demand and cost. This has happened at the same time as late frosts in North America destroyed or damaged wheat crops creating a predicted reduction in wheat supplies and an increase in costs. If wheat prices are high then substitutes such as maize are sought, further increasing maize demand and prices. The EU is expected to increase its share of biofuels, including bioethanol. At present the main feedstock for bioethanol production in the EU is wheat, and to a smaller extent excess wine alcohol. Still, the current use of cereals for bioethanol production in the EU25 is limited (around 3 million tons out of a domestic production of around 250 million tons in 2005).

The largest Spanish producer Abengoa has recently invested in a bioethanol plant in France (Abengoa Bioenergy France) that will produce bioethanol from maize and some companies are already breeding specific varieties for ethanol production. Despite this, in France, it is perceived that the production of biofuels will mainly rely on oilseed rape and therefore it will not affect maize production.

In Hungary, at present there are already two plants for bioethanol production. A new plant in Eastern Hungary will also start to operate by next spring. The new plant will take the place of the old Kaba sugar plant (owned by Eastern Sugar) and will primarily involve sugar beet farmers that had to give up their activities following the closure of the sugar refinery. The new plant is set to process around 300,000 tons of maize per year. Overall in Hungary it is estimated that the demand for maize ethanol could range between 1-1.5 million tons per year. Part of this maize is likely to come from areas previously sown with sugar beet. The remaining part could however come from maize previously destined to the export market. In theory the development of maize for bioethanol could facilitate (at least in theory) the introduction of GM varieties in Hungary. However, the reluctance of the feed industry to accept byproducts derived from GM varieties could represent a serious obstacle to the uptake of such varieties. All in all, the key factor (according to experts) is the decision by the ethanol factory whether to accept or not GM varieties, since the plant will not be able to run with segregated facilities.

Further developments in the maize sector in the EU mainly revolve around the increase in the area of GM Bt maize. The area of Bt maize in France reached 20,000 ha in 2007, mainly in the South-West where seed production is concentrated, and is expected to reach 80,000 ha in 2008. This in turn will require around 800 ha of GM Bt maize seeds, implying a more than 100% increase over the previous year (see Chapter 7). Another possibility for the future is the introduction of GM herbicide tolerant (HT) and GM HT/Bt maize varieties. If authorized for cultivation, experts believe that stacked GM maize with both insect resistance (Bt) and herbicide tolerance could be the next GM maize to be adopted by EU farmers. In this case the HT trait will be introduced as a "free bonus" on the Bt maize. GM maize with just herbicide tolerance (HT maize) is not expected to have a massive acceptance by farmers, and it would be used only as a resource in particularly bad years or in areas badly affected by weeds. GM maize resistant to corn root worm (CRW), if authorized, is likely to be demanded by farmers in areas such as Hungary where CRW is a problem (see Chapter 7).

To conclude, the production of bioethanol will have some effect on maize domestic use but it is not expected to have a significant impact on the grain maize area in EU25. The area of grain maize in EU25 should remain stable at around 6 million ha over the next 5 years (for EU27 the area should remain stable at around 9 million ha). Increased maize availability is expected to come from yield increase and reduced exports. At the same time feed use of maize is expected to grow at a more moderate peace than in the past because of low increase in meat demand in the EU (due to population

aging). Grain maize prices are expected to increase because of the higher demand for biofuels especially in the US.

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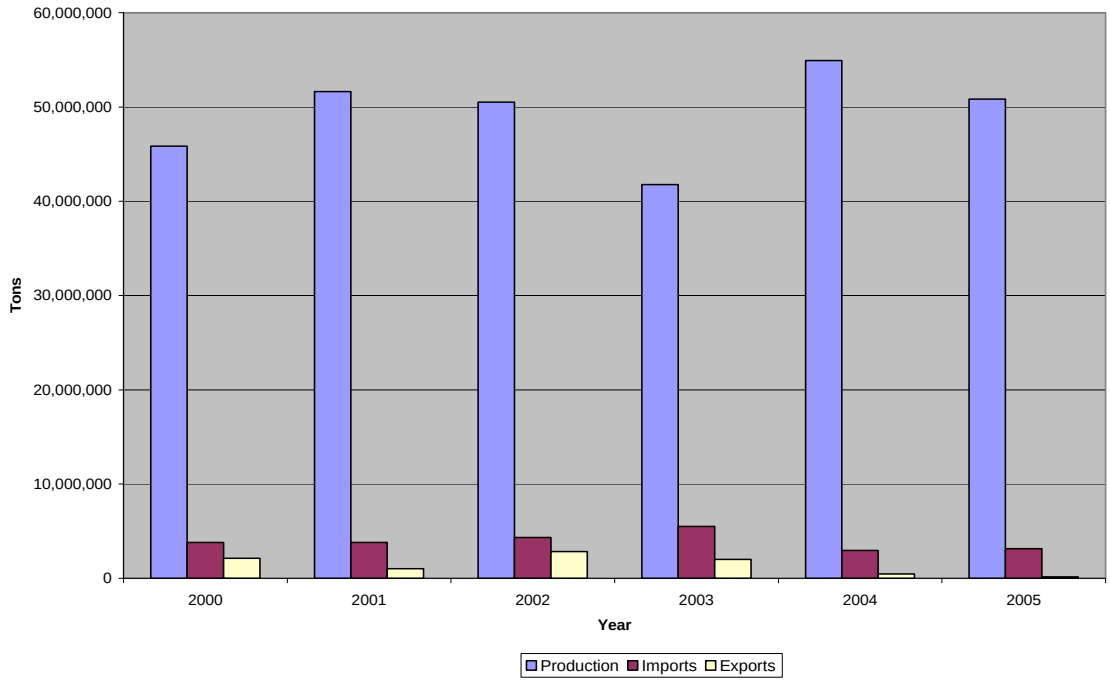
Chapter 6 Maize Trade in EU

6.1 Grain maize trade

EU25 is a net importer of maize (Figure 6.1). The volume of trade is relatively small compared to production (between 42-52 million tons over 2000-2005), with imports ranging between 2.9 and 5.5 million tons and exports between 0.16 and 2.1 million tons over 2000-2005. Argentina and Brazil (see Figure 6.2) account for the largest proportion of maize imports into EU25 (between 50-81% over 2000-2005). On average, net imports in the EU25 stood at around 5% of domestic production. The largest importer in the EU is Spain (between 3-4 million tons over 2000-2005) and the largest exporter is France (between 6-8 million tons over 2000-2005). These figures are much larger than the ones reported in Figure 6.1 since a substantial part of the trade flow is internal to the EU. Spain's imports, in fact, mainly originate from France (and to a smaller extent from Argentina). Similarly French maize is mainly (around 70%) exported to Germany, the Netherlands, Spain and UK. This confirms that extra-EU25 trade is small compared to production and intra-EU25 trade.

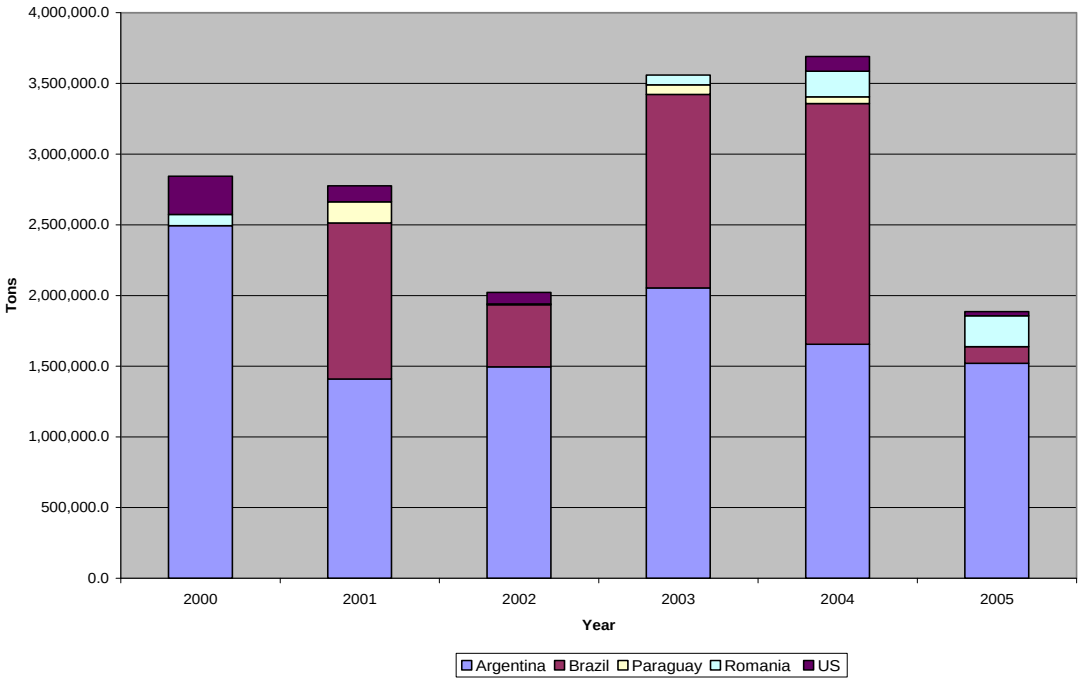


Source: EUROSTAT and USDA.

Figure 6.1: Maize production and trade in the EU25 over 2000-2005

Figure 6.2 illustrates the countries of origin of EU25 maize imports. Notice that the figures might be different from data reported in the text below for two reasons. At first they do not include all imports but only those referring to the Countries mentioned. At second the data represented in Figure 6.2 refer to the calendar year, while the data to which we refer in the discussion below refer to market year.

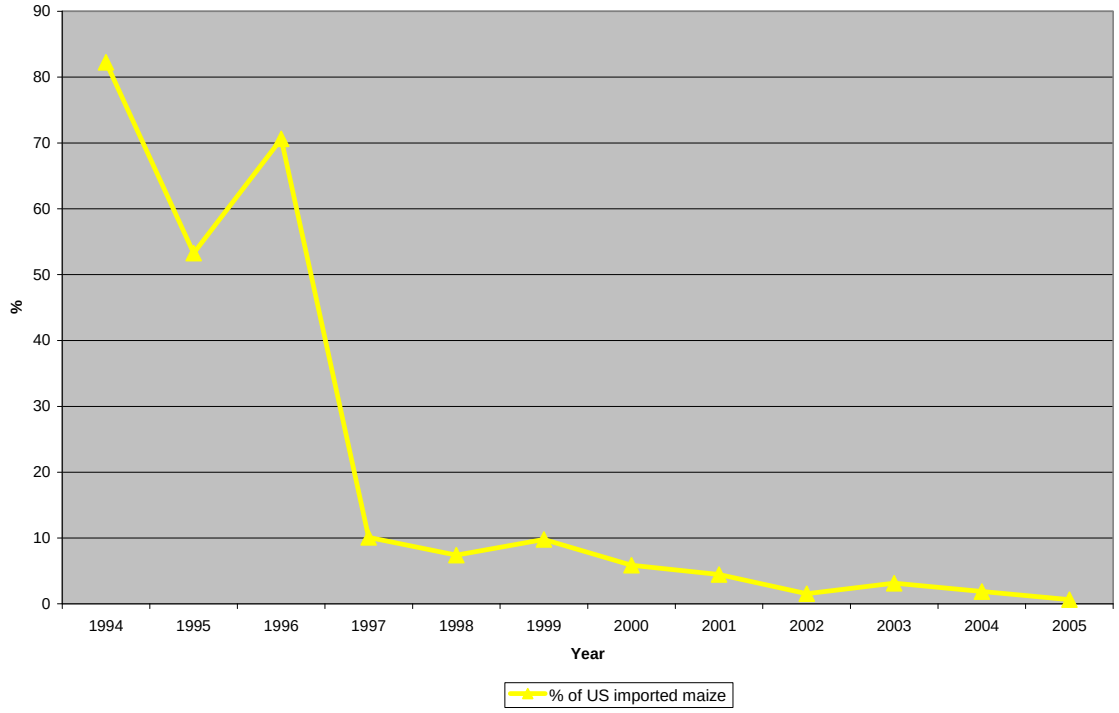
After 2004 imports from Brazil have drastically declined. This was due to an appreciation of the Brazilian currency, to an increase in Brazilian domestic use of maize (particularly in the poultry feed industry) and to an increase in the EU domestic production. It is clear that Argentina is the most important supplier of maize, while US maize imports have declined following the introduction of GM varieties in 1996/97. Argentina also has a high share of GM maize cultivated, but has adopted the policy of releasing only varieties approved for import into the EU. Figure 6.3 illustrates the proportion of US maize imports over total maize imports in EU25. More recently Serbia has become an important supplier of maize to the EU, with an estimated 1.2 million tons in 2006. Total imports of grain maize in the EU are expected to be relatively stable or increase moderately in the medium term.



Source: COMEXT

Figure 6.2: Major maize imports into EU25 over 2000-2005

Data from USDA FAS (referring to market year) suggest that over 2000-2005, maize imports have ranged between 3 million tons and 5.5 million tons. In 2002, despite a relatively high import of maize (4.3 million tons), net imports were unusually low at 2.9% of domestic production (compared to an average of 5%). This is a consequence of relatively good production in 2002 (over 50 million tons) and relatively low use of maize in feed, because of low wheat prices. During the year significant quantities of maize were exported outside EU25, mainly to Turkey, Russia, Bosnia and Bulgaria. In 2003 it is possible to notice an increase in maize imports to 5.5 million tons. Net imports in the same year were unusually high at over 8% of domestic production. This is the result of the drought which damaged crop production in the EU.



Source: USDA FAS

Figure 6.3: % of EU25 imports originating from US

In 2004, following the excellent crop, maize demand went up. As a consequence, despite the peak production (55 million tons), net imports have remained high (2.5 million tons) because of large maize incorporation in animal feed (mainly poultry feed). Finally in 2005, net imports reached 5.8% of domestic production, mainly because of a reduction in crop production (following reduction in corn area because of its low prices), since total imports stood at almost the same level as the previous year (i.e. around 3 million tons).

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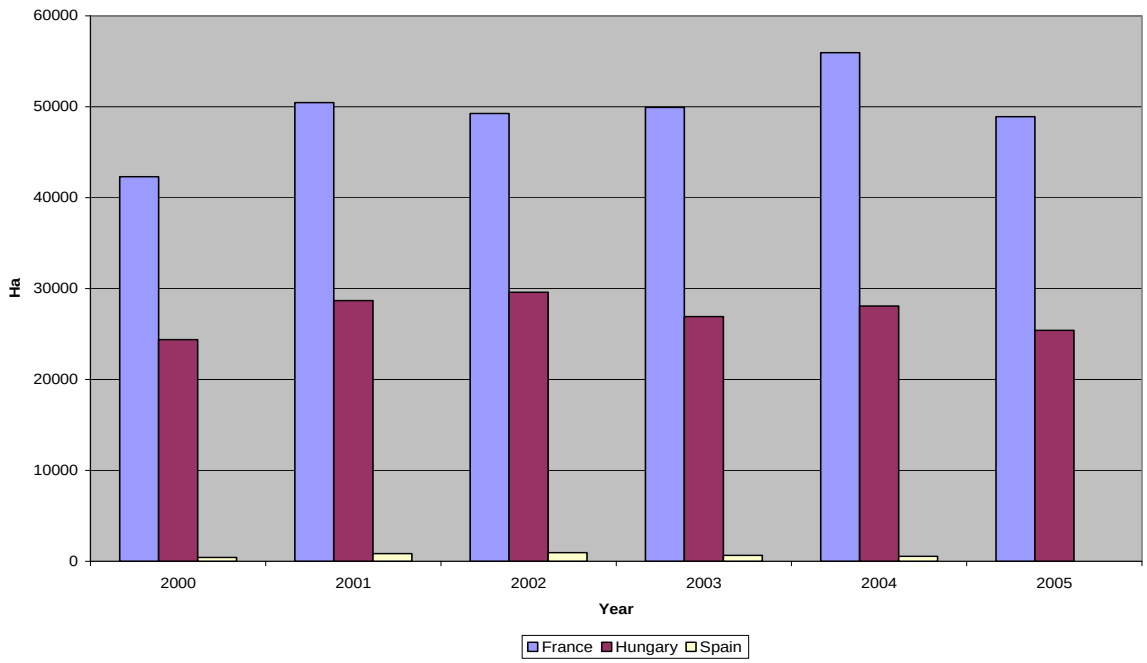
Chapter 7 Seed maize production

7.1 Seed maize production[9]

In the EU maize seed production mainly takes place in France and Hungary. However, we also include Spain in our analysis since it is the country in the EU with the largest share of GM Bt varieties (around 14%). Figure 7.1 illustrates the area of maize certified seed production in the three countries mentioned above.



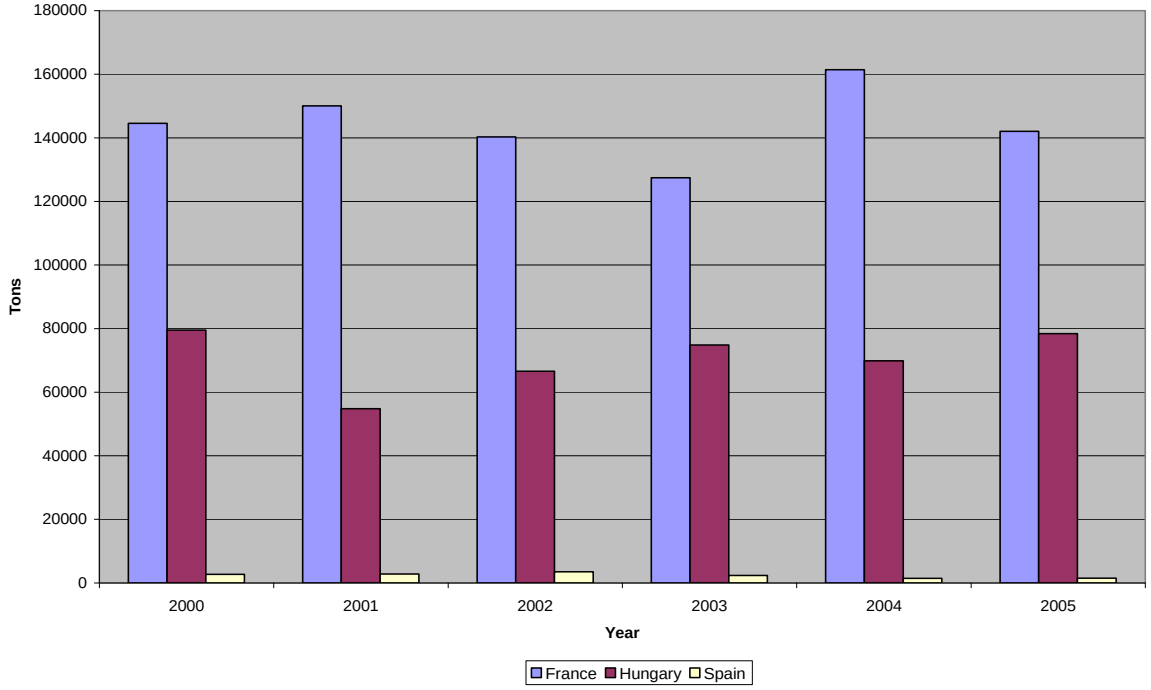
Source: ESCAA, GNIS, OMMI, MAPA

Figure 7.1: Area of certified seed maize production in France, Hungary and Spain

France is the country with the largest area dedicated to maize seed production with almost 50,000 ha in 2005. The area of seed maize in France has remained fairly stable over 2000-2005, except for a peak in 2004. This reflects the general expansion of the grain maize area in France (and elsewhere in the EU) registered in that year (see Chapter 5 on grain maize production). A detailed analysis of maize seed production in France is presented in section 3. Also in Hungary seed maize production has been relatively stable, with a peak in the two years 2001 and 2002. In Spain the area of seed production is relatively small and amounted to 550 ha in 2004.

Figure 7.2 illustrates the volume of certified seed production in the three countries under consideration. Maize seed production volumes in part reflect the extent of maize seed area in each country[10].

[9] When considering maize it is important to understand how 100% of the seeds used by farmers are certified. The use of farm-saved seeds in maize is not possible because all the varieties used are hybrids.



Source: ESCAA, GNIS, OMMI, MAPA

Figure 7.2: Volume of certified seed production in France, Hungary and Spain

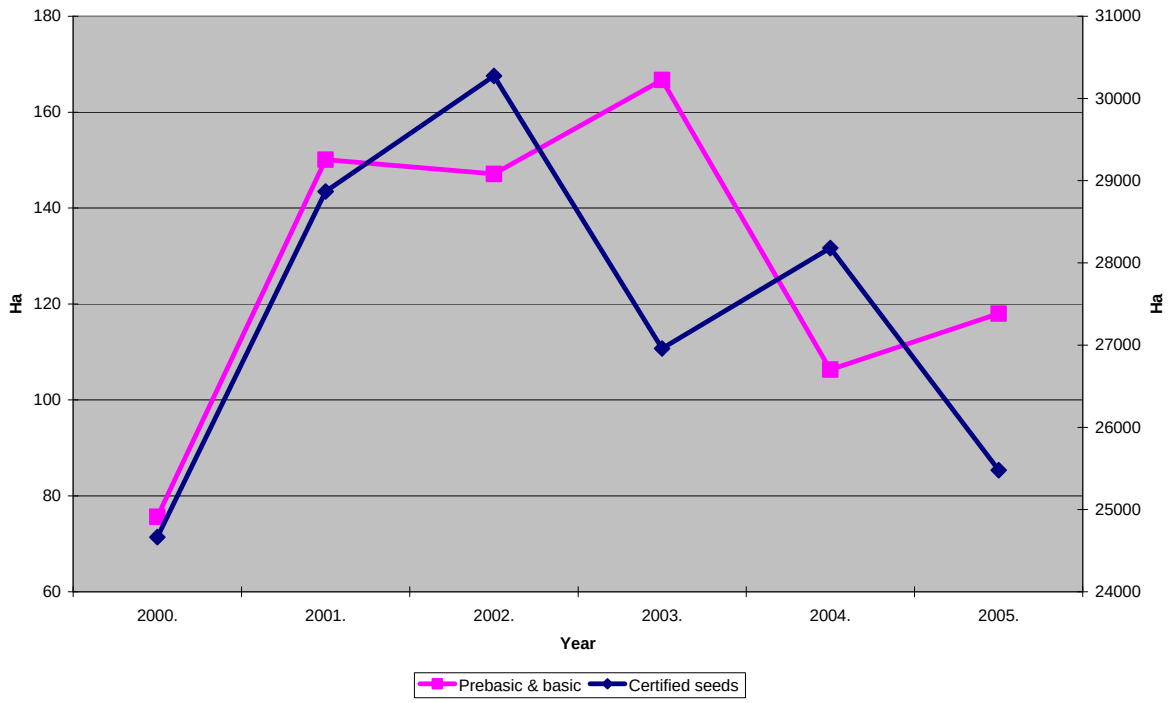
In Hungary, the data illustrated in Figure 7.1 show that the area of seed maize ranged between 25,000-30,000 ha over the period 2000-2005, with a peak in 2002. The variation in seed area reflects changes in the stock of certified seeds and expectations about the maize grain area. Hungarian maize seed production is totally oriented towards hybrids and no open pollinated varieties are produced. Maize is the most important crop in Hungary, occupying roughly 20% of the 5 million ha of arable land. Seed maize is mainly grown in the great Hungarian plains (Dél-Alföld and Észak- Alföld) in the Southern and Eastern part of the Country, where also the largest part (i.e. around 80%) of the grain maize is grown (Figure 7.3). Thus grain and seed maize productions share the same production regions in Hungary. Seed maize however is produced on irrigated land.

[10] The comparison between volume and area of certified seed production does not necessarily indicate the yield. In any year part of the produced seeds might not be certified in the producing Country (e.g. they can be exported and certified abroad), might not be certified at all (e.g. they are stored to be certified in the following year). Similarly part of the seeds certified in each year might have been imported or produced in previous years.

Figure 7.3: Regions of Hungary

The average size of a field for seed maize production in Hungary ranged between 25-34 ha over the period 2000-2005. This figure is smaller than the average grain maize production field of 50-60 ha.

The organization of production involves contracts among different actors in the supply chain. Breeding is in the hands of 2-3 national companies and large multinational companies who hold the patents on the different varieties. The producer of the seed material is usually a contractor. In Hungary the number of contractors ranged between 33-39 over 2000-2005. The contractors make arrangements with seed farmers for the multiplication of the seed material. The number of seed producing farmers ranged between 180-350 over 2000-2005. Once the seeds have been multiplied they are certified and treated and then distributed. The majority of seeds (70-75%) are distributed by the contractor company. There are around 30 contractor companies in Hungary (as already mentioned above), but two large cooperatives account for around 60% of the seed market. A proportion of seeds (around 25%) is distributed directly by the multinational breeders, who also get in touch with seed farmers without the intervention of the contractor companies. In such instances (i.e. direct production by multinational breeders), the farmers only rent their land to the multinational breeder who makes its own arrangements for all agricultural operations (e.g. sowing etc.).



Source: OMMI

Figure 7.4: Inspected seed maize area for pre-basic, basic and certified seeds production

The largest proportion of the seed maize area refers to certified (hybrids) seeds production (around 95%), while a small proportion is allocated for the production of pre-basic and basic seeds (see Figure 7.4). Figure 7.4 illustrates how the area for pre-basic/basic seed production ranged between 76-167 ha over 2000-2005, while in the same period the (inspected) area for certified seed production ranged between 24,000-30,000 ha. Most of the pre-basic/basic seeds used in Hungary for the multiplication of certified seeds are produced either in the US or in France.

No GM maize varieties are currently being produced in Hungary. Hungary has introduced a moratorium on GM Bt maize (Mon 810). At the same time the Hungarian Parliament has introduced very strict rules for coexistence, requiring 400 meters isolation distance for GM maize. The GM maize varieties authorized in the EU are Bt varieties resistant to the European Corn Borer (ECB). The presence of the ECB is particularly limited in Hungary. Similarly weed control problems in maize are not particularly strong. As such it is anticipated that the introduction of GM HT or Bt varieties resistant to the corn borer are not particularly suited to the Hungarian conditions.

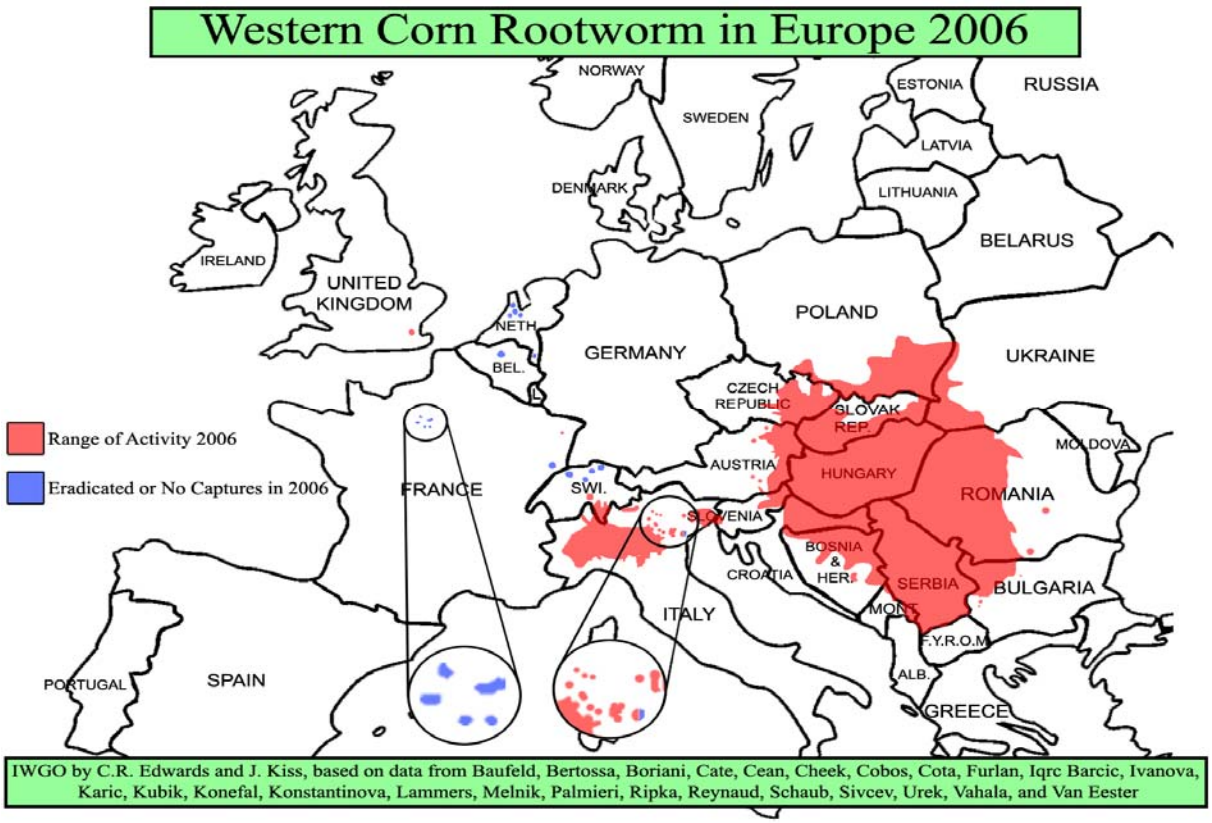
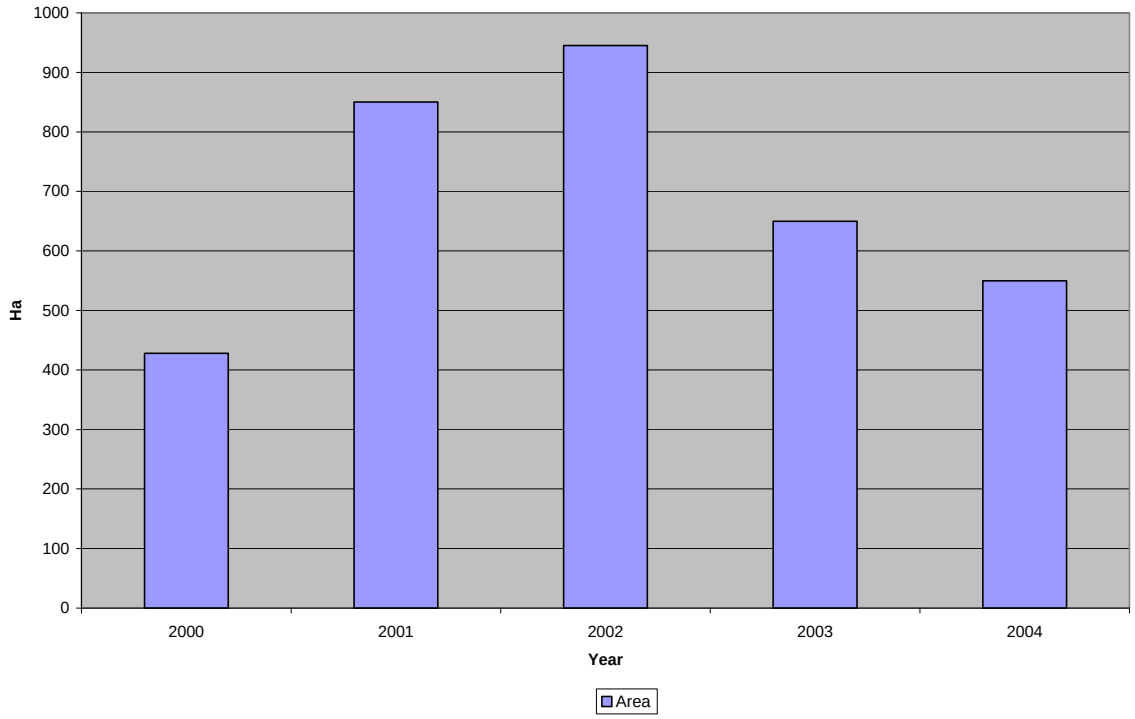


Figure 7.5: distribution of western corn rootworm in Europe

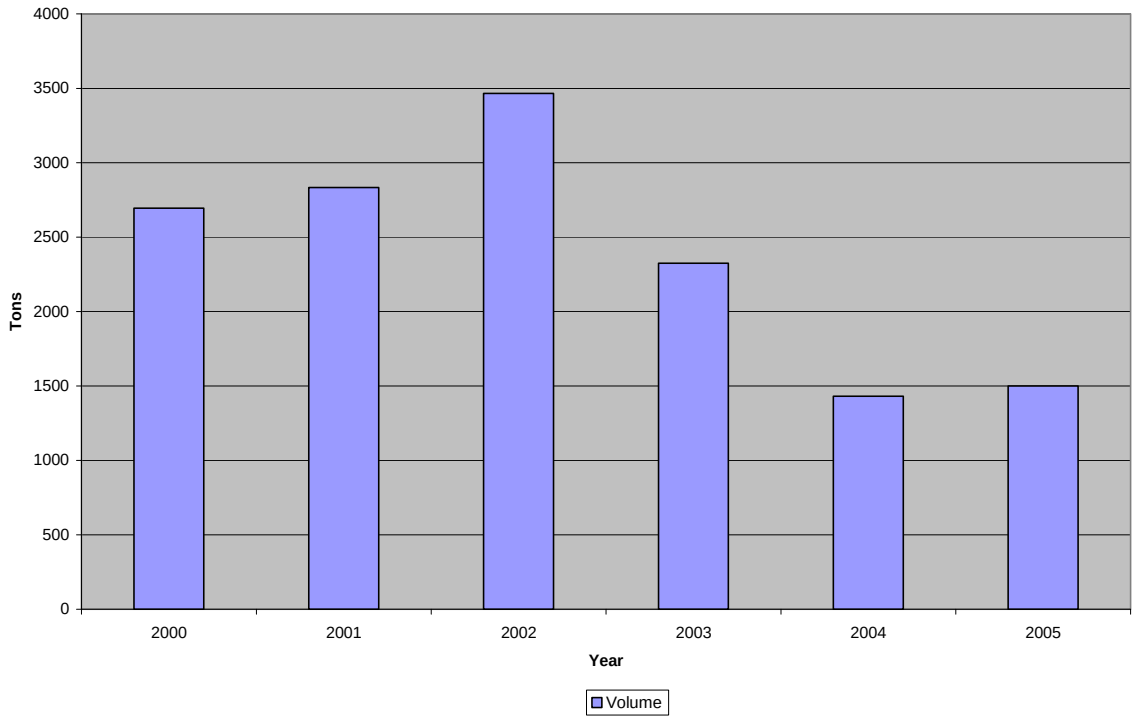
However another parasite, the Corn Root Worm (CRW, *Diabrotica virgifera*) represents a more serious threat to the Hungarian maize production. One review (Baufeld and Enzian, 2003) concludes that CRW can cause yield losses between 10-13% in maize. However yield losses of 30% were reported in Serbia and losses of 90% in Southern Hungary in 2003. Figure 7.5 clearly illustrates how the great Hungarian plains, together with Romania and Serbia, are the most affected area in Europe. GM maize varieties resistant to CRW are now commercially planted in the US. A USDA ex-ante study carried out in 2003, estimated that 35% of farmers were likely or very likely to adopt GM Bt maize against CRW (Payne *et al*., 2003). Discussion with Hungarian experts suggests that should such varieties be authorized for cultivation in the EU, then certainly the appeal for Hungarian farmers will be high. Even so it is perceived that the adoption of GM varieties of maize would be highly constrained by the public opinion.

With respect to organic maize, in 2006 there were only 6 ha of organic maize seed production in Hungary. The organic market is not big enough to attract the effort of breeders. Organic grain maize farmers use mainly conventional varieties.



Source: ESCAA

Figure 7.6: Area of seed maize in Spain

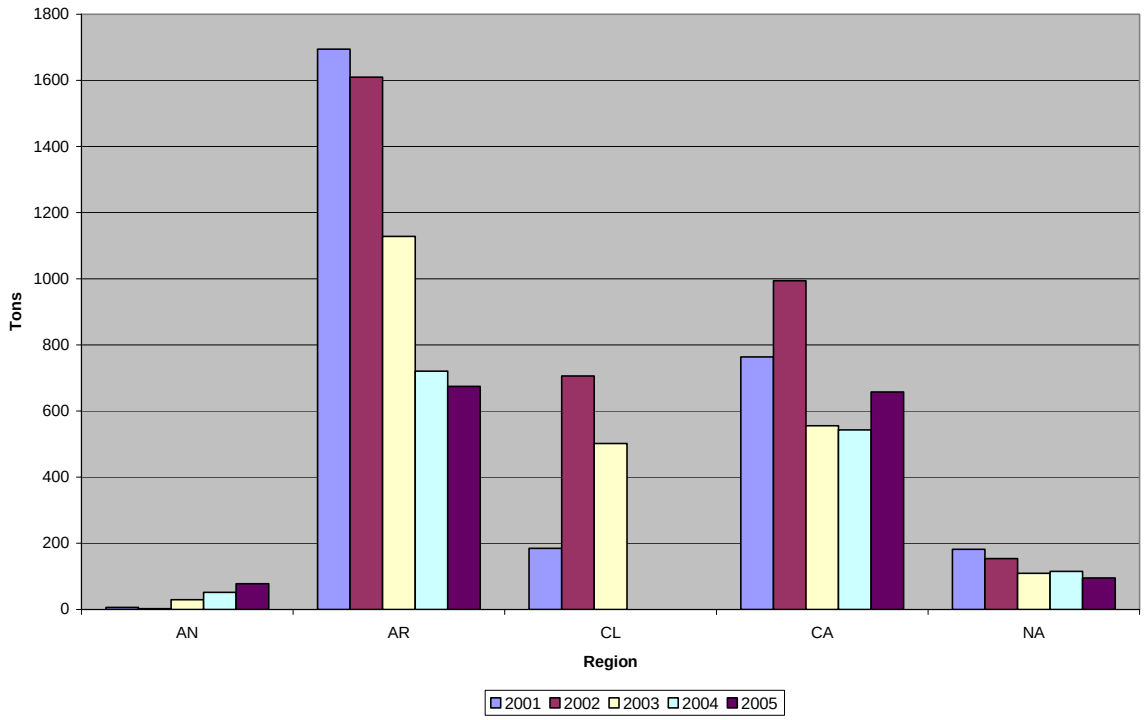


Source: ESCAA

Figure 7.7: Volume of seed maize production in Spain

Spain seed maize production is certainly negligible when compared to that of France and Hungary. Spain is essentially an importer of seed maize (see section on trade in seed maize). Figures 7.6 and 7.7

illustrate the area and volume of certified seed maize production over 2000-2005 (n.b. data on area were not available for 2005) in Spain. The peaks in both volume and area registered in 2001 and 2002 are strictly linked to the increase in the grain maize area in the same years. With respect to the regional distribution, Figure 7.8 shows how seed maize is essentially produced in three regions: Aragon (AR), Castilla-y-Leon (CL) and Cataluna (CA), all situated in the North of Spain (Figure 7.9). Cataluna and Aragon have very high penetration of GM Bt maize (up to 59% of the maize crop), while Castilla y Leon is essentially free of GM Bt maize. In the past three years there has been a general decrease in Spanish seed maize production. This is in part due to the accumulation of stocks from the previous years, and in 2005 to an increase in seed imports. GM Bt maize seed is produced and imported from North and South America with a small amount produced in France.



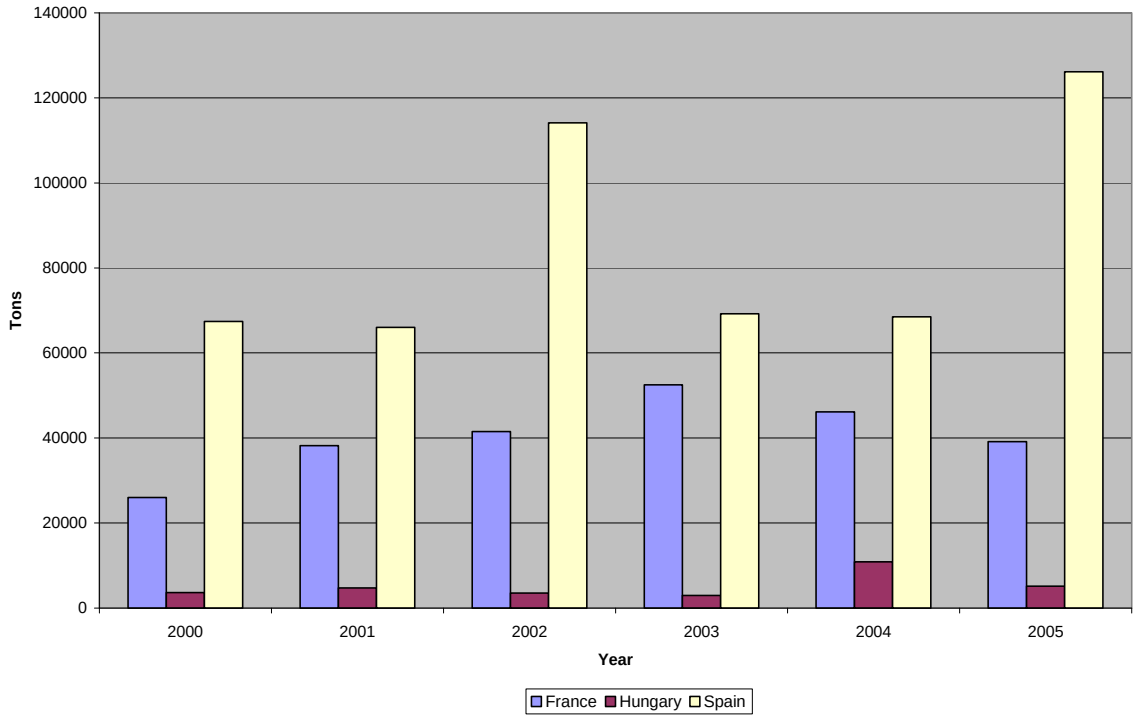
Source: MAPA

Figure 7.8: Regional distribution of seed maize production (volume) in Spain

Figure 7.9: Political map of Spain

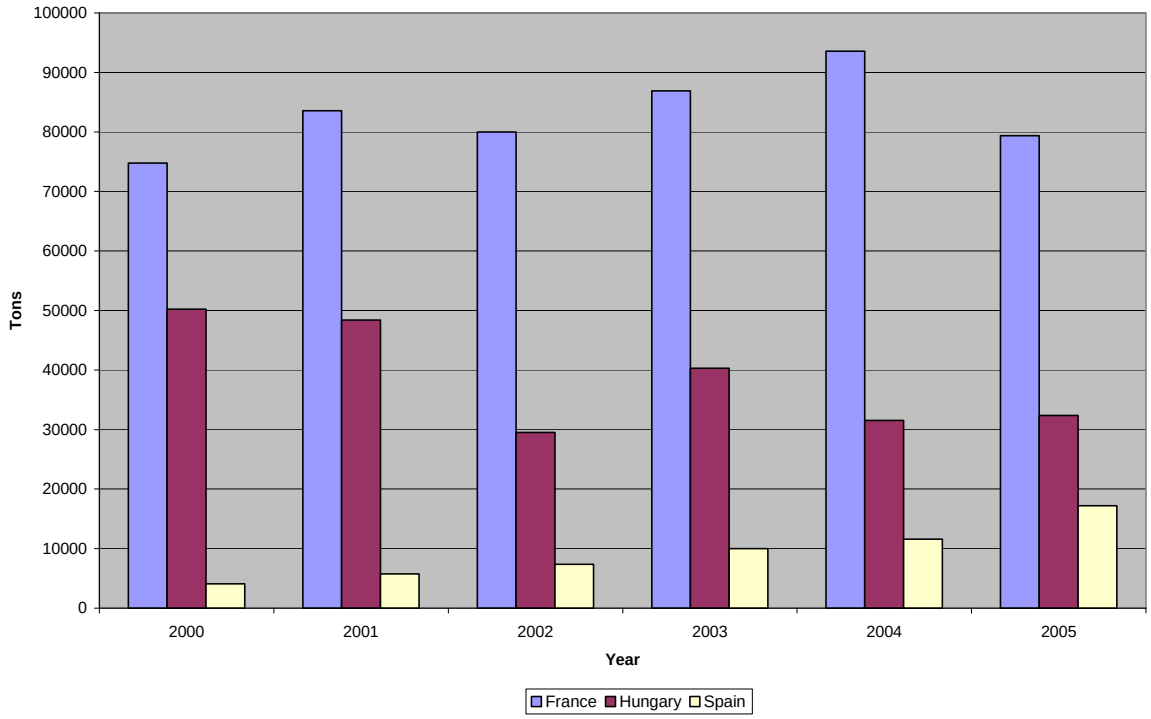
7.2 Seed maize trade

Figures 7.10 and 7.11 show aggregate figures for seed maize trade in France, Hungary and Spain. Spain is the larger importer of seed maize, followed by France and Hungary. However, by looking at Figure 7.11 it is clear that France is a net exporter of seed maize.



Source: COMEXT, GNIS

Figure 7.10: Total seed maize imports in France, Hungary and Spain

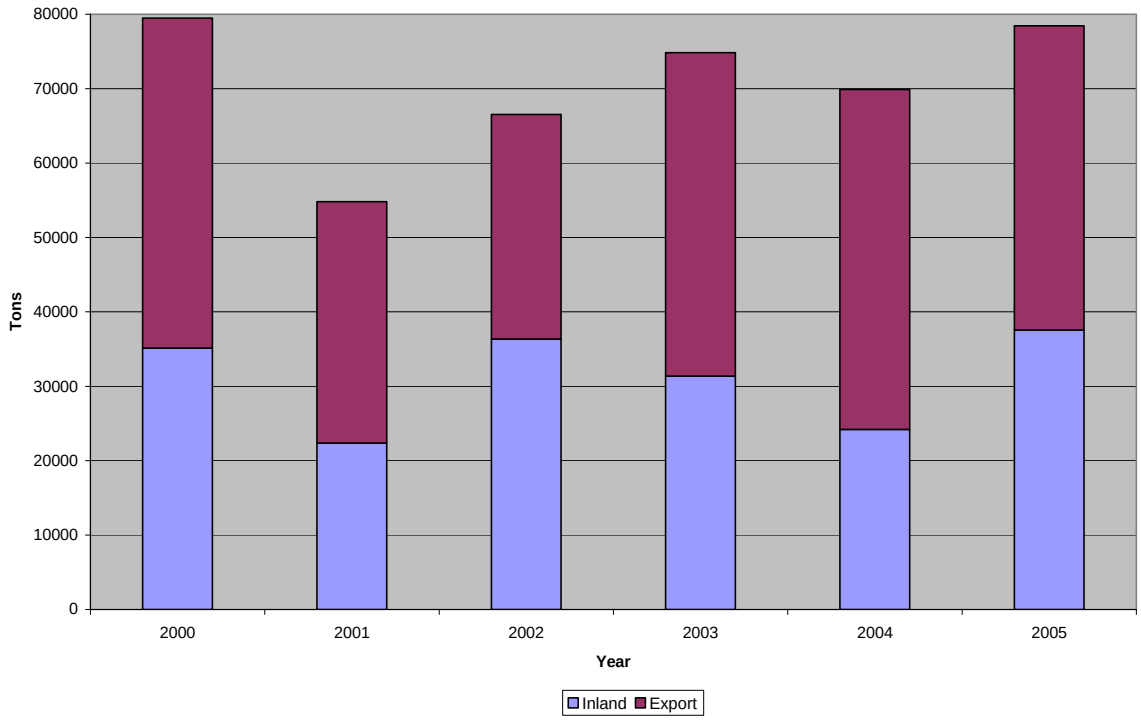


Source: COMEXT, GNIS

Figure 7.11: Total seed maize exports in France, Hungary and Spain

As already mentioned above, a detailed analysis of French seed maize production and trade is presented in section 3. Here we will focus on Hungary and Spain.

Most of the Hungarian seed maize production is destined to the export market (mainly France). Before accession the certification process was different for export and domestic seeds, being stricter in the latter case. Figure 7.12 illustrates the split between seed maize produced in Hungary and certified for domestic use and for export over 2000-2005. The variation in the volume of certified seeds reflects changes in the available stock of seeds. For example, in 2001 the area of seed maize actually increased, while the volume of certified seeds decreased. This was not due to low yields (yields in 2001 were actually 3.7 tons/ha, higher than 2000), but to the accumulation of seed in stocks from the previous year. In 2000 in fact, the volume of certified seeds was relatively high (over 79,000 tons). On the other hand the area of grain maize in Hungary remained almost unchanged. As such seeds from 2000 were still available for the 2001 campaign, thus reducing the need to certify a large volume of seeds in 2001.

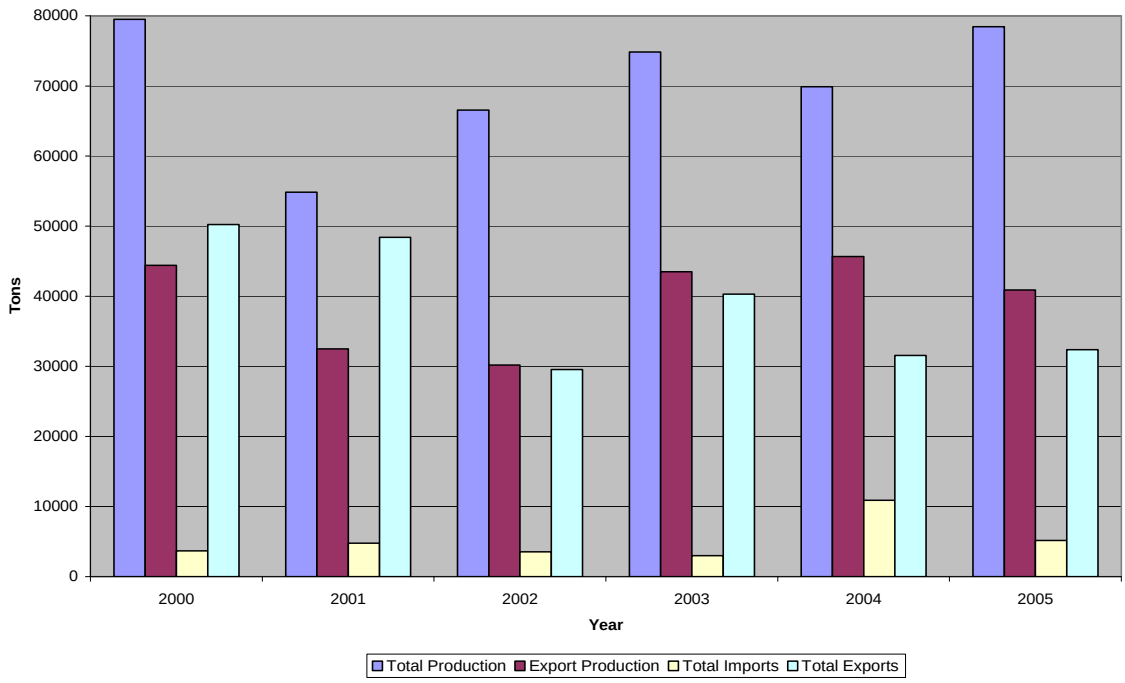


Source: OMMI

Figure 7.12: Hungarian seed maize production for home and foreign market

It is also interesting to look at the relative importance of seed maize trade compared to the volume of seed production in Hungary. Figure 7.13 clearly illustrates how seed maize imports are small compared to production and export. Also notice that in Figure 7.13 'Export Production' and 'Export' are reported. The former refers to that part of the volume of certified seeds in each year that are destined to the export market (based on OMMI data). The latter indicates the actual volume of seed maize exported in each calendar year (based on COMEXT data). The difference between the two figures reflects the fact that either not all the seeds certified for export in one year are exported in that year

(e.g. the value of 'Export Production' is higher than 'Export') or that part of the exported seeds in one year are seeds accumulated in stocks and certified in previous years (e.g. the value of 'Export Production' is lower than 'Export').



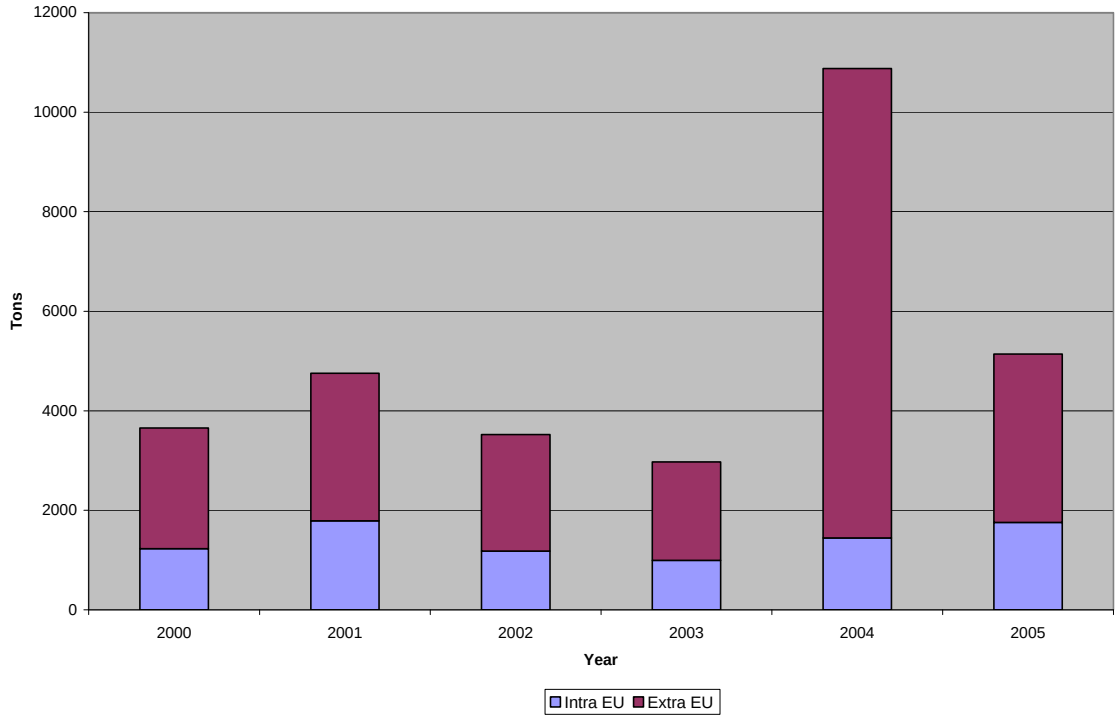
Source: Elaborated on data by OMMI and COMEXT

Figure 7.13: Volume of seed maize production and trade in Hungary

When looking at trade figures, it is important to make a distinction between intra-EU and extra-EU trade. Seeds can cross many borders before reaching the final users. As such particular care is required when interpreting trade figures. However, a distinction between intra-EU and extra-EU trade can provide at least an indication of the importance of Third Countries (i.e. extra-EU) as both source and destination of seed maize for Hungary. Figures 7.14 and 7.15 illustrate the breakdown of import and export of Hungarian seed maize between EU Member States and Third Countries. Notice that up to 2003 the Intra-EU figure only refers to EU15 (while the 2004 and 2005 Intra-EU figures refer to EU25).

Concerning seed maize imports into Hungary Figure 7.14 shows that extra-EU sources are relatively important (i.e. they represent most of the imported seeds into Hungary), but are still small compared to domestic seed production (see Figure 7.13). In particular, the US (around 1,200 tons in 2005), Romania (over 700 tons in 2005), Chile (over 500 tons in 2005) account for most of the imports into Hungary. In Figure 7.14 seed maize imports show a peak in 2004. Strangely this is the result of large quantities of seeds (over 7,000 tons) from Switzerland. It is however doubtful that the origin of these seeds is Swiss. It is more likely that Swiss companies imported the seeds to re-export them in the EU.

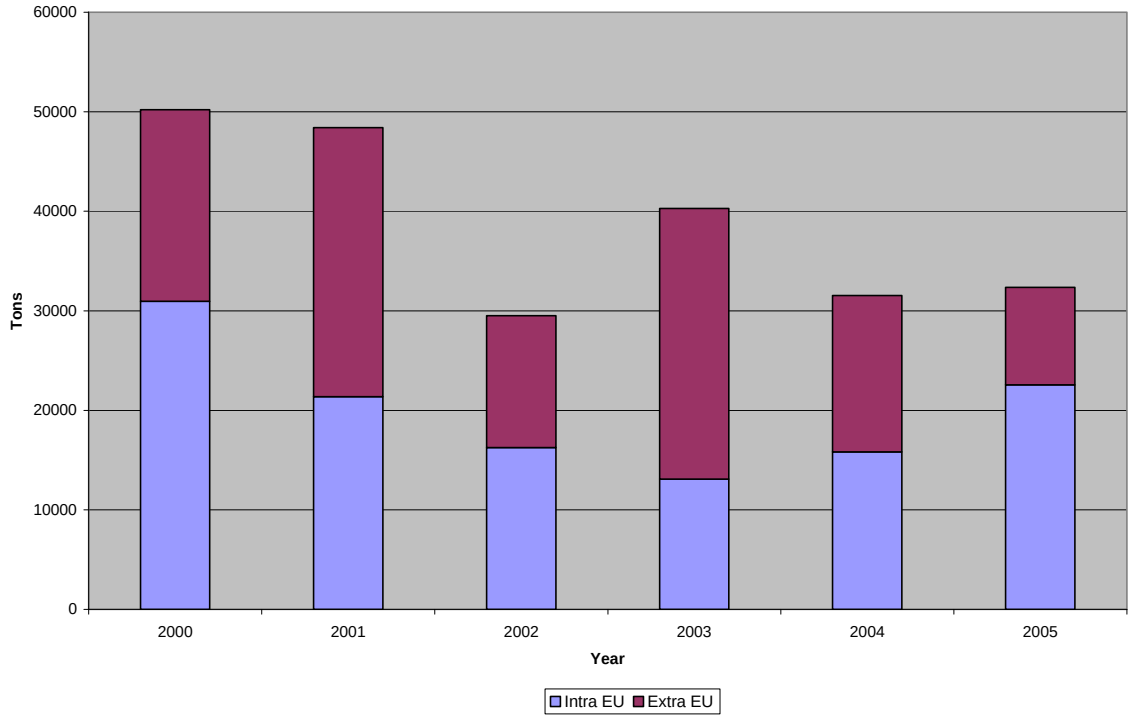
When looking at intra-EU imports, France turns out to be the main source of seed maize for Hungary, with over 1,300 tons in 2005.



Source: extrapolated from COMEXT data

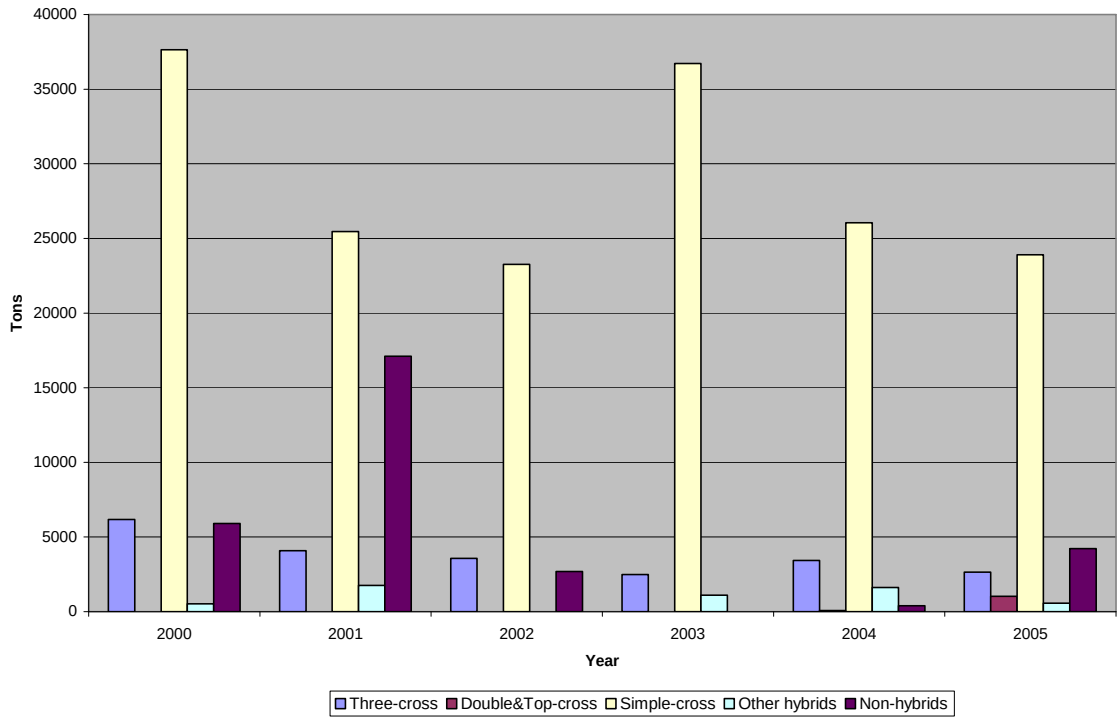
Figure 7.14: Volume of seed maize imports into Hungary by origin

On the exports side, Figure 7.15 illustrates how the extra-EU market is quite important for Hungarian seed maize. The most important destination Countries, in terms of volume of seeds exported, are Russia (around 2,400 tons in 2005), Ukraine (around 2,300 tons in 2005), Romania (around 1,800 tons in 2005) and Bulgaria (around 1,500 tons in 2005). Within the EU25 the most important destinations for Hungarian seed maize include the Netherlands (around 4,600 tons in 2005), France (around 4,600 tons in 2005), Germany (around 3,000 tons in 2005), Italy (around 3,000 tons in 2005), Poland (around 1,300 tons in 2005) and Slovakia (around 1,300 tons in 2005). Figure 7.15 also illustrates a reduction in total maize seed exports in 2002. An analysis of the COMEXT data suggest that this was due to: a) a drop in non-hybrids maize seeds export to Bosnia (from 9,800 tons in 2001 to 69 tons in 2002), Romania (from 5,200 tons in 2001 to 90 tons in 2002) and Yugoslavia (from 800 tons in 2001 to 0 in 2002) and b) a drop in simple hybrids maize seeds exports to France (from 8,000 in 2001 to 6,000 in 2002) and the Netherlands (from 3,200 in 2001 to 2,300 in 2002). In 2003, on the other hand, the increase in exports is mainly due to higher sales to extra-EU Countries like Switzerland (from 0 in 2002 to 10,500 tons in 2003), the US (from 560 tons in 2002 to 6,500 in 2003) and Ukraine (from 941 tons in 2002 to 2,100 tons in 2003).



Source: extrapolated from COMEXT data

Figure 7.15: Volume of Hungarian seed maize exports by destination

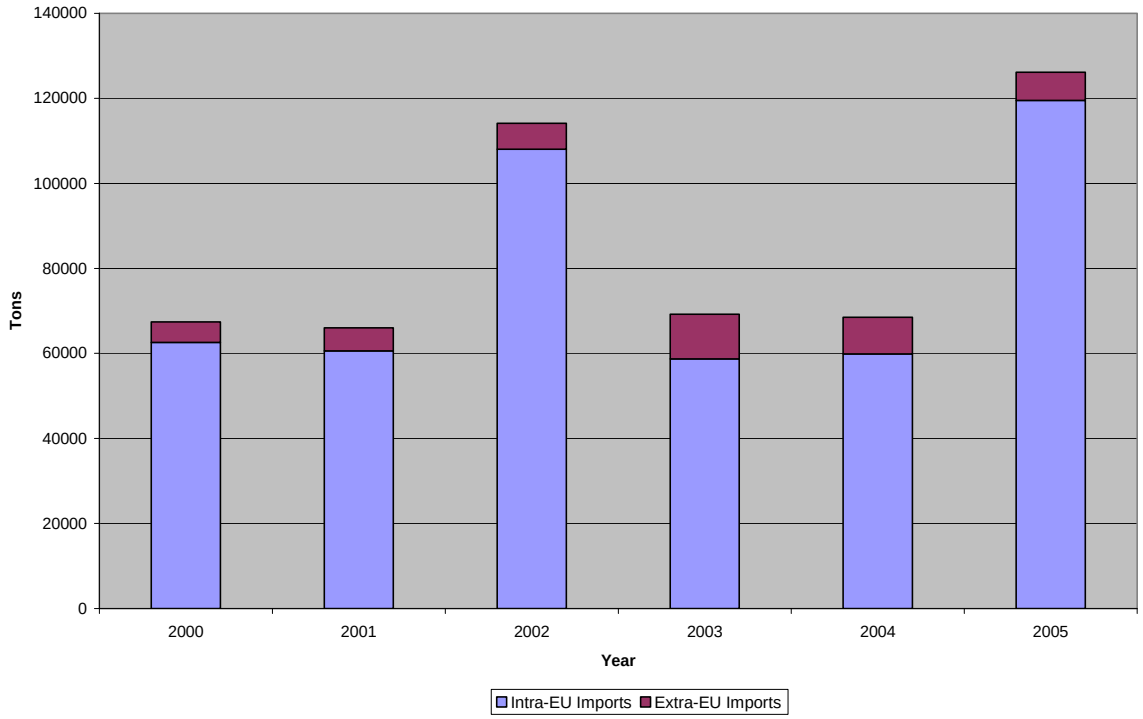


Source: Extrapolated on COMEXT data

Figure 7.16: Volume of Hungarian seed maize exports by category

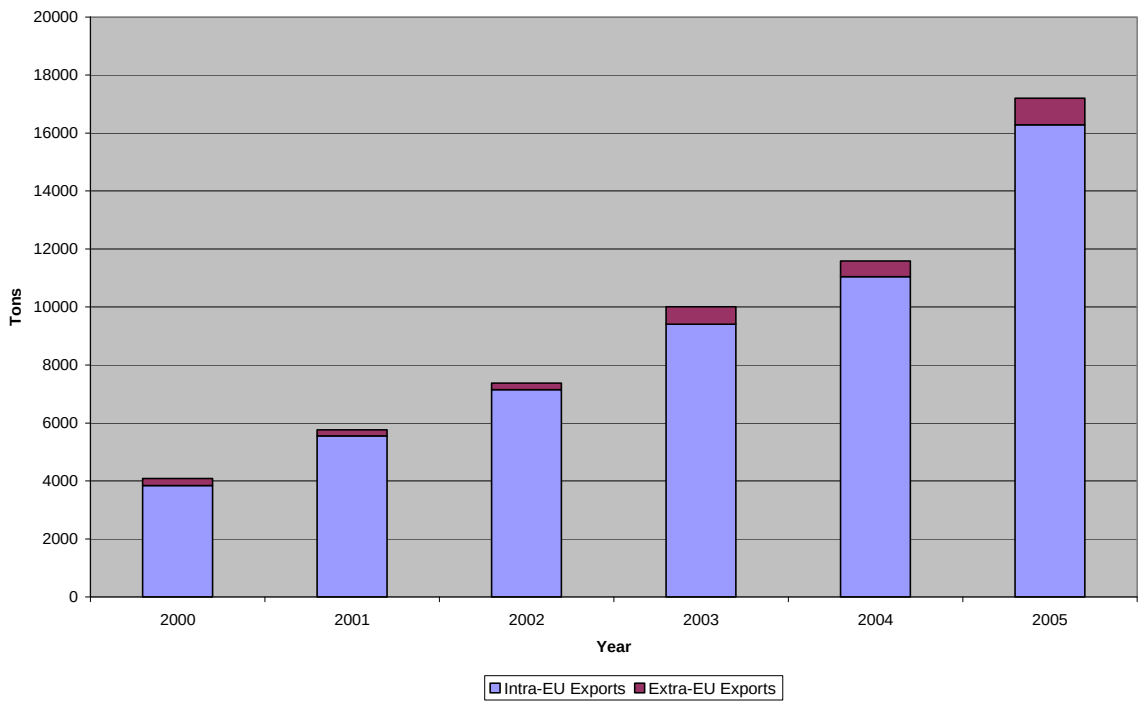
In general it appears that the dynamics of the Hungarian seed maize exports mainly reflect those of the simple hybrids seeds (which represent the largest proportion of Hungarian seed maize exported). This is clearly illustrated in Figure 7.16. It is evident the similarity in the patterns illustrated in Figure 7.15 and Figure 7.16. With these data and through an analysis of the COMEXT data it is evident that Hungarian seed maize exports suffered, over the period 2003-2005, from the loss of the simple hybrids markets in the US (from 6,500 tons exported in 2003 to 0 in 2005) and to a smaller extent in France (from 4,000 tons in 2003 to around 3,300 tons in 2005) and Poland (from 2,000 tons in 2003 to 1,300 tons in 2005).

With respect to Spain, Figure 7.17 illustrates imports of seed maize. Spain imports almost all the maize seeds from other EU countries. France is by large the major supplier of seeds to Spain (around 108,000 tons in 2005). On the other hand the US (around 4,400 tons in 2005), Turkey (around 900 tons in 2005), Romania (around 400 tons in 2005) and Chile (around 300 tons in 2005) seem to be the major extra-EU suppliers of seed maize. However, such official data are not necessarily indicative of the country in which the maize seeds were actually grown. A large (but unquantified) proportion of US maize seeds entering into Europe are actually grown in Chile.



Source: COMEXT

Figure 7.17: Spain seed maize imports



Source: COMEXT

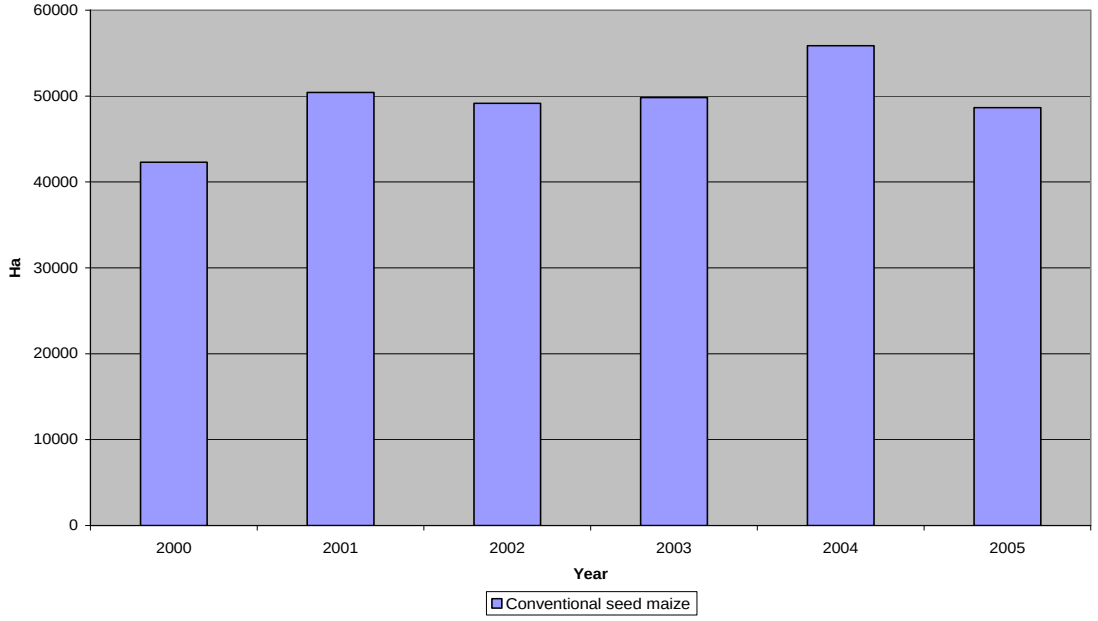
Figure 7.18: Spain seed maize exports

Figure 7.18 illustrates Spanish maize seed exports to other EU countries and to extra-EU countries. Again it is evident how the largest part of the exports is directed towards other EU Member States. Important destinations include France (around 8,000 tons in 2005), Portugal (around 4,700 tons in 2005) and Italy (around 1,500 tons in 2005). Despite the increase in seed maize exports, Spain is essentially an importer of seeds. It is also important to notice that a significant part of the export concern seed produced in Spain and processed abroad (e.g. in France) to be re-imported.

7.3 Case study: maize seed production in France

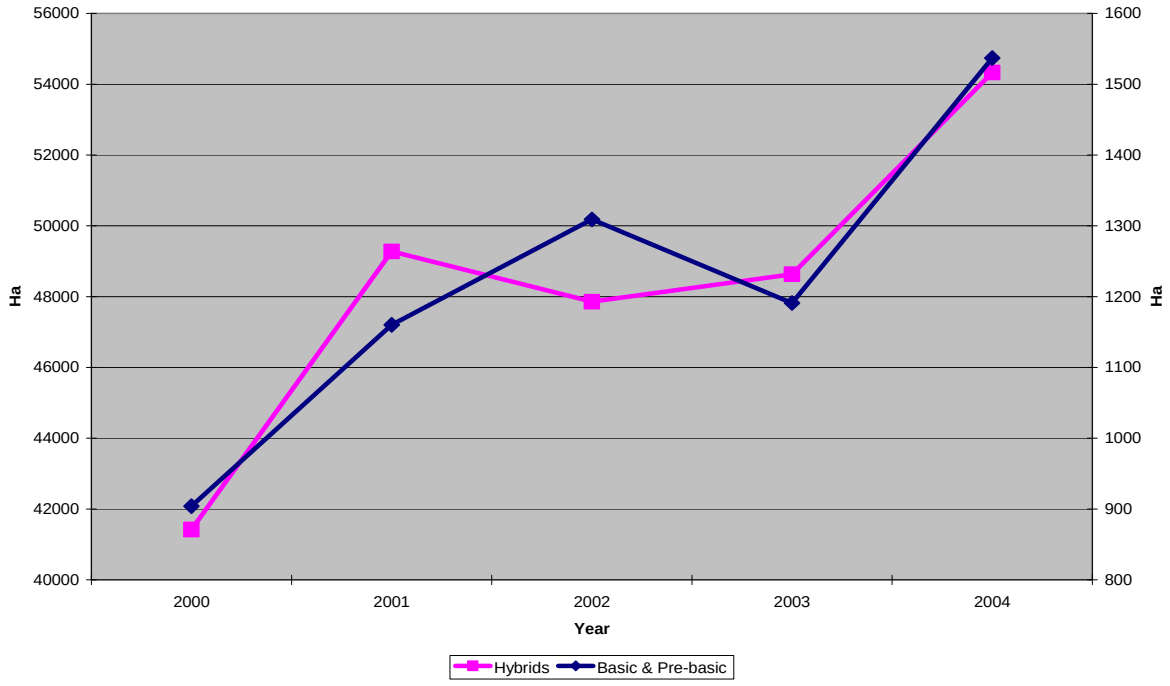
7.3.1 Production and Trade

France is the major producer of seed maize in the EU, with almost 50,000 ha in 2005. Figure 7.19 illustrates the area approved for the production of certified seed maize in France over the period 2000-2005. The area of seed maize in France over this period ranged between 42,000-56,000 ha, with a peak in 2004. The changes observed in the area of seed production follow changes in the stock of seeds and the expected area of crop maize. In 2004 there has been an expansion of maize grain area in the EU (see section on grain maize) which has been matched by an increase in the area of seed production.



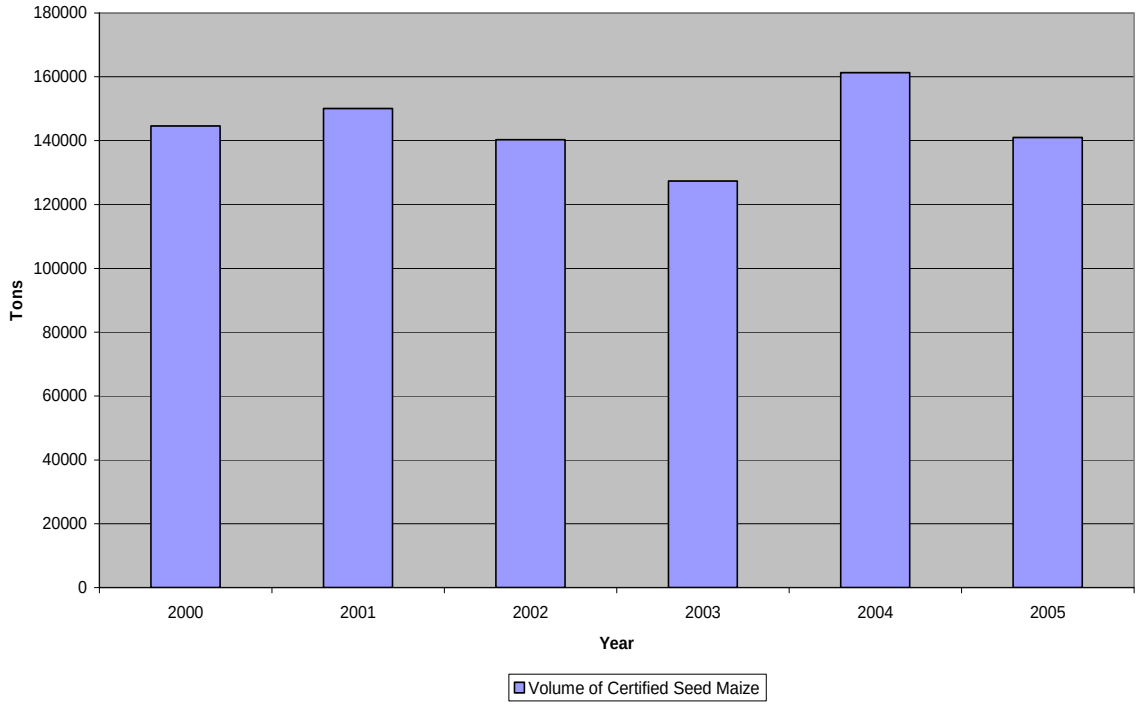
Source: ESCAA

Figure 7.19: Area approved for the production of seed maize in France



Source: GNIS

Figure 7.20: Area approved for hybrids and basic/pre-basic seed maize production in France



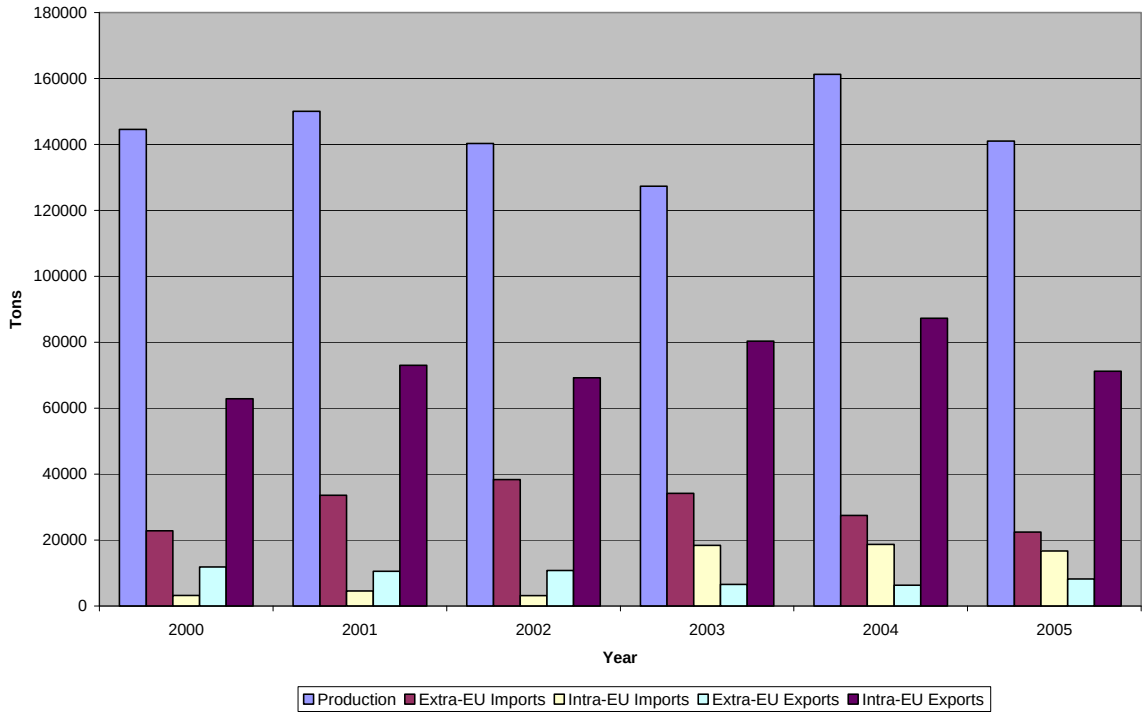
Source: ESCAA

Figure 7.21: Volume of seed maize production in France

Seed maize production in France is totally oriented towards hybrids. The data reported in Figure 7.19 include also basic and pre-basic seeds. However, as Figure 7.20 clearly illustrates, the share of basic and pre-basic seed production is quite small and stable at 1,000-1,500 ha (data for 2005 were not available).

The volume of certified seeds (Figure 7.21) follows closely the dynamics of the area for certified seed production. Data from GNIS and ESCAA suggest that around 70-75% of seed produced are certified[11]. For the future, experts believe that the area of seed maize in France will remain relatively stable.

[11] GNIS is the organization responsible for the certification of seeds in France. For maize such activity is delegated to AGPM and is in fact performed by the regional seed associations.



Source: GNIS and FNPSMS

Figure 7.22: Production and trade of seed maize in France

A large part of the seed produced in France is exported, ranging between 51-68% (Figure 7.22). The main destination market for French seed maize is within the EU. Data from FNPSMS indicate that Germany (around 36,000 tons in 2004) and Italy (around 12,000 tons in 2004) are the principal importers of French seed maize. Other important destinations include Spain (around 9,000 tons in 2004), the Netherlands (over 7,000 tons in 2004), Poland (around 4,500 tons in 2004) and Belgium (around 4,500 tons in 2004). An analysis of the data indicates that there have been little changes in the main European destinations of French seed maize since 2000.

With respect to extra-EU destinations, Ukraine stands out with around 1,600 tons per year over 2000-2004. Ukraine (and to a lesser extent Russia) represent new market opportunities for French seed maize production. However, there is also the risk that in the future part of the seed production could relocate in these countries because of lower production costs. At the moment the fact that both Russia and Ukraine are not complying with the OECD standards for seed production limits the possibilities of relocation.

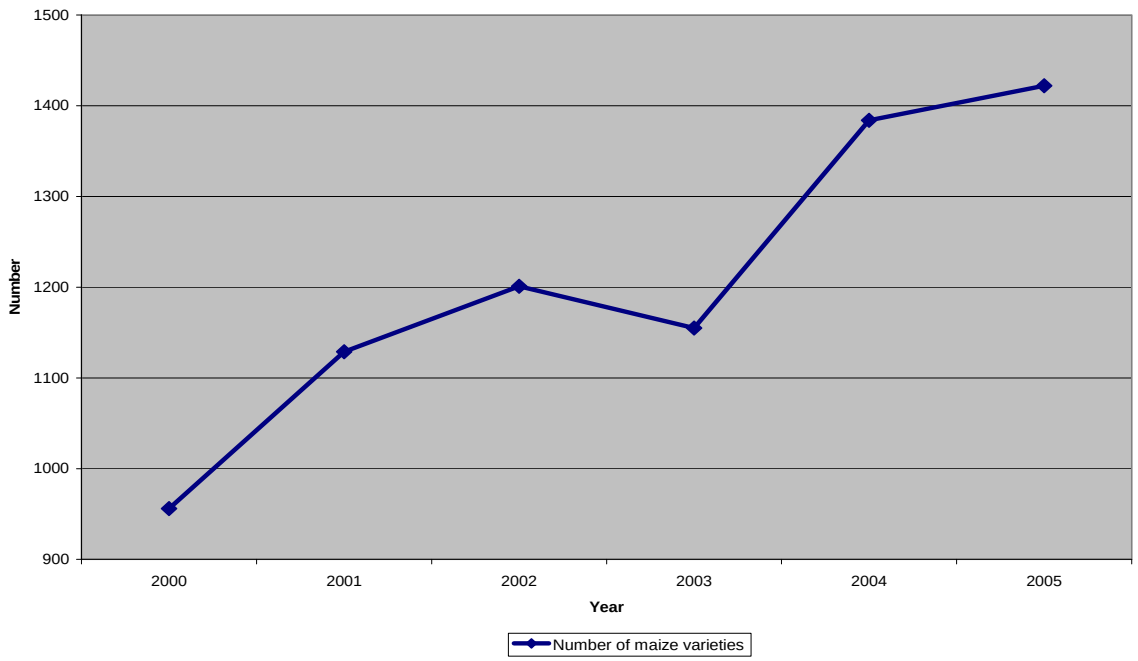
Concerning seed maize imports, Figure 7.22 shows an increase in intra-EU imports, mainly following the accession of Hungary. An analysis of the AGPM data shows how up to 2002 the US were the main suppliers of seed maize (around 16,000 tons) followed by Hungary (around 10,000 tons) and Chile (around 6,000 tons). In 2004 though Hungary became the main supplier (around 13,000 tons) followed

by the US (around 11,000 tons) and Chile (around 9,000 tons). However official trade data can be misleading since most of the seed maize imported from the US is actually produced in Chile.

7.3.2 Organization of production

The number of seed maize farmers has remained relatively constant over 2000-2005 in the range of 4,000 growers. Seed production is in the hand of a trusted number of specialized farmers. The average seed maize area per farmer ranged between 10-13 ha over 2000-2005. Another interesting aspect of maize seed production in France concerns the increasing number of varieties (Figure 7.23). Notice, however, that only a small proportion of these varieties are extensively grown (and account for the largest proportion of the production), while a large number of varieties are grown on very small areas. These are grown for early stage multiplication of parent lines for hybrid production or for varieties for submission to registration and other field trials. The increase in number of produced varieties is related to the expansion of both the national and international market and the necessity to produce variety suited to local growing conditions. This aspect is particularly important since a significant part (51-68%) of seed maize varieties produced in France is destined to the export market. The average number of varieties produced by each grower has also gone up from 1.3 in 2000 to 1.6 in 2005. Given the large number of varieties grown and the relatively small area per grower (between 10-13 ha over 2000-2005), French seed growers have developed the ability to ensure great purity standards when producing each variety on very small fields. More than 50% of varieties in 2005 were produced on areas between 3-10 ha. However, a significant proportion of varieties (around 15%) was also grown on area smaller than 2 ha. In comparison, seed maize in the US is produced on 300 ha fields.

Seed maize production in France is jointly organized at the regional/department level by the representatives of the seed companies (around 25 in France) and the (regional/local) seed growers' associations. Seed companies make the first step by offering contracts to seed growers (i.e. associations). Once the offer has been made representatives of the seed companies, together with representatives of the seed growers' associations determine the allocation of each variety to the different fields in the region/department. The process of assignation of varieties to fields normally takes place between December and middle April. In this respect, the management of seed production is very centralized. In some regions seed production is so important that it is given priority by the law over grain production. As such crop production is not allowed within a certain distance from the seed production fields. Where isolation requirements for seed production are not guaranteed by law, seed growers have been able to organize themselves and cluster the fields. It is estimated that this form of organization accounts for about 40% of total seed maize production in France. Only a small fraction of seeds is produced by 'isolated' growers.

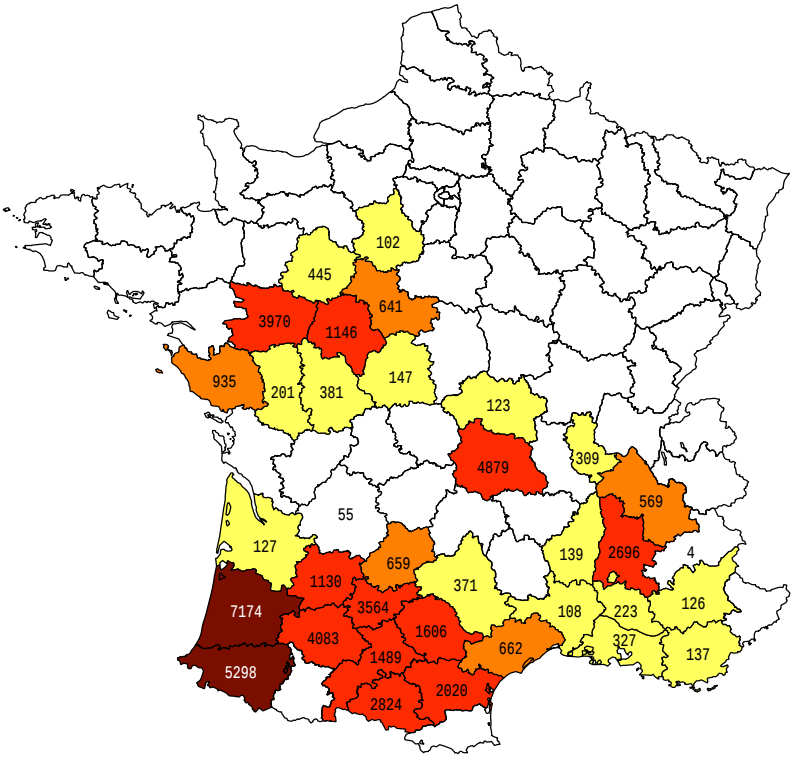


Source: GNIS

Figure 7.23: Number of seed maize varieties produced

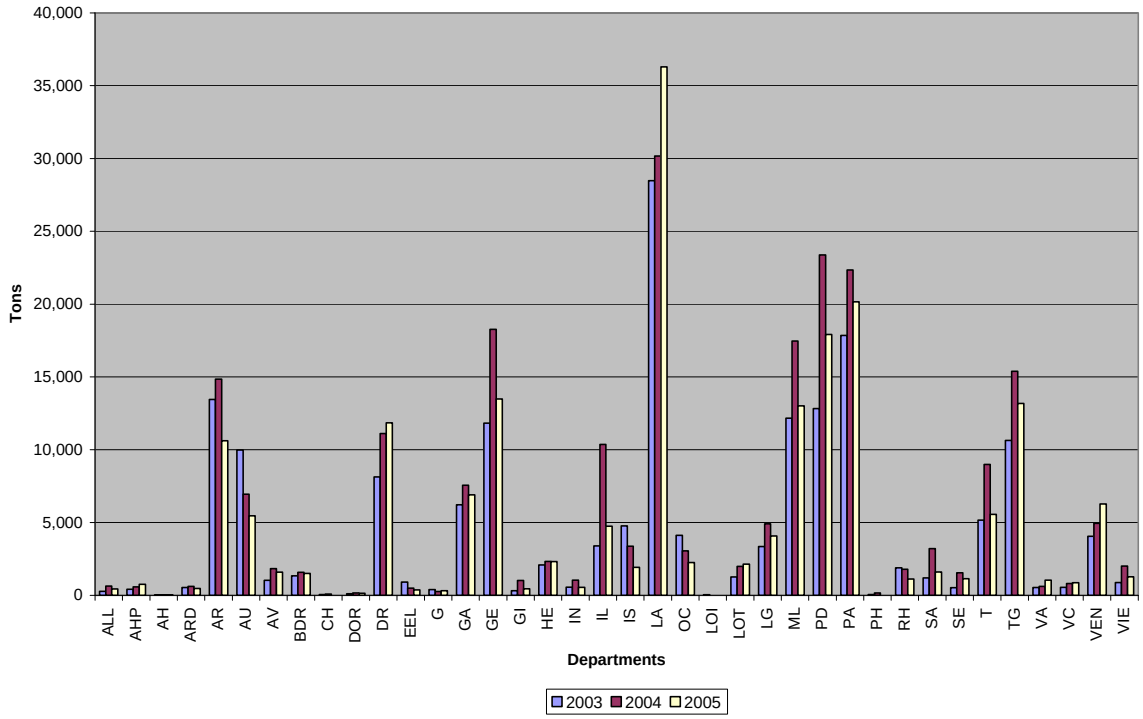
7.3.3 Regional analysis

Maize seed production in France is concentrated in the South-West, in parts of Central France and in parts of Western France. Figure 7.24 illustrates the distribution of conventional seed maize across the French Departments in 2005. The largest production occurred in Landes (7,174 ha in 2005), Pyrenees Atlantique (5,298 ha in 2005), Puy de Dome (4,879 ha in 2005), Gers (4,083 ha in 2005), Maine-et-Loire (3,970 ha in 2005) and Tarn-et-Garonne (3,564 ha in 2005). These six Departments accounted for almost 60% of the total maize seed area in France. The regional distribution of seed production in France has remained unchanged over the past 5 years mainly for two reasons. On one hand soil and climate in these regions are favorable to the production of maize. On the other hand the location of seed maize production reflects the regional distribution of trusted and experienced farmers. Because of the environmental factors of production (i.e. climate and factors), the location of seed and grain maize production overlaps in France. One exception is Maine-et-Loire where no grain maize production occurs, while seed production is substantial (3,970 ha in 2005).



Source: GNIS

Figure 7.24: Distribution by Department of maize seed production area (ha) in France in 2005



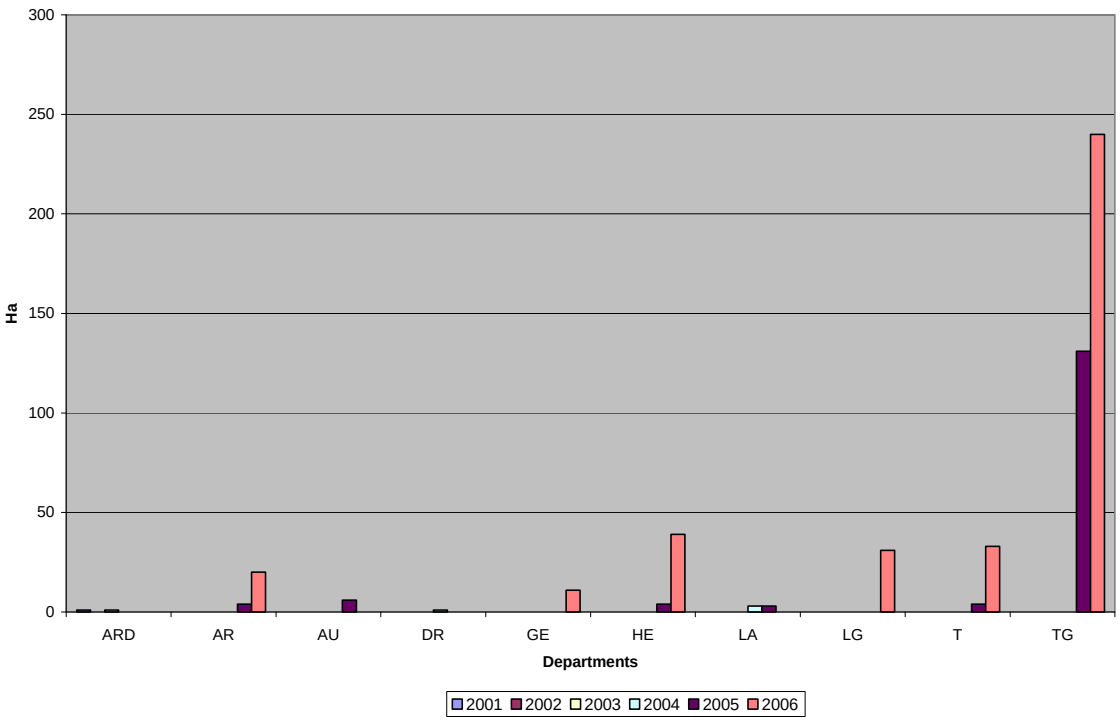
Source: GNIS

Figure 7.25: Volume of harvested seed maize in French Departments in 2003-2005

When looking at the volume of seed maize harvested (Figure 7.25), it is obvious that the regional distribution is analogous to the one illustrated in Figure 7.24. In 2005 Landes (LA) was the department with the highest volume of seed production followed by Pyrenees Atlantique (PA), Puy-de-Dome (PD), Gers and Maine-et-Loire. The figure also shows how in 2005 the volume of certified seeds decreased in almost all the Departments, except in LA.

7.3.4 GM and organic seed maize

Figure 7.26 illustrates the distribution of GM Bt seed maize in France by Departments. GM Bt seed maize has been introduced in France in 2001. However, up to 2004 the area of GM Bt seed maize was negligible (up to 4 ha). The increase in seed production occurred from 2004. Almost the entire production occurs in Tarn-et-Garonne (TG), in the South-West of France.

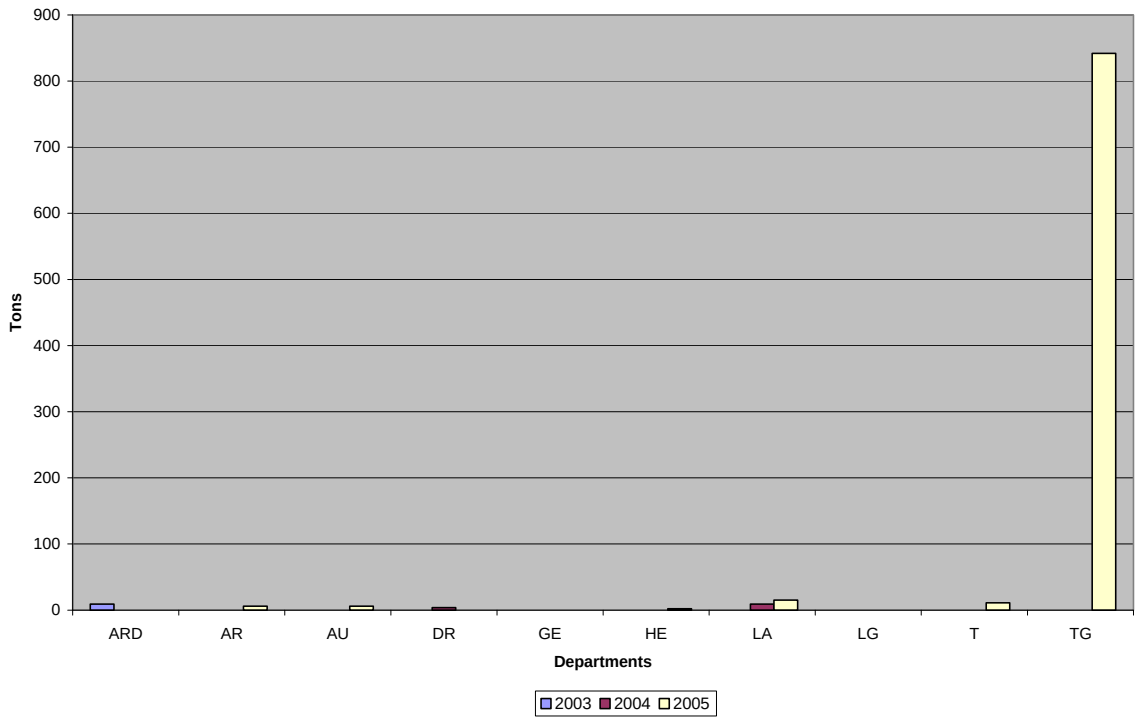


Source: GNIS

Figure 7.26: Regional distribution of GM seed maize area in France over 2001-2006

The distribution of volume of certified GM Bt maize seeds (Figure 7.27) is analogous to the distribution of areas illustrated in Figure 7.26. At present GM Bt seed maize production takes place in the same Department where conventional seed maize is produced. In the future it is possible that should the area of GM Bt seed maize become very high, seed companies (together with seed growers' associations) might pursue some sort of field allocation strategy within 'ilots', but segregation of production by Department is not contemplated. As already discussed in the section concerning the

organization of production, France has matured considerable experience over the past years to produce a large number of different varieties on small fields, through a centralized process of allocation of varieties to fields. From the industry perspective, the introduction of GM Bt seeds did not represent a major change in the organization of production.

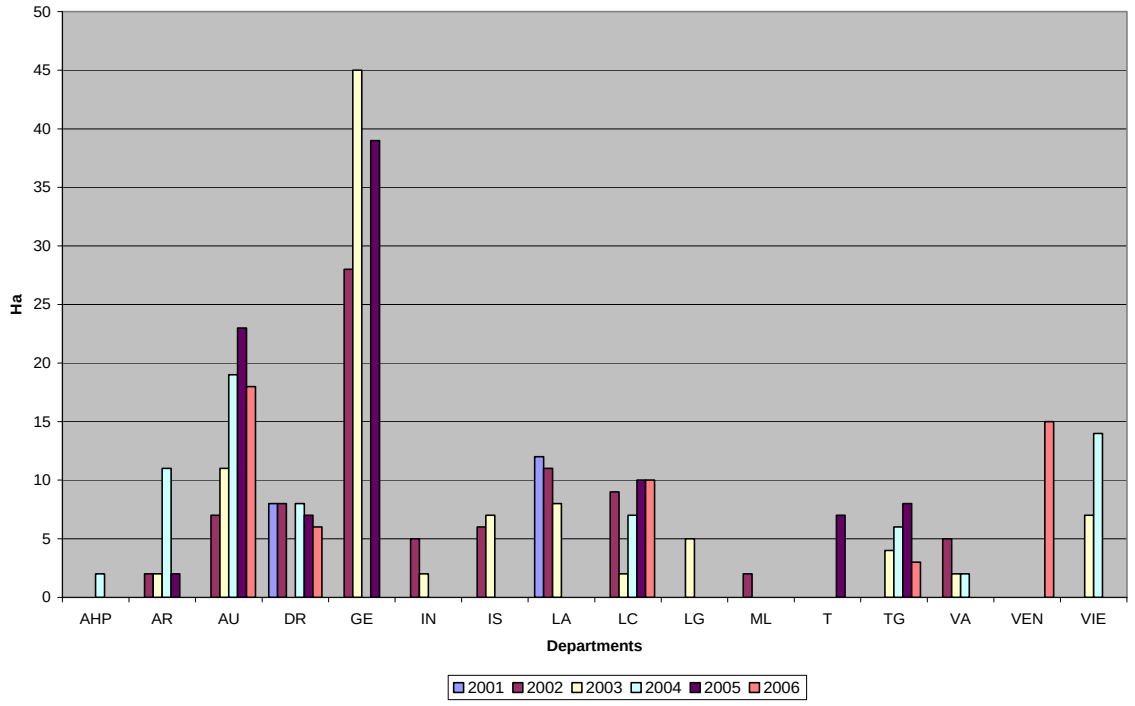


Source: GNIS

Figure 7.27: Regional distribution of GM seed maize volume in France over 2003-2005

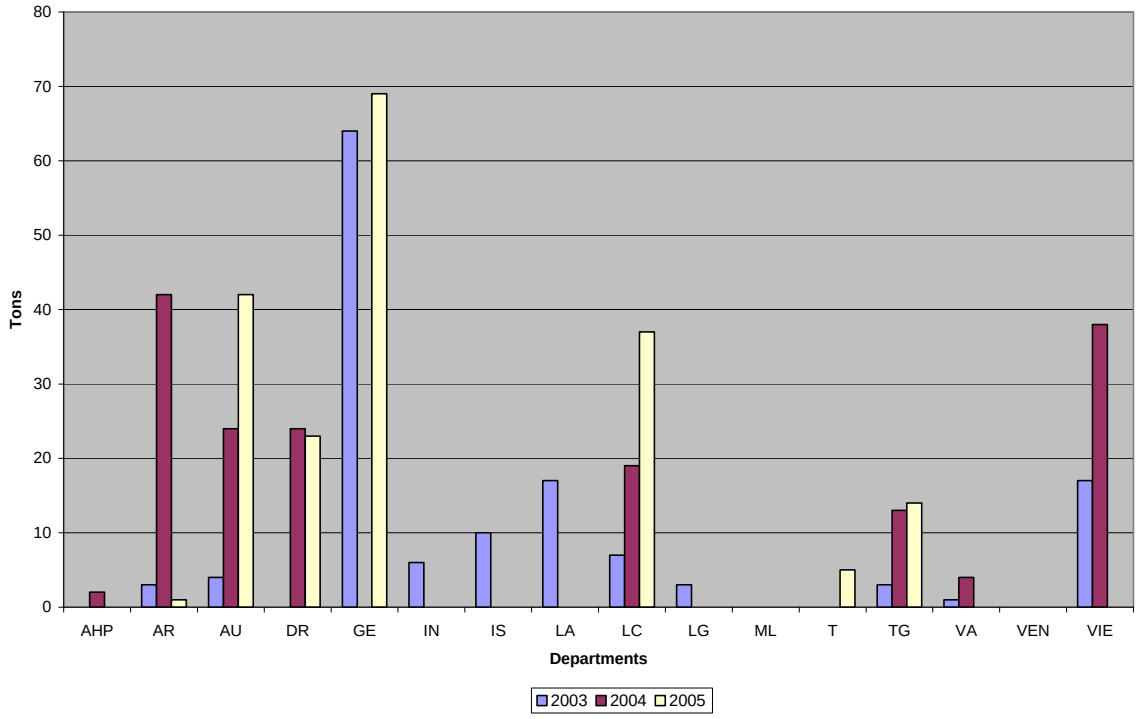
At the moment the expectations of the industry is for an increase in the area of both grain and seed GM Bt maize.

With respect to organic seed maize, the dedicated area of production ranged between 20-96 ha over 2001-2006 (data for 2000 were not available). Figure 7.28 clearly illustrates how in 2006 most of the production occurred in Aude (18 ha), Vendee (15 ha) and Loir-et-Cher (10 ha). It appears that no regional segregation of organic maize seeds is currently taking place in France. The volume of organic seed maize produced in France ranged between 135-191 tons over 2003-2005. The regional distribution of the volume of production (Figure 7.29) reflects the distribution of the organic seed areas.



Source: GNIS

Figure 7.28: Regional distribution of organic seed maize in France over 2001-2006



Source: GNIS

Figure 7.29: Regional distribution of the volume of organic maize seeds in France over 2003-2005

From the data presented it is clear that organic maize seed production in France is small compared to conventional seed production. Moreover it is difficult to identify a clear trend in the production of organic seed maize. Figures 7.28 and 7.29 seem to illustrate an increase in both area and volume of organic seed maize up to 2005 (e.g. in Gers). On the other hand in Gers, production of organic seeds was discontinued in 2006 (no information about the causes).

Consulted documents

Baufeld P. and Enzian S., 2003. Diabrotica virgifera virgifera, its potential spread and economic and ecological consequences in Germany. Available at http://www.bba.de/mitteil/presse/invspecies/artdiabrotica.pdf (last accessed 25/07/2007).

Payne J., Fernandez-Cornejo J. and Daberkow S., 2003. Factors affecting the likelihood of Corn Rootworm Bt seed adoption. AgBioforum 6(1&2): 79-86.

Acknowledgments

We would like to thank the following people for participating to the meeting held at GNIS in Paris on 19th April 2007: P. Gracien (GNIS Manager), M.F. Cazalere (Head of SOC, GNIS), P. Silhol (GNIS statistics), B. Fabre (GNIS, corn seed certification), D. Daviot (GNIS, corn seed sector), M. Monjarret (GNIS, sugar beet certification), J.D. Arnaud (GNIS, sugar beet sector), A. Toppan (SEPROMA, corn seed company), X. Ballenghien (SFPGB, sugar beet seed companies association), J.M. Sengenes (FNAMS, seed growers association), P.Coquin (FNPSMS, corn seed association), L. Nardi (FNAMS, seed growers association), G. Sicard (FNAMS, seed growers association), D.Gillard (FNAMS, seed growers association), B. Rossi (FNAMS, seed growers association) and G. Faure (OLEOSEM, oil seed plant companies association).

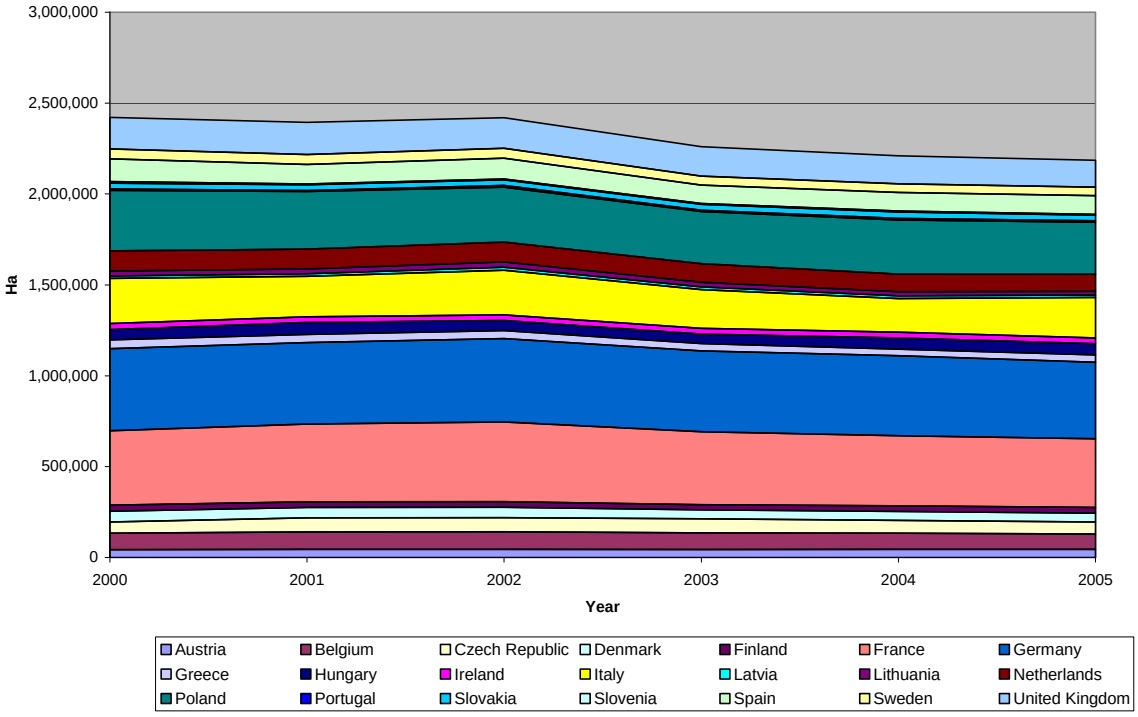
We would also like to thank the participants to the meeting held at OMMI in Budapest on 12 April 2007: Mr. G. Polgar (OMMI, Head of Seed Inspection Division), Mr. G.M. Fusti (OMMI, Senior Inspector) and Mr. R. Szabolcs (Hungarian Seed Association).

Chapter 8 Sugar Beet Production in the EU

8.1 Conventional Sugar Beet

EU Sugar beet production is relatively concentrated. Four countries (France, Germany, Italy and Poland) account for almost 60% of the area in EU25 (when also Spain, the UK and the Netherlands are taken into account the share goes up to 75%). Figure 8.1 illustrates how over the period 2000-2005 sugar beet area has been slowly decreasing from 2.4 million ha to 2.2 million ha (i.e. almost -10%). Before going further, it is useful to provide a brief description of the sugar regime in the EU. The principles of the EU sugar policy have remained largely unchanged for over 30 years (apart from a small reform operating over 2001-2006), up to the 2006 reform (EC Regulation 318/2006). Before the reform, the EU sugar policy consisted of: a) import restrictions with limited free access of certain suppliers (e.g. ACP and LD Countries); b) internal support prices ensuring returns to producers for a fixed quantity of production (i.e. quota) and c) export subsidy for a quantity of domestically produced sugar. The 2006 reform (n.b. the new regime started on 1st July 2006) introduced a 36% price cut over four years (starting in 2006/07), with partial compensation to farmers through the Single Farm Payment. Also a voluntary restructuring scheme lasting four years, with the aim to encourage closure of sugar factories, has been introduced. Finally, sugar for the chemical/pharmaceutical industry and for biofuels production will be excluded from production quotas. This new system will be valid until 2014/15.

A small decline in sugar beet area was registered in 2001 (-2%) as a result of delayed and reduced sowing due to heavy spring rains. However, up to 2002 sugar beet area in EU25 has been almost constant or slowly increasing, and reduction has been more accentuated in 2003. In 2002 a 7% cut in A and B sugar quota were announced well after planting decisions had been taken. As a consequence the reduction was de facto carried over in 2003 (i.e. building up of sugar from 2002 didn't require farmers to plant much sugar beet to meet the quotas). The area reduction was particularly evident in Poland, where oversupplies from the previous year led to a reduction in industry contracts with growers.

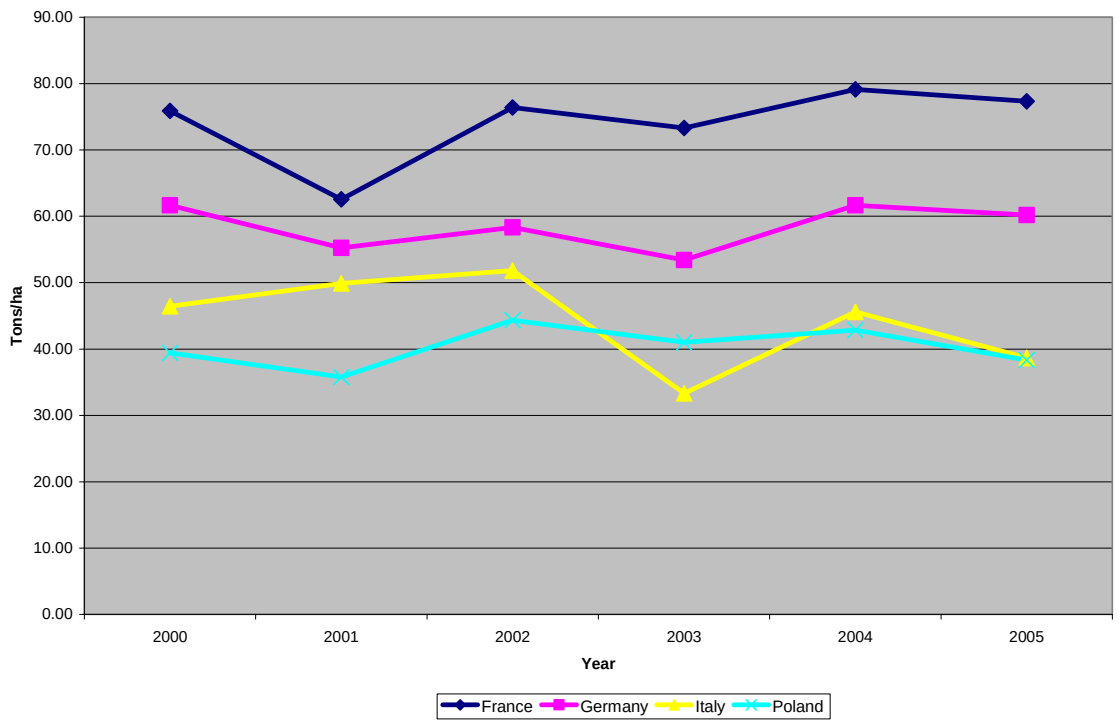


Source: FAOSTAT

Figure 8.1: Sugar Beet area in EU25

Even without considering the effects of the 2006 reform, sugar beet area has shown a declining trend. This is because on one hand there is a quota for sugar production in the EU, and on the other hand sugar beet yields have been slightly increasing over time (i.e. less beet area is needed to meet the quota). At the same time the strength of the Euro over the US dollar and low world sugar prices reduce the profitability of exporting C quota[12] sugar. As such, farmers are trying to just meet their quotas without overshooting.

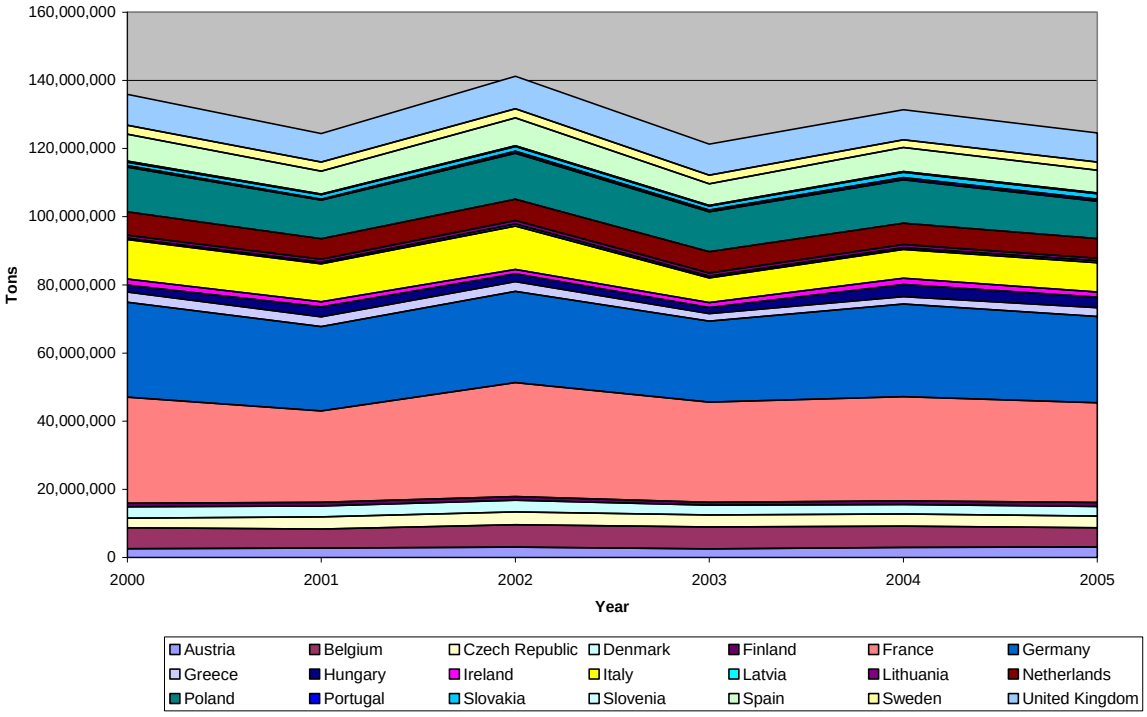
[12] C quota refers to any quantity of sugar produced in excess of A and B quotas. C sugar is not eligible for export refunds.



Source: Elaborated from FAOSTAT data

Figure 8.2: Sugar beet yields for the four largest producers in EU25

Poor growing conditions in 2001 resulted in a substantial drop in yield in EU25 (Figure 8.2), particularly in France (-20%), Germany (-14%) and the UK (-9%). In the UK a high incidence of the rhizomania beet disease also contributed to yields' reduction. Following area and yield reduction, sugar beet production in 2001 was substantially lower (-9%). In 2002 yields went back to normal level which, combined with a small increase in planted area, resulted in an increased production. Following the heat wave, yields were relatively low in 2003 (especially in Italy). As a consequence sugar beet production went down by almost 7% (Figure 8.3). Despite the further (small) reduction in plantings, production slightly recovered in 2004 because of good growing conditions.



Source: FAOSTAT

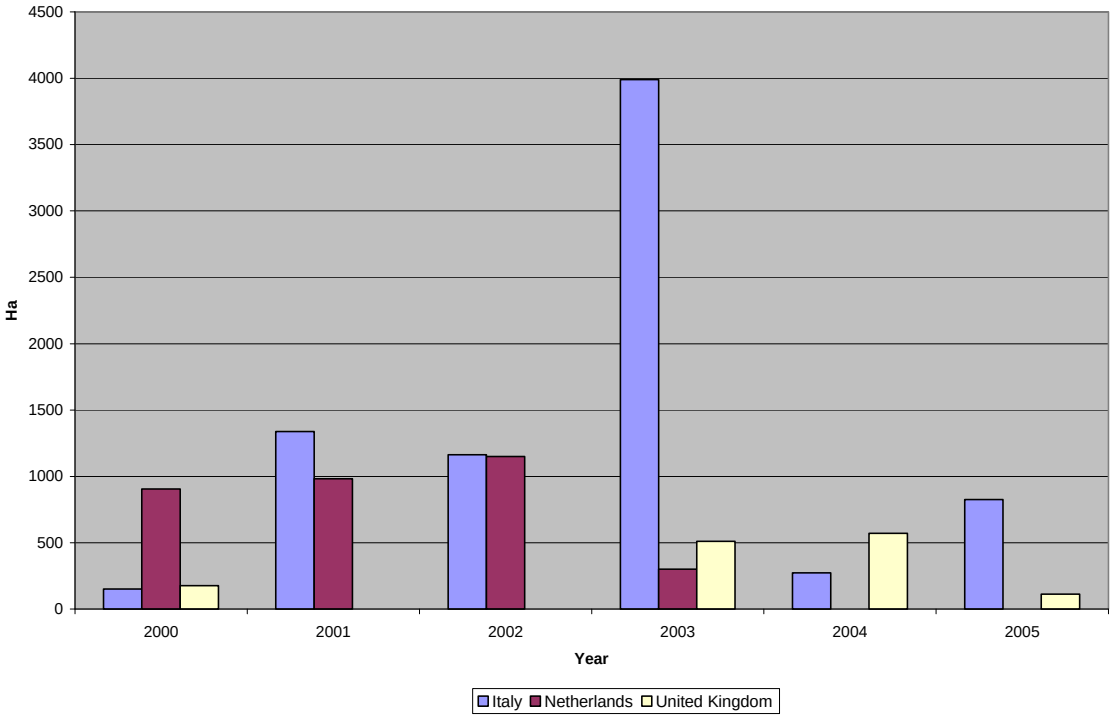
Figure 8.3: Sugar beet production in EU25 over 2000-2005

8.2 GM and Organic Sugar Beet

At present no GM sugar beet varieties are authorized or in the pipeline for cultivation in the EU. However GM HT sugar beet varieties have proved to achieve higher yields through better weed control (e.g. May, 2003). In the UK the benefits associated with the use of GM HT sugar beet have been estimated at £ 150/ha (around 225 €/ha at current exchange rates). In general there are great uncertainties about GM HT sugar beet in the EU. It appears that production of GM HT sugar beet varieties has just started in the US, and it is predicted that it will reach 80% of production in the next 3 years. In Europe sugar beet is mainly used for the production of sugar, and the resistance of the European consumers to buy GM products will play a crucial role in the adoption of GM HT sugar beet. If GM HT sugar beet is used for the production of bioethanol, consumers' resistance could be lower. However if the main manufacturers involved in bioethanol production are the same ones also involved in sugar production, then adoption of GM HT sugar beet for bioethanol production could be difficult in the EU.

On the other hand, organic sugar beet production is extremely limited in EU25, and destined to the production of sugar syrup to be integrated in organic food preparations. The most important Countries in terms of organic production are Italy, the UK, the Netherlands and Sweden (Figure 8.4). Even considering the 3,990 ha of organic sugar beet recorded in Italy in 2003, this still represents a mere 1% of the Italian sugar beet area in that year. In the other Countries illustrated in Figure 8.4, organic sugar

beet represented between 0.06-0.47% of total sugar beet area. Finally, when looking at Figure 8.4 it is important to bear in mind that the figures also include area under conversion.



Source: EUROSTAT

Figure 8.4: Organic sugar beet area (including area under conversion) in 4 EU Countries

8.3 Future developments

After the 2006 reform, sugar production in the EU will likely decline over the forthcoming years (European Commission, 2007). In accordance with the voluntary restructuring scheme, a few sugar factories have already been closed in the EU. Sugar production ceased in Ireland in 2006, with the closure of the Mallow's factory. Starting from 2007, Slovenia's only sugar factory will move towards ethanol production. All over the EU25 the least efficient sugar factories will be affected. In Italy the closure of 13 out of 19 sugar factories has been announced. Spain and Greece have also announced the closure of a sugar plant (the Azucarera Ebro in Ciudad Real and the EBZ plant in Xanthi respectively). Plants closure will have a knock on effect on sugar beet cultivation in these Countries.

Another important factor that will affect sugar beet production is biofuels demands. EC Directive 30/2003 sets a guideline for biofuels to account for 5.75% of all transport fuels by 2010, while a European Council decision in March 2007 set a target of 10% for biofuels share of all transport fuels by 2020. At the same time, under the Kyoto Protocol, the EU has committed to an 8% reduction in carbon dioxide emissions by 2012. Sugar beet (together with wheat) could become a source of bioethanol production in the EU. If on one hand the 2006 reform is likely to have a negative effect on

sugar beet area for sugar production and therefore negatively affect feedstock availability for bioethanol production, other considerations must be made in this respect. First, the 2006 reform will also substantially reduce the EU export capability (i.e. more sugar will be available on the internal market). Second, following the 2006 reform sugar beet qualifies for the set-aside payment when grown as a non-food crop and for energy crop aid of 45 euros/ha (on non set-aside area). Also, sugar produced for bioethanol is not included in the quota.

The consequences of the (eventual) introduction of GM HT sugar beet varieties are extremely uncertain. Experts in Italy and France are very cautious. Most sugar beet production suffers from weed problems which are expensive to control and therefore beet growers could benefit financially from the introduction of GM HT varieties. In the US, where sugar from GM beet does not require special labelling, the number of sugar plants accepting GM beets is increasing. In the EU however, adoption will depend on market acceptance, measures and costs for coexistence and consumers attitudes. Since sugar is extensively used in foods, the sugar manufacturers are extremely sensitive to the attitudes of European consumers and to competition from cane sugar which is currently non-GM in origin. If sugar beet were used for bioethanol production, consumer resistance would be lower. However adoption of GM varieties may not necessarily be easier as the manufacturers involved in bioethanol production will be the same ones involved in sugar production.

To conclude, the area of sugar beet in EU25 is expected to decrease over the medium term, as a result of the sugar reform, particularly in the least competitive regions. On the other hand sugar beet production could remain viable in the most competitive regions, mostly located in France, Belgium and parts of Germany, following restructuring of the sugar industry. Domestic use of beet sugar is expected to increase due to biofuel demand and increased competitiveness (i.e. expected price reduction) compared to other products like cereals' isoglucose. Concerning the use of GM HT sugar beet varieties, despite their positive effect on weed management practices, significant uncertainties remain about their effective adoption. Such uncertainties mainly reflect market acceptance from the sugar industry and final consumers.

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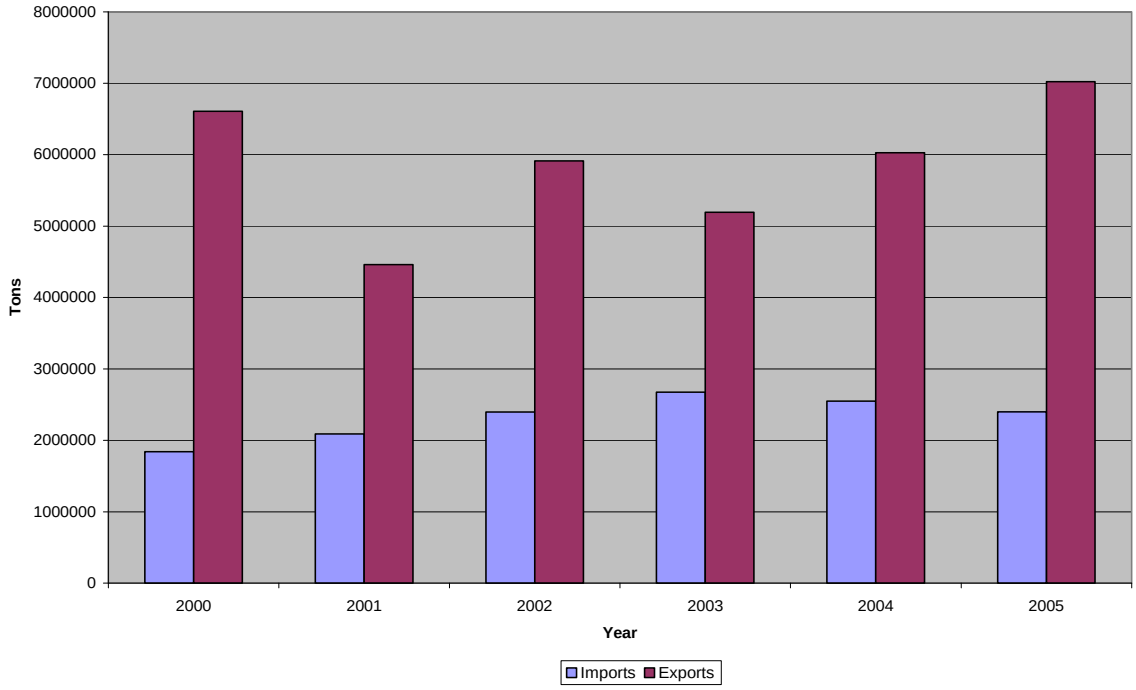
Chapter 9 Sugar Beet Trade in the EU

9.1 EU Sugar Trade

EU trade in sugar beet is almost inexistent. Given the high custom tariffs, EU mainly imports raw sugar for refining. Import of sugar into the EU consists mostly of preferential imports (either duty free or reduced duty) from African, Caribbean and Pacific (ACP) Countries. This provides the EU with a stable supply of raw materials for its sugar refineries and provides ACP countries with a steady income. Since imports are highly regulated, wide year to year fluctuations are not usually observed (Figure 9.1).



Source: FAS/USDA

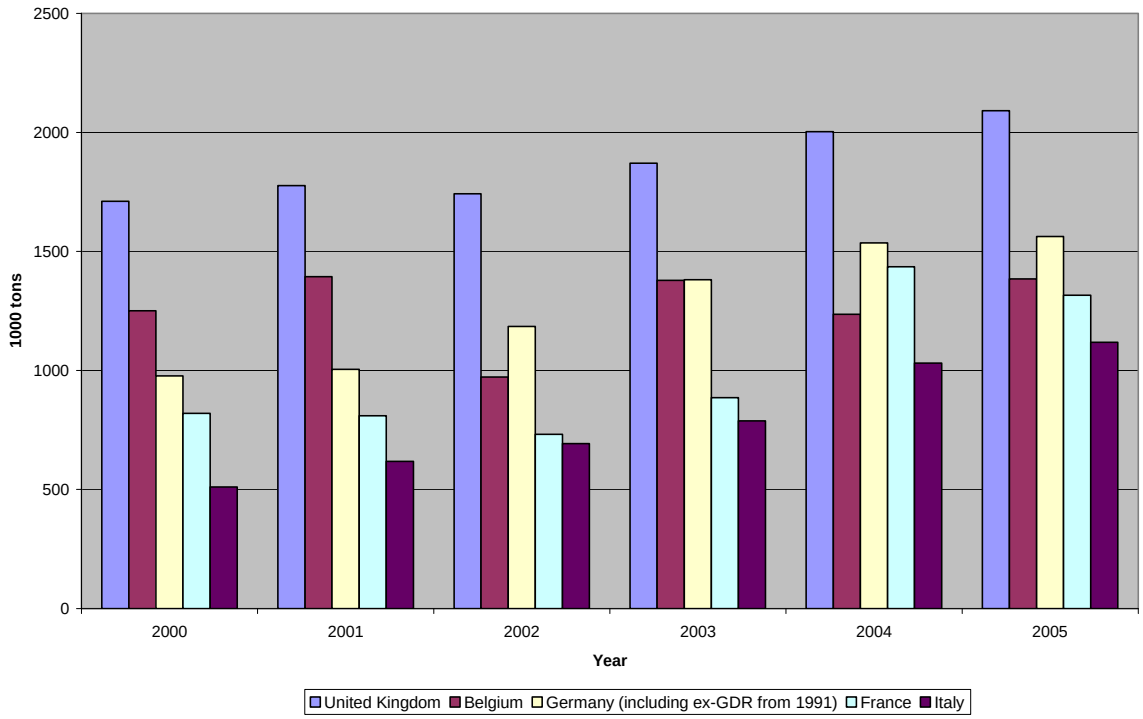
Figure 9.1: Sugar trade (raw and refined) in EU

In 2001 the 'Everything But Arms' (EBA) proposal was adopted (EC Regulation 416/2001). This provided for a progressive liberalization (i.e. elimination of tariffs) for imports from the 48 Least Developed Countries (LDC) starting in 2006, with full liberalization in 2009 (-20% in 2006, -50% in 2007, -80% in 2008). However, in practice the EBA agreement will have little effect since 39 of the 48 LDC Countries are also ACP Countries and therefore already enjoy preferential access to the EU market.

Figure 9.1 illustrates total sugar imports in raw sugar equivalent. Figures for 2000 and 2001 are slightly smaller since they refer to EU15. Aggregated data for EU25 prior to 2002 are not available.

However, analysis of USDA data indicates that (for imports) the order of magnitude of the difference between EU25 and EU15 is around 500,000 tons.

As already mentioned EU25 mainly imports raw sugar for refining. Figure 9.2 illustrates total sugar imports (raw and refined) by four Countries in EU25. Notice that these figures also include imports from other EU25 Member States.



Source: EUROSTAT

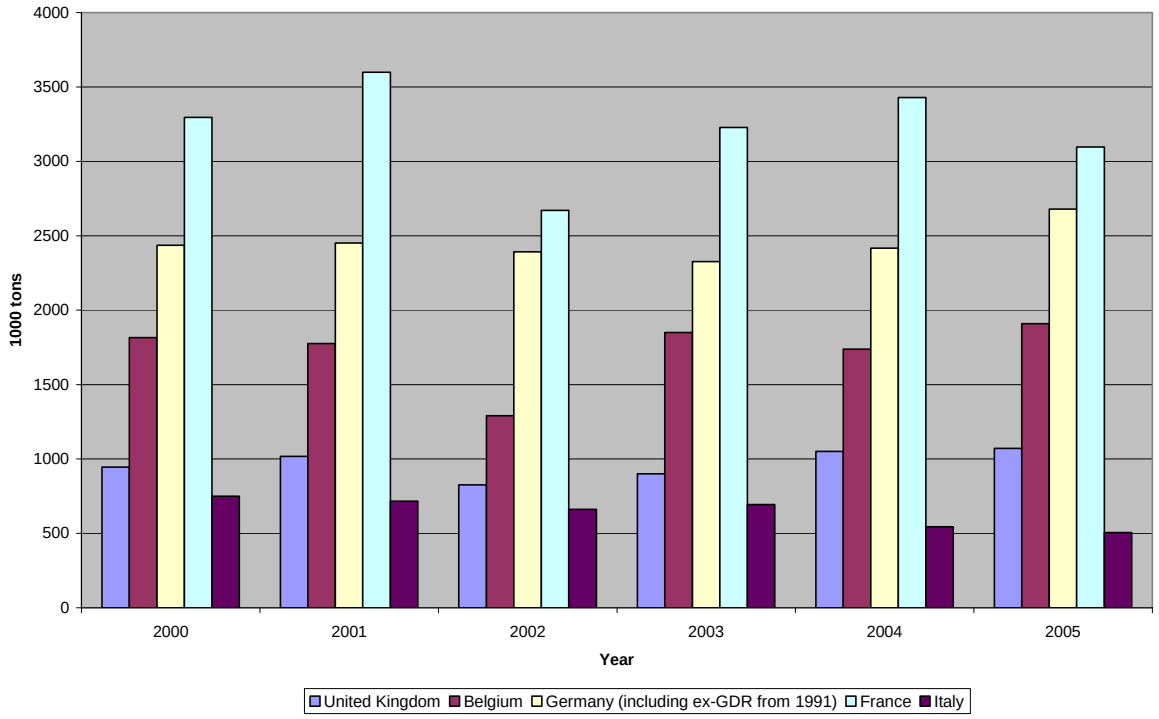
Figure 9.2: Total sugar (raw and refined) imports (including intra-EU) for the 4 main EU Countries

By far the UK is the largest importer of raw sugar in EU25. Of its 1.3 million tons of raw sugar imported in 2004, 0.466 million tons originated from Mauritius, 0.173 million tons from Fiji, 0.135 million tons from Jamaica and 0.1 million tons from Guyana (FAOSTAT). Notice that in 2001 and 2002 significant quantities of refined sugar were imported from Balkan Countries (mainly Serbia and Montenegro and Croatia) following the (temporary) allowance of duty free access into the EU[13].

EU mainly exports refined sugar. Traditionally EU exports to third Countries consisted of both subsidized and unsubsidized sugar. Subsidized sugar referred to part of A and B quotas that could not be internally absorbed. Subsidies are financed through a levy on producers. The GATT/WTO set ceilings on the volume of subsidized sugar exports and on the value of subsidies (since 2001 the limit

is 1.3 million tons of sugar for a subsidy value of 499.1 million Euros)[14]. C sugar was traditionally exported without subsidies. However, following the WTO ruling (see footnote 11), no new export licenses for C sugar have been issued after 22 May 2006.

Exports were quite high in 2000 because of relatively higher prices on the world market and increased C sugar supply (following a cut in A and B quota). Poor harvest in 2001, on the other hand, reduced C sugar supply and consequently exports. Because of the elimination of C sugar exporting licenses, 2005 is likely to be the last year of large EU sugar exports. Following the sugar reform adopted in 2006 (EC Regulation 318/2006), EU sugar exports are likely to go down. The largest exporters (of refined sugar) in EU25 are France, Belgium, Germany and the UK (Figure 9.3). Notice that data in Figure 6.3 refer also to exports within the EU25. The main destinations outside EU25 are Algeria (e.g. in 2004, 0.129 million tons from Belgium and 0.165 million tons from France), Syria (e.g. in 2004 0.243 million tons from Belgium and 0.194 million tons from France), Israel (e.g. in 2004 0.23 million tons from the UK and 0.157 million from Belgium) Switzerland (e.g. in 2004 0.128 million tons from Germany) and United Arab Emirates (e.g. in 2004 0.115 million tons from Germany).



Source: EUROSTAT

[13] The preferential access was suspended in 2003, following fraud concerns. In 2005 the EU introduced a Tarif Rate Quota (TRQ) for imports from Balkan Countries (i.e. Serbia and Montenegro, Bosnia and Herzegovina and Albania).
[14] Traditionally these figures did not include exports for an amount equivalent to preferential imports. However this has recently changed following the WTO panel decision on 28 October 2005.

Figure 9.3: Total sugar (raw and refined) exports (including intra-EU) from the 4 EU Countries[15]

Consulted documents

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USDA FAS, 2005a. GAIN Report E35225. EU25 – Sugar: EU agrees sugar reform.

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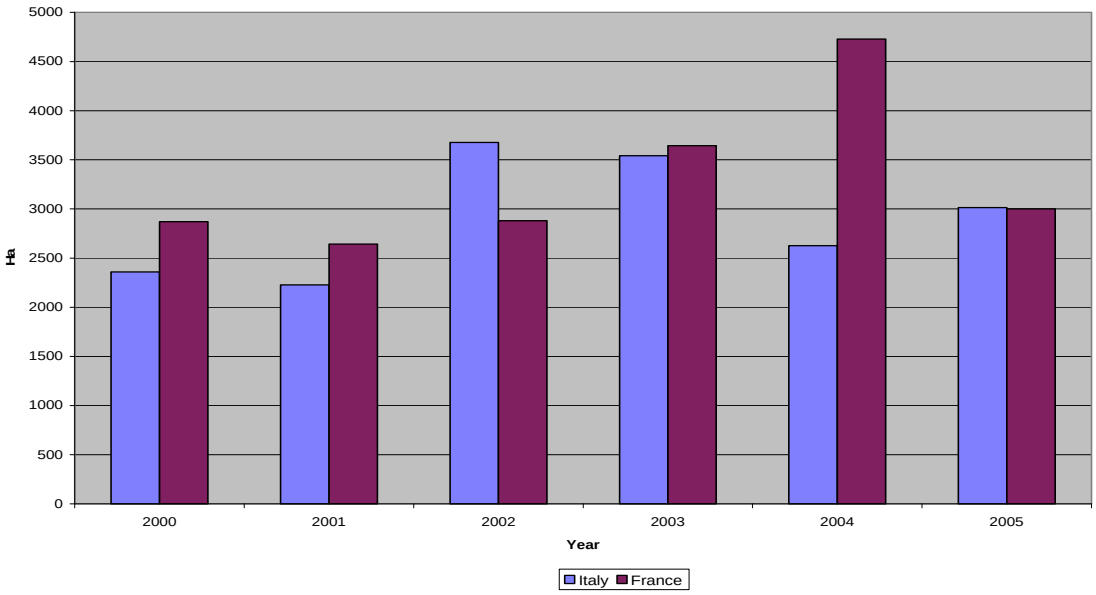
http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL

[15] The data in figure 2 refer to total sugar exports (i.e. raw and refined). However, the largest majority of export is made up by refined sugar.

Chapter 10 Sugar Beet seed production and trade in the EU

10.1 Sugar beet seed production

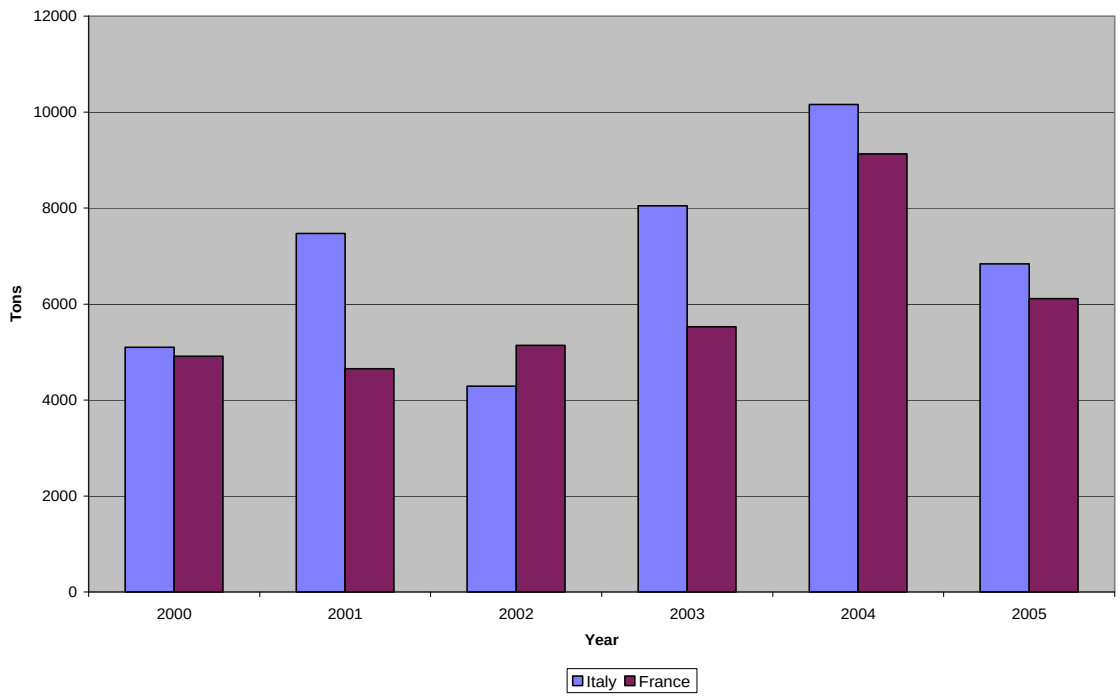
Figures 10.1 and 10.2 illustrate the area and the volume of certified sugar beet seed production in France and Italy. These two Countries are the major producers of sugar beet seeds in the EU. Notice that the data do not include fodder beet. However the area for fodder beet seed production ranged between 92-170 ha in Italy and 48-79 ha in France during 2000-2005.



Source: ESCAA, ENSE

Figure 10.1: Certified area for sugar beet seed production

The area of sugar beet seed production in France has been relatively stable at around 3,000 ha with a peak in of 4,728 ha in 2004. Similarly in Italy one can observe two peaks in the years 2002 and 2003 (3,678 and 3,542 ha respectively). In both cases the expansion in seed area seems to be related to high demand in the German market (see section on trade). When looking at the data on volume of certified seeds, it is necessary to be cautious, since the amount of certified seeds does not necessarily represent seed production in one year from the certified area. Indeed it can include imported seeds and seeds produced in previous years. This is well illustrated by the peaks in certified seeds production observed in Italy in 2003 an 2004, despite some reduction in the area of certified seeds.



Source: ESCAA and ENSE

Figure 10.2: Volume of certified seeds

In Italy the production of certified sugar beet seeds is mainly in Emilia Romagna, in Northern Italy. This region accounted for 99% of the sugar beet seed certified area in 2005. In particular production is concentrated in the four districts of Bologna, Ferrara, Forli' and Rimini. The sugar beet crop, on the other hand, is grown in many other regions in Italy including Lombardia, Piemonte, Marche, Abruzzo and Molise (see Figure 10.3). Sugar beet production is clearly concentrated in those regions where sugar factories are situated. The reasons behind the localization of sugar beet seed production in Emilia-Romagna are climatic and institutional/organizatonal, due to the presence of well-established and well organized companies (4-5 seed companies) and experienced seed farmers. Certified seed production accounts for all the seeds used in sugar beet production in Italy, since no farm-saved seeds are used in this sector. No information about the production of organic sugar beet seed is available for Italy, but this kind of production is likely to be very small. Italy is certainly an important area (together with France) for the multiplication of sugar beet seed in the EU, accounting for about 50% of seed production.

In France the production of sugar beet seed is concentrated in the South-West, South-East, Centre and some regions in the West, while crop production mainly occurs in the North of France. A detailed analysis on seed production in France is presented in section 3.

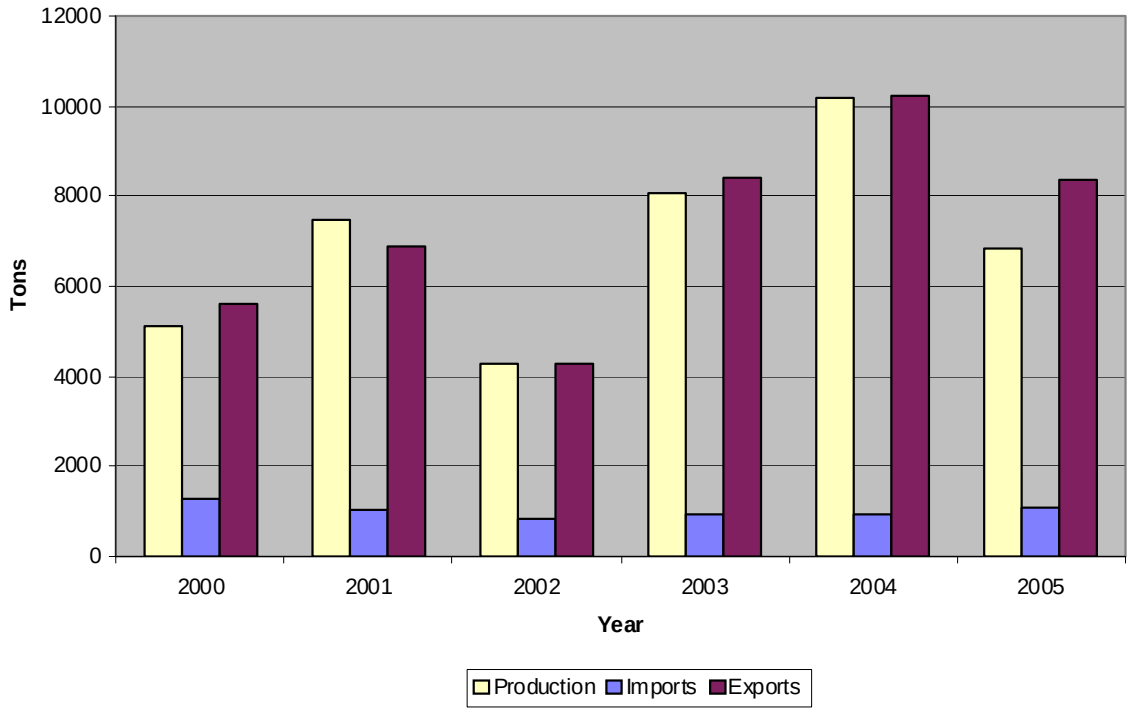
Figure 10.3: Regions of Italy

With respect to the future, the reform of the sugar regime is clearly affecting sugar production in the EU, with declining areas dedicated to sugar beet. This will invariably also affect the seed sector. The conversion of sugar plants into bioethanol plants could provide a stimulus to the sector.

10.2 Sugar beet seed trade

With respect to sugar beet seed trade, it is evident that Italy is a net exporter of seeds (Figure 10.4). However, Italy also imports seeds and an analysis of the COMEXT database indicates that all the seeds imported into Italy originate in other EU countries. In particular Germany (582 tons in 2005), the UK (206 tons in 2005), Belgium (101 tons in 2005) and France (98 tons in 2005) are the main

suppliers. However, Germany, the UK and Belgium are not initial producers of sugar beet seed and it is likely that the origin of such seeds is France. France multiplies new varieties and breeding lines for Northern European plant breeders. This seed is sent to Northern Europe for testing, rubbing, grading and seed coating and pelleting and is then sent to Italy for multiplication as certified seed. In addition some Italian seed is sent North for processing and pelleting and then re-imported.



Source: ENSE, ESCAA and COMEXT

Figure 10.4: Production and trade of sugar beet seeds in Italy

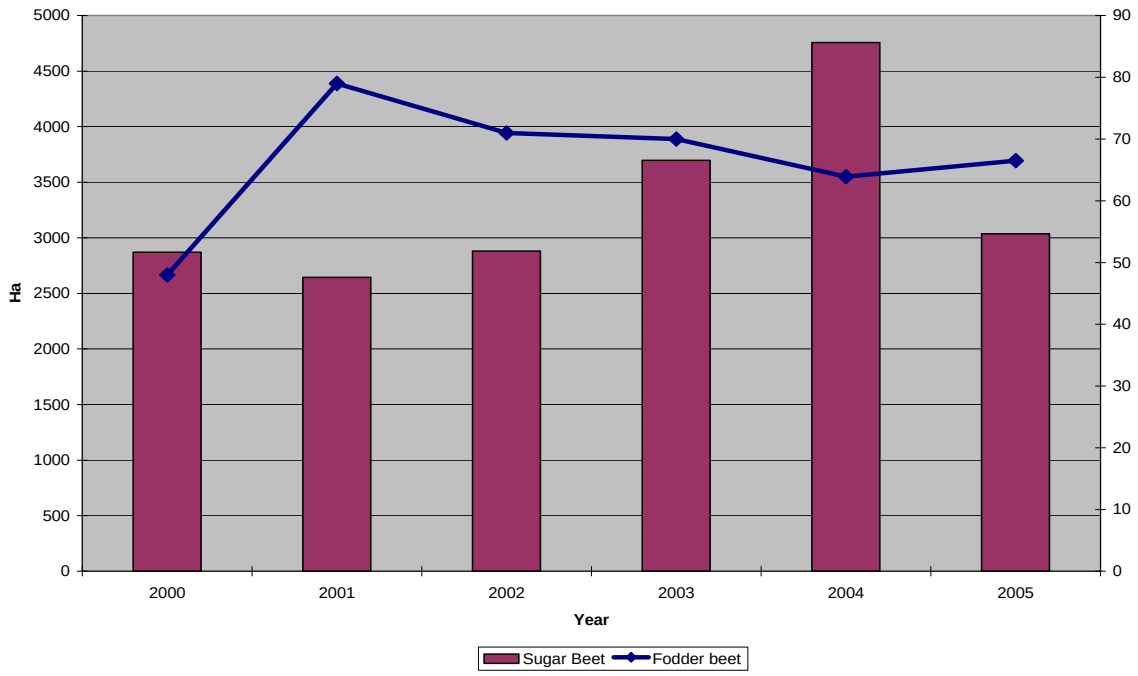
With respect to Italian sugar beet seed exports it appears that the main destinations are other EU Countries, in particular Germany (around 4,300 tons in 2005), Belgium (around 2,000 tons in 2005) and Denmark (around 1,300 tons in 2005). French seed exports are mainly orientated towards other EU countries as described in 10.3

10.3 Case study: sugar beet seed production in France

10.3.1 Production and trade

France has the largest area dedicated to sugar beet seed production in the EU. Figure 10.5 shows that the area of fodder beet seed production is negligible (between 50-80 ha over the period 2000-2005). The area of sugar beet seed production in France has been relatively constant over the period 2000-2005, with a peak in 2004. Discussion with experts suggests that such fluctuations are normal and do not reflect any particular trend. In fact, despite the reduction in the area of sugar beet crops in France,

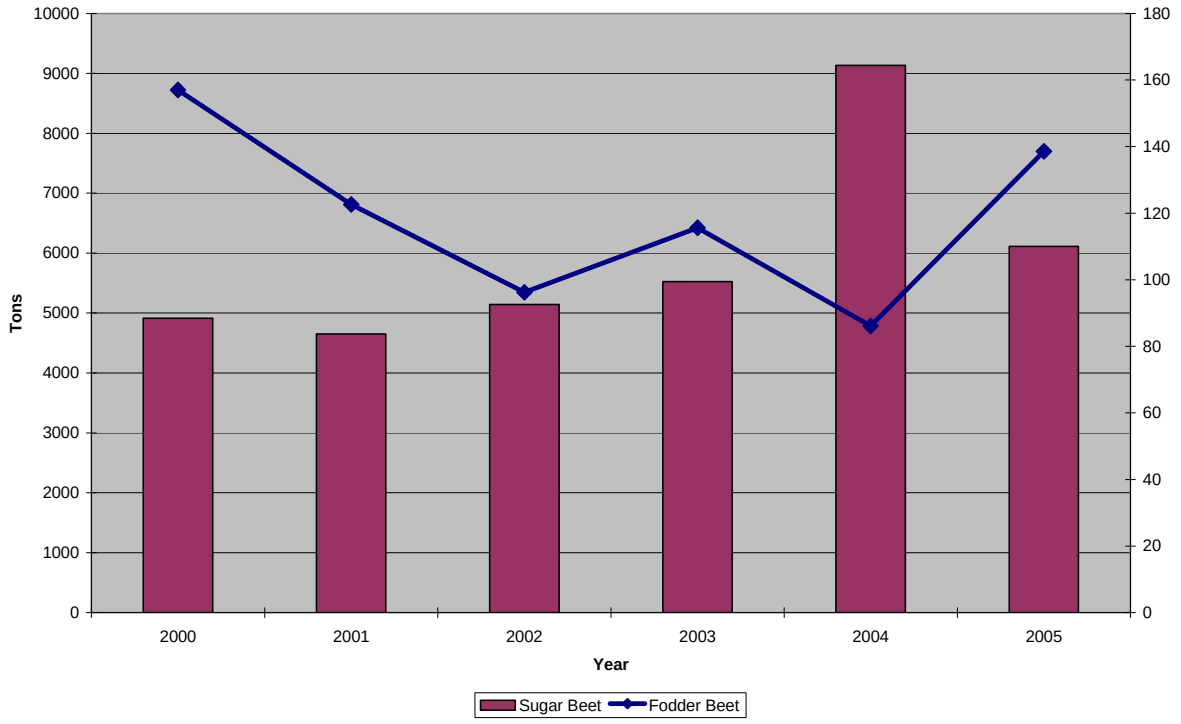
seed production has been relatively stable. This is due to the fact that French production is highly oriented towards the export market (around 80% of French seeds are exported). All the seed multiplication (even for Eastern Europe) is carried out in France and Italy.



Source: ESCAA and GNIS

Figure 10.5: Area of conventional sugar beet and fodder beet seed production in France

Figure 10.6 illustrates the production of sugar and fodder beet seeds. The changes in the production volume reflect the changes in the production area. Notice that Figures 10.5 and 10.6 only refer to conventional certified seeds and do not include organic seeds. In addition the data also include a small fraction basic seeds. For example, in 2004, the data reported in Figures 10.5 and 10.6 also include 44 ha of basic seeds (i.e. less than 1%) for a production of about 17 tons (less than 0.2%).

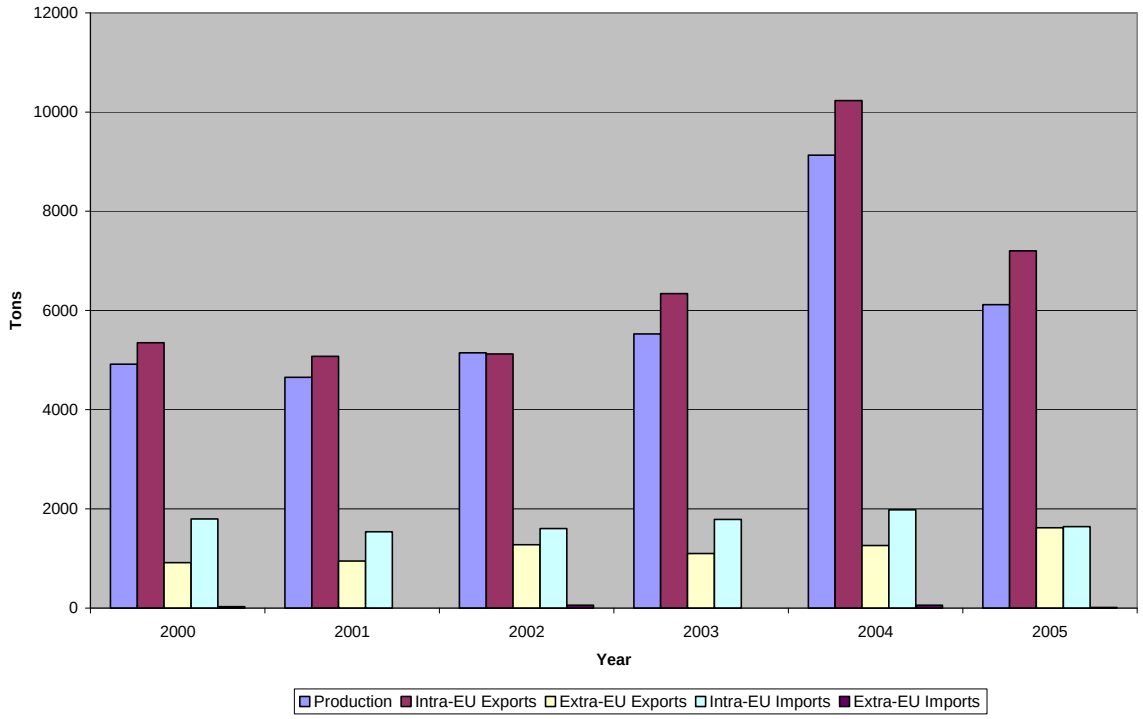


Source: ESCAA and GNIS

Figure 10.6: Volume of certified sugar beet and fodder beet seed production in France

France is essentially an exporter of sugar beet seeds (Figure 10.7). Most of the French sugar beet seed production is destined to the EU market. An analysis of GNIS data indicates that the main destination of French sugar beet seeds within the EU is Germany (around 5,400 tons in 2004) and the Netherlands (over 1,200 tons in 2004). With respect to Third Countries destinations, in 2004 Russia received around 410 tons and Magreb around 410 tons.

France imports relatively small quantities of sugar beet seeds. Most of the imports originate in the EU. In 2004 the main sources were Germany (around 750 tons) and Italy (around 750 tons). Germany is not an initial producer of sugar beet seeds and therefore the origin of such imported seeds could be Italy or France itself (e.g. re-imports).



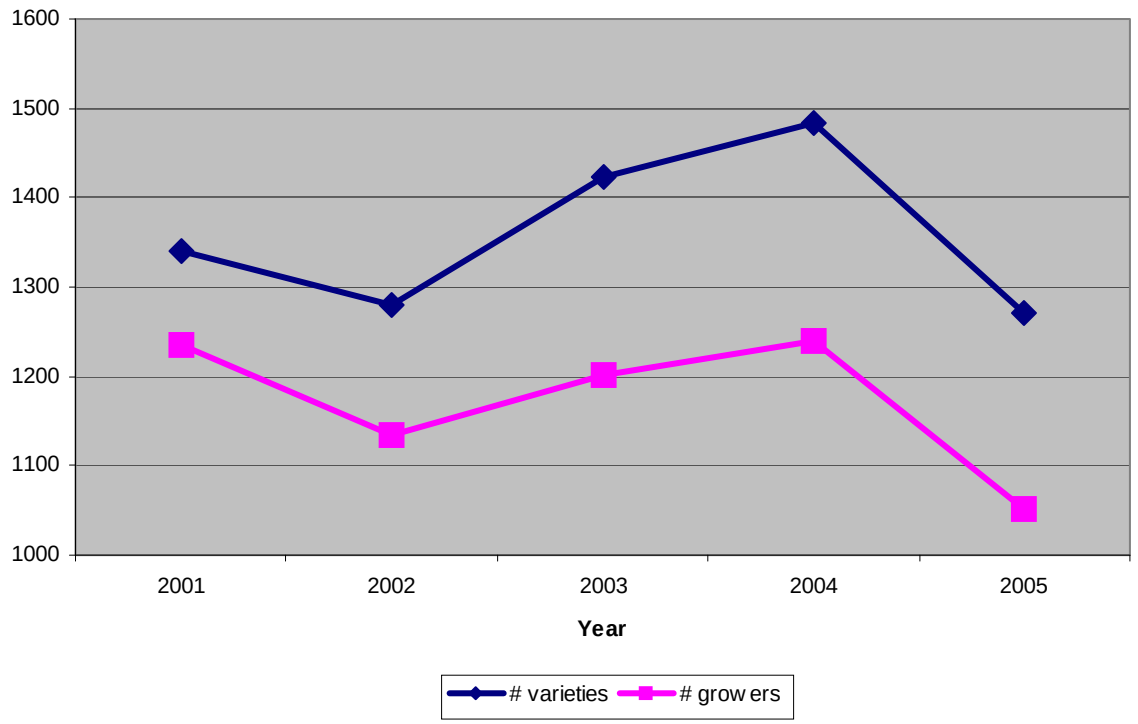
Source: ESCAA, GNIS and COMEXT

Figure 10.7: Production and trade of sugar beet seed in France

10.3.2 Organization of Production

The organization of sugar beet seed production mainly involves the companies who own the genetic material (i.e. the breeders) and the farmers. The figure of an intermediary is therefore absent. In France there are at present 5 breeders of sugar beet who directly contact seed growers, offering contracts. The sugar beet seed farmers represent a relatively stable group.

When looking at the number of sugar beet varieties, no significant trend appears (Figure 10.10). Over the period 2001-2005 (data for 2000 were not reported) the number of varieties ranged between 1270-1340. Also the number of sugar beet seed growers has remained relatively stable between 1051-1239 (see Figure 10.8). Despite this, it is possible to observe a correlation between the number of varieties grown and the number of growers. This is indicative of a system of production management in which the number of growers can vary according to the production exigencies. In fact the number of varieties grown by each grower has been extremely stable at between 1.1-1.2 during the period 2001-2005, with an average area of 2-3.2 ha per each variety. The average area of sugar beet seed production is also very small, in the range of 2.1-3.8 ha per grower. However, 11% of seed production in 2005 occurred on area smaller than 0.5 ha. This is because sugar beet seed production is traditionally very intensive and very small areas can produce sufficient seeds for a large number of varieties.



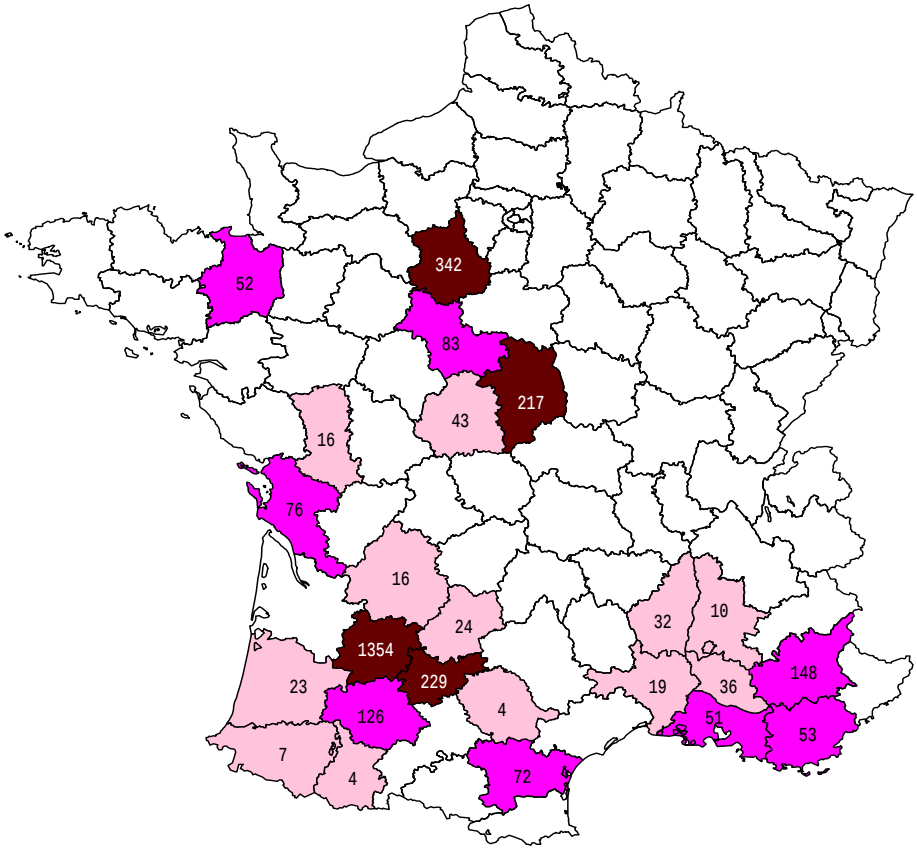
Source: GNIS

Figure 10.8: Number of sugar beet seed varieties and growers in France

10.3.3 Regional analysis

Sugar beet seed production in France is concentrated in the South-West, South-East, Centre and West. The most important producing regions are Lot-et-Garonne (1,354 ha in 2005), Eure-et-Loir (342 ha in 2005), Tarn-et-Garonne (229 ha in 2005) and Cher (217 ha in 2005). These four Departements accounted for about 70% of the area of conventional certified sugar beet seeds in France in 2005 (Figure 10.9).

By contrast, sugar beet production is concentrated mainly in the North of France. As such there is a separation between seed and crop production. The areas of sugar beet seed production have remained unchanged over the period 2000-2005 because of climatic conditions and organizational reasons. In addition, the regional distribution of sugar beet seed production reflects the distribution of experienced farmers.

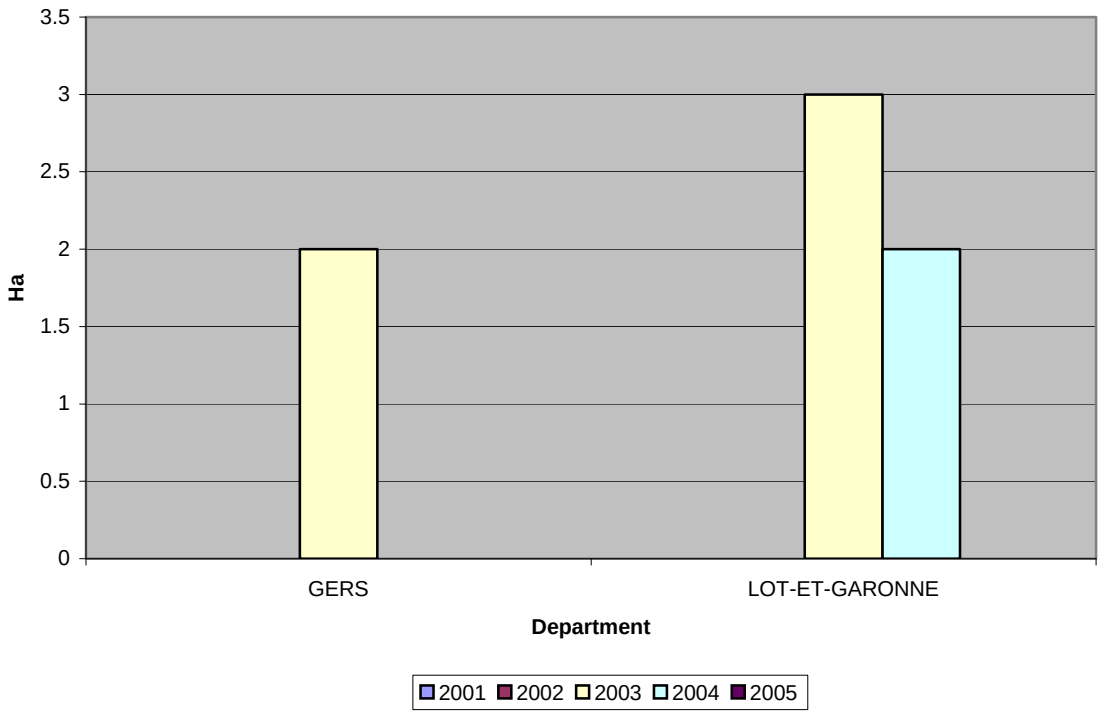


Source: GNIS

Figure 10.9: Distribution of sugar beet seed production in France in 2005

10.3.4 GM and organic sugar beet seed production

There is currently no organic sugar beet seed production in France (Figure 10.10). Very limited production has taken place in the past (for a total of 5 ha in 2003) in the Departments of Gers (in 2003) and Lors-et-Garonne (in 2003 and 2004), but it has been discontinued.



Source: GNIS

Figure 10.10: Regional distribution of organic sugar beet seed production in France

There is no commercial GM HT sugar beet seed production as no varieties have been authorized in the EU and as such no crop production is currently taking place. In general there are great uncertainties about GM HT sugar beet in the EU. It appears that production of GM HT sugar beet varieties has just started in the US, and it is predicted that it will reach 80% of production in the next 3 years. In Europe sugar beet is mainly used for the production of sugar, and the resistance of the European consumers to buy GM products will play a crucial role in the adoption of GM HT sugar beet. If GM HT sugar beet is used for the production of bioethanol, consumers' resistance will be lower. However if the main manufacturers involved in bioethanol production are the same ones also involved in sugar production, then adoption of GM HT sugar beet for bioethanol production could be difficult in the EU.

Acknowledgments

We would like to thank the following people for participating to the meeting held at GNIS in Paris on 19th April 2007: P. Gracien (GNIS Manager), M.F. Cazalere (Head of SOC, GNIS), P. Silhol (GNIS statistics), B. Fabre (GNIS, corn seed certification), D. Daviot (GNIS, corn seed sector), M. Monjarret (GNIS, sugar beet certification), J.D. Arnaud (GNIS, sugar beet sector), A. Toppan (SEPROMA, corn seed company), X. Ballenghien (SFPGB, sugar beet seed companies association), J.M. Sengenes (FNAMS, seed growers association), P.Coquin (FNPSMS, corn seed association), L. Nardi (FNAMS, seed growers association), G. Sicard (FNAMS, seed growers association), D.Gillard (FNAMS, seed

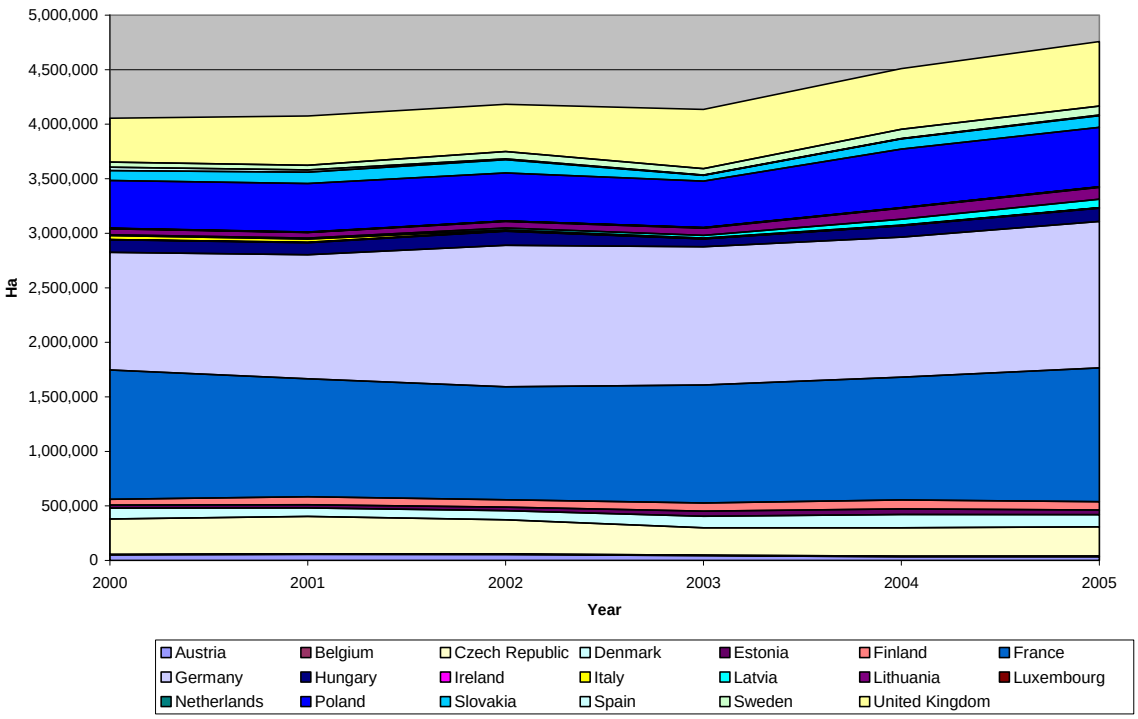
growers association), B. Rossi (FNAMS, seed growers association) and G. Faure (OLEOSEM, oil seed plant companies association).

For the information concerning sugar beet seed production in Italy, we would like to thank the participants to the meeting held at the Italian Ministry of Agriculture (MIPAAF) in Rome on 15th May 2007, Mr. M. Vilardi (MIPAAF), Mr. M. Desantis (MIPAAF), Mr. A. Manzo (MIPAAF), Mr. M. Nardi (Italian Seed Association, AIS), Ms. Elena Perri (ENSE), Mr. F. Golinelli (ENSE) and Mr. D. Strazzulla (MIPAAF).

Chapter 11 Oilseed Rape Production in the EU

11.1 Conventional OSR grains

Over the period 2000-2005 the OSR area has registered an increase from 4 to 4.7 million ha, with a marked increase after 2003 (Figure 11.1). The largest producers in 2005 (in terms of crop area) in the EU were Germany (1.3 million ha), France (1.2 million ha), the UK (0.6 million ha), Poland (0.5 million ha) and the Czech Republic (0.25 million ha). These five Countries accounted for over 80% of total EU OSR area in 2005.



Source: FAOSTAT

Figure 11.1: OSR area in EU 25

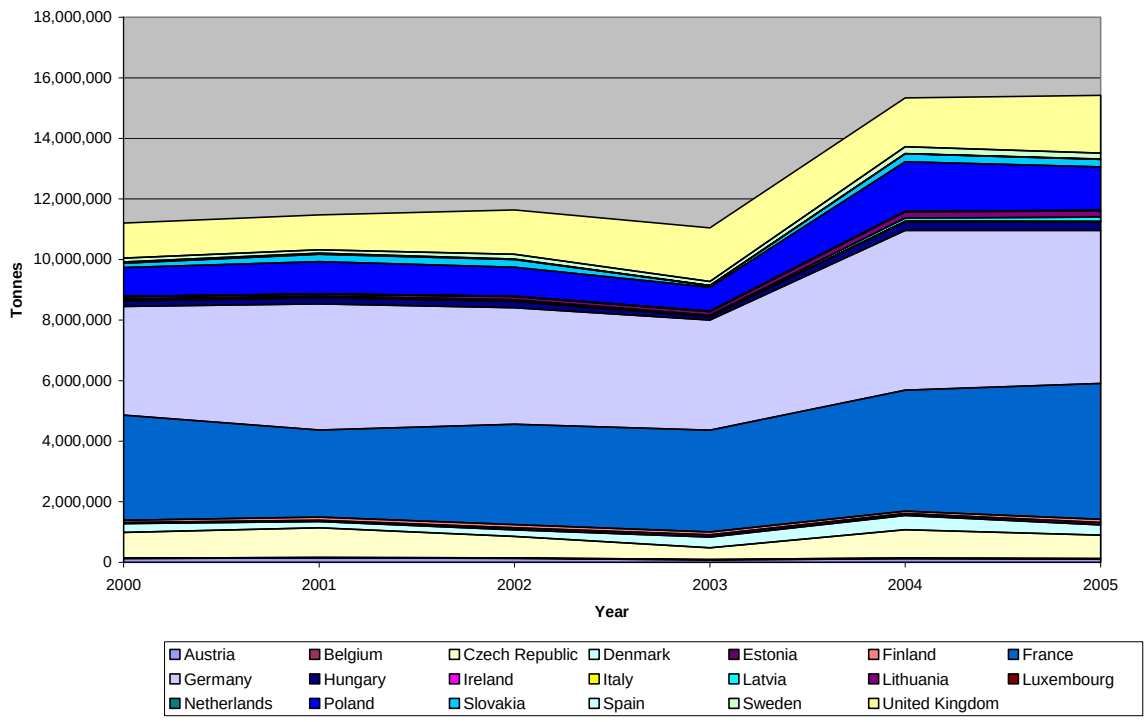
In analyzing the main developments in OSR production in the EU, it is necessary to take into account two important political factors: the Agenda 2000 reform of the CAP and the increased support for biofuels production. A thorough discussion of the Agenda 2000 reform is beyond the scope of this study, but it is sufficient to say that the reform provides for a gradual reduction in compensation payments for oilseeds, reaching 63 Euros/Ton from marketing year 2002/03 (in line with cereals' payments). For the period 2000/01 and 2001/02 payments were of 81.74 Euros/ton and 72.37 Euros/ton respectively.

In 2003, the European Parliament and Council adopted Directive 2003/30 on the promotion of the use of biofuels and other renewable fuels for transport. The Directive established (non-mandatory) targets

of 2% biofuels use by 2005 and 5.75% by 2010. At the same time, the Directive on taxation of energy products (EC Directive 2003/96 and subsequent amendments) provides a legal framework for different taxation of biofuels. Several MS have introduced partial tax rebates for biofuels.

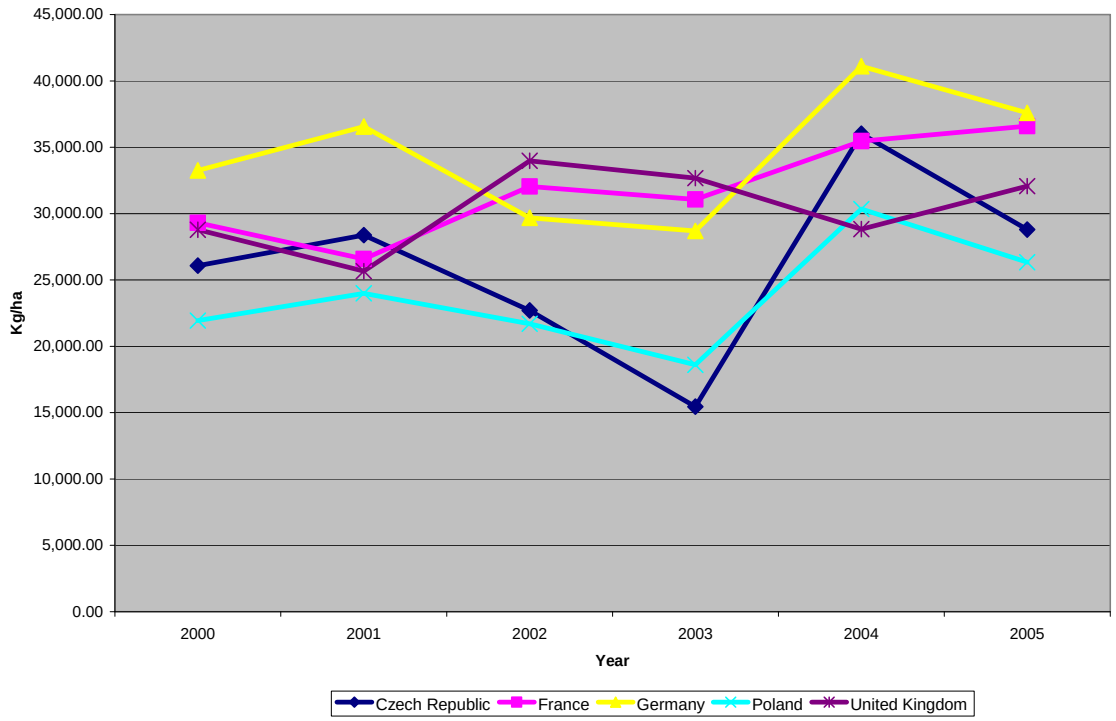
OSR area remained almost constant in EU 25 over the period 2000-2003 and increased over the period 2004-2005, partly because of the increase in biodiesel production. However different dynamics in the main producing countries can be identified. In Germany the area of OSR increased from 1.078 million ha in 2000 to 1.138 million ha in 2001 (+ 5.6%) and to 1.297 million in 2002 (+7.7%) and remained stable subsequently. The area expansion occurred despite the reduction in compensation payments (resulting from the implementation of Agenda 2000). High demand from the food industry[16] and from biofuels plants in Germany pushed prices up higher than cereals so that the price increase more than compensated the reduction in compensation payments. In France the reduction in OSR area begun in 2000 when 1.186 million ha were harvested (-10% compared to 1999) because of cuts in compensation payments and low producer prices. This decline continued in 2001 and 2002 (only 1.083 million ha and 1.036 million ha were harvested) when rapeseed oil prices went down. However rapeseed meal prices remained firm and as a result, the decline in oilseed prices was limited. In 2001 industrial rapeseed (mainly for biodiesel) already represented 25% of the production in France (i.e. around 0.28 million ha). In Poland, after a reduction in 2003 (from 0.439 million ha in 2002 to 0.426 million ha because of poor autumn weather that affected plantings) the OSR area increased significantly to 0.534 million ha in 2004 (+26%) because of higher producer prices in the previous year (due to low production) and anticipated higher profitability from EU accession. In Czech Republic OSR area decreased over the period 2001-2003 (from 0.324 million ha to 0.312 million ha). This was due to low producer prices due to excess of supply in previous years.

[16] Given the mandatory labelling requirements for oil derived from GM soybean, the food industry has partially switched to alternative oils, including rapeseed oil.



Source: FAOSTAT

Figure 11.2: Production of OSR (Tons)



Source: FAOSTAT

Figure 11.3: OSR Yield

Crop production in the EU (Figure 11.2) reflects the changes in the area and yields (Figure 11.3). Figure 11.2 illustrates a drop in EU 25 production in 2003. In general this was due to winterkill and

dry weather across much of Europe during the early spring as well as very hot and dry conditions during the summer. By contrast, area expansion (as discussed above) and good yields explain the increase in production recorded in 2004.

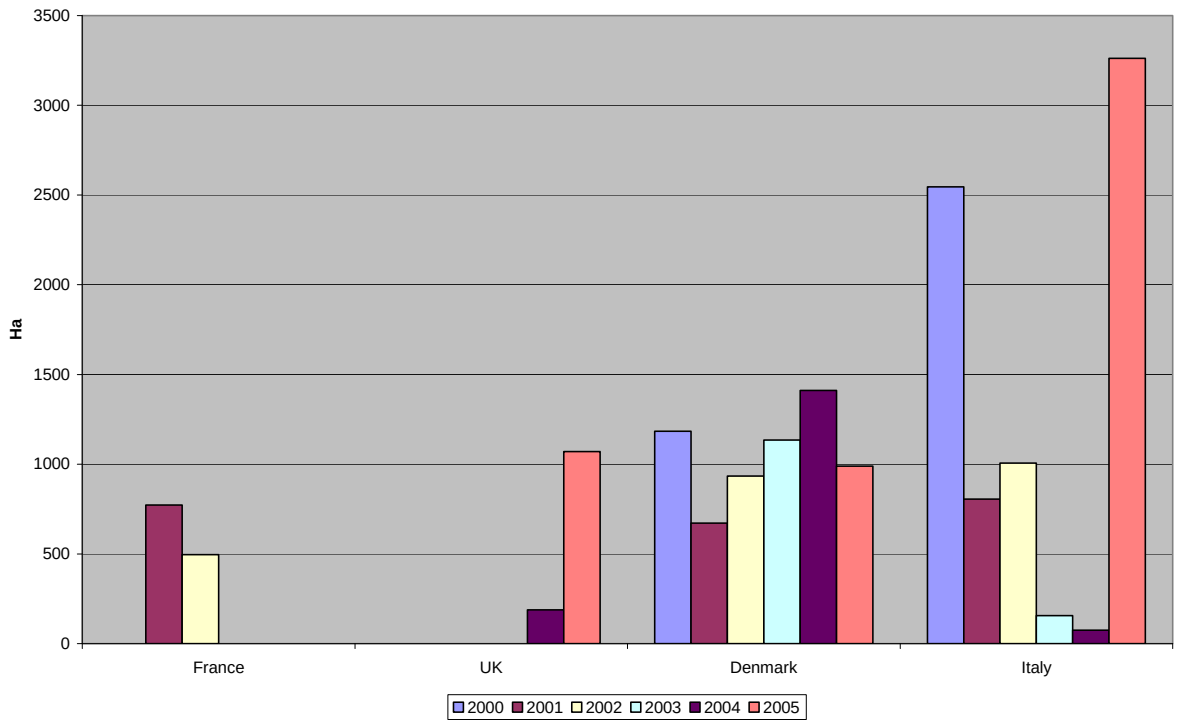
In order to better understand the factors behind the changes in production volumes, a more detailed analysis of OSR yields in the main producing countries of the EU is necessary. In Germany a relatively good growing season in 2001 (i.e. good yield due to favorable weather) was followed by a poor season in 2002, when heavy rains and a flooding in August substantially reduced yields. In 2003 yields were further reduced because of a summer draught. On the contrary exceptional yields have been recorded in 2004 because of low winter kill and good growing conditions in spring and summer. The 2005 yield was still above the five-year average, but lower than 2004, due to low temperatures that delayed crop development in the spring. Night frosts and too little precipitation in April caused some damage but the crop was able to recover because of a good spring. Also more extensive cultivation of hybrid varieties helped to maintain yields.

In France a low yield in 2001, due to unfavorable weather, was followed by an excellent 2002. The increase in the yield allowed for a 16% increase in production despite the reduction in planted area (see figures 11.1 and 11.2 and discussion above). In 2003 yields were somewhat limited by sever drought, while in 2004 and 2005 yield increased because of favorable weather (i.e. the dry conditions in 2005 suppressed disease levels). In the Czech Republic yields were particularly low in 2003 because of severe frost over winter and dry spring, while good weather conditions boosted yields in 2004. In Poland average yield was also particularly low in 2003. This was partially due to high winter killings, late spring and dry conditions at the end of April and beginning of May. On the other hand the increase in spring rape sowing (to compensate for low winter rape establishment due to bad weather in the autumn) also contributed to bring average yields down. On the other hand, good weather conditions during the whole growing season boosted yields in 2004.

11.2 GM and organic OSR grains

At present no GM OSR is being commercially grown in EU 25. However two HT varieties (developed by Bayer and by Monsanto) have been approved for imports and feed use in 2005. GM HT varieties are not designed for higher yields, but allow simplifying weed management practices. Desquilbet *et al*. (2001) estimated the benefits of GM HT OSR introduction in France to 24 million euros per year (due to reduction in weed control costs). The effect of HT OSR on biodiversity has been studied in the UK during the Farm Scale Evaluation (FSE). The results for winter oilseed rape indicate that there are no significant treatment effects on total weed densities. However monocot weeds are likely to be more abundant in GM HT OSR fields. No significant effect was recorded on invertebrates (Bohan *et al*., 2005).

With respect to organic OSR, the area is very small. Figure 11.4 illustrates data on total organic OSR area (i.e. fully converted and in conversion) for France, the UK, Denmark and Italy over the period 2000-2005. The data series is incomplete, but it provides an indication of the scale of organic OSR production in EU 25.



Source: EUROSTAT

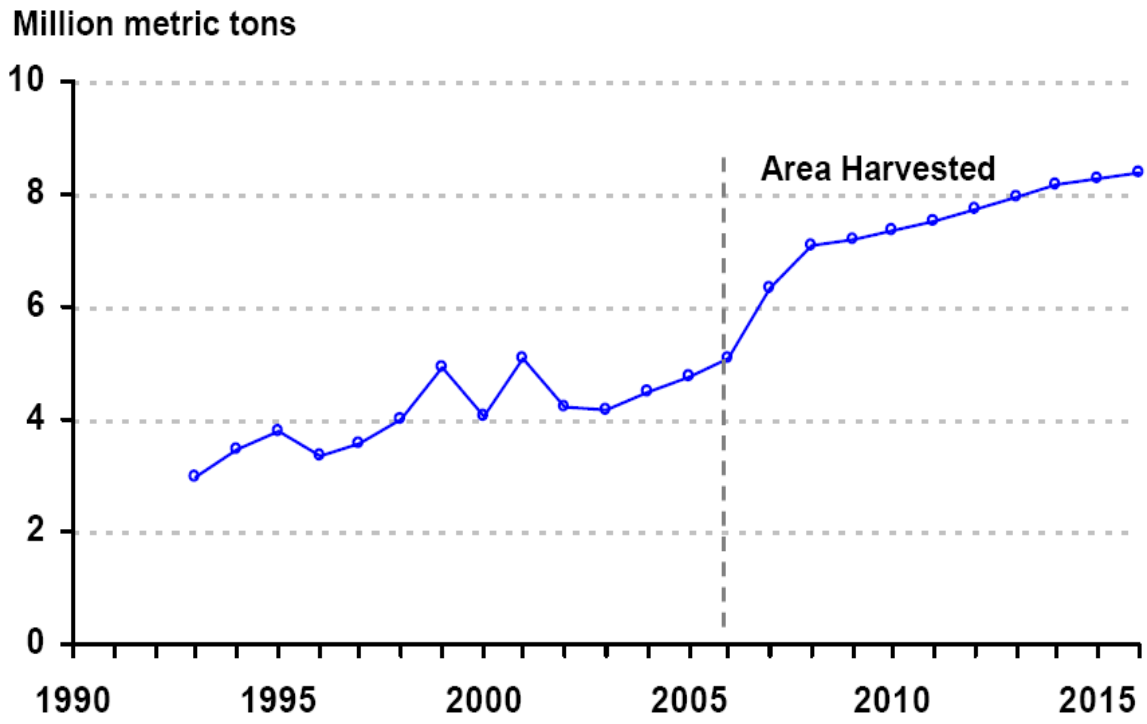
Figure 11.4: Organic OSR area (including area under conversion)

The proportion of total OSR area which is organic is fairly small (see Figure 11.4)l, ranging from 0.03-0.18% for the UK, 0.05-0.07% for France and 0.85-1.56% for Denmark. In addition, Brookes (2004) reports that in 2003 the share of organic OSR was 0.25% for Germany and averaged 0.16% for EU 15. The situation of Italy is very different, since the share of organic OSR increased from 7% to 92% over the period 2000-2005. It is important to notice how less than half of the organic area reported in Figure 11.4 for Italy is fully converted (the rest being under conversion). In addition, the Italian OSR production is very small, representing only 0.07% of EU production in 2005. Since there is no organic market for the oil, organic OSR is mainly grown in organic farms in Italy as a break crop, substituting cereals, or used as green manure (i.e. to be ploughed back into the soil to increase nutrient contents).

11.3 Future developments

The general forecast is for increased consumption for oilseeds (as meals or oils), with some modest increase in nominal prices (i.e. OECD forecasts a recovery for world oilseed prices from 235$/t in

2004 to 264$/t in 2014). In order to meet the increasing demand, OECD forecasts an expansion in oilseed area of 13 million ha by 2014, mainly soybeans in South America. In EU25 the expansion of biodiesel production will increase the pressure on the oilseed sector in general. At present rapeseed is the main feedstock, but in the future it is possible that high rapeseed oil prices might favour a switch to palm oil and soybean oil[17]. In order to meet the growing biodiesel demand the EU25 should double its rapeseed oil and soybean oil production or increase imports.



Source: USDA

Figure 11.5: Historic and projected area of OSR in the EU

Other important developments include the use of genetically modified herbicide tolerant (GM HT) varieties. Currently no GM OSR varieties are authorized for cultivation in the EU, but two GM HT varieties have been approved for import for feed use in 2005. These HT OSR varieties are widely grown in Canada. The main reason behind the large-scale adoption of GM HT OSR in Canada relates to the simplification of weed management practices. From a purely agronomic perspective, the adoption of HT OSR by EU farmers (if authorized for cultivation) could be technically very high in all OSR producing countries, given the difficulty of controlling weeds in this crop. Several economic studies have shown the positive impact on competitiveness of the crop (i.e. reduction of production costs and simplification of weed management). However, the actual adoption of such varieties (should they be authorized in the first place) will depend also on other factors, including regulations of

[17] At present the use of soybean oil in biodiesel production is being limited by the CEN standard which requires low iodine values.

coexistence, public acceptance of GM crops and future market developments. In this respect, it has been said that adoption of GM OSR could be driven by increased demand of biodiesel (since biofuels derived from GM crops need no labelling under current legislation). However this is not easy since the EU food industry is unlikely to accept GM-derived OSR oil and facilities for OSR crushing (for whatever use) cannot operate with a double use line (GM for diesel, non-GM for food). Confronted with this choice most crushing facilities will keep accepting just non-GM material. French and German experts believe that from the purely agronomic point of view (i.e. based on weeds infestations in OSR fields), GM HT varieties would be of interest to almost any grower.

To conclude, today the expectation is that the production of biofuels will probably lead to an expansion of the OSR crop which in turn will require an expansion of the seed production area. Predictions from the USDA suggest that the area of OSR in the EU27 should reach 7.5 million ha by 2010 (Figure 11.5). The expansion of OSR on set-aside land is limited by the Blair House Agreement (1 million ton of soybean meal equivalent). Despite the proved farmers' benefits of GM HT varieties, their introduction in the EU is still uncertain and depending on consumers' acceptance and coexistence regulations.

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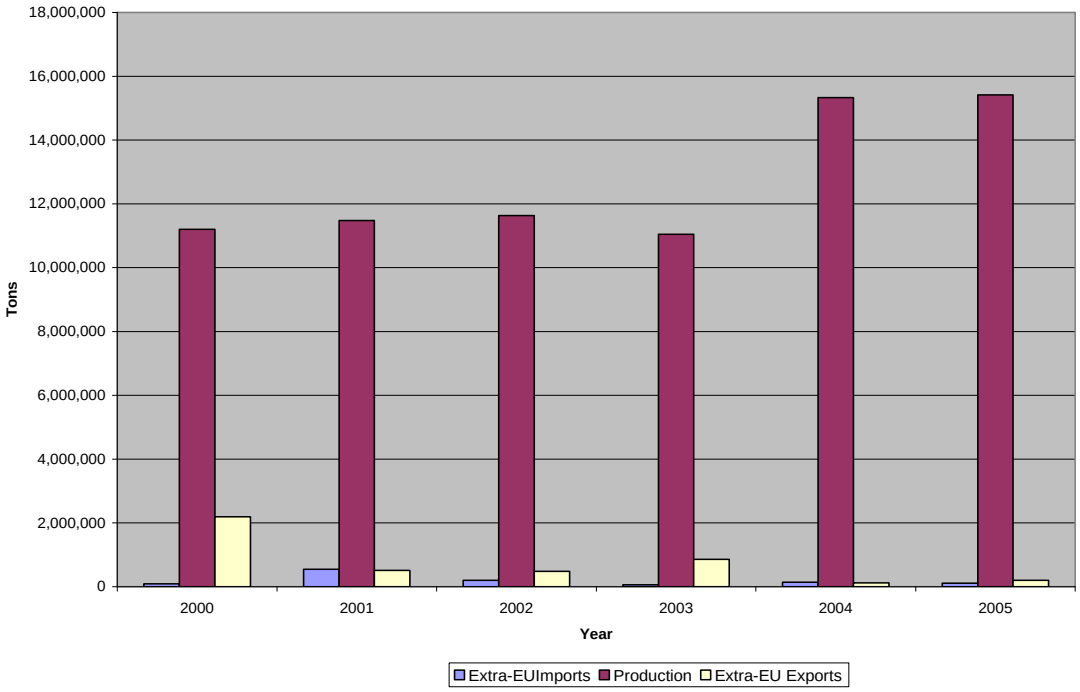
Chapter 12 OSR Trade in the EU

12.1 Trade in OSR grains

OSR trade outside EU25 is relatively small when compared with production, as shown in Figure 12.1 below, where only trade with Countries not belonging to EU25 (even for the period 2000-2003) is taken into account. Most of the trade is internal to the EU, and particularly important is trade with Central and Eastern European Countries (CEECs). Following the accession of CEECs, imports from outside the EU have become negligible.

Germany is the main importer of rapeseed with 1.4 million tones in 2004 (FAOSTAT). Traditionally, most of German imports have come from France, the UK and Czech Republic.

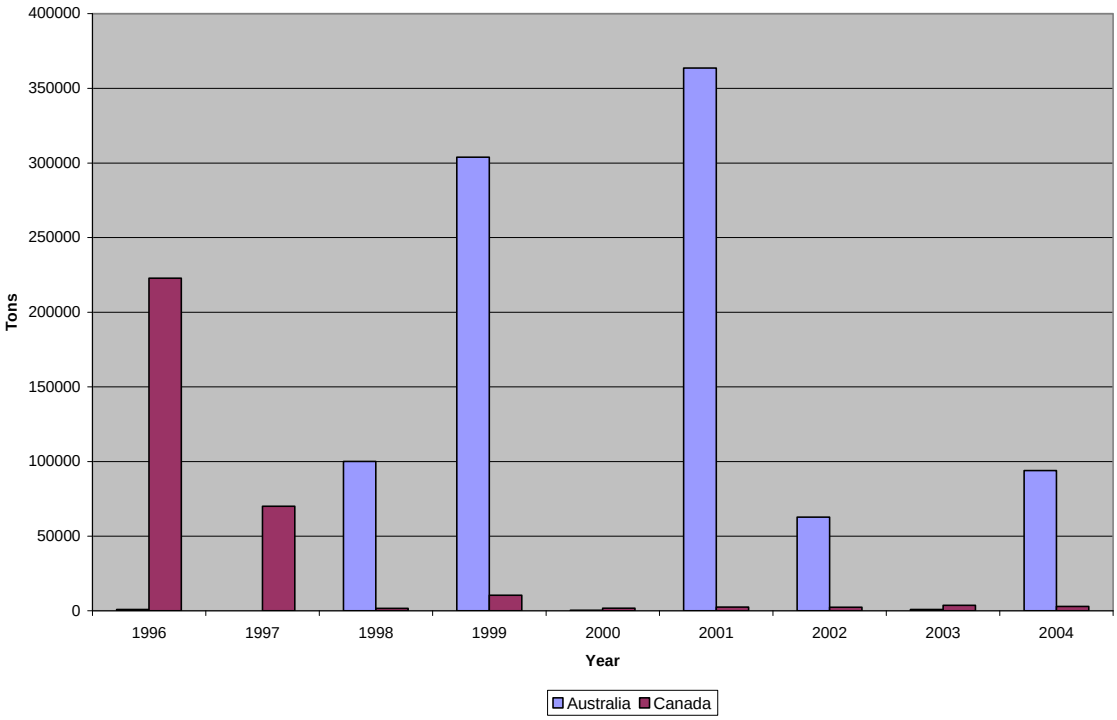


Source: USDA FAS; EUROSTAT.

Figure 12.1: Rapeseed trade and production in EU25

Caution is needed when interpreting the data because of differences in the sources. Some data-sets (e.g. FAOSTAT) refer to calendar year (i.e. Jan-Dec) while other datasets (e.g. PDS/FAS) refer to marketing year (usually Sept-Aug, but it may change depending on Countries and year considered). The trade data reported in Figure 12.1 are drawn from USDA FAS (and therefore are based on marketing year). However, in order to gain some understanding of the origins and destinations of imports and exports, reference to FAOSTAT is made when necessary, because of the completeness of the dataset. These figures do not necessarily indicate trade occurring in the same marketing year (since

they are reported per calendar year), but provide the best available estimate. The substitution of Canadian canola with Australian canola observed in Figure 12.2 and due to the introduction of GM HT OSR varieties in Canada in 1996/97 is remarkable. In Australia there have been discussions and currently a moratorium on cultivation of GM HT OSR is in place although the situation is frequently re-visited by growers and regulators and several studies suggest that is possible that Australia will soon go ahead with the cultivation of GM OSR. Finally it is worth mentioning how the EU approval in 2005 of two HT varieties for import in feed use could re-start imports from Canada. In future GM OSR may be imported for the production of biofuels. The regulations on labelling do not apply to the use of GM OSR for biofuels (i.e. they only apply to food and feed). However any by-products that enter the food/feed chain have to be labeled.



Source: Elaborated on the basis of FAOSTAT data

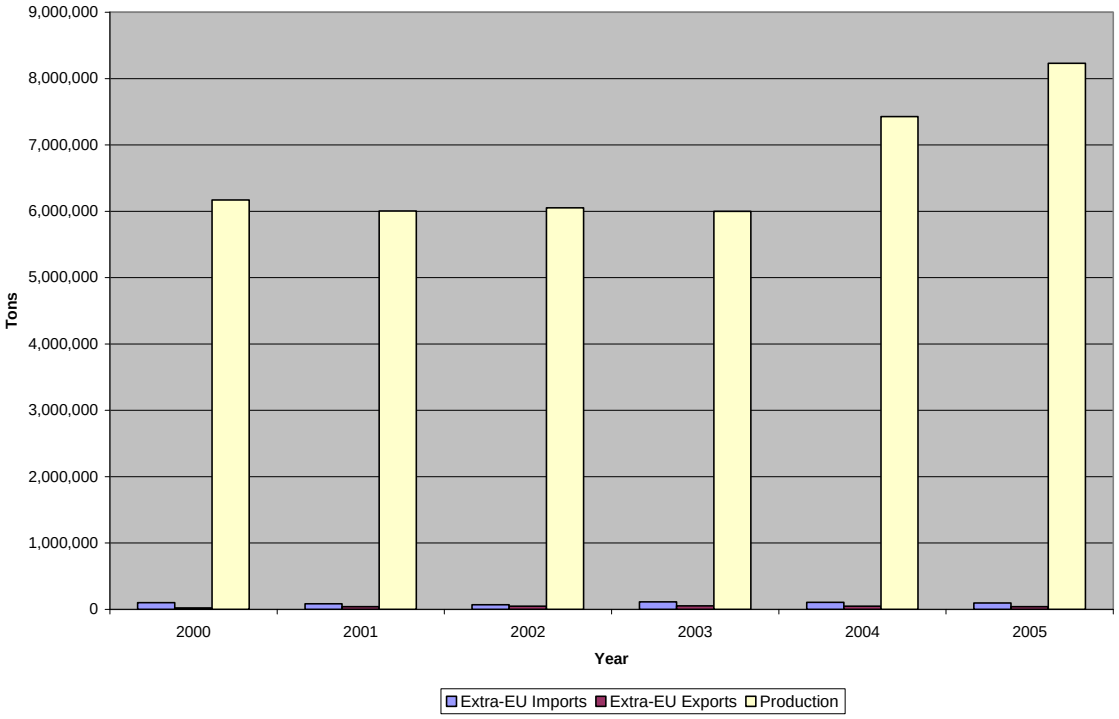
Figure 12.2: Cumulative OSR imports by 5 EU MS (DE, BE, DK, NE, UK, SW)

In 2000, total imports in EU25 stood at merely 0.088 million tons mainly from Russia (0.067 million tons as reported in COMEXT). In the same year 0.838 million tons were imported in EU15, mainly from Czech Republic (0.496 million tons) and Hungary (0.182 million tons). Exports in the same year were reported to be 2.2 million tons. In general, the strength of the US dollar over the Euro has made imports from EU very attractive. France and Germany alone exported 0.26 million tons to China and 0.33 million tons to Pakistan. France also exported 0.108 million tons to Bangladesh (FAOSTAT). The large exports to China also reflect the Country's expansion of crushing capacity, so China imported

more seeds and less oil. In 2001 an increase in EU imports and a decrease in export are recorded, possibly because of the low yield recorded in France and the UK. Specifically, USDA FAS reports total imports into EU25 at 0.544 million tons of which 0.363 million tons from Australia (i.e. almost 70%). However, imports into EU15 amounted to 1 million tons (mainly from CEECs). In the same year, exports amounted to 0.509 million tons (significantly down from 2.2 million tons of the previous year). France and Germany alone exported 0.12 million tons to Pakistan. German exports to China and Bangladesh were lower, standing at 0.055 and 0.064 million tons respectively (FAOSTAT). The reduction in the export is probably due to the relatively bad year recorded in France and the UK. The small increase in production observed in Figure 12.1 stems from good production in other EU25 Countries (mainly Germany and Czech Republic). In 2003 EU25 is a net exporter of rapeseed (over 0.8 million tons). This is due to the failure of the Canadian crop in 2002 and the consequent exports to Mexico. Following a bad production year in 2003 (i.e. very low yields in Germany, Poland and Czech Republic), EU 25 is a net importer in 2004 (over 0.02 million tons) and 2005 (around 0.01 million tons). Despite an expansion in production over 2004 and 2005 (following the 2003 biofuels directive), the trade balance has remained negative because of high demands in the EU (for food and biofuels) and because of the competitiveness of Canadian canola on the world market.

12.2 Rapeseed Meal Trade

Trade in OSR meal is relatively small compared to internal production in EU25 (Figure 12.3). Over the period 2000-2005 the EU25 has been a net importer of OSR meal, with imports ranging between 0.069-0.11 million tons (i.e. 1.2-1.8% of production) and exports ranging between 0.021-0.051 million tons (i.e. 0.3-0.9% of production). OSR meal is mainly used in animal feed, where it is can replace corn gluten feed and soy meal. Imports of OSR meal were relatively high in 2003 and 2004, standing at 0.11 and 0.105 million tons respectively. This was due to increased use of OSR meal in animal feed because of its price advantage over soy meal.

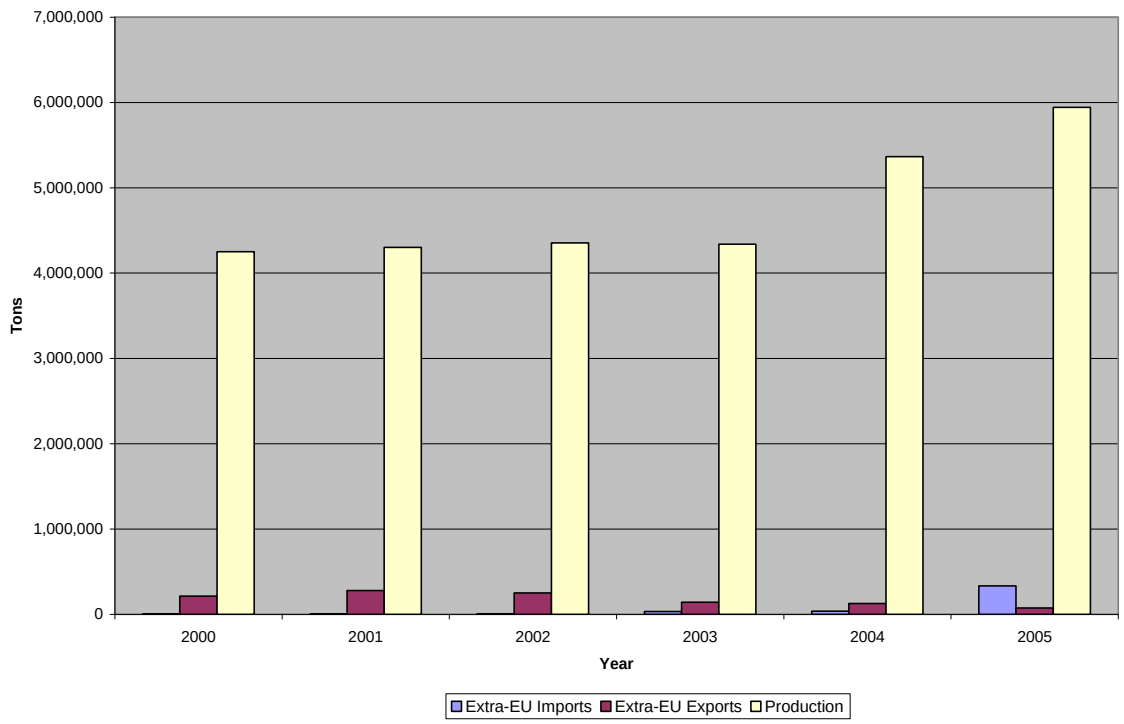


Source: USDA FAS

Figure 12.3: production and trade of OSR meal in EU25

12.3 Rapeseed Oil Trade

OSR oil trade in EU25 is small compared to production (Figure 12.4). However, over the period 2000-2005 some interesting dynamics can be identified. OSR oil imports rose constantly from 0.003 million tons in 2000 (i.e. 0.07% of domestic production) to 0.335 million tons in 2005 (i.e. 5.6% of domestic production). Over the same period exports declined from 0.212 million tons in 2000 (i.e. 5% of domestic production) to 0.075 million tons in 2005 (i.e. 1.2% of domestic production). The increase in OSR oil imports and the reduction in exports were due to higher internal demand in both the non-food sector (i.e. biodiesel) and by the food industry. The food industry prefers OSR oil because of the mandatory labelling requirements associated with the use of oil derived from GM soybeans (USDA, 2005b).



Source: USDA FAS/PSD

Figure 12.4: OSR oil production and trade in EU25

The main suppliers of OSR oil to EU25 are US (over 0.01 million tons in 2004), Russia (over 0.006 million tons in 2004), Ukraine and Canada (both over 0.002 million tons in 2004). Non food use of OSR oil accounted for about 50% in 2005, but it is expected to increase up to 60-70% in future years, replacing uses in the food industry. The high imports recorded in 2005 were due to the gap between domestic demand and local production. The foreseen expansion of the crushing capacity in the EU25 might reduce this gap in the future and by so doing help to soften OSR oil prices.

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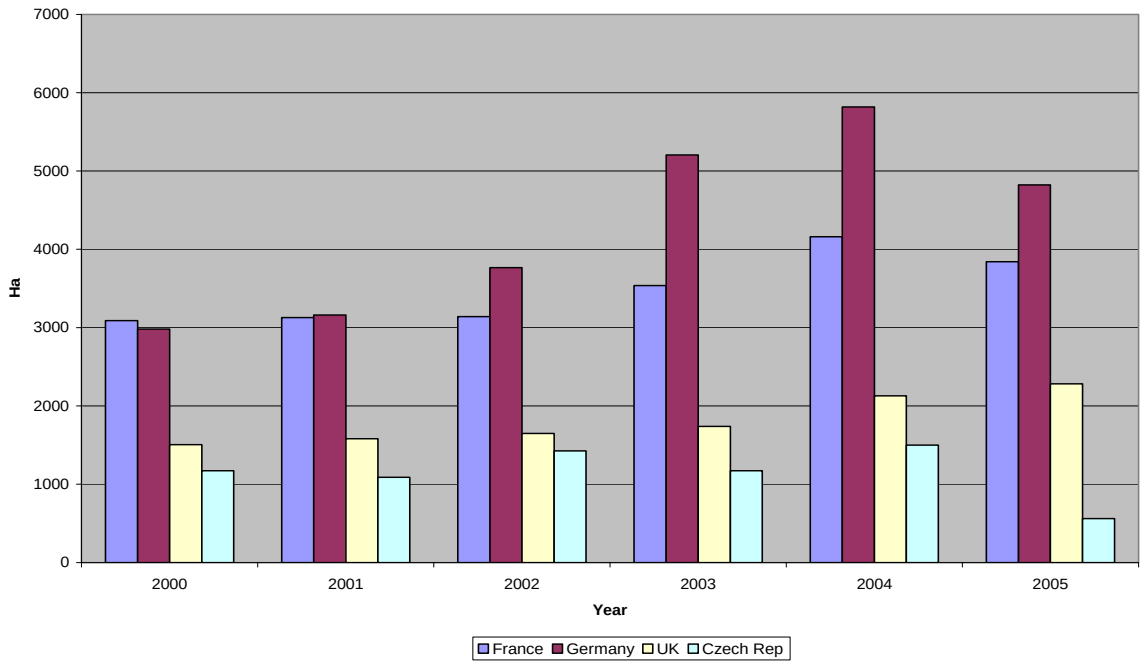
Chapter 13 OSR Seed Production and Trade in the EU

13.1 OSR seed production

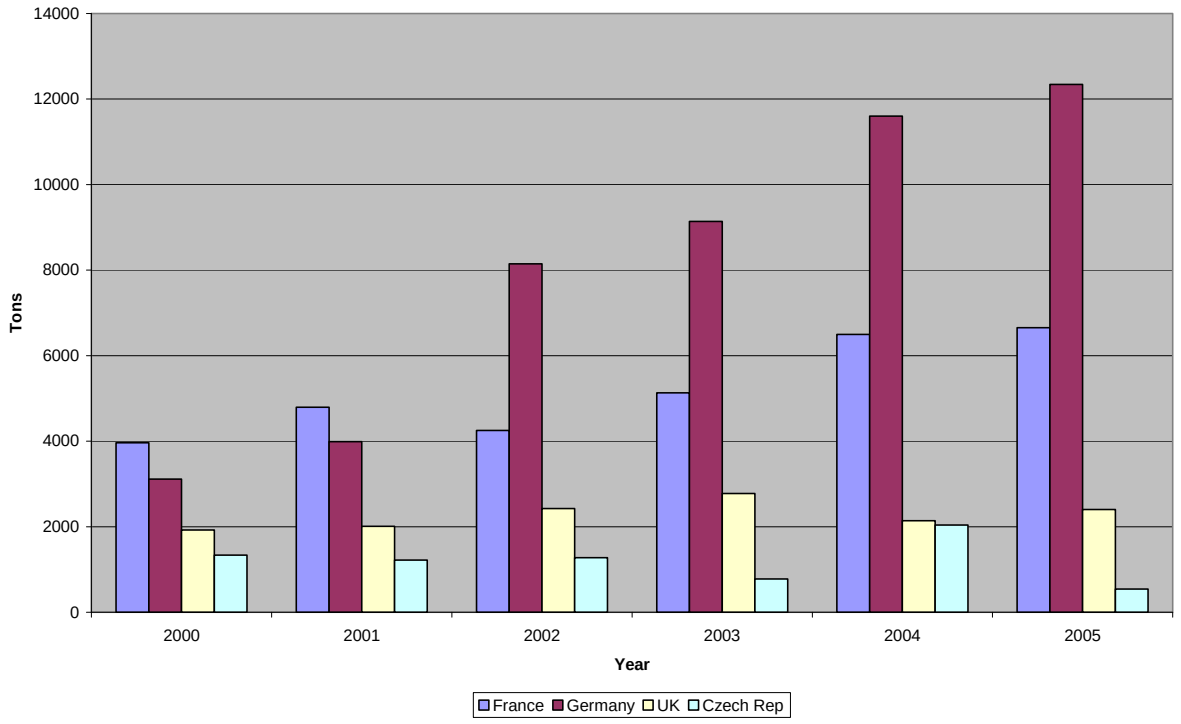
Figures 13.1 and 13.2 illustrate the area and amount of production of certified oilseed rape (OSR) seeds in 4 EU Member States (MS). These MS are leading OSR seed producers in the EU. Notice that these data do not include OSR seed for forage rape, but only refer to OSR for oil production and most of the varieties are winter rape. The data mainly refer to *Brassica napus*. Small quantities of *Brassica rapa* are also produced in some countries, but volume and area are not significant compared to *B. napus*.



Source: ESCAA, GNIS, NIAB, UKZUZ and Bundessortenamt

Figure 13.1: Area of certified OSR seed production

Germany has the largest area of OSR seed production, about 4,800 ha of *B. napus* seeds in 2005, followed by France (3,800 ha in 2005) and the UK (2,300 ha in 2005). The area of OSR seed production has been increasing in all the Countries considered except in the Czech Republic, where a reduction in 2004 actually took place. It is also interesting to notice how the increase in the area of seed production has been particularly strong in Germany.



Source: ESCAA, GNIS, NIAB, UKZUZ and Bundessortenamt

Figure 13.2: Volume of certified OSR seed production

The data on volume of seed production (Figure 13.2) reflect in part the evolution of the area of seed production. In Germany a moderate increase in the seed area resulted in a strong growth in the volume of OSR seed production. This is not so much due to a yield increase, but to the necessity to provide seeds for a growing area of OSR grain production. In fact the volume of certified seeds in each year is related to seeds produced in that year, to seeds produced in previous years (and not certified) and/or to imported seeds.

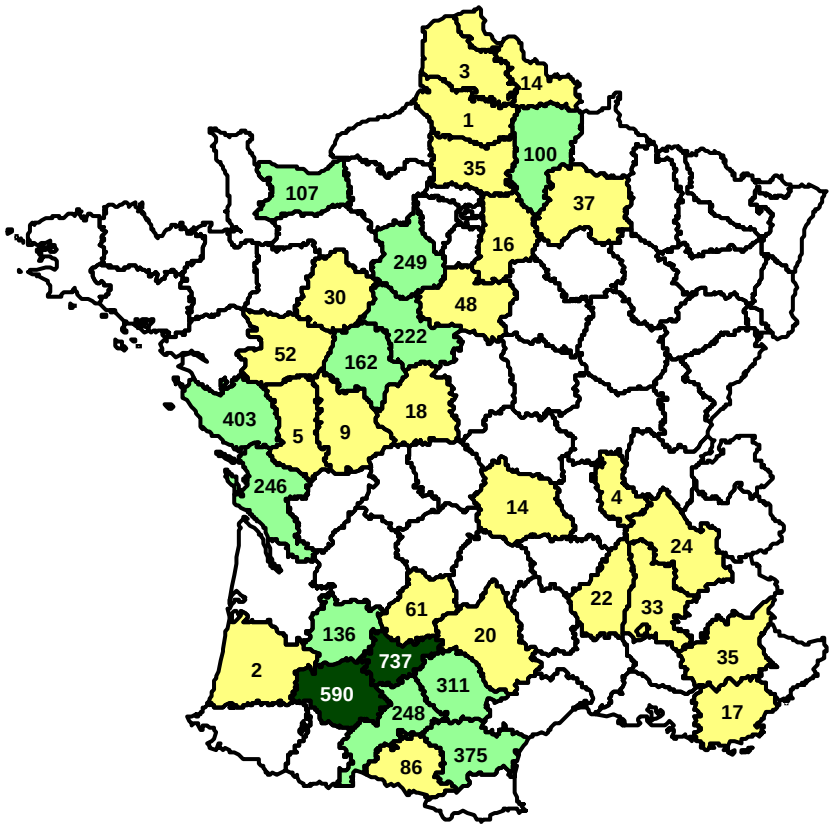
The increase in the area and volume of OSR seed production in the EU is directly associated with the increase in OSR cropping. In Germany and France the production of biodiesel has proved to be a particularly strong incentive for the expansion of OSR. However, the demand from the food industry for rapeseed oil in Europe has also increased and is in direct competition with the demand for industrial uses. There is a strong preference of the EU food industry for vegetable oils derived from conventional crops (i.e. non GM) and the worldwide cultivation of GM soybean has led the food industry to switch to alternative oils, including rapeseed (USDA, 2005).

In Germany the production of OSR seeds is mainly concentrated in the North/North-West part of the Country. Three Länder (Niedersachsen, Nordrhein-Westfalen and Schleswig-Holstein) accounted for 3,000 ha out of the total 4,882 ha of OSR seed in Germany. Soil and climatic conditions are favorable

for OSR growth in these regions and therefore there is both seed and grain production. A more detailed discussion of OSR seed production in Germany is presented in section 3.

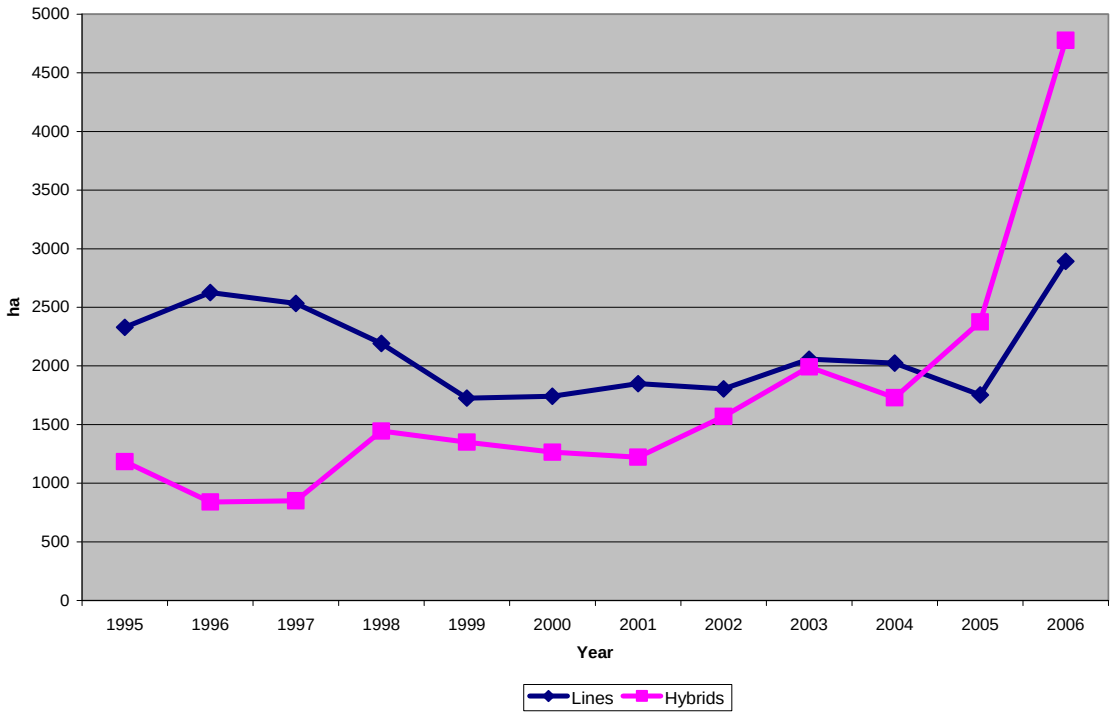
In France the area of certified OSR seed production has also increased during 2000-2005, in line with the expansion of the OSR crop. Data from GNIS (not illustrated in Figures 13.1 and 13.2) indicate that for 2006 the area of winter oilseed rape seeds (*B. napus*) was 7,950 ha and the volume of certified seeds produced was around 8,000 tons[18]. These data refer to all winter *B. napus* varieties, including the ones for fodder production. However, traditionally the proportion of *B. napus* seeds for fodder production is quite small in France (around 80 ha in 2005). The data illustrated in Figures 13.1 and 13.2 include also production of basic and pre-basic seeds. However, the largest proportion of the area (95%) and volume (99%) data illustrated refer to certified seed. The use of hybrid certified seeds accounts for roughly 30% of sales, while the remaining 70% is open pollinated. Because of this, the use of farm-saved seeds is also quite significant, providing seeds for 35% of the total OSR crop area and is increasing at a rate of 2% per year (Mr A. Gaudin, GNIS, personal communication). OSR seed production is mainly concentrated in the West (e.g. in 2005 Vendée 403 ha and Charente-Maritime 246 ha) and South-West (e.g. in 2005 Tarn-et-Garonne 737 ha, Gers 590 ha and Aude 375 ha) of France (Figure 13.3). Hybrid seeds are mainly produced in the South-West. In 2007, 3,536 ha out of a total of 4,751 ha of winter OSR seeds grown in the South-West were hybrids. The production of hybrid seeds increased in recent years. French companies have started joint-ventures with German companies in order to develop new hybrid varieties in an attempt to limit the use of farm-saved seeds. The increase in the production of hybrid is reflected in the expansion in the OSR seed area in South-Western France from 1,281 ha in 2000 to 4,751 ha in 2006. Figure 13.4 illustrates how up to 2004 winter OSR seed production was almost equally split between hybrids and lines. However since 2005 the proportion of the area allocated to hybrids has dramatically increased and today accounts for 62% of total winter OSR seed area in France.

[18] It is not possible to extract information about yield by comparing volume of certified seeds and area of seed production in each year since not all seeds produced in one year are necessarily certified and/or seeds from previous year and/or imported seeds might also be certified.



Source: GNIS

Figure 13.3: Distribution of OSR seed production areas (in ha) in France in 2005



Source: GNIS

Figure 13.4: Area of hybrids and lines OSR seeds in France

OSR crop production in France mainly takes place in the Central regions (e.g. in 2005 Cher 61,000 ha, Yonne 64,000 and Eure-et-Loir 68,000 ha), Eastern (e.g. in 2005 Cote d'or 54,000 ha), Northern (e.g. in 2005 Meuse 42,000 ha and Eure 42,000 ha) and Western (e.g. in 2005 Vienne 49,000 ha) regions of France. At the moment seed companies are not having problems in finding fields complying with the necessary separation distances. However, further increase of the OSR crop area in the future (e.g. because of biodiesel) could make things more difficult. Organic OSR seed production is almost non-existent in France (4 ha every year). The difficulty of controlling weeds in organic production systems is the main barrier to the development of an organic OSR sector.

In the UK a mild expansion in the area and production of certified OSR seed production has occurred over the past five years (see Figures 13.1 and 13.2), in order to meet the increasing demand by farmers. Most of the OSR seed production occurs in the South, where harvest is earlier and seeds can be processed and sold again in time for the autumn sowing season. On the other hand, OSR for grain production occurs all over the UK (with the exception of mountainous areas). The use of farm-saved seeds is consistent in the UK. Even if no official figure exists, it is estimated that farm-saved seeds account for at least 40% of the seeds used by farmers. With respect to organic OSR seeds, there are no official data since such production is not recorded. It is however believed that if organic OSR seed production occurs, it is indeed very small.

In the Czech Republic the area and volume of OSR seed production has remained fairly stable (see Figures 13.1 and 13.2) between 1,100-1,400 ha during 2000-2004, with a reduction to 560 ha in 2005. Unlike other EU Countries where biofuels have given an impetus to OSR production, in the Czech Republic OSR production has been stable since the availability of suitable growing area is a limiting factor. The data in figures 13.1 and 13.2 also include pre-basic and basic seeds, but their importance in terms of area and volume is very limited (maximum 5%). The use of hybrid seeds for OSR in Czech Republic has been estimated at around 20% in 2006. Use of farm-saved seeds is significant and growing, but no accurate estimates exist. OSR seed production in the Czech Republic mainly takes place in South Moravia (33% of the certified seed area in 2005), East Bohemia (26% of the certified seed area in 2005) and Middle Bohemia (19%). On the other hand OSR grain production is more evenly spread and takes place mainly in South Bohemia, Middle Bohemia, East Bohemia and West Bohemia.

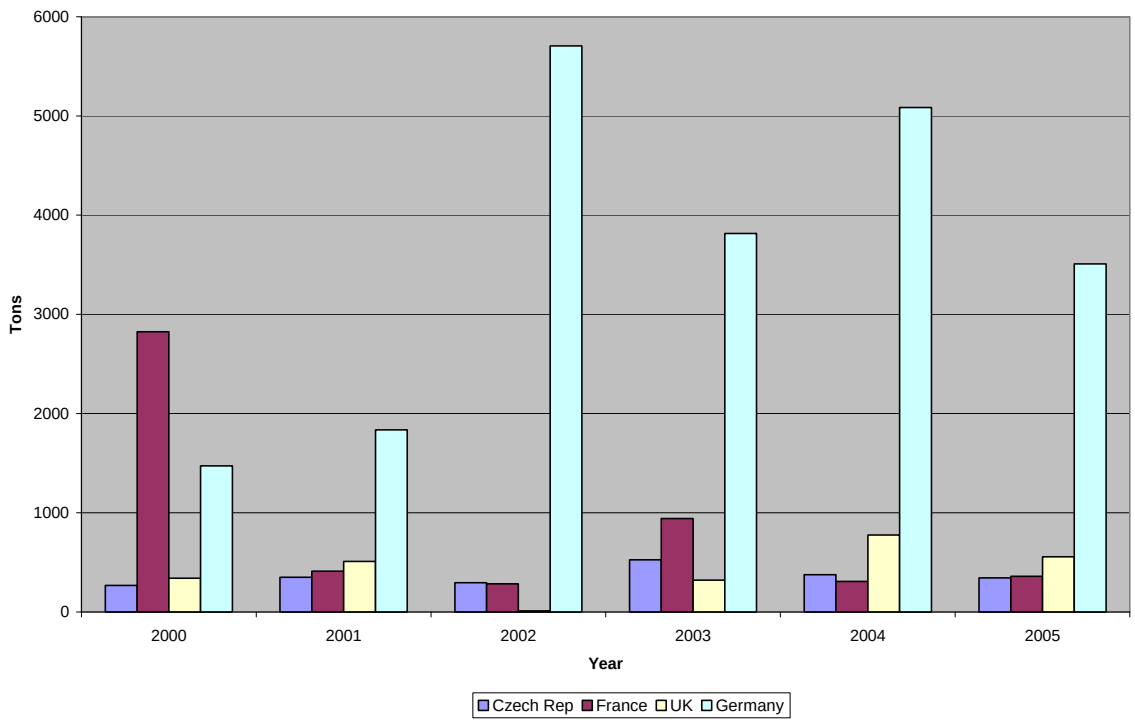
13.2 OSR seed trade

Figures 13.5 and 13.6 illustrate data on total imports and exports of OSR seed for the four EU25 Countries considered above (namely France, Germany, Czech Republic and the UK). France and

Germany are the major traders of OSR seeds in the EU. However, most of the OSR seed trade is internal to the EU.

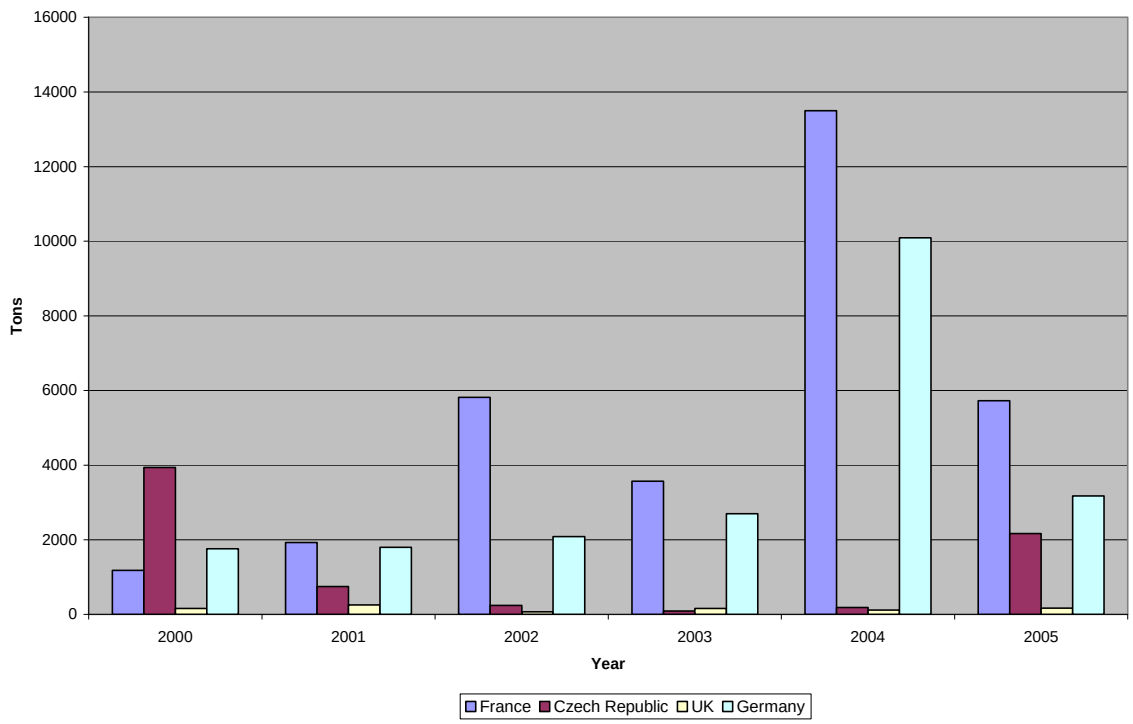
Figure 13.5 shows that Germany is by far the major importer of OSR seeds today, with over 3,500 tons in 2005. The COMEXT database indicates that most of the imports originate from France (around 1,600 tons in 2005) and Hungary (around 1,000 tons in 2005). In the same year Germany imported very small quantities of OSR seeds from Croatia (around 46 tons), Austria (around 2 tons) and Switzerland (around 1 ton). These figures are slightly lower than the one indicated by the German Ministry of Agriculture which in 2005 reported 170 tons of OSR seeds imported from outside the EU. The increase in German imports of OSR seeds (especially from 2002) is due to the expansion of the OSR crop area.

France imports are certainly lower than those of Germany. However, the COMEXT database indicates an unusually large quantity of OSR seeds imported from Luxemburg in 2000 (around 2,500 tons). Apart from this, it is also clear that French OSR seed imports mainly originate from other EU Countries. In fact most of the French imports are of German origin (around 200 tons over a total of 360 tons in 2005). The COMEXT database reports imports into France of very small quantities of OSR seeds from Argentina in 2002 (around 20 tons).



Source: COMEXT

Figure 13.5: OSR seed imports



Source: COMEXT

Figure 13.6: OSR seed exports

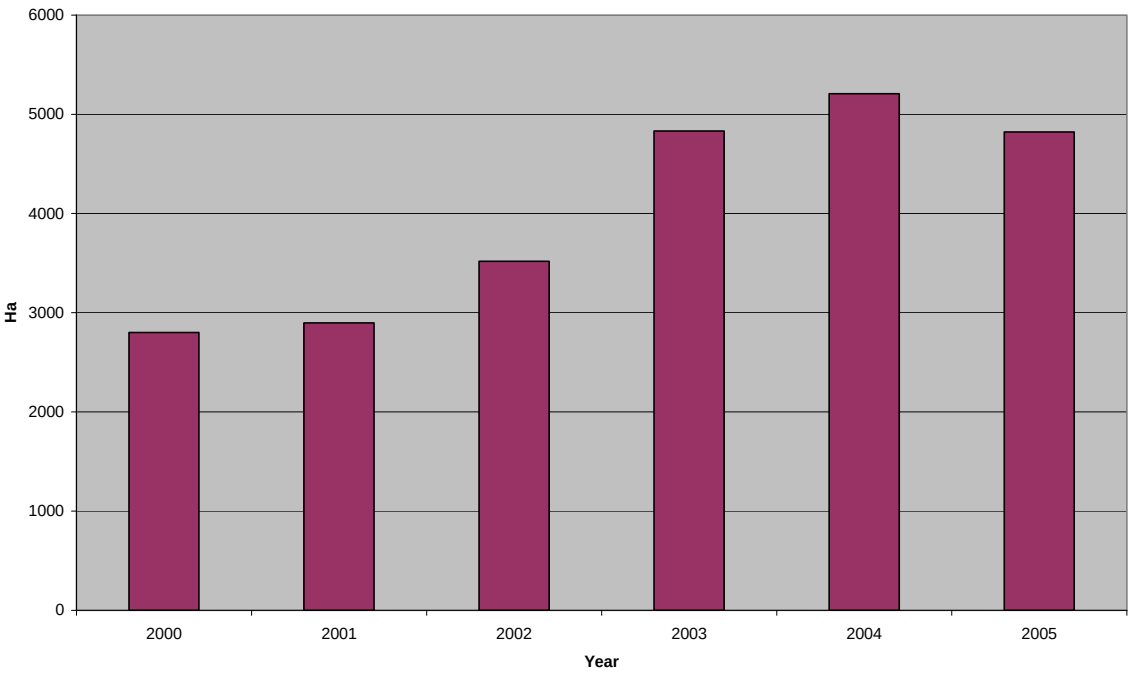
Figure 13.6 illustrates how France and Germany have been increasing the volume of exported seeds with a peak in 2004. Once again, most of the exports were directed towards other EU Countries. The COMEXT database indicates that in 2004 Germany exported more than 7,000 tons of seeds (i.e. around 70% of total OSR seed exports) to only two Countries: Belgium and the Netherlands. Similarly France in the same year exported almost 12,000 tons of OSR seeds (i.e. around 90% of its total OSR seed exports) to Belgium and Germany. Because of its climate, France is able to harvest is OSR seeds relatively early in the season and deliver them to other EU Countries (e.g. Germany) in time for planting. Germany has become a particularly important market for France since 2000 because of the development of hybrid varieties. Hybrid varieties account for 60% of plantings in Germany.

To conclude, it is difficult to interpret the available trade figures. Seeds move from one EU Country to another many times before being sold to farmers. This is because OSR seed processing does not necessarily take place in the same Country where the seeds are produced. In any case, it is evident that most of the trade flows of OSR seeds are internal to the EU.

13.3 Case study: OSR seed production in Germany

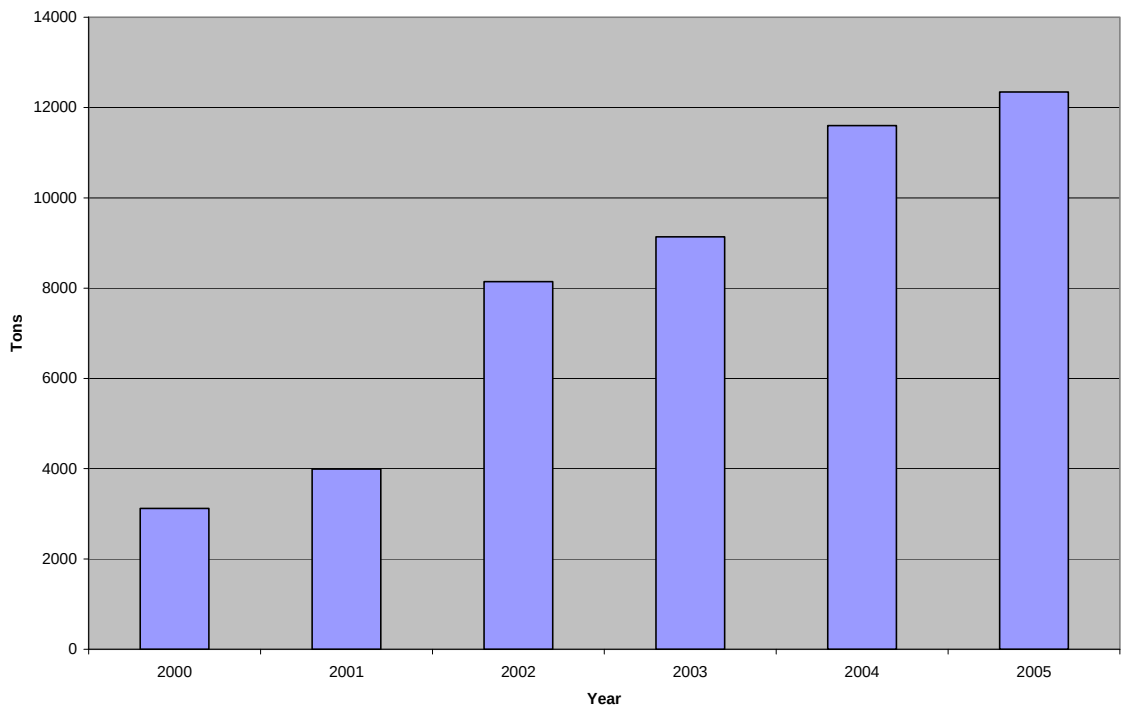
13.3.1 Production and Trade

Germany is one of the main seed producers of rapeseed in the EU. The main varieties produced are winter Swede rape (*B. napus*) for oil production and small areas of seed for spring varieties are produced (around 590 ha in 2004). Figure 13.7 illustrates a steady increase in the area of certified seed production over the period 2000-2004 and a small decline in 2005. The increase in certified seed area for rapeseed follows directly from the expansion of the rapeseed crop area recorded in Germany over the same period. As already mentioned in the crop section, the increase in rapeseed production in Germany reflects the increasing importance of biodiesel production. The reduction in sugar beet area (following the reform of the sugar sector) also has stimulated rapeseed production as a substitute crop in the rotation. Finally the high demand in rapeseed oil, because of the food industry concerns about GMO in soybean oil, has contributed to the increase in rapeseed area. Figure 13.8 illustrates the production volume of certified seeds during 2000-2005. In 2005, because of very high yields, an increase in volume has been recorded despite a reduction in the area (due to the high available seed stocks). The values in Figure 13.8 mainly refer to certified seeds (80%), but also include basic seeds.



Source: Bundessortenamt

Figure 13.7: Certified area of rapeseed (B. napus) seed production in Germany

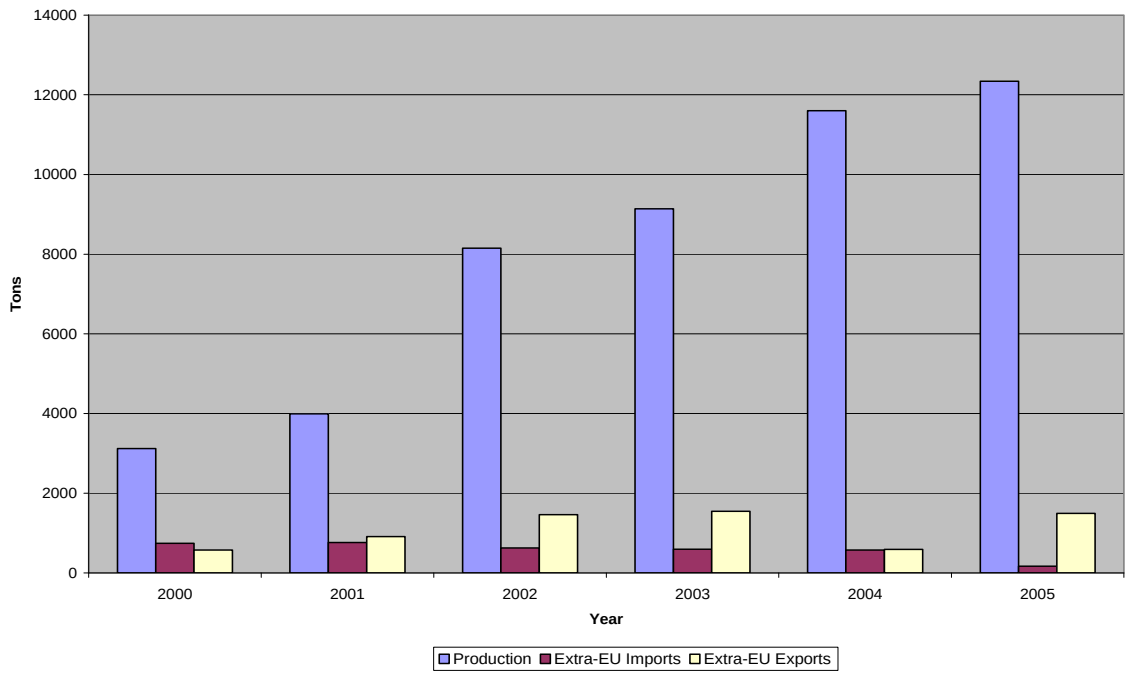


Source: Bundessortenamt

Figure 13.8: Certified volume of rapeseed (B. napus) seed production in Germany

The production of certified seeds in Germany is very important since the use of farm-saved seeds in oilseed rape crops is minimal (less than 5%). This is due to the great diffusion of hybrids (around 60% of grown varieties, compared to an estimated 30% in France), which encourages the use of certified seeds.

With respect to trade, Figure 13.9 illustrates Germany rapeseed seeds imports and exports with extra-EU Countries. It is evident how the scale of extra-EU trade is relatively small when compared to production volumes. On the other hand significant quantities of Germany-produced rapeseed seeds enter the EU Common Market. As already discussed above, the COMEXT database suggests that Belgium and the Netherlands are the preferred destinations. However, due to the large number of border-crossing that a lot of seeds might be subject to before final sales to farmers, it is difficult to interpret such data. In general, Figure 13.9 shows an increase in extra-EU exports. In this respect Russia and Ukraine have become important destinations for German seeds, especially after 2002. In 2005, COMEXT reports German rapeseed seed exports to Russia and Ukraine of 160 and 560 tons respectively. This is due to the increase in the use of certified seeds in these Countries on one hand and more in general to the increase in the volume of trade as a consequence of economic development. Another important destination of German seeds is Switzerland, with around 130 tons of seeds exported per year.



Source: Bundessortenamt

Figure 13.9: Extra-EU trade in OSR seed in Germany

The amount of certified seeds imported from third Countries is quite small (between 170-744 tons per annum during 2000-2005). Also the data in Figure 13.9 mainly refer to Countries that later on became part of the EU. For example in 2004 and 2005 Germany imported around 436 and 167 tons of rapeseed seeds from Romania (COMEXT), against total imports from third Countries for the same period of 574 and 170 tons respectively. The remaining quantities were imported mainly from Croatia and Russia. The only other extra-EU imports of rapeseed seeds concern very small quantities from Canada (0.1 tons in 2005, mainly spring varieties) and Chile (0.4 tons in 2005).

13.3.2 Production Organization

Seed production is a specialized activity and it is usually organized on contract basis. In general the contracts involve a number of actors. These are normally the breeder (i.e. the company that developed the varieties), the multipliers organization (i.e. the representative of the specialized producers of certified seeds) and the seed distributor (i.e. the company that sells the certified seeds to grain farmers).

Normally the breeders produce 'in house' pre-basic and basic seeds. In Germany at present there are eight breeders of rapeseed. Basic seeds are then given to multipliers for the production of certified seeds. Multipliers are specialized farmers who know by experience how to comply with the standards set by the EU legislation for the varietal purity. In Germany the average field size for multiplication of certified seeds is around 20 ha. However there are some regional differences. For example, the average

field size in East Germany is larger for historical reasons. It is worth mentioning how one company sets higher standards for the production of hybrid seeds. The setting of higher standards is used as a marketing strategy in order to preserve the position in the market.

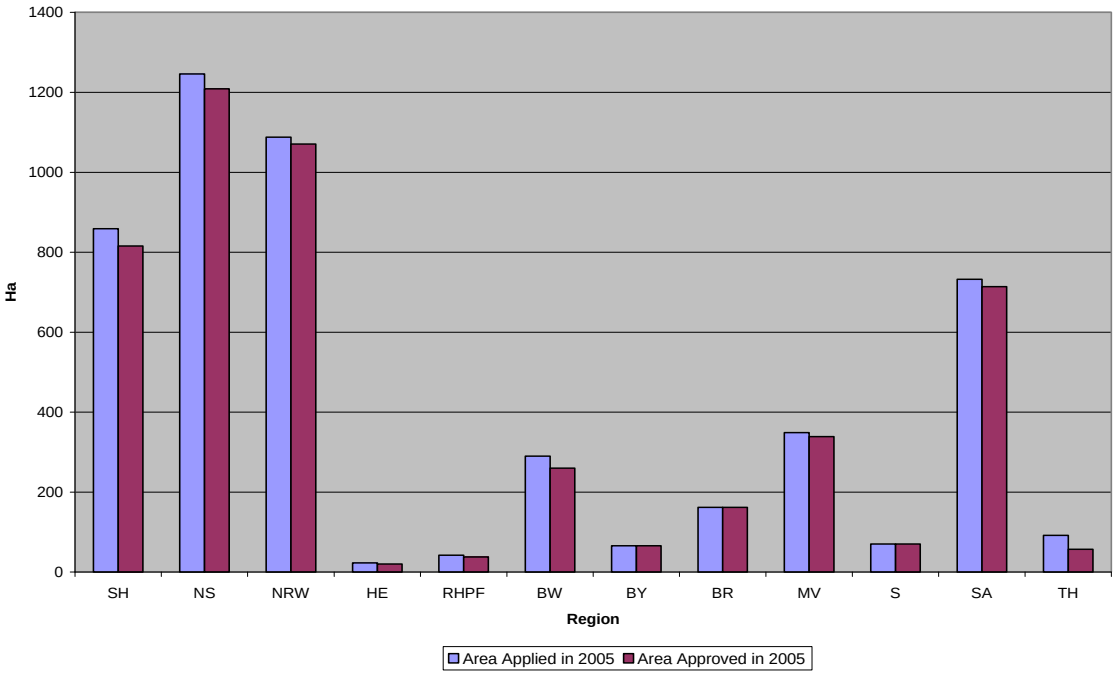
Once the seeds are produced by the multipliers they are sold for a pre-established price to seed distributors who then sell them to farmers for grain production. The distributors will pay a fee to the breeder (also this established in advance and regulated by a contact) in order to reward the company for the development of the varieties.

13.3.3 Regional Analysis

Oilseed rape seed production is concentrated mainly in three Länder in Germany (see figure 13.10 for a map of the Länder of Germany). Figure 13.11 illustrates the area applied for and the area approved for the production of certified seeds in Germany by region in 2005. Niedersachsen (NS), Nordrhein-Westfalen (NRW) and Schleswig-Holstein (SH) account for over 3,000 ha of the total 4,882 ha approved for the production of certified seeds. These Länder have better growing conditions, in terms of soil type and weather, for oilseed rape in Germany. Because of this, rapeseed grains and seed production take place mainly in the same parts of Germany, the West and North-West (Figures 13.10 and 13.11).

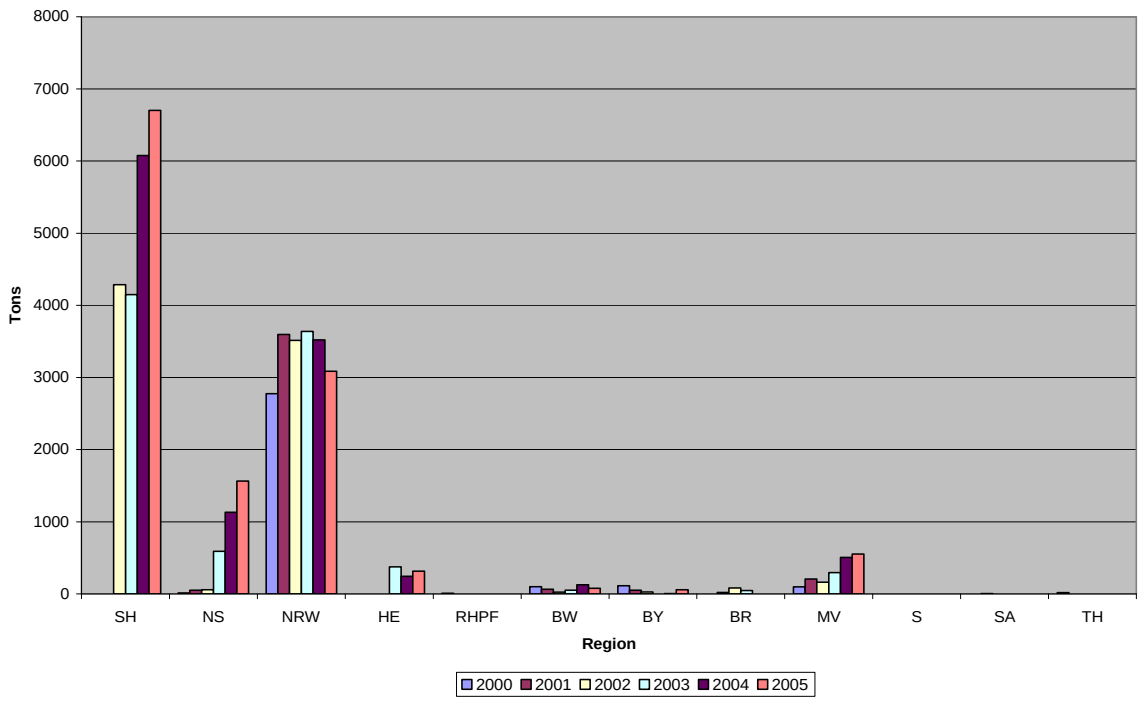
Figure 13.10: Map of the Länder of Germany

The largest volume of certified seed production occurs in SH, despite the fact that the area of certified seeds is significantly larger in NS and NRW (Figure 13.12). This is due to the fact that the processing plants for seed treatment (mainly seed coating) are located in SH. With annual precipitations around 800-1000 mm per year and a very long vegetative period, SH is ideal for OSR production. Also, unlike NS, in SH there are not many sugar factories (only 2 in fact) and consequently there is less sugar beet production, leaving more space for the production of rapeseed. For this reasons seed companies have established their plants for seed certification in the region. However in the future, due to a decline in sugar beet production, rapeseed for grains and seed production could move further into other regions like NS.



Source: Bundessortenamt

Figure 13.11: Area for the production of OSR seeds in Germany in 2005



Source: Bundessortenamt

Figure 13.12: Volume of OSR seed production in Germany[19]

13.3.4 GM and organic seeds in Germany

At present no seed production of GM OSR seed varieties is taking place in Germany, since no varieties have been authorized. Despite this, it is believed that the use of GM HT varieties could be useful in order to reduce the costs of weed control programs. Since weed control programs are undertaken by every OSR grower, the use of GM HT varieties could in theory be interesting to all the OSR farmers. However, the practical level of adoption will depend on many other factors including public opinion and coexistence measures. With respect to segregation issues, at this very early stage it is believed that GM rapeseed seed production could be located in East Germany, where the presence of larger farms could facilitate compliance with coexistence measures.

Despite the increasing demand in organic rapeseed products (i.e. oil), almost no production of organic OSR seeds occurs in Germany (only 20 ha in 2006). This is due to the small size of the organic rapeseed production in Germany (and elsewhere in Europe), which does not encourage breeders to invest in the development of varieties able to overcome the technical problems associated with organic production. These technical limits concern both weed and insect control.

[19] Notice that for some regions data are missing for some years.

Acknowledgments

Most of the data and information provided in this section were collected during a meeting at the Bundessortenamt in Hannover in April 2007. We would like to thank the participants and organizers of the meeting, namely Mr. Von Kroecher, Mr. Klein and Mr. Freudenstein of Bundessortenamt, Mr. Von Klitzing (Verband der VO-Firmen), Mr. Betz (Verband niedersächsicher Saatguterzeuger) and Mr. Aβmann (Vorsitzender der Arbeitsgruppe Anerkennungsstellen für Saat- und Pflanzgut).

We would also like to thank the following people for providing information on OSR seed production in the respective Member States: Mr. A. Chapman (NIAB, UK), Mr. D. Jurecka (UKZUZ, Czech Republic), Mr. A. Gaudin (GNIS, France).

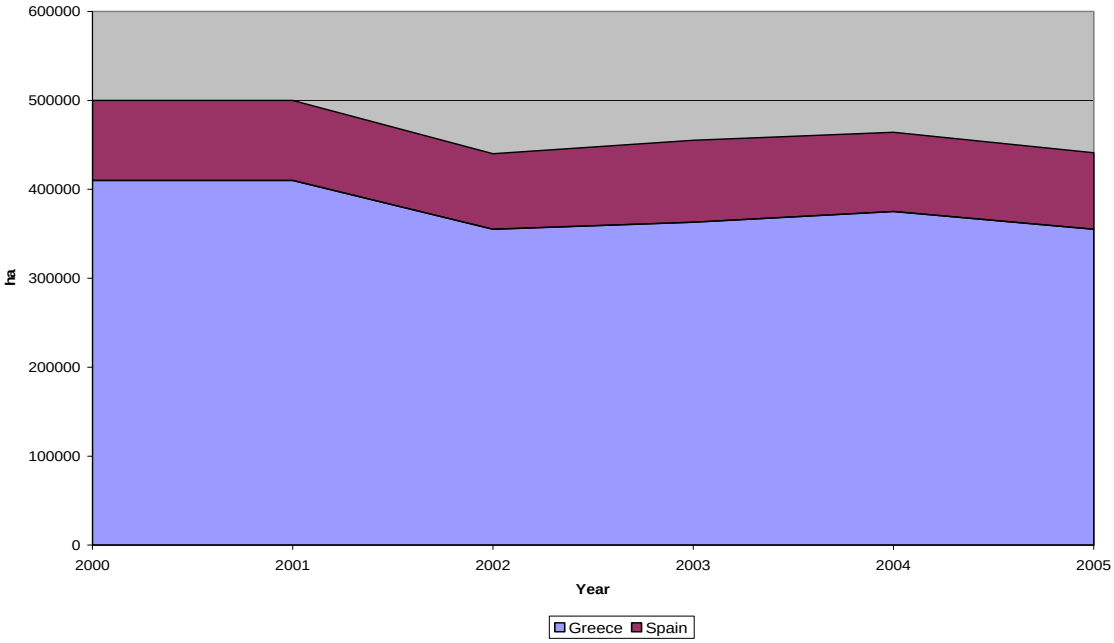
Consulted Documents

USDA FAS, 2005. GAIN Report E35118 – EU25 Oilseeds and Products: Annual Report.

Chapter 14 Cotton Production in the EU

14.1 Conventional cotton

In the EU cotton is commercially produced only in Greece and Spain (production in Portugal is extremely limited). EU production of cotton represents less than 3% of world production. Cotton is generally grown in poor rural areas in the EU. Before the 2003 CAP reform, the cotton regime was based on a direct payment per ton of unginned cotton subject to a National Guaranteed Quantity (NGQ) for each Member State. EC Regulation 1051/2001 establishes the NGQ at 0.782 million tons for Greece, 0.249 million tons for Spain and 0.0015 million tons for each other Member State. When production exceeds the quota, the level of aid is reduced. The level of aid was paid to processors who in turn had to pay a minimum price to producers.



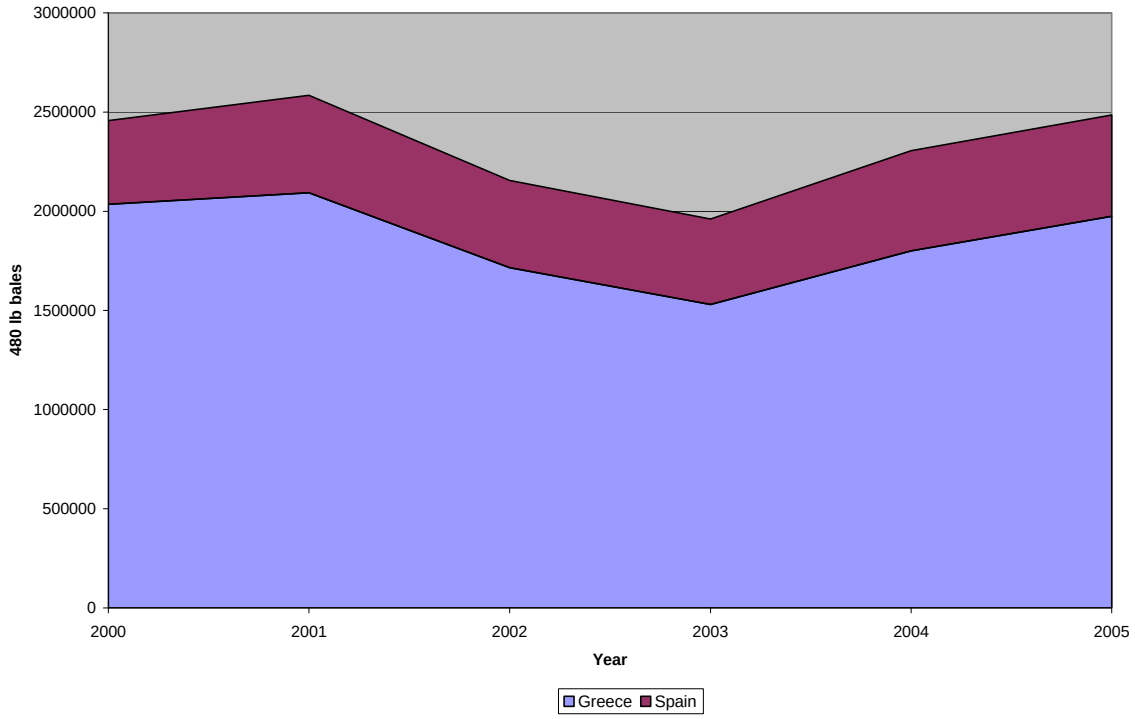
Source: USDA FAS

Figure 14.1: Cotton area (area harvested) in Greece and Spain

The cotton area in Greece and Spain is illustrated in Figure 14.1. Cotton in Greece is mainly grown in Thessaly, Macedonia and Central Greece (Figure 14.2).

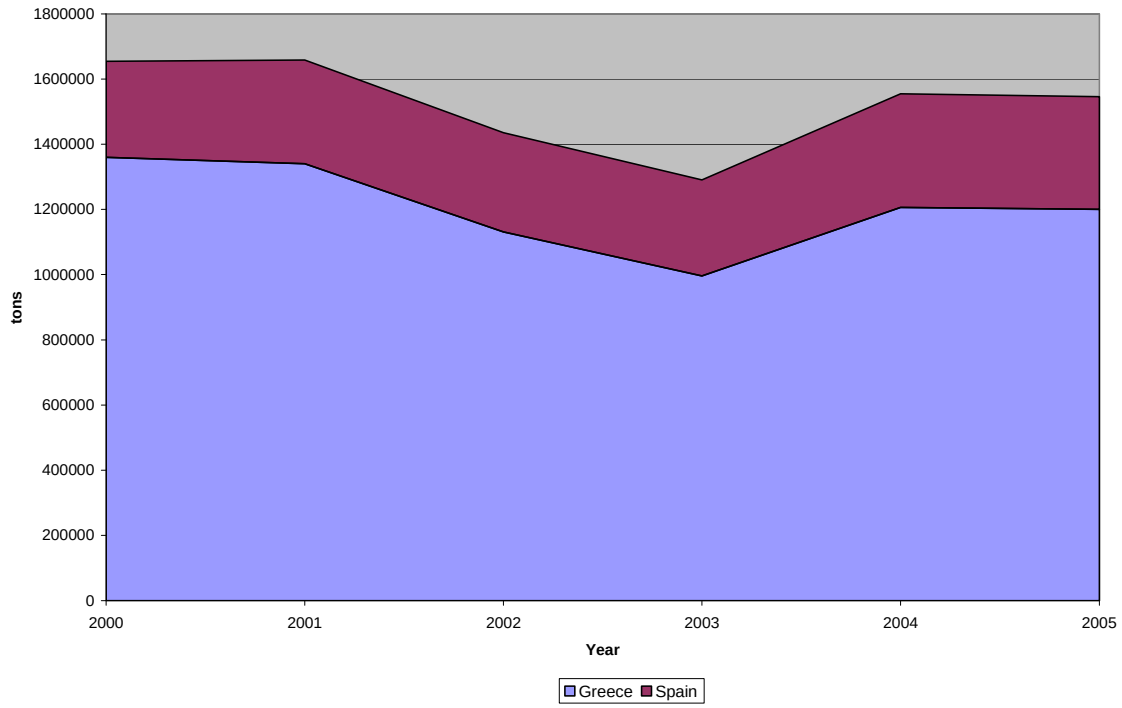
Figure 14.2: Map of Greece

Greek production remained constant (0.41 million ha) up to 2001, despite efforts from the Ministry of Agriculture to persuade growers to reduce plantings in order to stay within the EU quota and avoid penalties. Despite this, good weather conditions during the growing season, improved genetic material (i.e. mainly seeds imported from the US) and plant technical improvements led to a yield increase in both the fields (an estimated 3.3 tons of cotton seeds per ha) and the cotton mills (an estimated extraction rate of 34%) in 2001. In this year, cotton yield stood at 5.1 bales/ha (of 480 lb each) for cotton lint and 3.2 tons/ha for cottonseeds (Figures 14.5 and 14.6). Following the excessive production in the EU (an estimated 1.34 million tons of cottonseeds against a quota of 1.031 million established by EC Regulations 1050/2001 and 1051/2001), Greek farmers received a significantly lower price in 2001 for cottonseeds (0.6-0.7 euros per kg, compared to 0.93 for 2000).



Source: USDA FAS

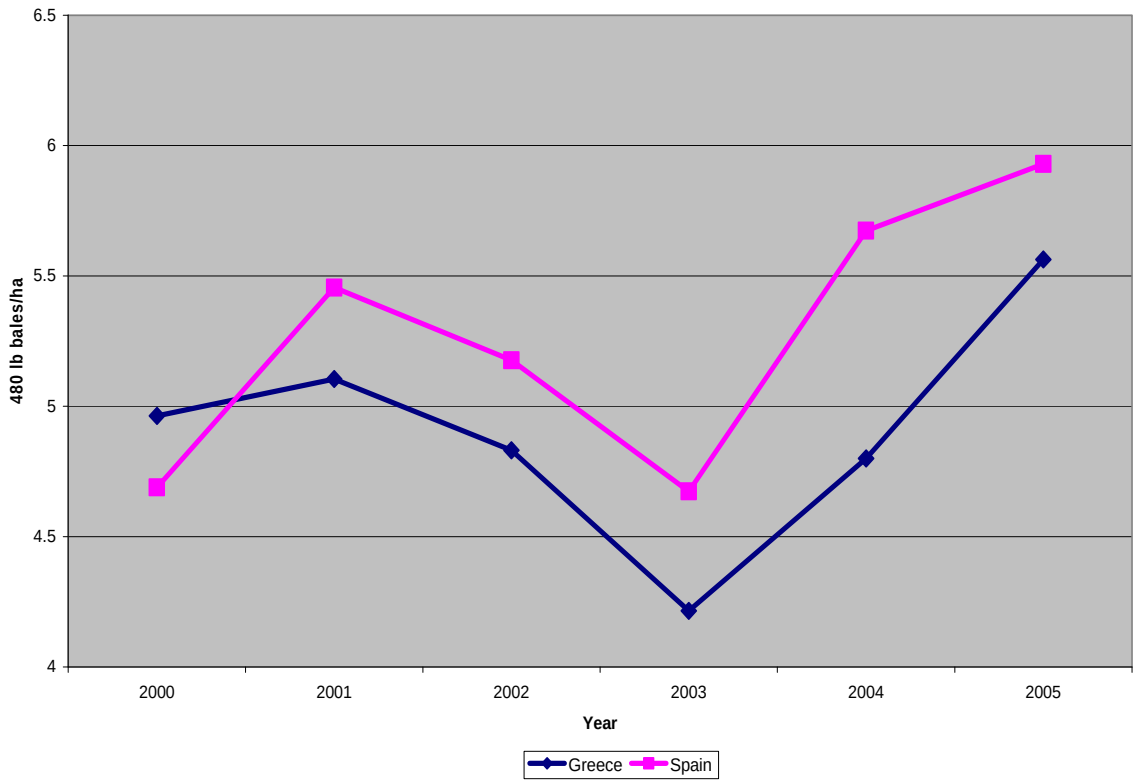
Figure 14.3: Production of cotton lint (bales) in Greece and Spain



Source: data elaborated from USDA FAS

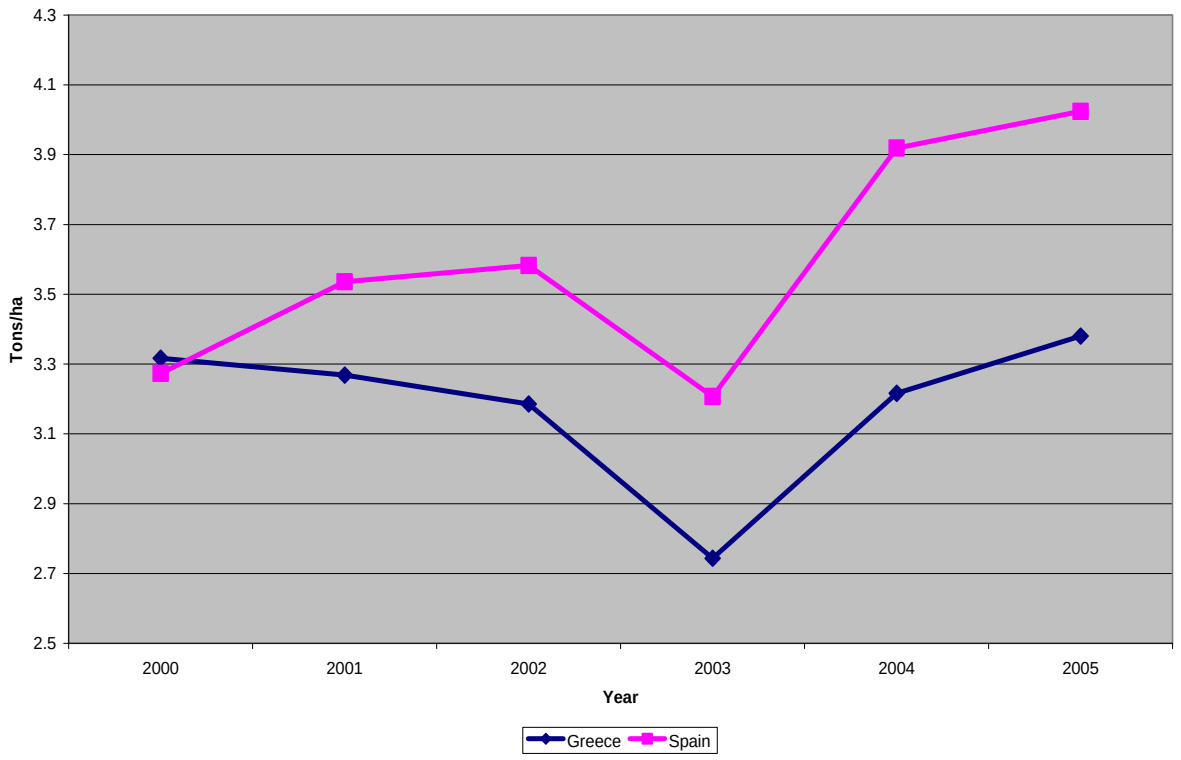
Figure 14.4: Production of cottonseeds (tons) in Greece and Spain

Following the 2001 price reduction (because of excessive production) in 2002 cotton area was reduced, partly due to efforts of the Greek Ministry of Agriculture. Despite the reduction in area cultivated, production of cottonseeds stood at 1.131 million tons still exceeding the quota. In 2003, cotton seed production fell to 0.996 million tons (Figure 14.4), corresponding to an estimated 1.5 million bales (i.e. 332,700 tons of lint) (Figure 14.3). The drop in production was due to relatively reduction in the area cultivated (harvested area was 0.363 million ha), but mostly due to lower cottonseed yields (around 2.74 tons/ha) because of extensive green bollworm infestations. In the following years (i.e. 2004 and 2005) the area did not vary significantly, while production went up to normal levels, thanks to better yields following good weather conditions (Figures 14.5 and 14.6).



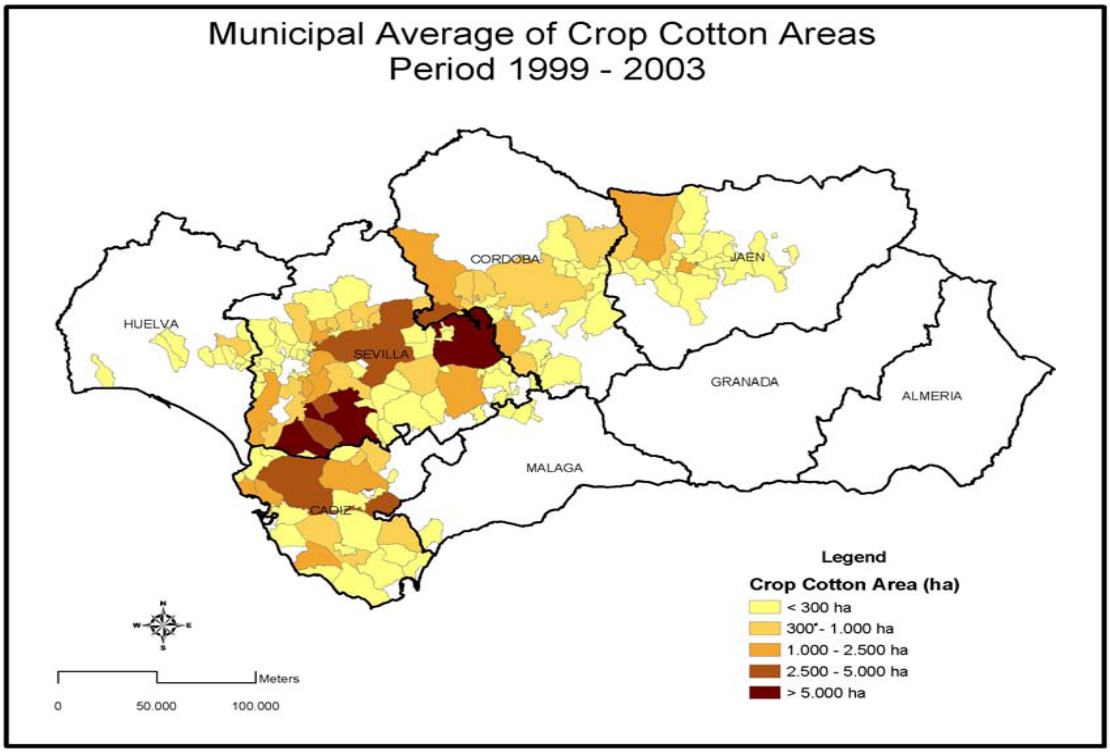
Source: elaborated from USDA FAS

Figure 14.5: Cotton lint yield (bales/ha) in Greece and Spain



Source: elaborated from USDA FAS

Figure 14.6: Cottonseeds yield (tons/ha) in Greece and Spain



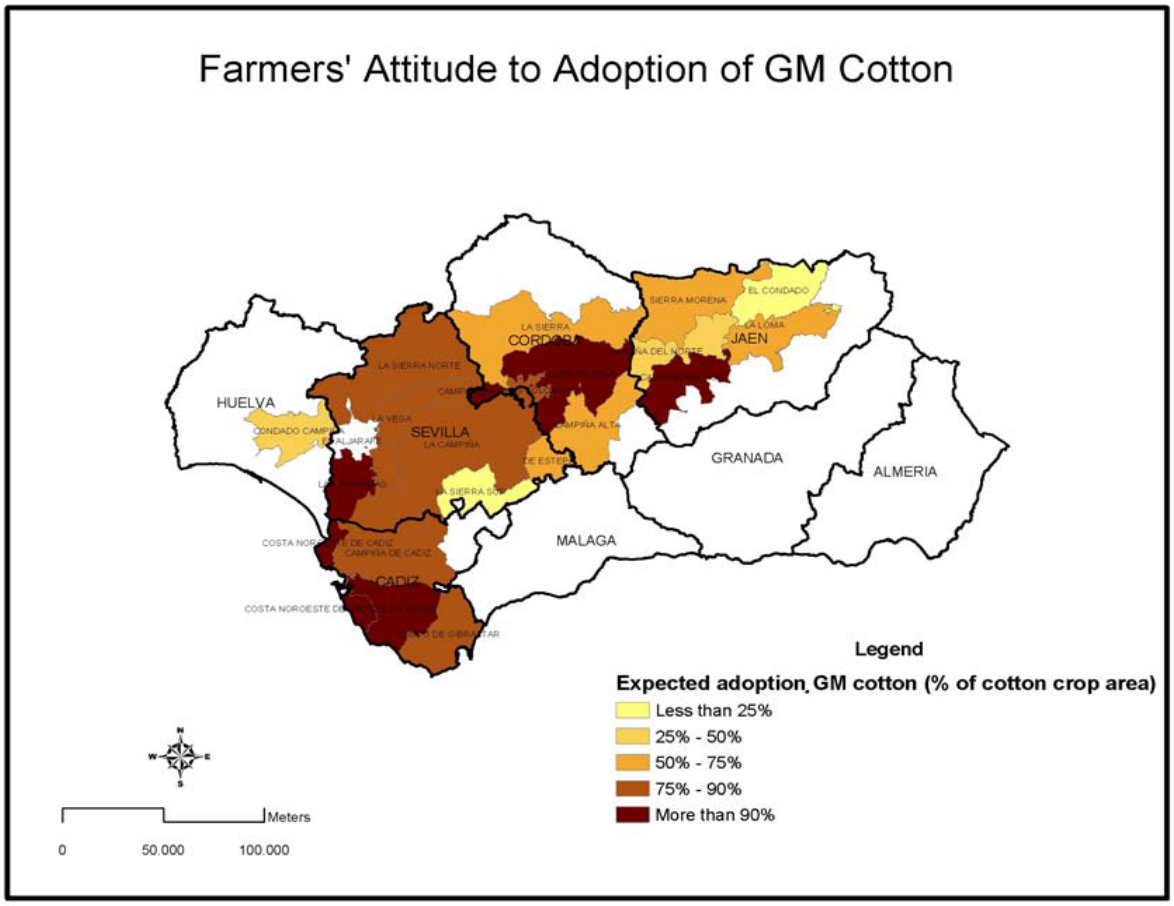
Source: Gomez-Barbero and Rodriguez-Cerezo (2005)

Figure 14.7: Average cotton crop area in Andalusia 1999-2003

Cotton production in Spain is concentrated in the Guadalquivir basin in Andalusia (Figure 14.7). Even for Spain, up to the 2003 CAP reform the crop area (harvested area) ranged between 0.085-0.09 million ha over 2000-2005 (Figure 14.1). Over the same period production ranged between 0.295-0.346 million tons of cotton seeds and 0.422-0.51 million lint bales (480 lb each). Low yields for cottonseed were recorded in 2000 (because of excessive rain during the planting season) and in 2003 (because of the high incidence of the plant pest *Helicoverpa armigera*). On the other hand, cottonseed yields were particularly high in 2001, 2002, 2004 and 2005 because of good weather during the growing season.

14.2 GM cotton

In the EU25 no GM cotton has currently been authorized for production or import. However several requests for authorization for import have been presented. The requests, refer to Bt cotton, herbicide tolerant (HT) cotton and stacked Bt/HT cotton for import and food/feed use.



Source: Gomez-Barbero and Rodriguez-Cerezo (2005)

Figure 14.8: Farmer's attitude towards GM Cotton in Andalusia (Spain)

No requests for cultivation are likely to be presented in the near future because of the strong opposition of Greece and because of the presence of the *aad* marker in most of the Monsanto varieties.

GM Bt cotton reduces the yield loss caused by bollworm infestations. An ex-ante study (Gomez-Barbero and Rodriguez-Cerezo, 2005) shows how in Andalusia (Spain) 58% of cotton farmers were aware of GM Bt cotton in 2003 and among them 95% showed a willingness to adopt such varieties. In the most important producing areas as the Guadalquivir valley, the Marisma marshlands, the Campiña de Cadiz and La Janda, farmers willingness to adopt reached 75% of the cotton area (Figure 14.8). The main reasons for the high willingness to adopt GM Bt cotton in Andalusia are the expected increase in gross margins because of lower pesticides application. The authors suggest that savings due to lower spraying could be around 150 €/ha in a typical farm in Andalucia. Premium for GM seeds should be deducted from this figure. Such results are consistent with the existing literature. Huang *et al*. (2004) estimated the yield advantage of Bt cotton in China at 7-10% and the cost savings at 20-33% (equivalent to an average of 121 €/ha). At the same time the adoption of GM Bt cotton in China led to a reduction in insecticides applications (6 applications per crop on average compared to 20 applications for conventional cotton), total insecticide use (5 times less than conventional) and farmers' insecticides poisoning incidence (5-8% compared to 12-29% among conventional cotton growers) (Huang *et al*., 2003). Morse *et al*. (2005) conclude that the adoption of Bt cotton in India led to significant increases in gross margin (between 43-73%, depending on local conditions).

14.3 Future developments

Following the CAP reform, a new regime was to apply from 1st January 2006. Under the new regime (EC Regulation 864/2004), the support would have been provided as a decoupled single farm payment for 65%, while the remaining 35% would have still been provided as an area payment[20]. The total area eligible for the area payment in the EU is 0.440 million ha divided between Greece (0.37 million ha), Spain (0.07 million ha) and Portugal (0.00036 million ha). For Greece the area payment was established at 594 euros/ha for the first 0.3 million ha and to 342.85 euros/ha for the remaining 0.07 million ha. For Spain the payment was established at 1039 euros/ha while for Portugal the payment was established at 556 euros/ha. The support is subject to production ceilings. If the ceilings are exceeded, support is reduced proportionally. The new regime was effectively blocked by the European Court of Justice who ruled in favor of Spain. Spain made a case against the reform questioning the effects of partial decoupling (at 35%) on the financial viability of cotton production. At present the

[20] Notice that growers did not benefit from direct payments, but benefited indirectly from the aids provided to processors. Therefore, under the new regime the 65-35% split is computed on the basis of the estimated national allocation that producers received indirectly over the period 2000-2002.

future perspective of cotton production in the EU are uncertain and will depend on political developments. However it appears that the cotton area is destined to decline. Over 2005-2007 the cotton area in Spain and Greece has gone down to 0.045 million ha and 0.3 million ha respectively.

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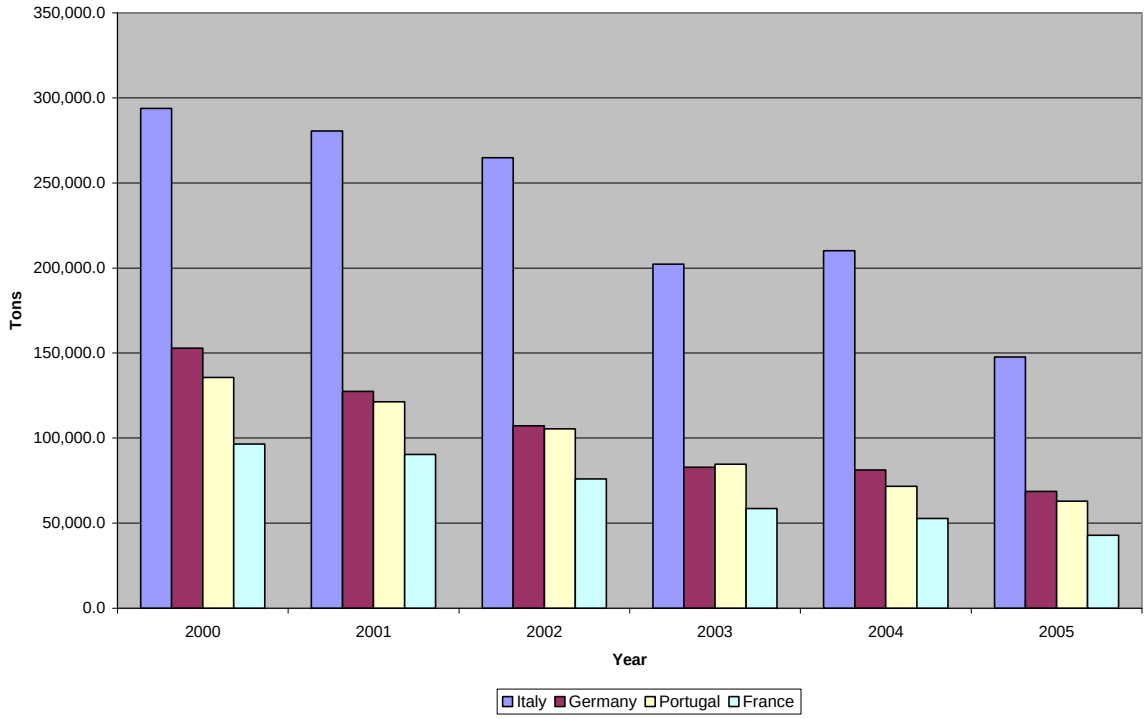
Chapter 15 Cotton Trade in EU25

There is a variety of cotton products, including cotton seed meal/oil, raw cotton, cotton yarns and cotton textiles, reflecting different processing stages. In this analysis we will focus on raw cotton, since it reflects the stage closer to agricultural production and cottonseed meal and oil, since they are used (at least to some extent) in compound feeds and for human consumption.

15.1 Cotton lint trade

In the EU25, the top four importers of cotton (lint) in 2005 were Italy (0.148 million tons), Germany (0.069 million tons), Portugal (0.062 million tons) and France (0.043 million tons). In the same year the major exporters were Greece (0.294 million tons), Spain (0.087 million tons), Germany (0.017 million tons) and France (0.006 million tons). Figures 15.1 and 15.2 illustrate imports and exports of cotton lint by the top 4 Countries in EU25 over the period 2000-2005.

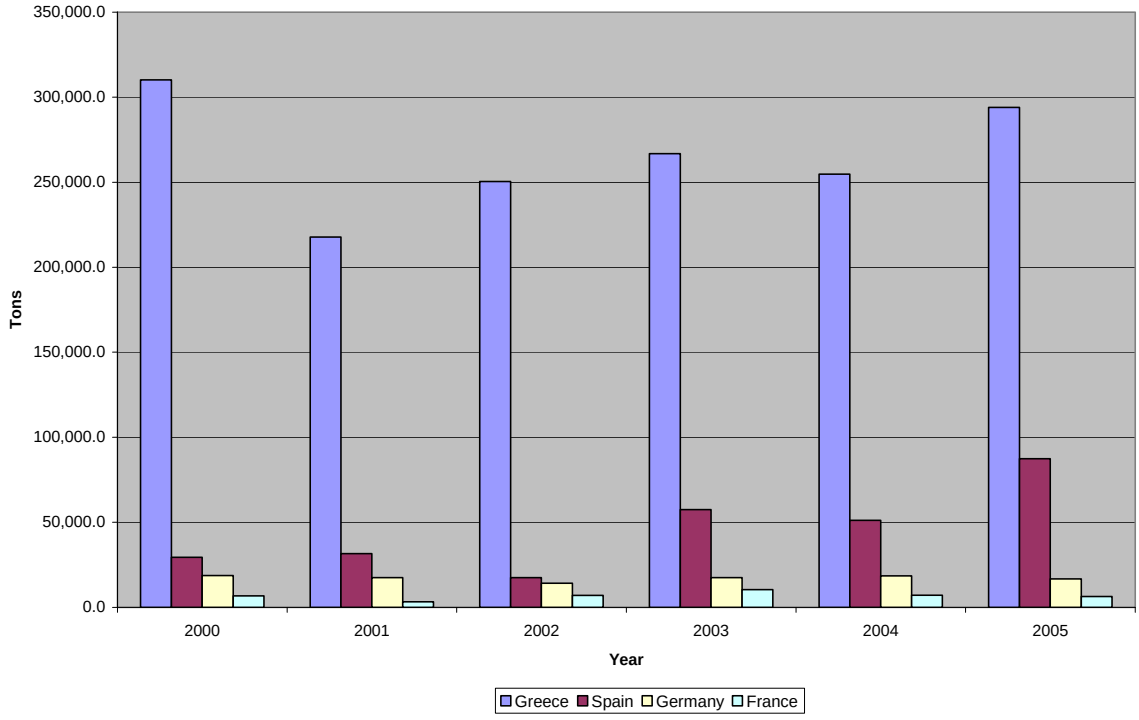


Source: USDA FAS

Figure 15.1: Imports of cotton lint by top 4 EU25 Countries

The four Countries reported in Figure 15.1 account for almost 70% of raw cotton imports in EU25. Italy alone accounts for 30% of cotton imports into EU. Italy's cotton imports have been declining by almost 50% over 2000-2005. The same pattern has been recorded in Germany and Portugal. The main

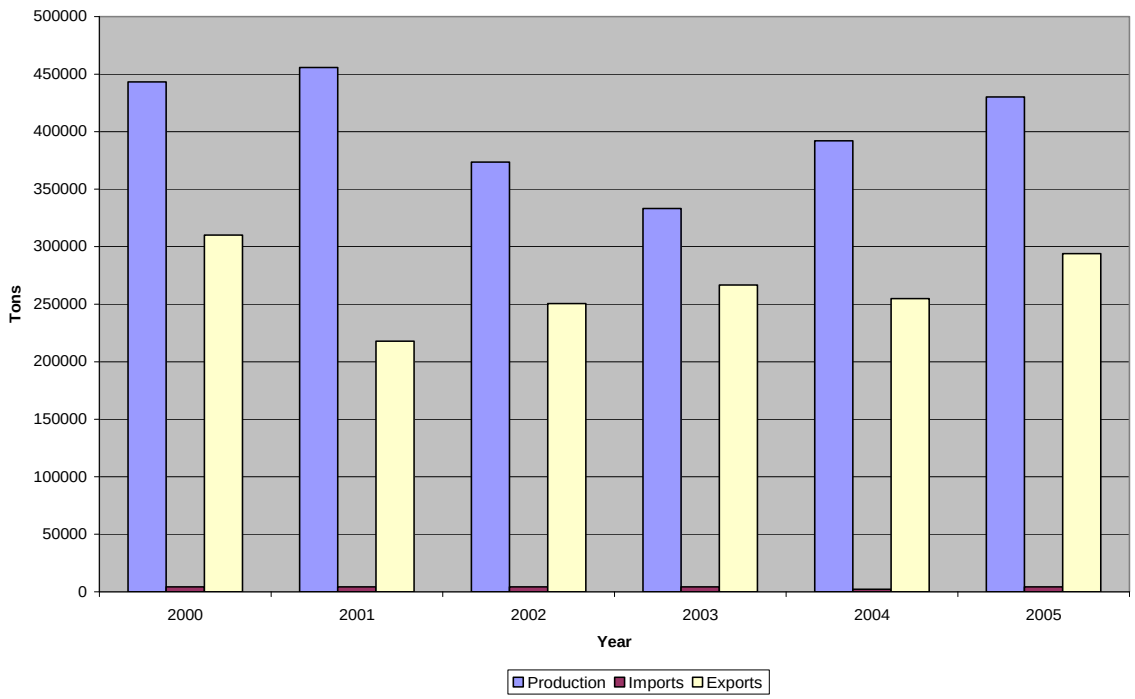
reasons for this are economic stagnation over this period and relocation of the processing industry to Eastern Europe and Asia. Cotton imports closely follow consumption and export markets. The processing industry in Italy, Germany and Portugal is not competitive compared to factories located in China, India and Eastern Europe. The main sources of raw cotton for Italy are Greece, Syria, Uzbekistan, Australia and the US (especially for extra long staple cotton).



Source: USDA FAS

Figure 15.2: Exports of cotton lint by top 4 EU25 Countries

With respect to exports, intra-EU25 trade is quite significant. However, since production only takes place in Greece and Spain (and very small quantities in Portugal), the analysis will focus on Greece. Greece is the largest exporter in the EU25, with around 0.25-0.31 million tons of cotton lint exported over the period 2000-2005. Figure 15.3 shows that exports are a significant part of Greek cotton production (between 47-80% over 2000-2005).



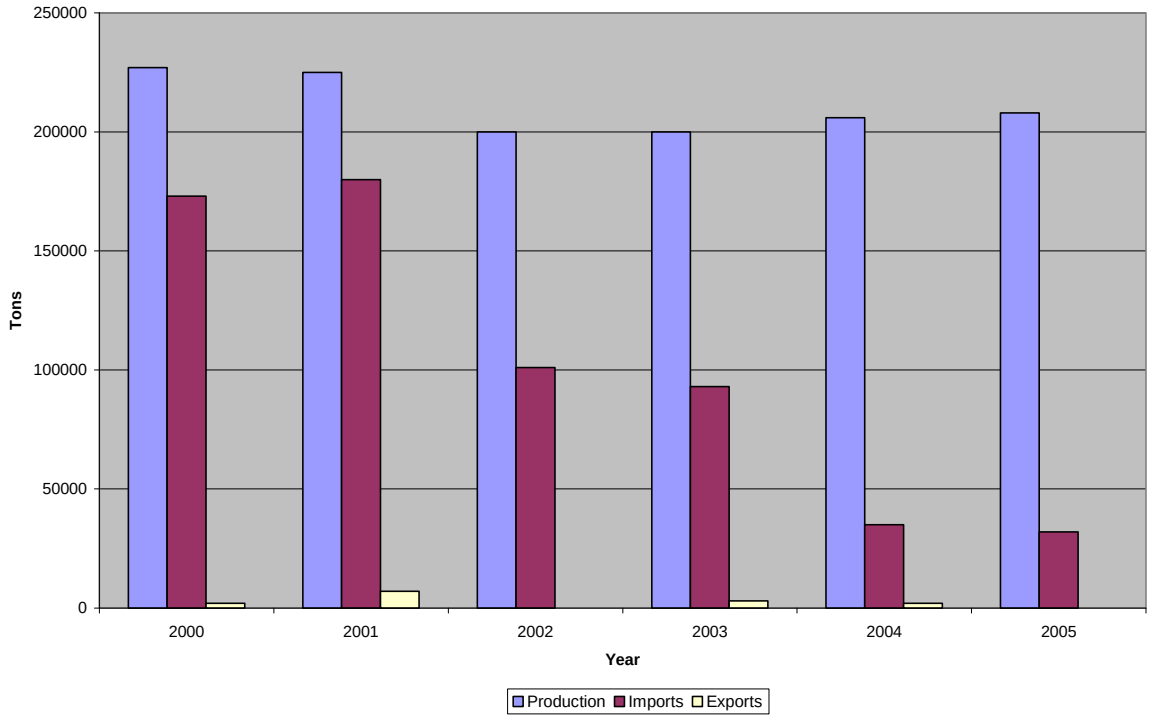
Source: USDA FAS

Figure 15.3: Greece production, imports and exports of cotton lint

Over the period considered the main importers of Greek cotton were Turkey (around 0.13 million tons in 2005) and the EU (particularly Italy). However, low international prices in 2001 made Greek cotton uncompetitive and resulted in a decline in exports in that year. Over the following years Greek cotton exports recovered and showed an increase in 2005. This was also due to the strength in the demand from Turkey and traditional EU importers like Italy.

15.2 Cottonseed meal trade

The EU25 is a net importer of cottonseed meal and Figure 15.4 shows that cottonseed imports ranged between 0.032-0.18 million tons during 2000-2005. Cottonseed meal is mainly used by feed compounders. In Greece such compound feeds are mainly used by the poultry industry, while in Spain they are mainly used for the production of dairy cattle. However, it is important to note how the use of cottonseed meal is very small when compared to other oilseed meals, particularly soybean and oilseed rape meals. Figure 15.4 also shows the sharp decline in cottonseed imports from 2002 onwards. Data from FAOSTAT indicate that in 2004 the main suppliers of cottonseed meal for EU25 were Benin (ca. 0.017 million tons), Brazil (ca. 0.013 million tons), Kazakhstan (ca. 0.012 million tons) and Togo (ca. 0.005 million tons). These figures are not entirely consistent with the ones reported by USDA FAS (and illustrated in Figure 15.4), but we believe they can provide a rough indication of the sources of cottonseed meal.

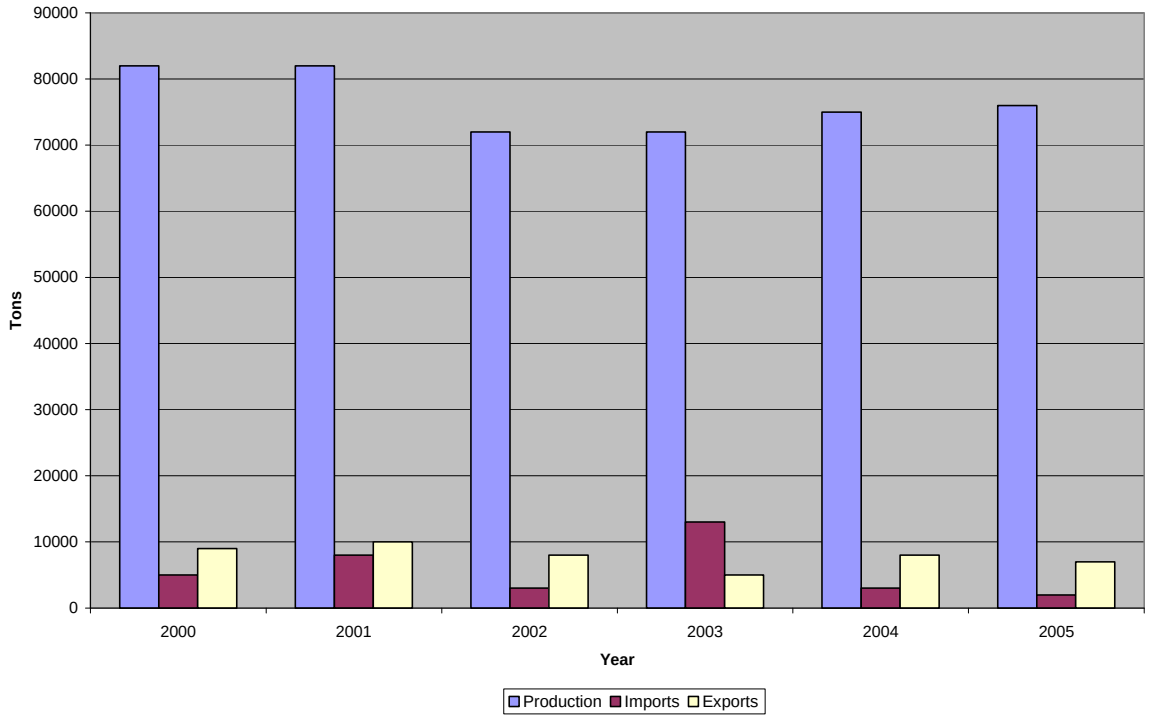


Source: USDA FAS/PSD

Figure 15.4: Production and trade of cottonseed meal in EU25

15.3 Cottonseed oil trade

Cottonseed oil is to some extent used as cooking oil because of its low price. Figure 15.5 shows production and trade of cottonseed oil in EU25. Data on production illustrate the same pattern observed for cottonseed meal (not surprisingly). The observed reduction in cottonseed oil production reflects also reduced crushing. Imports of cottonseed oil are relatively low (between 0.002-0.013 million tons over 2000-2005). FAOSTAT data indicate that in 2004 Turkey was the largest supplier of cottonseed oil (around 0.0018 million tons). With respect to exports, Greece is the only exporter of cottonseed oil in the EU25. In 2004 Bulgaria was the main destination receiving almost 0.0015 million tons (FAOSTAT)



Source: USDA FAS

Figure 15.5: EU25 production and trade of cottonseed oil

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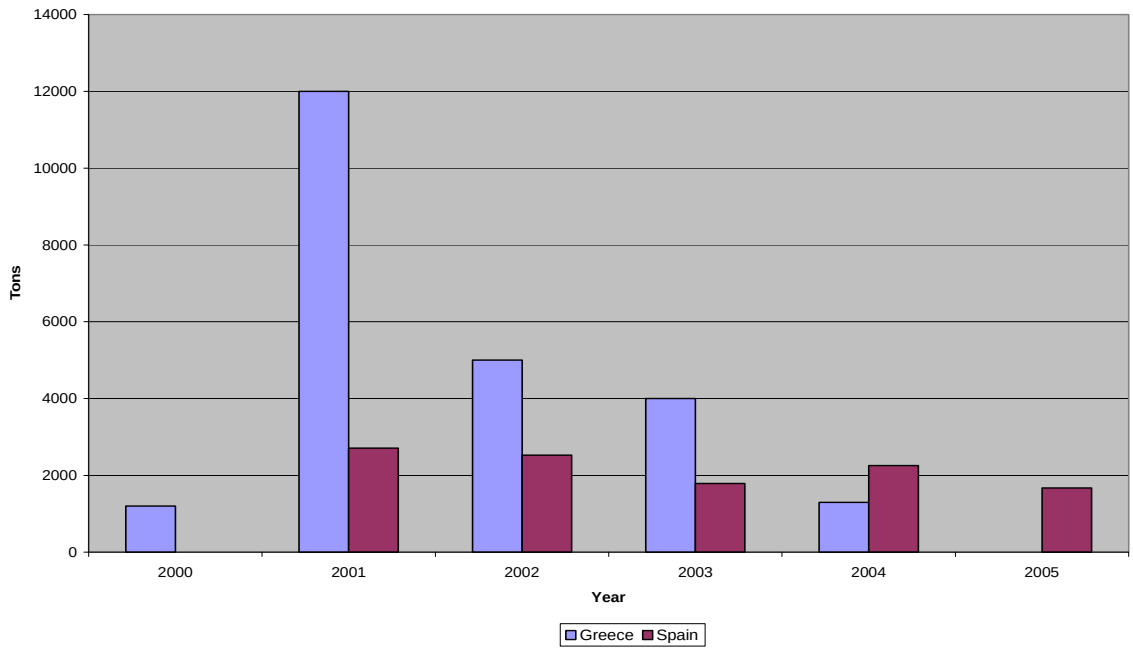
Chapter 16 Cotton Seed Production and Trade in the EU

16.1 Cotton seed production

Cotton seed production in the EU25 mainly occurs in some regions of Greece (mainly Thessaly and Macedonia-Tracia) and Spain (in Andalusia), the only two Countries with significant cotton production. Figure 16.1 illustrates the evolution of production volume over the period 2000-2005.

In Greece, seed of local cotton varieties is produced by local companies and by the Cotton Institute. Traditionally, cotton seed varieties were produced by the Hellenic Cotton Board until 2002, when this was abolished. Of the seed produced by the private companies, it is believed that 60% are derived from breeding programs in the USA.



Source: USDA and MAPA

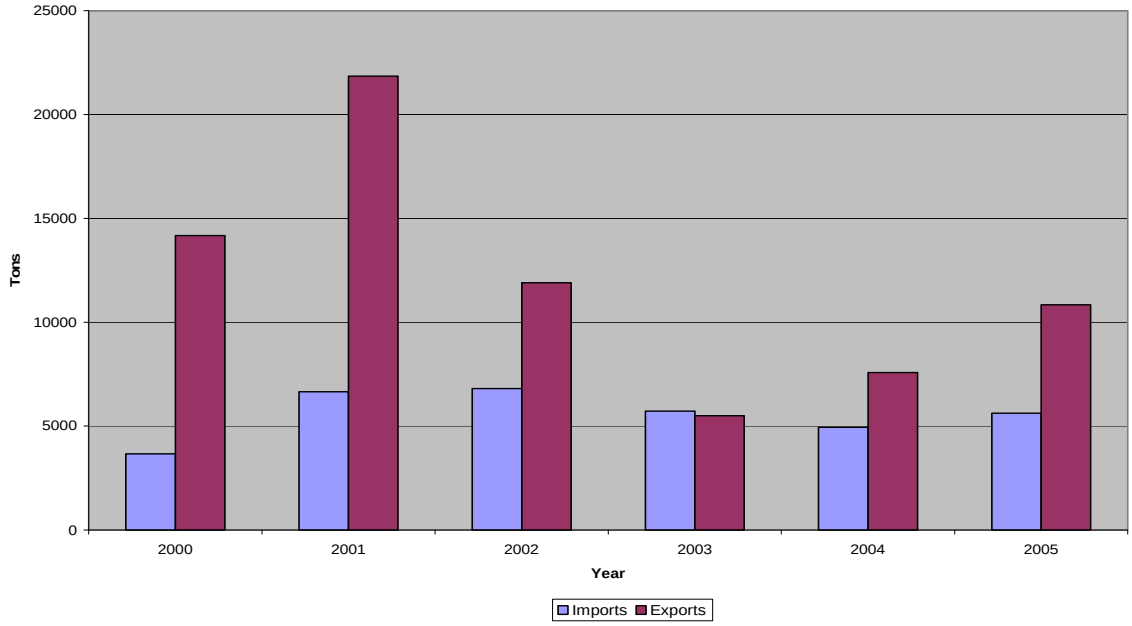
Figure 16.1: Cotton seed production volume in Greece and Spain

Domestic production of cotton seed has been declining over time because of the reduced area of cotton plantings and increased reliance on imported seeds. Over the period 2000-2005 the cotton area in Greece declined from 410,000 ha to 355,000 ha. As such seed requirements also declined. Seed production in 2000 was particularly low because of high stocks from the previous years. However, the presence of adventitious GM material in some imported seed samples created a shortage of seeds in 2000. Seed growers took advantage of the situation by expanding production in the following year (12,000 tons of seed domestically produced). Due to bad weather, in 2002 domestic production was at 5,000 tons despite extensive plantings (up to 20,000 ha of cotton seeds).

In Spain cotton seed production has been relatively constant, reflecting a slower decline in cotton plantings (from 90,000 ha in 2000 to 86,000 ha in 2005). All the production takes place in Andalusia (because of good climatic conditions suitable for cotton and water availability), close to the main crop production area. Certified seeds cover only part of the annual sowings as farm-saved seeds are also used. Also, not all the cotton seed produced in Spain are certified and not all certified seed production is sold for crop production.

16.2 Cotton seed trade

Data on seed trade are sparse and in what follows we report mostly from the COMEXT database and on USDA GAIN reports. The two sources are not always consistent but at least they provide a general perspective of cotton seed trade in the EU25. Figure 16.2 illustrates cotton seed trade for Greece.

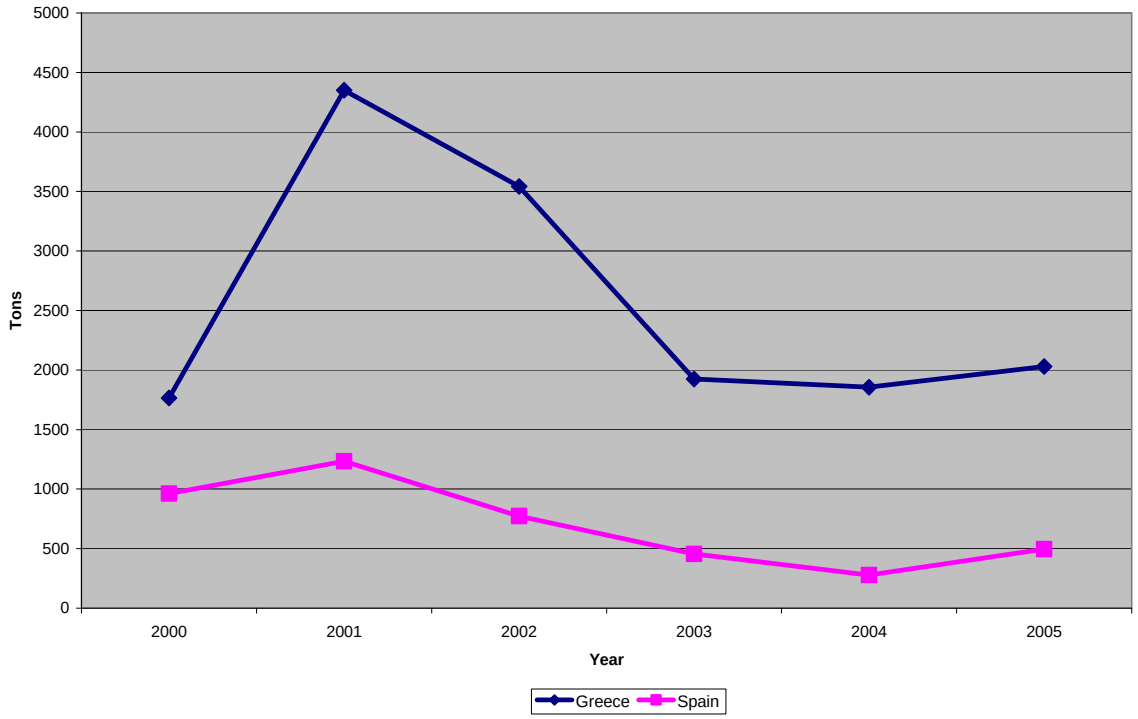


Source: COMEXT

Figure 16.2: Cotton seed trade in Greece

USDA sources indicate that before 2000 the size of the cotton seed market in Greece was about 12,000 tons (to plant around 410,000 ha plus replanting). A substantial share of this market was supplied through US imports (between 8,000-10,000 tons). However, following the discovery of adventitious GM materials in some seed samples imported from US in the spring 1999, seed imports went down to 3,700 tons in 2000 (of which 1,800 from US). The adventitious presence of GM material in imported cotton seeds led the Greek authorities to take a decision requiring the absence of GMOs in imported seeds. The decision negatively affected cotton seeds imports and this created a shortage of planting seeds which is the main cause for increased cotton seed area in 2001 (Figure 16.1). In the years 2001-

2005 USA cotton seed imports have certainly increased compared to 2000, but remained lower than the pre-2000 levels (Figure 16.3). Despite this, the US is still the main exporter of cotton seeds for Greece accounting for 36-65% of total Greek cotton seed imports. Today other major exporters of cotton seeds to Greece include Australia (2,200 tons in 2004) and Turkey (3,000 tons in 2005).



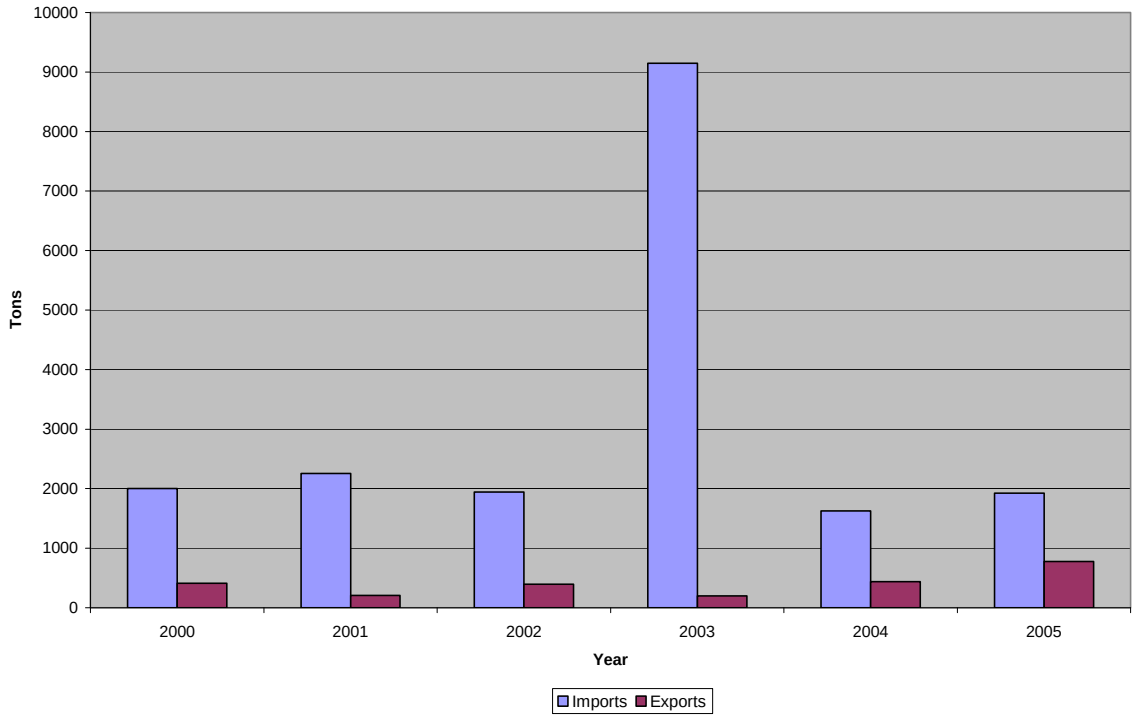
Source: COMEXT

Figure 16.3: Cotton seeds imports originating in the US

In general cotton seeds imports declined over the period 2002-2005 from 6,800 tons to 5,600 tons (Figure 16.2). The decline is due to the reduction in cotton plantings over the same period (see section on cotton production). The small increase in imports observed in 2005 was due to the high use of seed stocks in the previous year, when bad weather conditions at planting times required a significant amount of replanting. Figure 16.2 also shows that Greece is a net exporter of cotton seeds, mainly to Italy and more recently to Hungary and Belgium. Since these Countries have no internal production of cotton, it is likely that they re-export.

Spain is a net importer of cotton seeds (Figure 16.4), with no significant exports (except small quantities to Greece). If one excludes 2003, total seed imports ranged between 1,600-2,200 tons over 2000-2005. The main exporters of cotton seeds to Spain are the US (277-1264 tons), Turkey (308-777), Australia (478-922). The share of US imports has been declining over 2001-2004 in favour of seeds imported from Turkey and Greece, mainly because of the issue of GM. Total seed imports were

extremely high in 2003 though (9,100 tons of which 7,500 from Greece). This was due to the relatively high cotton plantings in the same year (around 92,000 ha).



Source: COMEXT

Figure 16.4: Cotton seed trade in Spain

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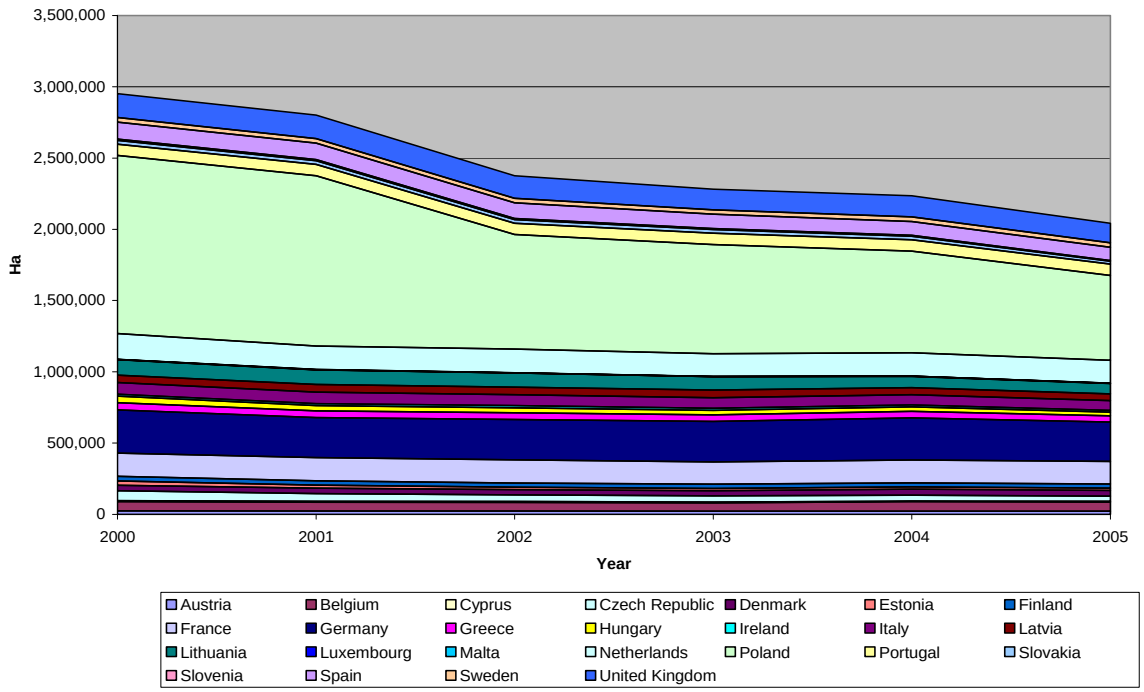
Chapter 17 Potato Production in the EU

17.1 Ware potato production

In the EU25, five countries (Poland, Germany, the UK, the Netherlands and France) account for over 60% of potato production. The area in potato cultivation in EU25 decreased by almost 30% from 2.9 million ha to just over 2 million ha (Figure 17.1) during 2000-2005. This was mainly due to reduced potato cultivation in Poland (figure 17.2), which dropped by almost 50% (i.e. – 0.6 million ha) over this period. There are multiple reasons for this. Potatoes were extensively used as an animal feed in Poland but in more recent years the use of potato as feed has sharply declined and today potatoes are primarily used for other purposes (e.g. starch, table, processing) with only surpluses or by-products used for feed. Similarly, in ethanol production potatoes used to be the major feedstock but have now been replaced by cereals.

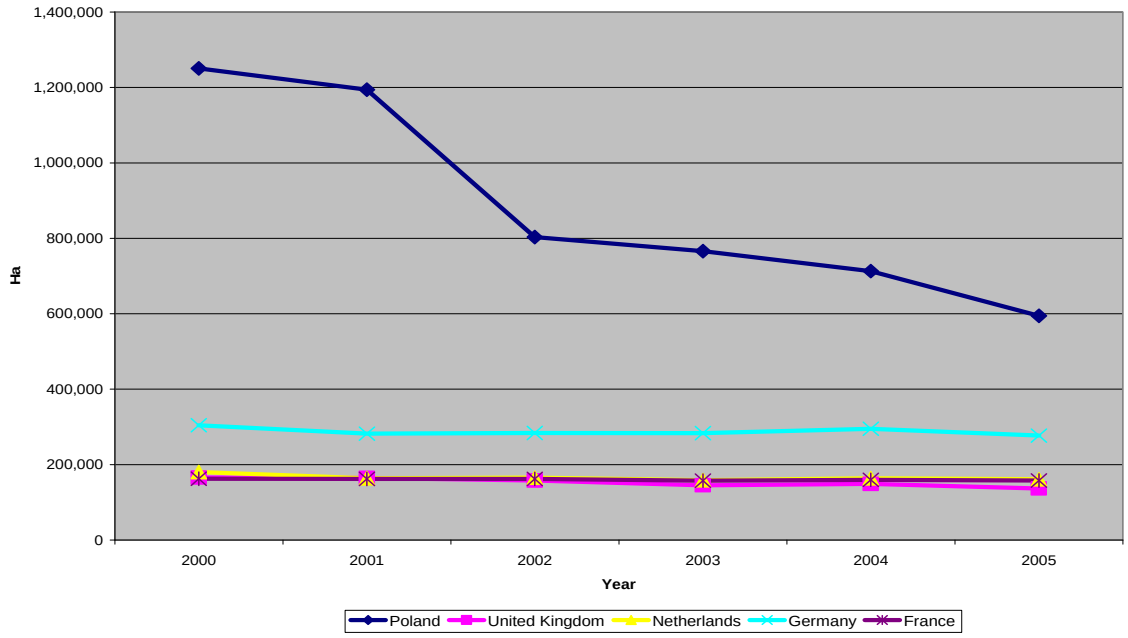


Source: FAOSTAT

Figure 17.1: Potato area in EU25

Accession of Poland to the EU in 2004 has further accelerated this process, since under the CAP cereals are supported but potatoes are not. Per-capita consumption of potatoes in Poland has also declined from 134 to 129 kg per year (Dr. Wieslaw Dzwonkowski personal communication), therefore contributing to reducing in production. Finally the improvement in the performance of varieties and the increase in yield (Figure 17.4) have also contributed to the reduction in cultivated area. This is

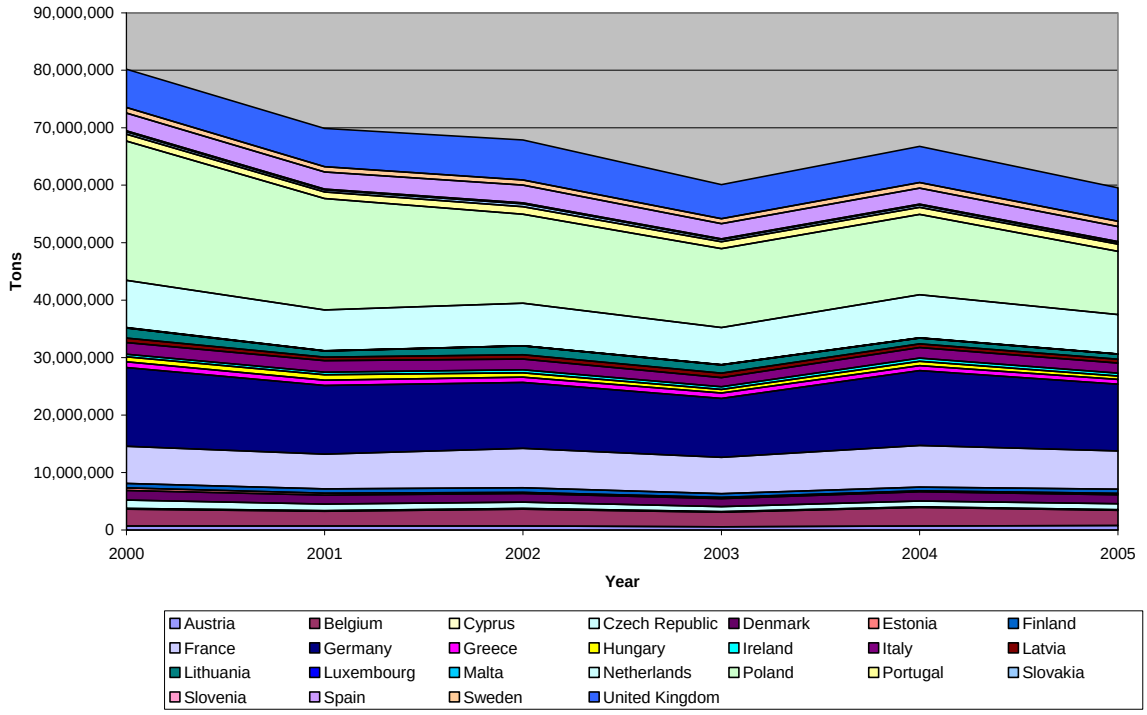
partly a consequence of many gardeners and other non-professional producers no longer growing potatoes.



Source: FAOSTAT

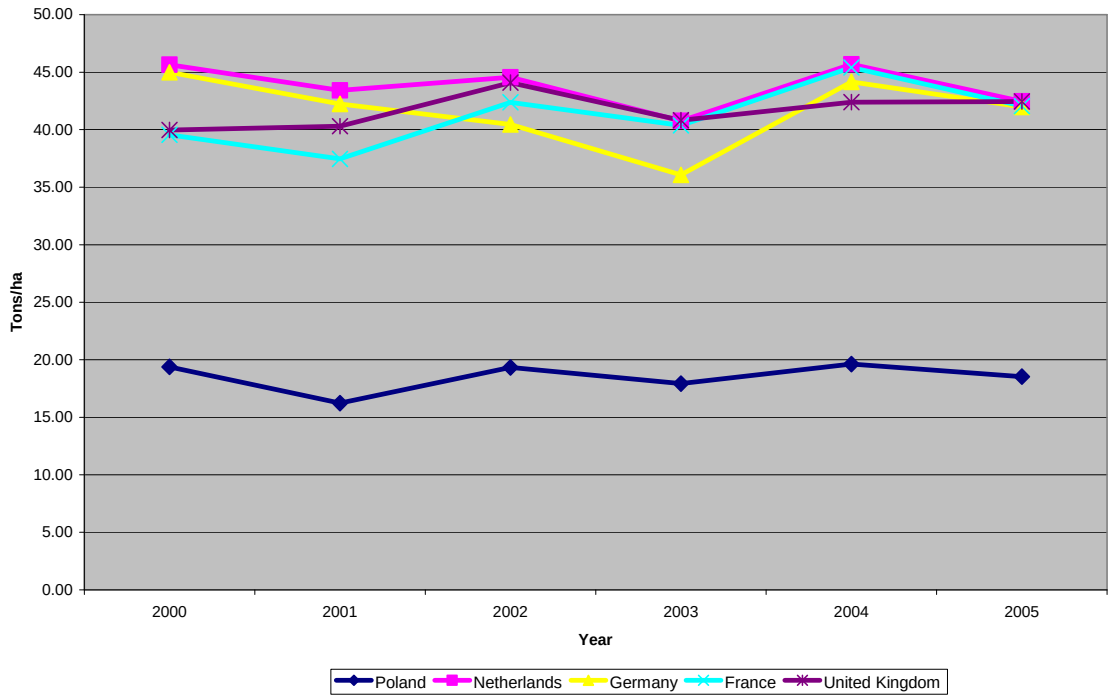
Figure 17.2: Potato area in top 5 Countries

In the other major producing Countries, the potato area remained fairly stable over this period (Figure 17.2). Observed changes in production in EU25 (Figure 17.3) can then be explained by looking at yields (Figure 17.4). The summer drought in 2003 resulted in lower production in all the main producing regions. On the contrary, 2004 was a high production year because of improved weather conditions (i.e. cooler summer and higher rainfall). Potato yield has been stable or slightly increasing in France, the UK and Poland, while it appears to have been decreasing in the Netherlands and Germany. Apart from Poland, where the decrease in production for self-consumption by small farms played a major role, yields variation can be attributed to weather conditions.



Source: FAOSTAT

Figure 17.3: Potato volume in EU25



Source: FAOSTAT

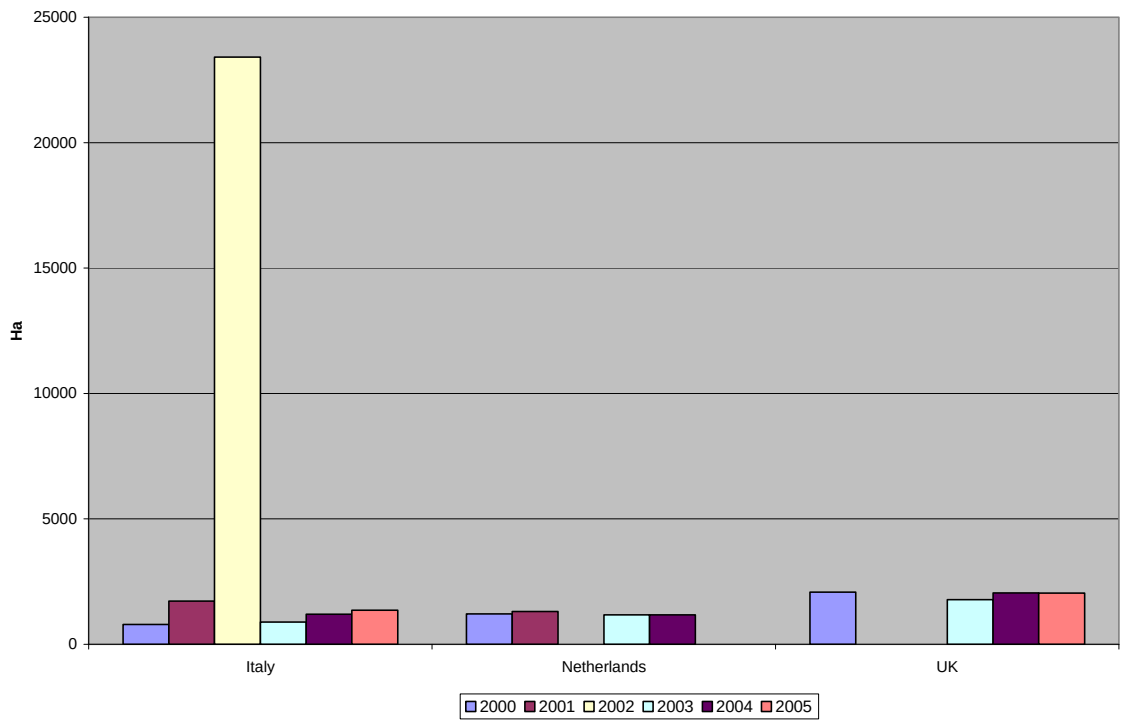
Figure 17.4: potato yield in top 5 Countries

Industry statistics suggest that for EU15 the major production is of table potatoes (around 34%), processing (around 20%) and starch potatoes (around 17%). Starch potato production is a regulated sector in the EU. The main elements of the regime include a quota system, support to growers through minimum guaranteed prices and area payments and support to processors. EC Regulation 1868/1994 and its following amendments establish a total quota for potato starch production in EU25 of 1.949 million tons. This corresponds to a quota of 1.762 million tons of starch for starch producing Countries of EU15 (i.e. Denmark, Germany, Spain, France, the Netherlands, Austria, Finland and Sweden) and 0.187 million tons of starch for the new Member States after 2004 enlargement (Czech Republic, Estonia, Latvia, Lithuania, Poland, Slovakia).

Starch potato growers must have a contract with a processor. Processors must pay at least a minimum price of 178.31 euros/ton of starch (i.e. this is equivalent to a minimum price of 35.66 euros/ton of potato with 17% starch content, as established by EC Regulation 2235/2003). The minimum price is adjusted according to the starch content. Also a payment to potato growers of 110.54 euros/ton of starch (n.b. the payment applies to the quantity of potato necessary to produce 1 ton of starch) is made. Following the introduction of the Single Payment Scheme (SPS, as from EC Regulation 1782/2003), from 2005/2006 40% of the area payment will be decoupled and included in the SPS, while the remaining 60% (i.e. 66.32 euros/ton of starch) will be maintained as specific area payment. Finally an aid to processors (who have paid the minimum price to growers) is guaranteed in the measure of 22.5 euros/ton of starch.

17.2 Organic and GM potato

Data on organic potato production in the EU are scattered. Figure 17.5 shows the total organic potato surfaces (i.e. fully converted and under conversion) for Italy, the Netherlands and the UK. With the exception of Italy in 2002, the area of organic potato has been quite limited during 2000-2005, ranging between 0.000797 million ha (in Italy in 2000) and 0.002 million ha (in the UK in 2000). Most of the area (between 47% and 93%) is fully converted. Overall, the area of organic potato production in the three Countries under consideration (excluding Italy in 2002) represented between 0.7-2.1% of the domestic potato area. In this context the extremely high area of organic potato production in Italy in 2002 (over 0.023 million ha), looks unusual.



Source: Eurostat

Figure 17.5: Area of organic potato in Italy, the Netherlands and the UK.

At the moment no GM potato varieties have been authorized for cultivation in the EU, but a variety of GM potato for starch production is being considered (see section 17.3).

It is worth mentioning how in Romania in 2000 a small area of GM Bt ware and seed potato (New Leaf varieties), tolerant to the Colorado Potato Beetle (*Leptinotarsa decemlineata*) were cultivated (see Chapter 19 for information about the New Leaf potato seed varieties in Romania). The varieties were dropped from the National Catalogue in 2003.

17.3 Future developments

The existing negative trend in the pro-capita consumption of potato is expected to continue because of increases in disposable incomes. At the same time the increasing trend in potato yield is also expected to continue. As a result the potato area in the EU is expected to decline by 0.6-1.2% per annum.

An important development concerns the possible introduction of GM potato varieties for starch production. Currently the EU is considering the authorization of such varieties. The GM varieties would produce only one of the two components of starch (amylopectin), which otherwise would have to be separated during processing, allowing a reduction in the costs of starch production. Since the GM varieties do not offer any direct agronomic benefit to farmers, their adoption would be definitively driven by the starch industry. The Netherlands and Germany are the two largest growers of starch potato in the EU with around 0.05 million ha and 0.03 million ha respectively in 2005. Starch potato

production in the Netherlands is mainly concentrated in the North-East, while in Germany it takes place in the North, North-West and South-West. These are the areas were the adoption of GM potato varieties is likely to happen first. Despite the difficulty of making predictions, a general willingness of farmers to adopt GM varieties for starch production was noted. It seems that BASF has already contacted enough farmers willing to produce the seeds in Germany (mainly in the same areas of starch potato crop production).

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http://www.fao.org

http://www.fas.usda.gov/psdonline/psdquery.aspx

http://www.fas.usda.gov/scriptsw/attacherep/

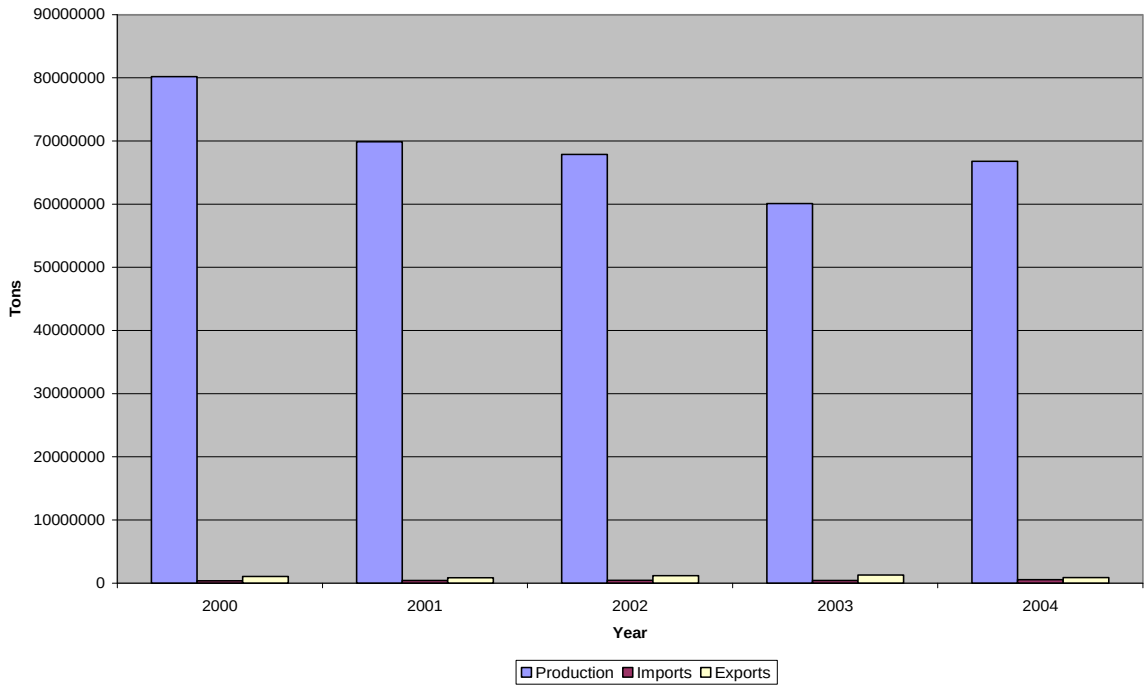
http://fd.comext.eurostat.cec.eu.int/xtweb/

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL

Chapter 18 Potato Trade in the EU

18.1 Ware potato trade

Potato trade is quite small compared to internal production in the EU (Figure 18.1). This is because potato is costly to store and transport and because of plant health issues.



Source: FAOSTAT

Figure 18.1: Potato production and trade in EU15 and EU25[21]

Over the period 2000-2004 (data for 2005 were not available) potato imports from Third Countries into EU15 (EU25 in 2004) ranged between 0.36-0.54 million tons (i.e. 0.4-0.8% of domestic production), while exports ranged between 0.83-1.3 million tons (i.e. 1.2-2.2% of domestic production). In 2004 the main importers were Belgium (around 0.024 million tons), the Netherlands (around 0.017 million tons) and Spain (around 0.042 million tons). In the same year, the main exporters of potatoes to EU25 were Israel (around 0.062 million tons to Spain, Belgium and the Netherlands only), Egypt (around 0.012 million tons to the Netherlands) and Morocco (around 0.009 million tons to Spain, Belgium and Netherlands alone). In terms of exports, in 2004 the Netherlands were the largest exporters with significant quantities to Algeria (around 0.098 million tons), Senegal (around 0.044 million tons), Russia (around 0.036 million tons), Egypt (around 0.035 million tons), Mauritania (around 0.021 million tons) and Morocco (around 0.019 million tons).

[21] Data for the period 2000-2003 refer to EU15.

Consulted websites

http://www.fao.org

http://www.fas.usda.gov/psdonline/psdquery.aspx

http://www.fas.usda.gov/scriptsw/attacherep/

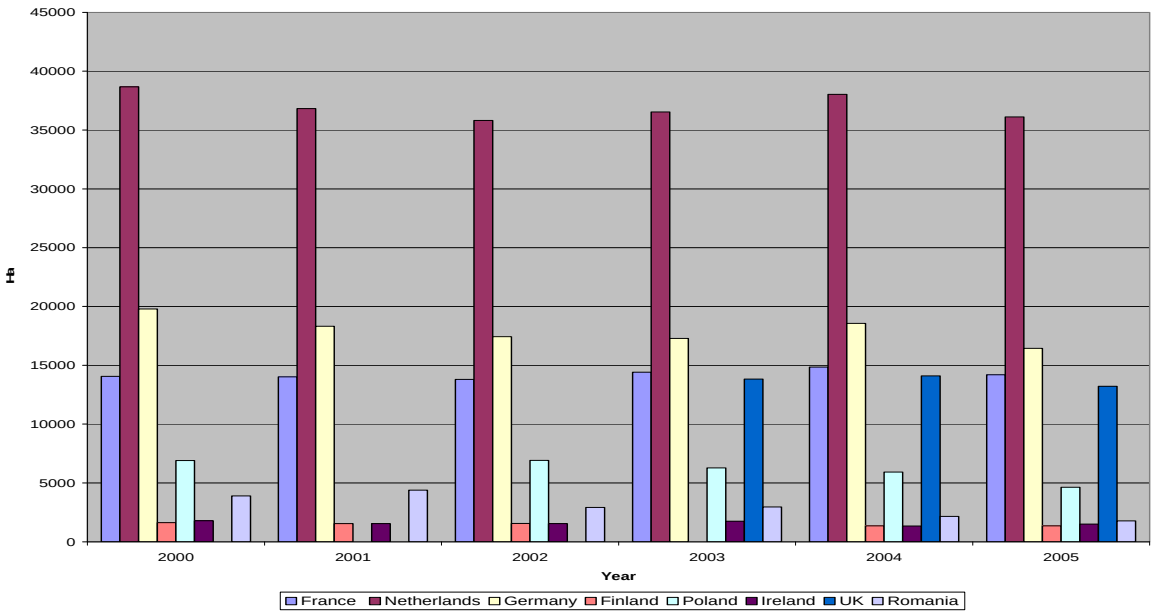
http://fd.comext.eurostat.cec.eu.int/xtweb/

http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_33076576&_dad=portal&_schema=PORTAL

Chapter 19 Seed Potatoes Production and Trade in the EU

19.1 Seed potato production

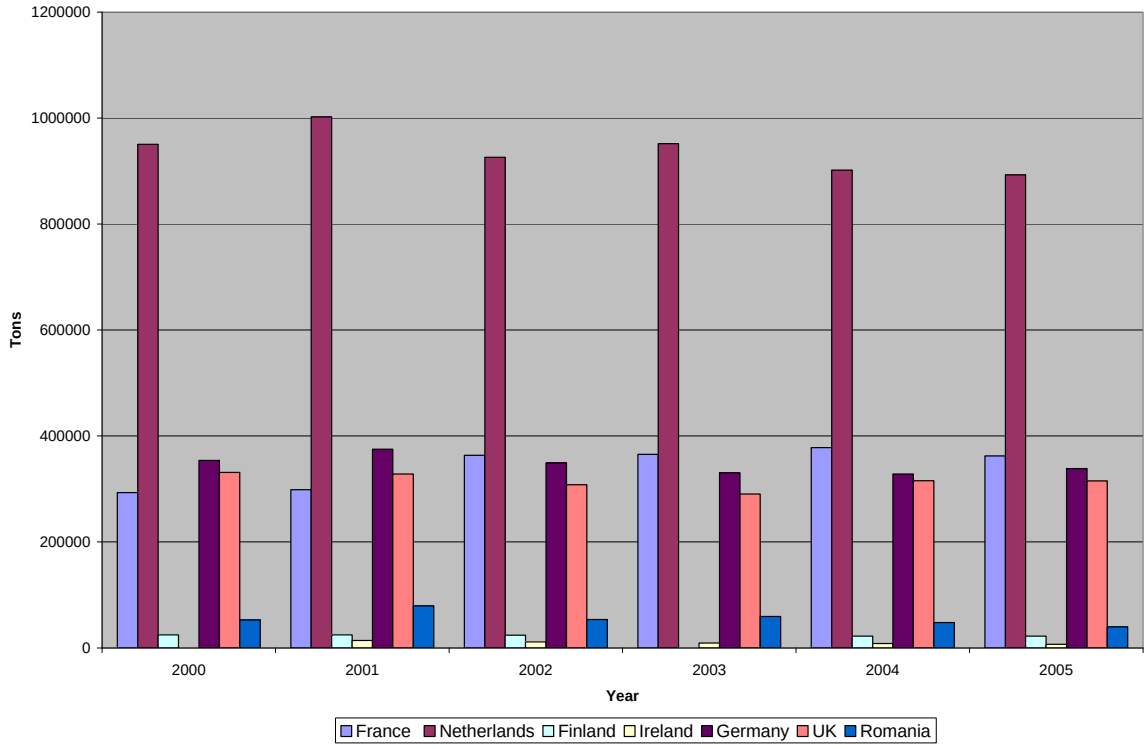
Potatoes are propagated by tubers and not from true seed but the propagating tubers are known as seed potatoes. Under European law only basic seed potatoes or certified seed potatoes can be sold in the market (EC Directive 56/2002). Basic seed potatoes are mainly used for the production of certified seed potatoes, which in turn are mainly used for the production of ware potatoes, though some farmers may multiply seeds for their own use. In both cases strict regulations with respect to tolerance to viruses and pests and inspection requirements are laid down by European and national laws. Within the EU there are High Grade Seeds Areas (HGSA) where production and marketing of seed potatoes is restricted only to basic seeds (Decision of the European Commission of 19/12/2003). Such areas include parts of Germany, Finland and the UK, areas of the Azores above 300m of altitude and the entire territory of the Republic of Ireland. Figures 19.1 and 19.2 illustrate the area and volume of seed potato production in the major producing countries in EU25 during 2000-2005[22].



Source: ESCAA, NAK, GNIS, BPC, Bundessortenamt, MTT, PIORIN and NIAB.

Figure 19.1: Seed potato area in major producing countries in EU25

[22] Data for the UK were not available for 2000-2002.



Source: ESCAA, NAK, GNIS, BPC, Bundessortenamt, MTT, PIORIN

Figure 19.2: Volume of certified seed potato by major producing countries in EU25

The largest producers were the Netherlands (around 36,000 ha in 2005), Germany (around 18,000 ha in 2004), France (around 14,000 ha in 2005) and the UK (around 13,000 ha in 2005). The data show that the area and the volume of potato seed production have remained more or less constant in the EU during 2000-2005. This reflects the trends observed in potato production in EU25 (see Chapter 17 on potato production). A small increase in seed potatoes area is registered in 2004 in France, the Netherlands and Germany. This was mainly due to the recorded (small) increase in potato crop area in those countries in the same year and the consequent need to increase seed stocks. In the Netherlands, despite the area increase, the volume of certified seed potatoes decreased in 2004 because of excessive rains and flooding, particularly in Friesland (seed potatoes were damaged by brown rot).

In the Netherlands potatoes seed production is mainly concentrated in the North and North-West of the Country, in provinces like Friesland, Groningen, Noord-Holland and Flevoland. On the other hand ware potato production mainly takes place in the South. Starch potato production mainly takes place in the North-East. Despite this, experts believe that seed and crop potatoes can be grown side by side with clear separation distances (Mr. Van de Haar personal communication). The approved area for seed potato production in the Netherlands (Figure 19.1) mainly refers to basic seed production (52% in 2005) and certified seed (41.5% in 2005), while prebasic seeds represent a small fraction (6.5% in 2005). Most of the seed potatoes produced in the Netherlands are for human consumption. This

reflects the fact that starch potato production accounts for roughly 30% of the total crop production (50,700 ha out of a total of 155,800 ha in 2005). Also starch potato seed production is more limited due to the use of farm-saved seeds. The use of farm-saved seeds is not allowed in other types of potato production in the Netherlands. Organic seed potatoes production is estimated at between 1-3% of total seed potato production in the Netherlands. No production of GM seeds, apart from few field trials, is currently taking place in the Netherlands. At the moment no dramatic changes in the production of seed potatoes in the Netherlands are foreseen. It is generally expected that the crop and seed area will not increase in the next 5 years (Henk van de Haar, NAK, personal communication).

In Germany seed potatoes production is mainly concentrated in three Northern Länder (Niedersachsen, Mecklenburg-Vorpommen, and Schleswig-Holstein) and in the South-Eastern Land of Bayern. At the regional level there is no separation between seed and crop production, since soil type and climate largely determine in which area potatoes can be grown. The total area of seed potatoes in Germany has been relatively stable over the past years between 16,000 – 20,000 ha over 2000 – 2005. As the major potato crop producer and the second major potato seed producer, Germany was selected for a case study. A detailed analysis of seed potato production in Germany is presented in section 3.

In France the area of certified seed potato production has remained largely unchanged around 14,000 ha, with production levels around 360,000 tons of certified seeds per annum. With respect to trade, seed potatoes imports mainly originate from within the EU. Once again this pattern reflects the effect of strict phytosanitary measures on seed potato imports within the EU. France exports significant quantities of seed potatoes to Tunisia (12,000 tons in 2005), Algeria (7,000 tons in 2005) and Egypt (7,200 tons in 2005) where they are grown for ware production in extended growing seasons for early and late season markets in Europe.

In the UK the area of seed potato production has also been relatively stable between 12,000 ha and 14,000 over 2003 – 2005. The reason for this is the reduction in the area cultivated for crop potato. However, due to good growing conditions in 2004 and 2005, the amount of certified seeds has actually gone up in those years, standing at around 315,000 tons in 2005. Almost 80% of seed potatoes production occurs in Scotland (around 260,000 tons in 2005), while England and Wales account for the remaining 20%.

The area of certified seed potato production in Romania has ranged between 1800-4400 ha during 2000-2005, while the volume over the same period has ranged between 40,000-80,000 tons per annum. In general there has been a decline in seed potato production in Romania, especially in 2004-2005,

when the area dropped from 2,500 ha to less than 1,800 and the volume of certified seeds dropped from 54,000 tons to less than 40,000 tons. However in 2000-2005 there was an increase in seed potato imports, especially from the Netherlands and Germany (see section on trade). The decline in seed potato production is due to the low profitability to seed growers. The use of farm-saved seeds in Romania is still extensive and has been estimated to account for 80-90% of the market.

Romanian seed potato production data illustrated in Figure 19.1 and 19.2 refer to conventional certified seeds. However, in 2000 25 ha of GM potato certified seeds were grown in Romania (16 in the Department of Brasov and 9 in the Department of Harghita, both in the Centre of Romania) for a volume of 183 tons (110 tons in Brasov and 73 tons in Harghita). The varieties (Superior Newleaf) were modified to express a Bt toxin to control the Colorado Potato Beetle (*Leptinotarsa decemlineata*). The GM varieties were cancelled from the national catalogue in 2003. No organic seed potatoes are produced in Romania.

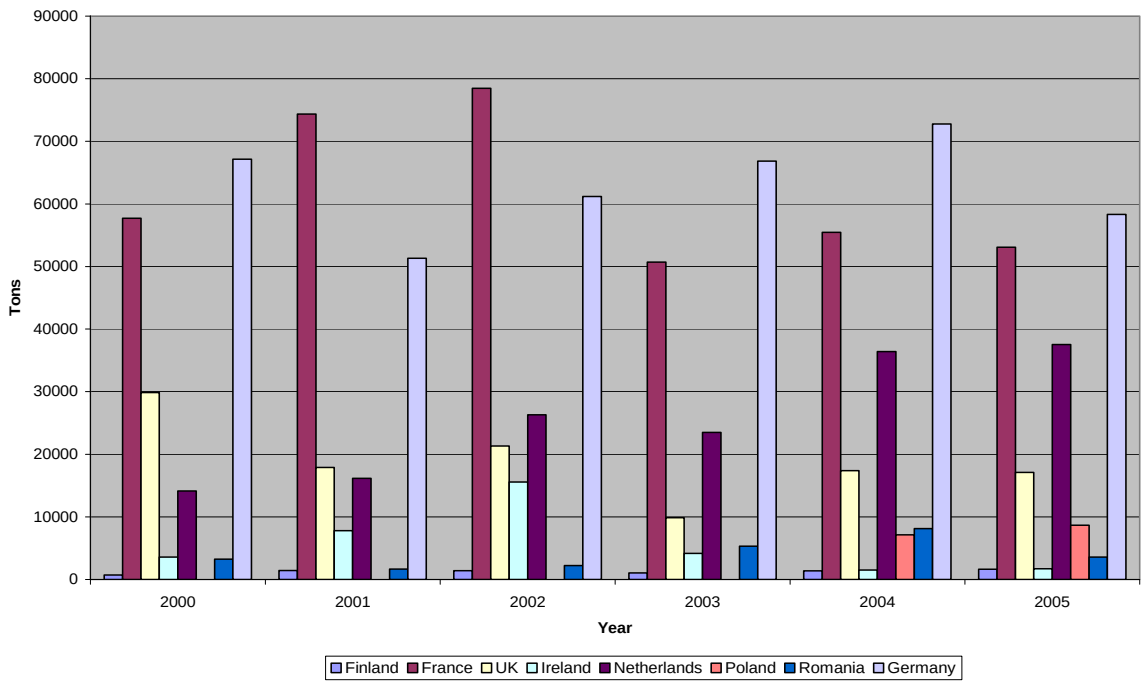
Potato seed production mainly occurs in isolated mountainous areas in the Centre-East, North-East and East of the Country[23]. The most important departments for potato seed production in Romania are Brasov (516 ha out of a total of 1769 in 2005), Covasna (292 ha in 2005), Harghita (327 ha in 2005), Neamt (153 ha in 2005) and Suceava (244 ha in 2005). On the other hand potato crop production is more wide-spread, with large ware potato production for supermarket in the Centre of Romania (Harghita, Covasna and Brasov) and early potato production in the South (Dimbovita). Starch potato production is at low levels in Romania and is currently taking place only in the Department of Sibiu (Centre).

Poland despite being the largest potato grower in the EU (albeit declining quickly), has only limited production of seed potatoes. There is extensive use of farm-saved seed, especially in small farms. Over the period 2000-2005 the area for certified seed potato production has declined from 6,900 ha to 4,600 ha due to the reduction in the crop area.

19.2 Seed potato trade

Figures 19.3 and 19.4 illustrate data on seed potato trade by major producing countries in EU25. France is the largest importer of seed potatoes, followed by Germany and the Netherlands. It is also possible to observe an increase in French seed potato imports over the period 2000-2002. This is related to the increase in the exports rather than the increase in potato plantings (which in fact decreased over the same period).

[23] This helps to minimize the risk of virus or other pathogens/pests attacks.

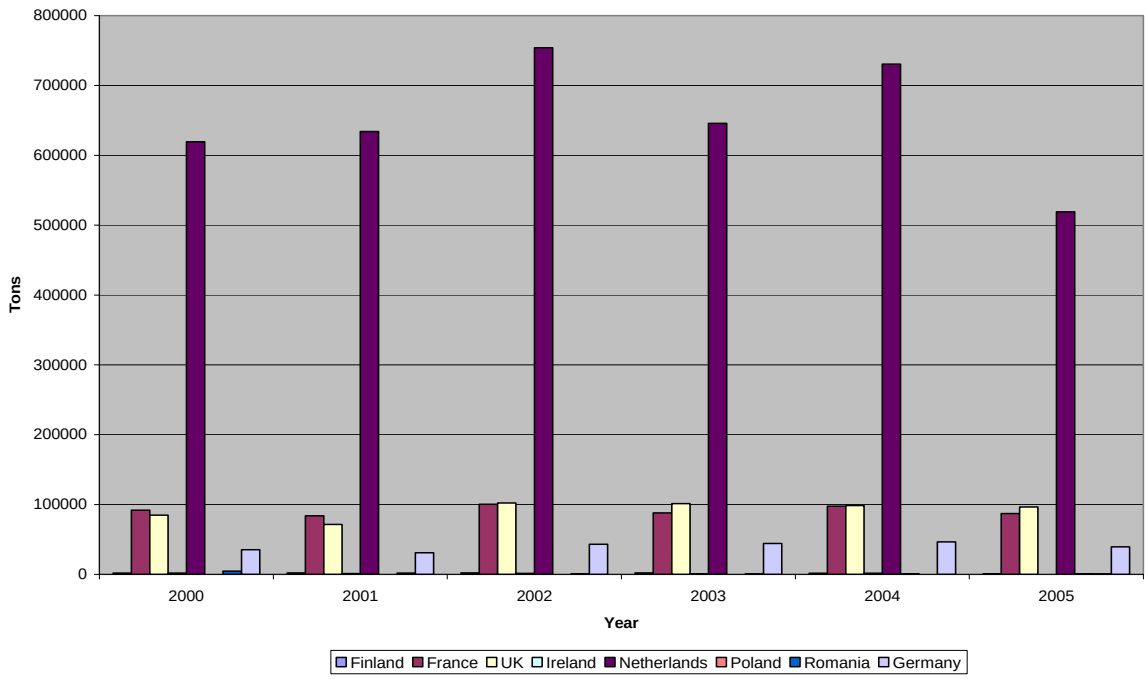


Source: COMEXT

Figure 19.3: Seed potatoes imports by the 'top 8' EU25 Countries

For the countries considered in Figure 19.2, all the imports originate in the EU. This is due to the strict standards of tolerance for pests and diseases imposed by the EU. The EU does not allow imports of seed potatoes from outside the EU, except from Switzerland and in case of derogation.

The Netherlands are by far the major potato seeds exporter in the EU25, followed by France and the UK. Significant quantities of seed potatoes are exported outside the EU25. France exports outside the EU are mainly directed towards Algeria (around 7,000 tons in 2005), Egypt (around 7,200 tons in 2005) and Tunisia (around 12,000 tons in 2005). The Netherlands also export significant quantities of potato seeds to Egypt (around 40,000 tons in 2005), Algeria (around 28,000 tons in 2005), Cuba (around 20,000 tons in 2005), Lebanon (around 16,000 tons in 2005), Israel (around 12,000 tons in 2005) and Tunisia (around 10,000 tons in 2005). Figure 4 also shows that Dutch exports of seed potatoes were particularly high in 2002 and 2004. This was mainly due to larger than usual quantities of seed potatoes export to Algeria (around 115,000 and 99,000 tons in each respective year). Similarly, the low Dutch exports recorded in 2005 are a result of the drop in exports to Algeria (down to just 28,000 tons) due to changes in export requirements that could not be met by the exporters.



Source: COMEXT

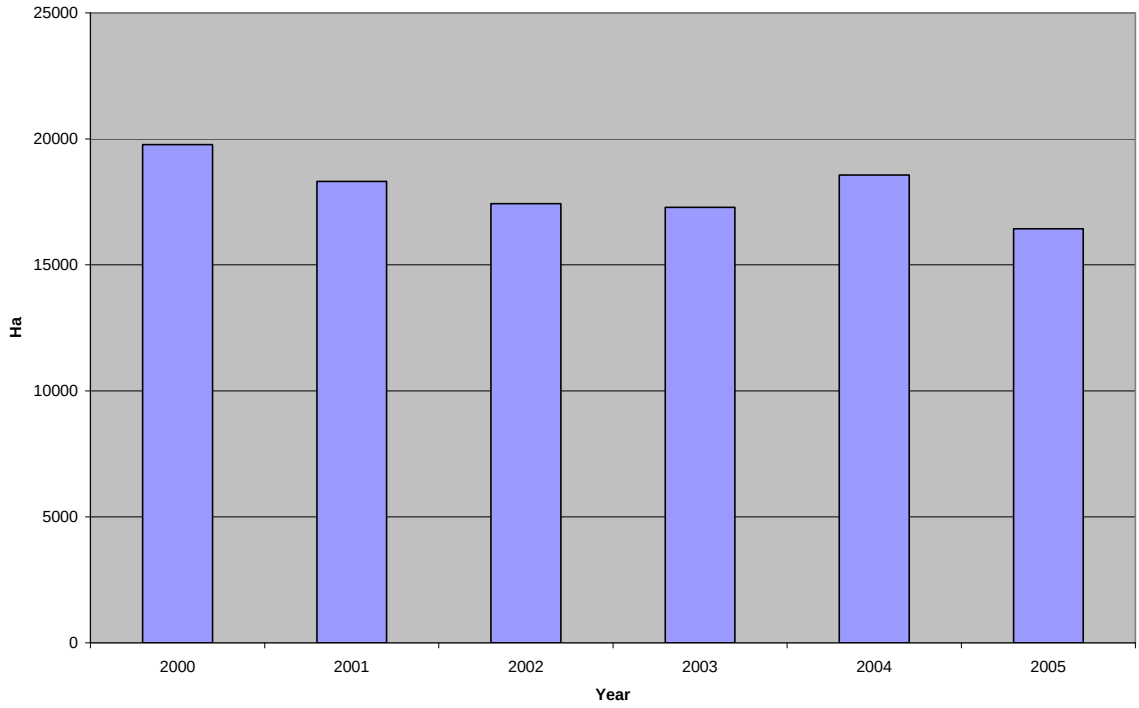
Figure 19.4: Seed potatoes exports by the 'top 8' EU25 Countries

In general the large amount of seed potatoes exported by EU producers to North African Countries (e.g. Algeria) is due to the ability of these Countries to grow the crop also in the winter season. The production taking place in these Countries is subsequently exported to the EU. In this way the EU benefits from an extra growing season in the winter. At the same time the EU is sure that the quality of the imported crop conforms to its internal standard (since the varieties are grown from seeds provided by the EU itself).

19.3 Case study: seed potato production in Germany

19.3.1 Production and Trade

Germany is one of the largest producers and trader of seed potatoes in the EU, together with the Netherlands and France. In 2005 16,435 ha were approved for the production of certified seeds in Germany.

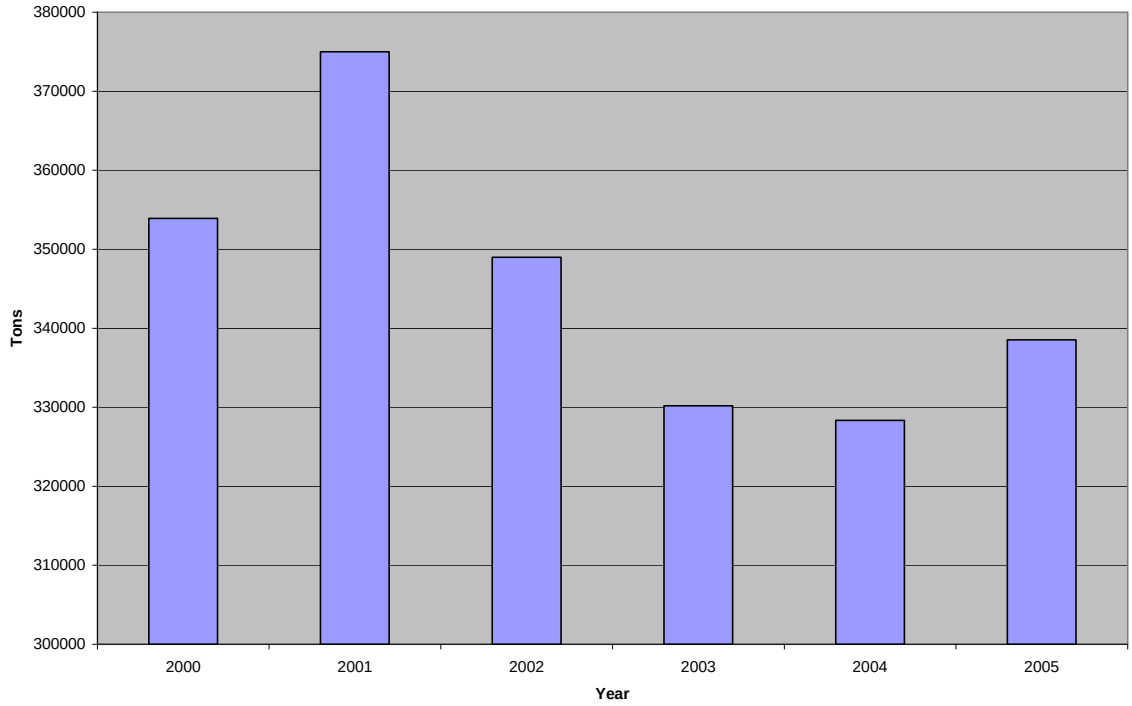


Source: Bundessortenamt and ESCAA

Figure 19.5: Area of certified seed potatoes production

Figure 19.5 shows that the area of certified seed potato production in Germany over 2000-2005 has been constant (or slightly declining). This is in line with the observed trend in potato crop production in Germany and the EU as a whole. Experts foresee a reduction in potato area in the EU at a rate of 0.6-1.2% per annum. As already explained in the crop section, this decline is due mainly to reduced pro-capita consumption of potato products as a consequence of an increase in disposable income and increase in the yield.

Most of the seed varieties grown are for the production of ware potatoes (for food and processing industry). However, the data in Figure 19.5 also include areas for the production of starch potato seeds. In 2005 about 2,600 ha of certified potato seeds were dedicated to the multiplication of starch potato varieties. The production of starch varieties is relatively small. This reflects the limited area of starch potato production in Germany (around 30,000 ha) compared to ware potatoes (around 270,000 ha). Starch seed potatoes are grown in the four Länder of Niedersachsen, Mecklenburg-Vorpommern and Bayern Brandenburg. The production of starch potato crops is also concentrated in these Länder, so seed and crop production coexists.



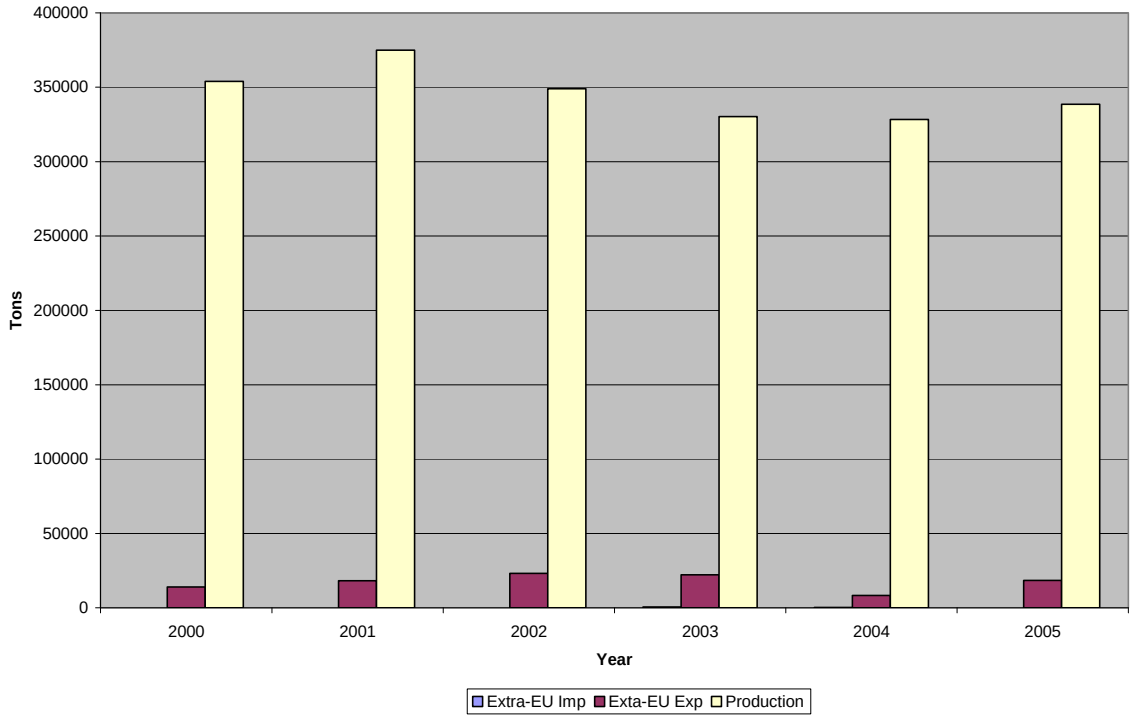
Source: Bundessortenamt

Figure 19.6: Volume of certified seed potatoes in Germany

The data presented in Figure 19.6 mainly refer to certified seeds (80%) but also include basic and pre-basic seeds. Basic and pre-basic seeds are produced internally by the breeding companies.

Farm-saved seeds are a significant proportion of the seeds used in potato crop production, representing around 50-60% of seeds used by farmers. However, the use of farm-saved seeds is mainly restricted to the production of ware potatoes and 'non-contract' potatoes more in general. Traditionally the production of starch potatoes and other contract produced potatoes (e.g. for chips production) mainly relied on certified seeds (i.e. the contract requires farmers to use certified seeds). In the past 2-3 years though, due to the decrease in starch potato prices, starch potato farmers have been able to use farm-saved seed potatoes in order to reduce production costs.

Figure 19.7 illustrates Germany seed potatoes trade with Third Countries, as reported by the German Ministry of Agriculture. Seed potatoes imports are extremely limited, ranging between 0-480 tons per annum during 2000-2005. An analysis of the COMEXT database suggests that the origins of the imports recorded up to 2004 were mainly Countries that later on became part of the EU (notably Poland and Czech Republic). However, direct comparison of the COMEXT data with the one reported in Figure 19.7 is not entirely appropriate due to possible differences in the datasets.



Source: Bundessortenamt and German Ministry of Agriculture

Figure 19.7: Extra-EU trade of seed potatoes in Germany

Seed potato exports to third Countries were higher but small compared to production. During 2000-2005 the volume of German seed potatoes exported outside the EU ranged between 8,301-23,171. Comparison with COMEXT data suggests that exports to Russia have become more important in recent years (around 1,500 tons in 2004). This reflects a general increase in trade patterns (including seeds) between the EU and Russia due to general economic developments in these regions. The COMEXT database also suggests that there is a significant trade of seed potatoes within the EU and significant exports from the EU (not necessarily from Germany) to North African and Middle East Countries (e.g. Algeria, Tunisia, Egypt, Lebanon, Israel)[24].

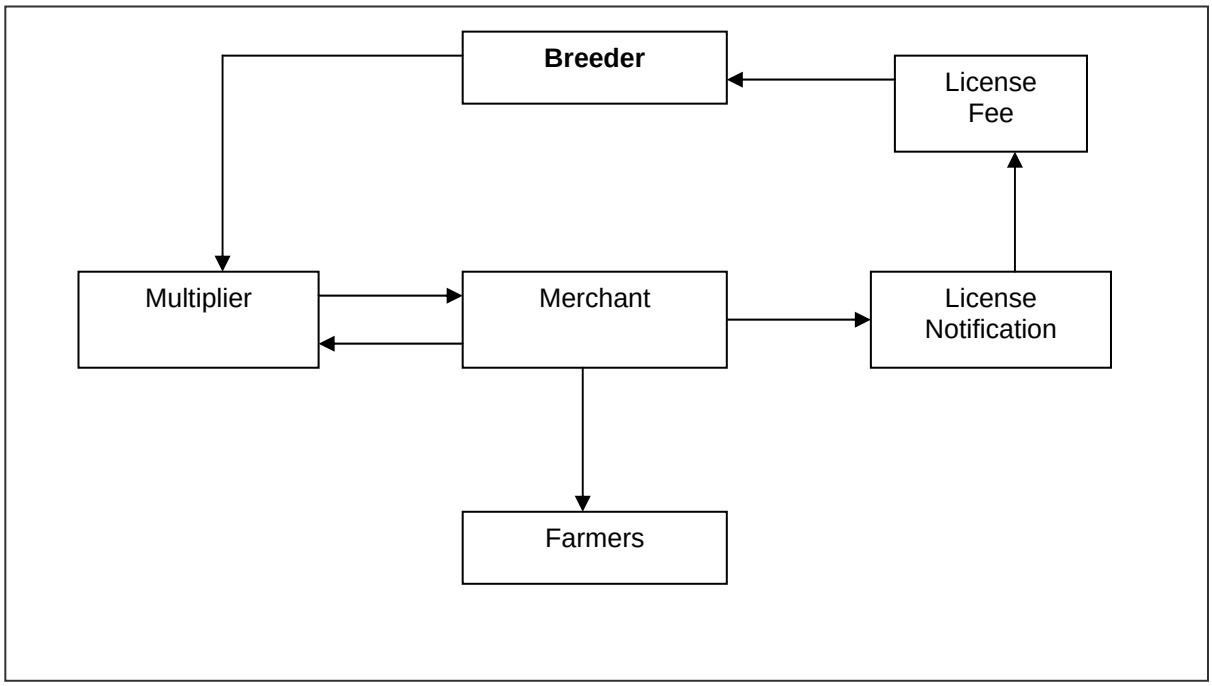
19.3.2 Production Organization

Seed production is a specialized activity organized through contract production. There are usually three main actors in a contract for the production of seed potatoes: the breeder (i.e. the company that develops the varieties), the multipliers organization (i.e. the representative of seed producers) and the distributor (i.e. the company that markets the seeds). On the basis of the arrangements for the sale of the certified seeds, at least two different organization structures can be identified:

[24] Notice that German seed potatoes might cross many borders within the EU before reaching extra-EU destinations.

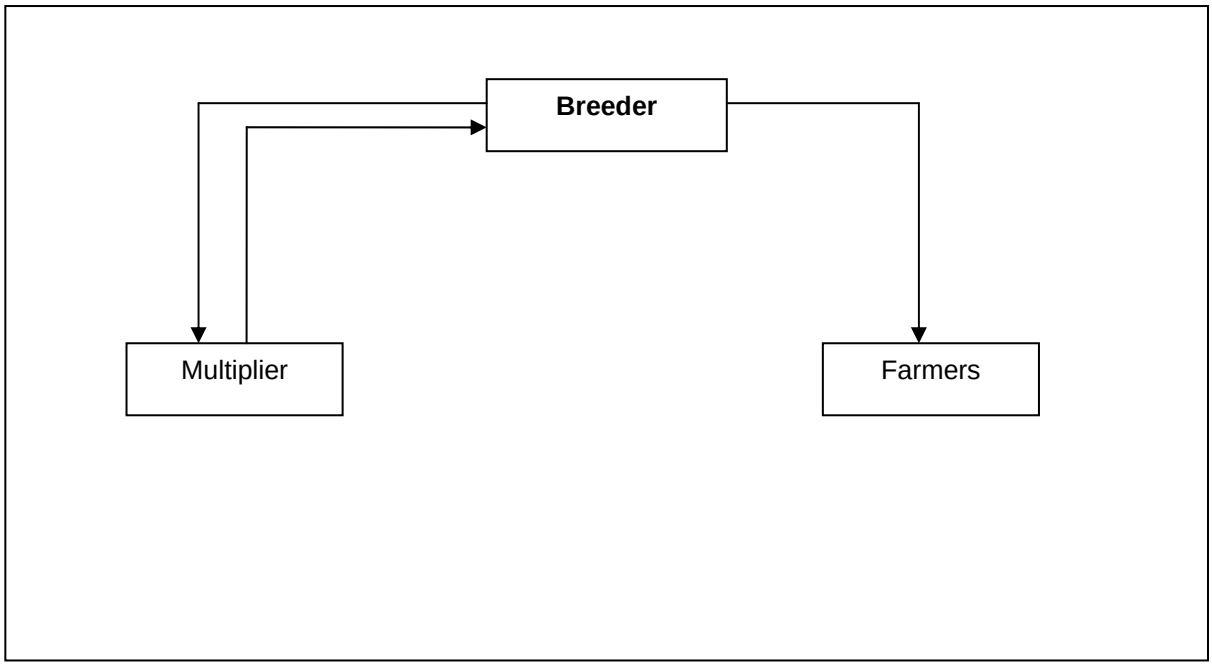
1. **Seed sales through contracting party:** in this case (see diagram in Figure 19.8) the breeder provides the seeds to the multipliers who grow them. The certified seeds are then marketed by the seed merchants who pay a fee to the breeder.
2. **Direct sales by the breeder:** in this case (see diagram in Figure 19.9) the breeder provides the seed material to the multiplier who produce certified seeds. Such seeds are then directly marketed by the breeder without the intermediation of seed merchants. This structure is becoming more and more widespread as plant breeders wish to get greater margins on seed sales by removing the merchant from the chain.

In Germany there are around 25-30 potato breeders (excluding license applicants from the Netherlands), and most of them are small companies. The market is very concentrated with few large firms (e.g. Europlant holds around 30% of the market) and many small 'niche' breeders. In order to defend their market position against the larger players the small companies share not only breeding material but also know-how. With respect to the number of multipliers, over the past ten years their number has shrunk. In Niedersachsen, for example, the number of multipliers has decreased from around 1,200 to less than 500.



Source: Adapted from Erbe G., 2002.

Figure 19.8: Organization of potato seed production and sales through contracting party



Source: Adapted from Erbe G., 2002.

Figure 19.9: Organization of potato seed production and sales directly by the breeder

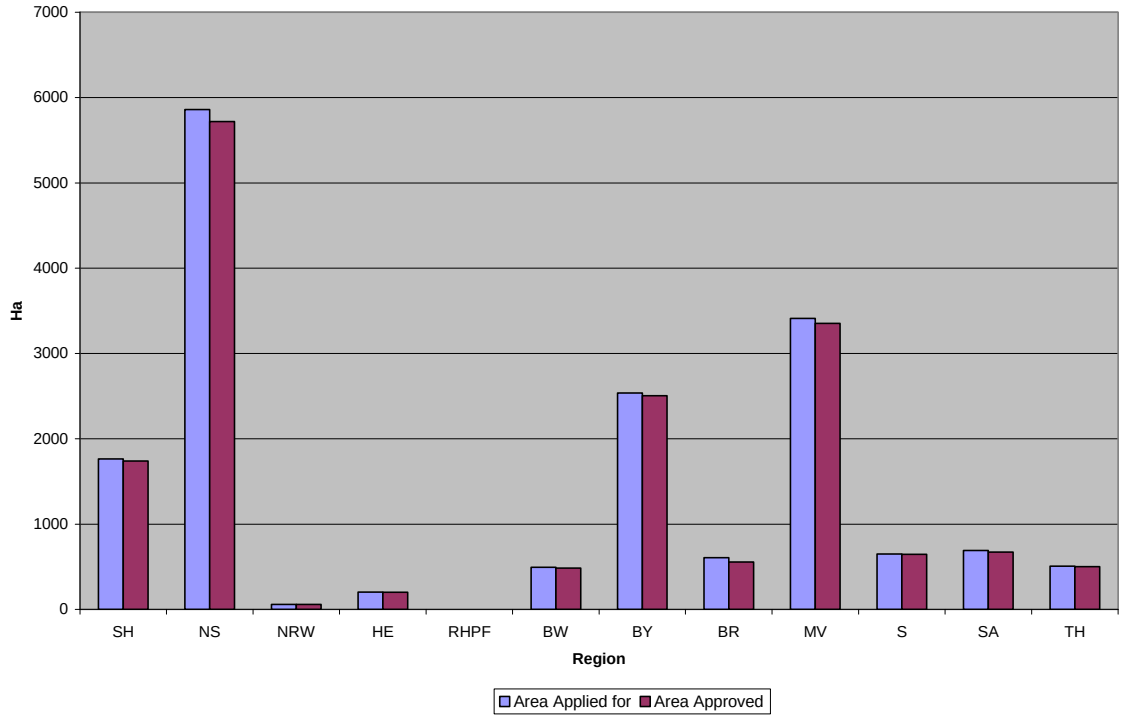
19.3.3 Regional Analysis

Seed potato production is concentrated in four Länder in Germany (see Figure 19.10 for an illustration of the Länder of Germany). Figure 19.11 illustrates the distribution by Länder of area applied for and approved for the production of seed potatoes in 2005. Niedersachsen (NS), Mecklenburg-Vorpommen (MV), Bayern (BY) and Schleswig-Holstein (SH) account for over 13,000 ha out of the total 16,000 ha approved for the production of seed potatoes in 2005. Growing conditions (i.e. soil and climate) are the main factors that explain the distribution of seed potato areas in Germany. Thus seed and crop production largely occur in the same regions.

Figure 19.10: Map of the Länder Germany

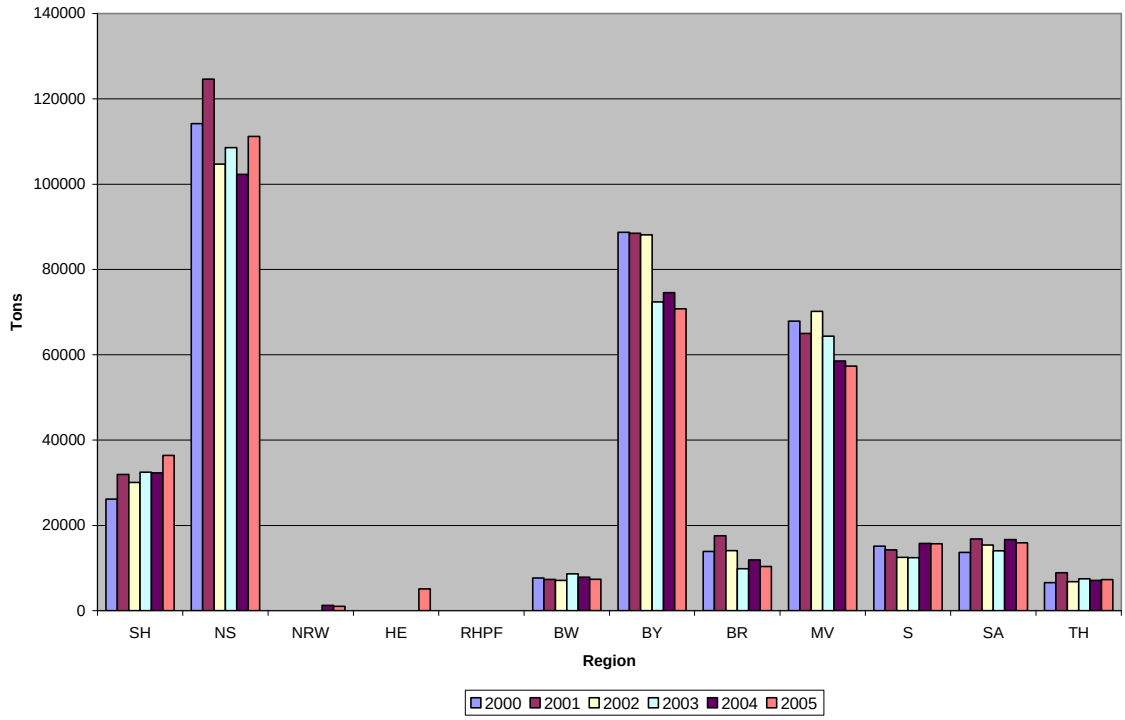
The largest area of seed potato production is clearly in NS. However MV is also particularly important because of the presence of areas for the production of high grade seed potatoes. In this area the marketing of seed potatoes is restricted only to basic seeds.

With respect to volume of certified seed potato production, the regional distribution reflects entirely the area distribution (see Figure 19.12). In all the main regions there was a decrease in certified seed potato production over the period 2000-2005. As already mentioned before, this was the result of a more general reduction in the potato crop area in the EU.



Source: Bundessortenamt

Figure 19.11: Area applied for and approved for the production of certified seed potatoes in Germany



Source: Bundessortenamt

Figure 19.12: Volume of certified rapeseed seed production in Germany

19.3.4 GM and organic seeds

At present no GM potatoes have been authorized in the EU and therefore no commercial production of GM varieties for crop or seed takes place in Germany. Also no GM potato field trials are being carried out at the moment.

Currently the EU is considering the authorization of GM potato for starch production. The GM varieties produce a single component of starch (amylopectin), thus avoiding processing to separate the components. Since the GM varieties do not offer any direct agronomic benefit to farmers, their adoption would be definitively driven by the starch industry. However, there appears to be a general willingness of farmers to adopt GM varieties for starch production and BASF has already contacted farmers willing to multiply the seeds. The production of GM potatoes would take place in those Länder of Germany traditionally specialized in the production of starch potatoes (for seed and crop), namely Niedersachsen, Mecklenburg-Vorpommern, Bayern and Brandernburg.

No data exists on area and volume of organic seed potato production in Germany. The organic potato market is still a niche market accounting for about 2-4% of the total. Thus, the production of organic seed potatoes is considered to be fairly limited. The demand for organic food is growing in Germany (as in other EU Countries) and it is possible that production of organic seed potatoes will increase in the next years to meet the demand. However it is likely that organic seed potato production will remain a niche activity.

Acknowledgments

Most of the data and information provided in this section were collected during a meeting at the Bundessortenamt in Hannover in April 2007. We would like to thank the participants and organizers of the meeting, namely Mr. Von Kroecher, Mr Klein and Mr. Freudenstein of Bundessortenamt, Mr. Von Klitzing (Verband der VO-Firmen), Mr. Betz (Verband niedersächsicher Saatguterzeuger) and Mr. Aβmann (Vorsitzender der Arbeitsgruppe Anerkennungsstellen für Saat- und Pflanzgut).

We would also like to thank the following people for providing information about potato seed production in the respective Member States: Mr. H. Van de Haar (NAK, the Netherlands), Mr. I. Dykes (British Potato Council, the UK), Mr. J. Tuomisto (MTT Economic Research, Finland), Mr. A. Wasik and Mr. K. Smaczynski (PIORIN, Poland).

Consulted documents

Erbe G. (Hrsg.), 2002. Handbuch Saatgut Vermehrung.

NAK, 2004. Annual Report. Available at http://www.nak.nl (last accessed 22/03/2007).

Chapter 20 The use of EU agricultural crops for biofuel production

20.1 Current use of domestic crops for biofuels production

Total production of biofuels in EU25 in 2005 was 3.2 million tons of biodiesel and 0.7 million tons of bioethanol. The largest producers of biodiesel in EU25 in 2005 were Germany (around 1.6 million tons), France (around 0.5 million tons) and Italy (around 0.4 million tons). In the same year the biodiesel production capacity of the EU25 stood at about 6 million tons, suggesting a utilization rate of over 50%.

Bioethanol production in EU25 amounted to 0.7 million tons in 2005, while in the same year the installed production capacity was above 1 million tons, indicating a utilization rate of 70%. There were 23 ethanol plants in the EU-25 in 2006 (of which 6 in France, 5 in Germany, 3 in Spain). Current projections suggest that by 2008 the number of ethanol plants should go up to 47-63, with a significant expansion in France (additional 5-6 plants), Germany (additional 0-3 plants) and Spain (additional 2 plants).

An important part of the feedstock used for biofuel production in the EU comes from domestic cultivation of crops. The total land used for crops dedicated to biofuel production in EU25 (referred to as "energy crops" in other publications) has been growing very fast in the past years. In terms of land, it grew from 1.4 million ha to an estimated at 2.6-2.8 million ha in 2005, of which

- 0.9 million ha coming from set-aside land (of which 0.8 million ha were cultivated with rapeseed),
- 0.6 million ha coming from land receiving the energy crop premium of 45 euros/ha (of which 0.4 million ha with rapeseed)
- 1.1-1.3 million ha cultivated on land without specific subsidy.

The main feedstock used is oilseed rape for biodiesel production. It is estimated that the uptake of EU-produced OSR for biodiesel has grown from 4.5 million tons in 2004 to an estimated 8 million tons in 2006. This means that a very large share of the EU production of OSR (over 50%) now goes to biodiesel production. Biodiesel facilities could also be using minor amounts of other EU-produced oilseed crops, in particular sunflower and soybeans.

For the EU bioethanol sector, the uptake of EU-produced feedstocks has been lower compared to the biodiesel sector, but also shows a growing trend. The main feedstocks are cereals (wheat, barley and corn) and sugarbeet. The use of EU-grown cereals for ethanol passed from 0.7 to 3.0 million tons in the 2004-2006 period. This represents just above 1% of the 2006 EU crop of cereals being used for ethanol. For sugarbeet its use in ethanol production has started only recently and less information is

available, although current use (2006 figures) could be around 1 million tons of sugar equivalent (representing about 5 % of the crop).

20.2 Prospects for the use of EU crops for biofuel production in the 2020 horizon

The recent decision of revising the biofuel targets for EU countries to incorporate a minimum 10 % biofuel by 2020 sets the policy framework affecting the evolution of EU crops for biofuels. Several analyses have been published during 2007 on how this policy decision will impact demand of biodiesel and bioethanol in the EU, as well as detailed analysis on impacts on crop market prices and land uses.

We are interested in the impact of this new EU policy framework on the domestic use of relevant crops for biofuels. We summarise below the quantitative projections published for the main crops grown for biofuel in the EU, specifically projections for the short-medium term (year 2014). There are also projections for the longer term (2020). All these projection are obtained by incorporating the new policy framework (the 10% target for 2020) into the models.

For biodiesel-oriented crops

- EU use of oilseeds by 2014 is estimated at 66.6 million tons, of which 19.5 million tons for biofuels. Production is estimated at 34.6 million tons
- For Oilseed rape, the projection puts total EU use in 2020 (for food/feed and biodiesel) at 32.8 million tons, of which 21 million tons used for biodiesel (currently at 8-9 million tons). Domestic production will raise and reach 20.6 million tons. Given the high consumption, imports of OSR will become necessary.
- Projections for total EU use of soybeans are 21 million tons by 2020. The part used for biodiesel is estimated at 7.88 million tons of soybean. However the domestic EU production of soybean will continue to be very small compared to the needs and is estimated at 3.46 million tons for 2020. Therefore soybean import will continue to be very high.
- Sunflower consumption in the EU is projected at 11 million tons in 2020, of which 1.29 million tons for biodiesel. EU production (9.28 million tons by 2020) will cover most of the needs.

Regarding feedstocks for ethanol production, the main crops will remain cereals (wheat, maize and barley) followed by sugarbeet. There are several scenarios for the use of biomass for cellulose ethanol, but this biomass will come initially from the same cereal crops (straw). The projections for the impact on the main crops for 2014 and 2020 (incorporating the 10% target) are the following

- Total maize use is estimated at 65.7 million tons by 2014, of which 5.1 million tons will be destined to bioethanol production. Domestic production in 2014 is estimated at 63.1 million tons, covering most of the needs.
- By 2020 total maize use in EU27 is expected to reach 70.2 million tons, with a forecast of 14.2 million tons used for bioethanol. This is because the increase in bioethanol production is expected to really kick-in only after 2011. The domestic production of maize in the EU by 2020 is expected to be at 69.2 million tons (basically covering most of the needs)
- Soft wheat consumption in EU27 is expected to reach 120.8 million tons by 2014, of which up to 12.1 million tons could be used for bioethanol. EU27 production is set at 137.8 million tons by 2014, more than needed for domestic use.
- By 2020 wheat consumption is expected to be at 138.95 million tons, of which up to 43 million tons for the production of bioethanol, much higher than the 12.1 million tons expected by 2014. Again this is due to the fact that bioethanol production capacity is estimated to increase sharply after 2011. Domestic production of soft wheat in the EU is expected to reach 156 million tons by 2020.
- Barley is a substitute of wheat in some EU countries for the production of bioethanol but we only 1-2 million tons of this crop are expected to be used for bioethanol production (basically no growth from current use)
- Finally, sugar consumption in the EU will be about 20.9 million tons by 2014, of which 2.2 million tons for bioethanol production. EU27 production is expected to be at 15.6 million tons.
- By 2020, domestic consumption of sugar is expected to be at 19.1 million tons, of which 2.3 million tons will be for bioethanol production. Estimates for EU production of sugar are at 16.9 million tons for 2020.

In conclusion, current figures and recent projections for the medium-long term indicate that significant use of EU-produced feedstock for biofuels is taking place and will increase substantially for OSR, wheat, and maize. A significant but comparatively smaller use of sugarbeet, soybeans and sunflower is taking place and will continue.

20.3 Demand for biofuel feedstocks and uptake of GM crops in EU agriculture

We concluded that use of EU-produced crops for biofuels is and will be high for several crops. A few characteristics make the process of adoption of GM crops for biofuels different than for food/feed uses. Currently biofuels (ethanol or biodiesel) produced from GM crop need no specific labeling in the EU, so the acceptance by the final user may not be as problematic as in food uses. Feedstock production cost is crucial to the competitiveness of the EU crops for biofuels. Therefore there will be a strong

pressure to cut production costs at farm level and at factory level to remain competitive compared with fossil fuels. And cost reduction is the main characteristic associated to currently available GM crops (see below)

With respect to bioethanol, it is noteworthy that processing plants produce ethanol and by-products for feed (no by-products for human food) so they could operate with GM feedstock for the feed/fuel markets. With respect to biodiesel the situation is slightly different since crushing factories for oil production will not have difficulties in using GM feedstock if they work entirely for biodiesel production, but if they have to also use the facility for crushing oils for food (a market that does not demand GM in the EU) some segregation may be needed, playing against the acceptance of GM. But there is no information on how this issue is going to be approached by oilseed crushing plants, and further studies are needed. However, it must be said that neither the EU bioethanol nor the EU biodiesel industry has (to our knowledge) taken a position in relation to the uptake of GM crops to satisfy the forecasted demand. Therefore at this moment it is difficult to make a forecast on the potential uptake of EU GM feedstocks for biofuel production.

Consulted documents

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European Commission

EUR 23443 EN – Joint Research Centre – Institute for Prospective Technological Studies
Title: A Descriptive Analysis of Conventional, Organic and GM Crop and Certified Seed Production in the EU
Authors: Michele Graziano Ceddia and Emilio Rodríguez Cerezo
Luxembourg: Office for Official Publications of the European Communities
2008
EUR – Scientific and Technical Research series – ISSN 1018-5593
ISBN 978-92-79-09563-4
DOI 10.2791/38071

Abstract
Recently, the introduction of GM crops and GM seeds in agricultural production in the EU and elsewhere has raised the issue of adventitious presence of GM seeds in conventional seed lots. Article 21(2) of Directive 2001/18/EC provides that for products where adventitious or technically unavoidable traces of authorised GMOs cannot be excluded, a minimum threshold may be established below which the products shall not have to be labelled in accordance with the provisions of the Directive.

In the absence of such thresholds, which is the current status of seed production, the legislation requires the labelling of conventional seed lots which contain any detectable adventitious traces of GM seeds (which have been authorised for cultivation under Community legislation) (Directive 2001/18/EC). The legal requirement is not new and has been in place since labelling provisions were introduced under Directive 90/220/EEC and maintained under Directive 2001/18/EC (which replaced Directive 90/220/EEC). It remains illegal to place on the market conventional seed lots that contain GM seeds that have not been approved for cultivation. This has been the case since Directive 90/220/EEC entered into force in 1991.

The Commission is currently examining the possibility to establish thresholds for the maximum adventitious presence of GM material in certified seeds and is assessing the impact associated with the introduction of different threshold values, as regards to agronomic (technical) feasibility of production and to economic impacts for seed producers, farmers, food and feed producers, and the necessary freedom of choice between genetically modified, conventional and organic crops.

In this context, understanding the current status and likely evolution of crop and seed production in the EU is necessary as a basis to carry any further assessment of the effects of the regulation of adventitious GM presence in seeds. Understanding the likely distribution of GM commercial crop and GM seed production in the EU is also important when looking at the adventitious presence of GM material in conventional seeds. Data on the likely adoption and regional distribution of GM crops in the EU for short-medium term could be significant for this purpose.

The aim of this study is to gather basic information/data on the EU crop and seed production for a number of crops. The crops under considerations are maize, sugar beet/fodder beet, cotton, oilseed rape, soybean and potato. Data will refer to conventional, GM and organic varieties. With respect to seed production, in the present study (given the time constraint) the attention will be focused on certified seeds. Also the study will focus on commercial seed production, therefore excluding farm saved seeds from the analysis. Given these premises, the study's objectives entail:

- Collection of data on volume, acreage and trade of crops in EU 25 and major trading partners (e.g. U.S.) and identification and analysis of main changes over time and analysis of future developments.
- Collection of data on volume, acreage and trade of certified seed production in relevant Member States, analysis of main changes over time and identification of main future developments in key MS.
- Identification of main seed producing regions in the EU and collection of information/data relative to the potential adoption by farmers of GM varieties of the above mentioned crops in these regions.

The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.

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LF-NA-23443-EN-C

ISBN 978-92-79-09563-4

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