Co-existence of GM and non GM arable crops: the non GM and organic context in the EU[1]

Graham Brookes & Peter Barfoot

PG Economics Ltd

Dorchester, UK
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Executive summary

Within the co-existence debate in Europe, anti GM groups often claim that there is no demand for genetically modified (GM) crops in Europe and that GM and organic crops cannot successfully co-exist without causing significant economic harm/losses to organic growers. This paper examines these claims by exploring the issues of demand for non GM crops, and by identifying the context of organic arable crop production in some of the main agricultural economies of the EU.

Market for non GM products in the EU

This market (ie, where buyers actively request that supplies are certified as being non GM) can essentially be found in relation to the uses of soybeans and maize (and their derivatives). Current EU requirements for non GM ingredients of maize and soybeans account for about 27% of total soybean/derivative use and about 36% of total maize use. In respect of other arable crops such as oilseed rape and sugar beet, there is no real GM versus non GM market in the EU because, in the case of oilseed rape, no GM product is currently permitted for planting or importing for use, and in the case of sugar beet, no GM sugar beet crops are currently grown commercially anywhere in the world.

Organic sector context

The share of EU crops planted to organic for which GM traits are currently available[2], or are likely to become commercially available in the next five years is extremely low (about 0.41%). This very low level of plantings and importance reflects a combination of reasons including adverse agronomic factors (eg, a need for sites with few weed problems and the nutrient demanding nature of crops like oilseed rape), limited demand, and market preference for competing (imported) produce (eg, cane sugar).

The future

The level of demand for crops for which the non GM status is important, is likely to be limited and found mostly in the sugar sector. Even in this latter sector, other market and policy pressures to adopt cost reducing technology, like GM herbicide tolerant sugar beet, are likely to arise by 2008-09.

Any further expansion in the EU organic area will be concentrated in higher value products that have characteristics such as being bulky, perishable and more commonly consumed without processing (eg, fruit, vegetables). Even if there were a substantial increase in the EU organic area planted to combinable crops, the sector would remain very small relative to total arable crop production.

Co-existence of GM and non GM crops

The evidence to date shows that GM crops growing commercially in the EU and in North America have co-existed with conventional and organic crops without economic and commercial problems – only isolated instances have been reported of adventitious presence of GMOs occurring in organic crops, even in North America where GM crops dominate production of soybeans, maize and canola[3].

[2] This paper examines arable crops used primarily for food and feed purposes. It does not include coverage of cotton, the fourth main GM crop to be widely grown on a global scale

[3] This relates to reports of adventitious presence of GM material occurring in organic crops that have resulted in economic losses for organic growers (eg, loss of organic price premium). It does not include instances where trace levels (within the boundaries of very sensitive testing equipment) of GM material may have been detected, but which did not result in any economic loss

For the future, the likelihood of economic and commercial problems of co-existence arising remains very limited, even if a significant development of commercial GM crops and increased plantings of organic crops were to occur. Therefore if highly onerous GM crop stewardship conditions are applied to all EU farmers who might wish to grow GM crops, even though the vast majority of such crops would not be located near to organic-equivalent crops or conventional crops for which the non GM status is important, this would be disproportionate and inequitable. In effect, conventional farmers, who account for 99.59% of the current, relevant EU arable crop farming area could be discouraged from adopting a new technology that is likely to deliver farm level benefits (yield gains, cost savings) and provide wider environmental gains (reduced pesticide use, switches to more environmentally benign herbicides, reduced levels of greenhouse gas emissions[4]).

[4] See PG Economics (2003a) for detailed analysis of this: appendix 5

1 Introduction

Since 1998, a *de facto* moratorium on the regulatory approval of new genetically modified (GM) crops in the EU has operated, effectively stopping the commercialisation of GM crop traits that might be adopted by EU farmers. The only exception to this has been the planting of GM (Bt) maize in Spain (32,000 hectares in 2003), which received approval prior to the moratorium in 1998.

As new legislation designed to pave the way for lifting the moratorium has been agreed (ie, relating to labelling and traceability applicable from April 2004), one of the main subjects of current debate remains the economic and market implications of GM and non GM crops being grown in close proximity (ie, co-existing).

Within the co-existence debate in Europe, anti GM groups often claim that there is no demand for GM crops in Europe and that GM and organic crops cannot successfully co-exist without causing significant economic harm/losses to organic growers.

This paper examines these claims by specifically exploring the issues of demand for non GM crops and derivatives, and identifying the context of organic arable crop production in some of the main agricultural economies of the EU.

2 What is co-existence?

Co-existence as an issue relates to '*the economic consequences of adventitious presence of material from one crop in another and the principle that farmers should be able to cultivate freely the agricultural crops they choose, be it GM crops, conventional or organic crops'* (EU Commission 2003). The issue is, therefore, not about product/crop safety (the GM crop having obtained full regulatory approval) but about the economic impact of the production and marketing of crops which are considered safe for the consumer and the environment.

Adventitious presence of GM crops in non GM crops becomes an issue where consumers demand products that do not contain, or are not derived from GM crops. The initial driving force for differentiating[5] currently available crops into GM and non GM came from consumers and interest groups who expressed a desire to avoid support for, or consumption of, GM crops and their derivatives, based on perceived uncertainties about GM crop impact on human health and the environment. This has subsequently been recognised by some in the food and feed supply chains (notably some supermarket chains and many with interests in organic farming) as an opportunity to differentiate their products and services from competitors and hence derive market advantage from the supply of non GM products. In addition, some food companies have withdrawn from using GM derived ingredients so as to minimise possible adverse impact on demand for their branded food products if they were to be targeted by anti GM pressure groups.

To fully accommodate this perceived demand for product differentiation, it is important to segregate or identify preserve (IP) either GM or non GM derived crops and to label these and derived (food) products throughout the food supply chain. Whilst absolute purity of the segregated product is striven for, it is a fact of any practical agricultural production system that accidental impurities can rarely be totally avoided (ie, it is virtually impossible to ensure absolute purity).

[5] Generally referred to either segregation of identity preservation

Adventitious presence of one crop within another crop or unwanted material can arise for a variety of reasons. These include, for example, seed impurities, cross pollination, volunteers (self sown plants derived from seed from a previous crop), and may be linked to seed planting equipment and practices, harvesting and storage practices on-farm, transport, storage and processing post farmgate. Recognising this, almost all traded agricultural commodities accept some degree of adventitious presence in supplies and hence have thresholds set for the presence of unwanted material. For example, in most cereals, the maximum threshold for the presence of unwanted material (eg, plant material, weeds, dirt, stones, seeds of other crop species) is 2%, although in durum wheat, the presence of non durum wheat material is permitted up to 5%.

3 What is the real, current level of demand for non GM products in the EU?

This section examines the extent to which there is (or not) demand for non GM products in the EU. It focuses on those crops and their derivatives for which GM varieties are already widely commercially grown on a global basis and which could be grown in the EU for food and feed uses.

A distinct non GM market began to develop in the EU in 1998 (for ingredients used in human food) and was extended to the animal feed sector from about 2000[6]. It focused largely on soybeans and derivatives, and to a much lesser extent maize, because these were the first two crops to receive import and use authorisations in the EU (before the introduction of the *de facto* moratorium). Key features of the soybean market development have been:

- In the human food sector a switch to using alternative non GM derived ingredients (eg, the replacement of soy oil with sunflower or rapeseed oil). This was relatively easy for a number of food products like confectionery and ready meals where soy ingredient incorporation levels were low (eg, 1%). This course of action has been more difficult to take in the animal feed sector because of the importance of soymeal as an ingredient in some feeds (eg, broiler feeds where typical incorporation rates are 20%-25%);
- If the GM crop or derivative could not be readily replaced, non GM derived sources of supply were sought. This focused mainly on Brazil (but not exclusively) and involved the initiation of identity preserved (IP) or segregated supply lines (traditional supply lines use commodity based systems where there is broad mixing of seed in bulk for transportation) to ensure non GM derived supplies to customer-specific tolerances were adhered to;
- GM derived crop ingredients have largely been removed from most products directly consumed (by humans). However, there are two major exceptions to this; soy oil derived from GM soybeans (Table 1) and ingredients derived from GM micro organisms (which continue to be widely used). In the animal feed sector, the demand for non GM soymeal affects about 25% of the EU market. In the industrial user sectors, there is little or no development of the non GM market[7] (ie, the market is indifferent to the production origin of raw materials);
- It has been reasonably easy for the European buyers to identify and obtain supplies of non GM derived soybeans and soymeal at 'competitive prices'. Where the adventitious presence threshold applied has been 1%[8] (for the presence of GM material), price

[6] Brookes G (2001)

[7] This refers to all non food industrial uses and does refer to industrial uses where the raw materials are destined for human food use (eg, maize starch used in food products)

[8] And more recently 0.9% in line with the new legal threshold

differentials have tended to be in the range of 2% to 5% (ie, non GM soy has traded at a higher price than GM soy), over the last two years. When tighter thresholds and a more strict regime of testing, traceability and guarantees are required (eg, to a threshold of 0.1%), the price differential has been within a range of 7%-10%;

- the additional cost burden of supplying non GM ingredients has largely been absorbed by the supply chain up to the point of retailers (ie, the cost burden has fallen on feed compounders, livestock producers and food manufacturers and has not been passed on to retailers and end consumers);
- any price differential that has arisen has been mainly post farm gate. At the farm level in countries where GM crops are widely grown, there has been and is currently very little development of a price differential. In Brazil (the focus of non GM supplies of soybeans), there has, to date been no evidence of a non GM price differential having developed. In the US and Canada, the farm level price for non GM supplies has tended to be within the range of 1%-3% higher than GM supplies, and this level of differential in favour of non GM crops has had little positive effect on the supply of non GM crops (ie, GM plantings have continued to increase, with the price differential being widely perceived to be an inadequate incentive for most farmers to grow non GM crops like soybeans)[9]. In Brazil, trade sources[10] also suggest that a farm level differential of 5%-10% for non GM soybeans will be required to keep a significant volume of Brazilian soybean farmers growing non GM soybeans once GM soybeans are permanently approved for planting in Brazil[11].

Table 1: Estimated GM versus non GM soybean and derivative use 2002-03 in the EU (tonnes)

Product	Market size	Non GM share	Non GM share (%)
Wholebeans	*1,500,000*	*330,000*	*22*
Of which used in human food)	200,000	200,000	100
Of which used in feed	1,300,000	130,000	10
Oil	*2,120,000*	*830,000*	*39*
Of which used in food products	1,720,000	805,000	47
Of which used in feed and industrial products	400,000	25,000	6
Meal	*30,770,000*	*8,300,000*	*27*
Of which used in human food	800,000	800,000	100
Of which used in animal feed	29,970,000	7,500,000	25

Sources: PG Economics, Oil World, American Soybean Association

Developments relating to the GM versus non GM maize market have followed a similar path to the developments discussed above in relation to soybeans:

- The food industry targeted removal of all GM derived ingredients from products, including GM maize or;

[9] Some US farmers of GM soybeans have also reported positive price differentials in favour of GM soybeans because of the lower levels of impurities found in their crops

[10] With interests in the supply of non GM soybeans

[11] In 2003 when GM soybeans have been given temporary approval for planting about 18% (3.24 million hectares) of the Brazilian soybean crop is reported to have been GM

- non GM derived sources of supply were sought. This was relatively easy and focused on domestic EU origin sourcing, where the approval and commercial adoption of Bt maize has been very limited. The need to initiate identity preserved (IP) supply lines has also been limited because of the absence of GM maize material in the vast majority of EU supplies. Only in Spain where 20,000-25,000 hectares of Bt maize have been grown annually in the period 1998-2002 has a (potential) need for greater attention to segregation/IP been relevant and even here, there have been limited problems. The majority of Bt maize grown in Spain is concentrated in a few regions and is supplied to the local animal feed compounding sector, where there is little demand for non GM ingredients;
- the demand for non GM material is mostly found in the food sector (including starch). However, these uses account for a minority of total EU maize use (about 23%: Table 2), with the feed sector being the primary user of maize (75% of total use[12]). Overall, about 36% of total demand for maize in the EU is required to be non GM;
- as non GM maize accounts for 96%-98% of EU maize supplies[13], the development of a clear GM and non GM derived maize market has been less marked than in the market for soybeans and derivatives. Where users of maize (notably in the food and starch sectors) have specifically required guaranteed non GM maize (to the same thresholds as non GM soy of mostly 1% and some to 0.1%), price differentials have tended to be in the range of 1% to 3% (ie, non GM maize prices have been higher than GM maize prices). These price differentials have been post farm-gate with no apparent price differential at the farm level;
- the cost burden (where applicable) of using non GM derived maize has generally been absorbed by the food chain.

Table 2: Estimated GM versus non GM maize use 2002-03 in the EU (million tonnes)

Product	Market size	Non GM share	Non GM share (%)
Food & starch	8.97	6.28	70
Feed	29.25	7.31	25
Seed	0.78	0.55	70
Total	**39**	**14.14**	**36**

Source: PG Economics

Overall, the analysis above suggests that current EU requirements for non GM ingredients of maize and soybeans (ie, where buyers actively request that supplies are certified as being non GM) accounts for about 27% of total soybean/derivative use and 36% of total maize use. The implementation of the new EU regulation on traceability and labelling of GM products is also unlikely to have any significant impact on the markets for GM versus non GM soy and maize. This is because the vast majority of organisations that require certified non GM products have already taken steps to locate and procure their (non GM) requirements[14]. Only at the margin is there likely that some additional demand for non GM soy and maize products, with the net effect likely to be a fairly small increase in the size of the non GM sector of the soy and maize markets.

In respect of other arable crops such as oilseed rape and sugar beet, there is no real GM versus non GM market in the EU because, in the case of oilseed rape, no GM product is currently

[12] The balance is accounted for by seed

[13] The GM share comes from Spanish production of about 0.32 million tonnes in 2003 and annual imports of between 0.6 and 1.4 million tonnes from Argentina

[14] In many cases this policy was also extended to products derived from GM crops like soy oil even though they did not have to be labelled prior to 18 April 2004

permitted for planting or importing for use in the EU[15], and in the case of sugar beet, no GM sugar beet is currently grown commercially anywhere in the world.

4 Context of organic arable crop production in the EU

This section examines the context of organic production in some of the main arable crops for which GM traits are currently awaiting EU regulatory approval or are likely to be bought forward for regulatory approval in the next few years.

4.1 General

The total EU (15) area devoted to organic agriculture in 2002 was estimated at about 4.3 million hectares[16]. This is equal to about 3.5% of the total EU utilised agricultural area. The vast majority of the organic area (about 90%) is grassland, with crops accounting for the balance.

Although this total EU area has been rising for several years (eg, from 2.28 million hectares in 1998), the total organic area in some member states has stabilised since 2000 (eg, Denmark, Finland and Austria (Source: IFOAM).

4.2 Oilseed rape

In 2003, the EU 15 planted about 3.13 million hectares to oilseed rape. France, Germany, the UK and Denmark accounted for the vast majority of these plantings (94%). Within these four countries, the area planted to organic crops totalled 4,811 hectares, equal to 0.16% of total oilseed rape plantings (Table 3). The largest area of organic oilseed rape was found in Germany (3,200 hectares), where the organic share was 0.25% of total plantings. The country with the largest share of total organic oilseed rape plantings was Denmark (865 hectares or 0.82% of total Danish oilseed rape plantings).

In terms of the accession countries, Poland has the largest area devoted to oilseed rape (360,000 hectares in 2003). There are no official statistics available on the certified organic oilseed rape area in Poland, as available statistics are not disaggregated to the individual crop level. Trade sources indicate that there is no certified organic oilseed rape crop in Poland. For the other CEECs with significant oilseed rape plantings, the organic share was 1.23% and 0.19% respectively in Slovakia and Hungary (Table 3)[17].

Table 3: EU certified organic oilseed rape areas: main countries of production (hectares)

Country	Total oilseed rape area 2003	Organic area	Organic as % of total area
France	1,083,000	496 (1)	0.05
Germany	1,280,000	3,200 (2)	0.25
UK	477,000	250 (3)	0.05

[15] It is, however interesting to note the ultra cautious behaviour of some crushers in the UK, where for crops supplied in 2004 (now that the new labelling and traceability law is operational), farmers will be required to make declarations as the non GM status of their oilseed rape crops, purely because of the (remote) possibility of GM adventitious presence arising from a GM oilseed rape farm scale trial

[16] Source: IFOAM

[17] There are no official statistics available on the certified organic oilseed rape area in the Czech Republic, as available statistics are not disaggregated to the individual crop level

Denmark	106,000	865 (1)	0.82
Total leading four	*2,946,000*	*4,811*	*0.16*
EU 15	*3,131,000*	*Not available*	
Poland	360,000	Nil	Nil
Slovakia	98,000	1,207 (1)	1.23
Hungary	140,000	260 (1)	0.19

Sources: Coceral, ZMP, Cetiom, Soil Association, Danish Agricultural Advisory Service, Hungarian Ministry of Agriculture, Central Agricultural Control & Testing Institute Bratislava
Notes: (1) = 2002, (2) = 2001, (3) = 2003

4.3 Maize

The total area planted to maize (grain and forage) in the EU 15 was 8.68 million hectares in 2003. The main producing countries are France, Italy, Germany, Spain and Austria, which together account for 88% of total EU 15 plantings. Within these five countries, the area planted to organic crops totalled 43,300 hectares, equal to 0.57% of total maize plantings (Table 4). The organic share across the leading maize growing countries was within a range of 0.12% in Spain and Belgium, rising to 1.9% in Austria.

In the acceding countries, the largest maize producer is Hungary where 1.14 million hectares were planted to maize in 2003. Within this, 0.2% was certified as organic. In Slovakia, the organic area was 1,525 hectares (1.16% of total plantings). There are no official statistics available on the certified maize areas in Poland and the Czech Republic, as available statistics are not disaggregated to the individual crop level.

Table 4: EU certified organic maize (including forage) areas: main countries of production (hectares)

Country	**Total maize area 2003**	**Organic area**	**Organic as % of total area**
France	3,051,000	9,998 (1)	0.33
Italy[18]	1,835,000	14,994 (2)	0.82
Germany	1,673,000	12,200 (2)	0.73
Spain	829,000	1,000 (3)	0.12
Austria	265,000	5,108 (1)	1.93
Total leading five	*7,653,000*	*43,300*	*0.57*
EU 15	*8,684,000*	*Not available*	
Hungary	1,143,000	2,238 (2)	0.2
Slovakia	132,000	1,525 (2)	1.16

Sources: Coceral, ZMP, FNIP, Belgian Agricultural Economics Institute, Austrian Agricultural Economics Institute, CFRI, Hungarian Ministry of Agriculture, Italian Ministry of Agriculture, Central Agricultural Control & Testing Institute Bratislava

Notes: (1) = 2002, (2) = 2001, (3) = 2003

4.4 Sugar beet

In 2003, the total area planted to sugar beet in the EU 15 was 1.73 million hectares. The main producing countries are Germany, France, Italy, the UK, the Netherlands, and Spain which

[18] Organic area in Italy includes crops in conversion, which accounted for about 50% of the total area. Trade sources also indicate that the 2003 organic area fell to under 10,000 hectares due to difficulties in growing the crop in 2002 and rejection of some supplies by buyers because of unacceptably high levels of mycotoxins

together account for 80% of total EU 15 plantings. Within these six countries, the area planted to organic crops totalled 1,550 hectares, equal to 0.11% of total sugar beet plantings in these countries (Table 5). The only countries with plantings of certified organic sugar beet were the UK, Germany, Netherlands and Denmark with 500, 400, 650 and 139 hectares respectively (a range of 0.09% to 0.61%).

In the accession countries, Poland has the largest sugar beet area (300,000 hectares). There is no reported certified organic sugar beet grown in Poland[19] and the recorded areas in Slovakia and Hungary are also very small.

Table 5: EU certified organic sugar beet areas: main countries of production (hectares)

Country	Total sugar beet area 2003	Organic area	Organic as % of total area
France	367,000	Nil (1)	0.00
Germany	435,000	400 (2)	0.09
UK	162,000	500 (3)	0.3
Italy	205,000	0 (2)	0
Netherlands	107,000	650 (3)	0.61
Spain	100,000	Nil (2)	0.00
Total leading six	*1,376.000*	*1,550*	*0.11*
Austria	43,000	Nil (1)	0.00
Denmark	54,000	139 (1)	0.26
EU 15	*1,730,000*	*Not available*	*0.077*
Poland	300,000	Nil (2)	Nil
Hungary	56,000	1 (2)	Nil
Slovakia	30,000	277 (2)	0.9

Sources: Coceral, ZMP, BIES, British Sugar, Suker Unie, Danish Agricultural Advisory Service, Austrian Agricultural Economics Institute, Hungarian Ministry of Agriculture, Italian Ministry of Agriculture, Central Agricultural Control & Testing Institute Bratislava
Notes: (1) = 2002, (2) = 2001, (3) = 2003

4.5 Reasons for the very small share of organic arable crops

As indicated above, the organic share of these three crops grown in the EU is extremely low. Table 6 and Table 7 also demonstrate this in terms of the relative importance of the three crops combined. For example, in France and Germany, the organic share of the total area planted to the three crops is only 0.23% and 0.47% respectively.

This very low level of plantings and importance reflects a number of reasons, some of which are common to all three crops, and some that are crop-specific:

- In all three crops, weeds are a major problem and can cause significant yield loss and downgrading of a crop. Therefore, organic growers need to use rotation, mechanical methods, hand labour and land with a low incidence of weeds to minimise weed establishment when the crop canopy is not well established. These organic practices are constrained by the availability of resources such as land and labour, and lead to increased costs (which require price premia to maintain profitability);
- In arable crops such as organic sugar beet, effective weed control is highly dependent on mechanical control and hand labour. It is difficult to find adequate amounts of labour

[19] Source: Sugar processing sector

willing to do hand weeding (eg, the requirement in organic sugar beet is an estimated 60 hours/ha) for short periods in the spring. Hand labour requirement also adds considerably to total weed control costs. For example, in the UK (2002) average expenditure on hand weeding was €455/hectare[20] compared to the average expenditure on weed control in conventional sugar beet crops (based largely on herbicides) of €108/hectare;

- Soil nutrients, notably nitrogen, are a key factor impacting on yield in all crops. In the case of organic oilseed rape, it is not grown as readily as organic wheat because it demands high levels of soil nitrogen which are limited in an organic rotation. In conventional arable production, oilseed rape is usually grown as a break crop in rotation with wheat and allows farmers to maximise the yield potential of first year wheat;
- Levels of production risk tend to be higher in organic arable crops than conventional crops. This acts as a disincentive to convert to organic production for many combinable crops;
- There has been a general lack of demand for these organic crops. With a lack of demand, processors see little economic incentive to provide dedicated processing facilities for crops like sugar beet and oilseed rape, and plant breeders see little incentive to invest in the supply of organic seeds of these crops. The lack of processing facilities and the availability of some organic inputs are sometimes cited as contributory factors for the limited development of these markets and hence possible signs of market failure in the organic sector. However, it is unlikely that market failure has occurred because the small scale of demand has provided the appropriate economic signals to the supply chain and resulted in very little development of production and processing[21]. In the oilseed rape sector, the market for organic rapeseed oil is very small. A significant proportion of the rapeseed oil used is in the non-food sector where there is virtually no organic market for any vegetable oil. Also, in the human food sector rapeseed oil is widely considered by consumers to be an inferior product relative to alternatives like sunflower oil (even though its health profile may be superior). The high degree of substitution between different vegetable oils used as food ingredients also means that the lowest cost organic oils dominate market use and contribute to limiting the level of organic premia obtainable. Similarly, organic sugar beet faces competition from organic cane sugar which can be produced much more cheaply than organic beet (and is attractive in the high priced organic sugar market, even after payment of import duties) and is preferred by most refiners and food users of organic sugar.

It is also important to highlight that this very small development in the organic area planted to these three crops has occurred even though most member states have provided financial support schemes to assist farmers to convert and maintain organic production systems for a number of years.

Table 6: Relative importance of organic oilseed rape, sugar beet and maize: main EU countries (%)

Country	Share of total UAA accounted for by oilseed rape, sugar beet and maize	Share of total area of oilseed rape, sugar beet and maize accounted for by organic crops
Austria	10.26	1.49
Denmark	12.03	1.34

[20] Source: Organic Farm Management Handbook

[21] If a fundamental imbalance between supply and demand developed, a substantial organic premium would have occurred. There is no evidence that such a large price premia has developed for organic crops that require processing, suggesting that there is no market failure

France	15.23	0.23
Germany	19.54	0.47
Spain	3.35	0.11
UK	5.00	0.23

Sources: Various: European Commission, Coceral, ZMP, Cetiom, FNAP, Soil Association, Danish Agricultural Advisory Service, MAPYA, Austrian Federal Institute of Agricultural Economics, , Hungarian Ministry of Agriculture, Italian Ministry of Agriculture, Central Agricultural Control & Testing Institute Bratislava
Notes: For years see tables 3-5

Table 7: Relative importance of organic agriculture and organic oilseed rape, sugar beet and maize within organic production: main EU countries (%)

Country	Organic share of total utilised agricultural area (UAA)	Share of total organic area accounted for by organic oilseed rape, sugar beet and maize
Austria	8	1.89
Denmark	6	2.88
France	2	2.03
Germany	4	2.50
Spain	1	0.26
UK	5	0.23

Sources: Various: European Commission, Coceral, ZMP, Cetiom, FNAP, Soil Association, Danish Agricultural Advisory Service, MAPYA, Austrian Federal Institute of Agricultural Economics, , Hungarian Ministry of Agriculture, Italian Ministry of Agriculture, Central Agricultural Control & Testing Institute Bratislava
Notes: For years see table 3-5

5 The future level of demand for non GM products and context of organic arable crops

5.1 Future demand for non GM derived products

As indicated in section 3, the existence of real markets and demand for non GM products is limited to a minority of uses in the soybean and maize sectors.

However, anti GM groups also often claim that there is generally little or no demand for GM products in the EU (ie, that there is stronger demand for non GM products). This perception does, however fail to take into consideration several factors that suggest otherwise. These include:

- In relation to soybeans and maize, usage is mostly concentrated in the animal feed sector and/or industrial sectors. In these markets, most users have not required their raw materials to be certified as non GM and hence the level of positive demand for non GM crops and derivatives has been limited. In the soybean and derivative markets, where the market for non GM is widely perceived to be the most developed, demand for non GM material accounts for 27% of total consumption across the EU (see section 3) and is found mostly where ingredients are used directly in human food and as feed ingredients in the poultry sector. In other words, a significant majority of total consumption does not require certified non GM material;
- where markets have actively required the use of non GM crops and their derivatives to be used, these have, to date been relatively easily obtained at prices that are similar to, or trade at only a small positive differential relative to their GM alternative. Any additional cost associated with this supply (relative to a cheaper GM-derived alternative) has largely been absorbed by the supply chain upstream of retailers, with no impact on consumer

prices. When the supply chain has been able to demonstrate difficulty in absorbing even small additional costs involved in using only non GM ingredients (eg, in some of the livestock product sectors) to their customers in the retail sector, the non GM requirement has tended to be dropped or made less demanding (eg, applying only to premium ranges of products instead of all produce, such as free range eggs or outdoor-reared pork and bacon) rather than the additional cost being accepted by retail chains and/or passed on to final consumers. This behaviour suggests that the level of demand amongst end consumers for non GM products is highly price sensitive and would fall substantially if a consumer price level differential were to develop between GM and non GM derived products;

- in some markets GM crops trade at a price premium relative to conventionally produced crops. Examples include GM soybeans in Romania and GM canola in Canada, where reduced levels of impurities in the oilseeds arriving at crushing plants have resulted in quality premia being paid to the supplying farmers of anywhere between +1% and +3%[22]. Also in some markets, notably China, consumer market research suggests a willingness amongst consumers to pay higher prices for GM crops because of the perceived benefits of the technology (primarily the reduction in pesticide use)[23];
- whilst many consumer market research studies (eg, the GM Nation Debate in the UK) suggest widespread opposition to GM products by consumers, such studies should be placed in context. Often such research uses biased language in questions, there is a poor level of understanding of the subject by respondents and actual buying behaviour is not explored to verify views expressed. In addition, some research, like GM Nation in the UK is based on a biased, self-selected audience. As such, this type of research is of limited value in identifying underlying consumer views, attitudes and actual purchasing behaviour. Where more carefully controlled research is conducted with representative samples of consumers (eg, Institute of Grocery Distribution in the UK in 2003) such research suggests that for a significant majority of people, the issue of whether their food is derived from GM crops is not important. For example, the IGD research found that 74% of respondents 'are not sufficiently concerned about GM food to actively look to avoid it' and it is not seen as a priority.

For the three main crops for which GM traits are seeking regulatory approval[24] for plantings in the EU in the next few years (maize, oilseed rape, and sugar beet), the level of future non GM demand is likely to vary by crop, market and use:

- non GM demand will probably be highest where the crops are going into human food. Sugar beet is probably the crop most affected here, especially as in most EU states, there is a monopoly buyer of sugar beet that can effectively dictate what varieties are planted by growers. Whilst EU sugar beet processors maintain a policy of not accepting GM sugar beet (the current stated policy of most processors) there will be no market for GM sugar beet in the EU. If this policy changes by the time of commercialisation (eg, for use in non food sectors such as bio-ethanol) and/or export opportunities in the bio-ethanol market arise, a GM market may develop;
- In contrast, a significant part of the animal feed and industrial sectors (about three-quarters of the ingredients used in EU animal feeds) are largely indifferent as to whether crops used are derived from GM crops or not. For crops destined for these markets, the level of active demand for crops/derivatives that have certified non GM status is likely to

[22] Sources: Brookes G (2003) and Canola Council (2001)
[23] Source: Quan L (2002)
[24] Or having already gained regulatory approval in the case of some Bt, insect resistant maize events

remain limited. For maize, 75% of grain maize is used in the feed sector and 100% of forage maize is fed to animals. For oilseed rape, about 95% of rapemeal is used in the feed sector and about 50% of rapeoil is used in industrial uses (eg, bio-diesel);

- The nature of competition also affects the demand for non GM crops. In markets where (low) price is considered to be the primary driver of demand (this is relevant to both domestically consumed foods and to export markets), access to the lowest priced products and raw materials is the main criteria used for purchasing. In such markets (eg, frozen rather than fresh poultry), GM based feed ingredients tend to be attractive because they are often cheaper to produce than the non GM alternative, and hence the demand for non GM alternatives is small.

Overall, this points to the level of demand for crops and derivatives, for which the non GM status is important, being limited and found mostly in the sugar sector. Even in this latter sector, pressure to adopt cost reducing technology, like GM herbicide tolerant sugar beet, is likely to rise by 2008-09, because of likely reforms to the EU sugar support system (probable significant cuts in support prices), increased competition from low priced imports (sugar from the least developed countries can enter the EU market duty-free from 2008-09) and the further development of the market for bio-fuels, in line with EU targets for adoption of these fuels.

5.2 Future context of organic production

The certified organic production area in the EU of the main crops for which GM traits are most likely to be commercialised in the next few years is currently very low (just under 50,000 hectares or 0.41% of the combined total area of the three crops of oilseed rape, sugar beet and maize in the main EU countries growing these crops).

In the future it is possible that the organic area of these crops could expand, although, as indicated earlier there are a number of constraints to this:

- Crops like oilseed rape tend to be of limited interest to organic farmers because of the crop's high nitrogen requirement relative to other break crops and the market for organic oilseed rape is very small (those demanding organic oils prefer alternatives such as sunflower);
- For sugar beet and cereals, which are largely processed before consumption, the EU sector is often faced with intense competition from imported sources of (raw material) supply which tend to be more competitively priced (eg, underlying competitive advantages of producing organic sugar cane relative to organic sugar beet, or organic wheat produced in countries like Argentina relative to the EU). Access to lower cost and more readily available sources of labour also contribute to competitive advantages in many third countries;
- An important part of demand for combinable crops also comes from the livestock sector. Here the development of demand for organic produce has not matched growth experienced in the fruit and vegetable sector and is showing signs of having peaked (eg, up to 40% of organic milk in the UK has recently had to be sold into the conventional market without an organic price premium (Wise 2003)) and similar organic surpluses have been reported in the organic dairy markets in Austria, Denmark and Germany.

This suggests that any further expansion in the EU organic area will be concentrated in higher value products that have characteristics such as being bulky (raises cost of transport and hence reduces the competitiveness of imports, eg, potatoes), perishable and more commonly consumed without processing (eg, fruit, vegetables). Even if it was assumed that there was a substantial (eg, tenfold) increase in the EU organic area planted to combinable crops in the next 5-10 years, the sector would remain very small relative to total arable crop production[25]. It is also important to recognise that in the sectors where the organic share is higher (notably fruit and vegetables) that no GM agronomic traits applicable to fruit and vegetables grown in the EU are 'on the horizon' for at least ten years.

6 Co-existence of GM with non GM and organic crops to date

6.1 The EU

For a crop to be marketed as organic, it must have been cultivated on land that has been through a period of conversion (typically two years) and grown according to organic principles such as only using selected (natural) pesticides and fertilisers from farm manure or nutrient enhancing crops. However, these organic principles do not restrict the use of crop varieties or species developed by methods such as 'alien gene' transfer (eg, used to breed yellow rust resistance and bread-making qualities into wheat from unrelated species or the cultivation of triticale, a man-made hybrid of wheat and rye[26]).

Baseline organic requirements are set at an EU level although each organic certification body has the freedom to set its own principles and conditions that may be stricter than the legal baseline. As a result, there may be several different organic standards operating in member states, each striving for market differentiation relative to others.

In relation to the adventitious presence of GMOs, the base EU regulation covering organic agriculture (2092/91) states 'there is no place for GMOs in organic agriculture' and that '(organic) products are produced without the use of GMOs and/or any products derived from such organisms'. The legislation made provision for a *de minimis* threshold for unavoidable presence of GMOs which should not be exceeded, but did not set such a threshold. In the absence of such a legal threshold having been set, the general threshold of 0.9%, laid down in the 2003 Regulation on labelling and traceability, is the current legally enforceable threshold.

Although the current legally enforceable threshold for GMO presence labelling is 0.9%, some organic certification bodies apply a more stringent *de minimis* threshold on their members (0.1%, the limit of reliable detection).

For conventional growers of non GM crops in the EU, the 'benchmark' for determining whether a crop or derivative has to be labelled as GM or not is also the legally enforceable threshold of 0.9%, although some buyers may choose to set more stringent thresholds (eg, 0.1%).

Against this background, evidence from the only current example of where GM crops are grown commercially in the EU (Bt maize in Spain[27]) shows that GM, conventional (non GM) and organic maize production have co-existed without economic and commercial problems. This

[25] It should also be noted that despite the provision of subsidies to support both the conversion and maintenance of organic production systems in most EU member states for several years, even in countries like Austria, where 8.3% of the total agricultural area was classified as organic in 2002, the share of this area accounted for by organic oilseed rape, sugar beet and maize was still only 1.89%

[26] Triticale is an artificial hybrid of wheat and rye and is a popular organic crop. Triticale is an example of a wide-cross hybrid, made possible solely by the existence of embryo rescue (a method of recovering embryos in laboratory culture) and chromosome doubling techniques (the restoration of fertility using mutagenic chemicals). The triticale crop could not exist without human manipulation of the breeding process, nor could wheat varieties produced using alien gene transfer techniques

[27] See Co-existence of GM and non GM crops: case study of maize grown in Spain (2003), PG Economics www.bioportfolio.com/pgeconomics

includes in regions such as Catalunya where Bt is concentrated[28]. Where non GM maize has been required in some markets, supplies have been relatively easily obtained, based on market-driven adherence to on/post farm segregation and by the purchase of maize from regions where there has been limited adoption of Bt maize (because the target pest of the Bt technology, the corn borer is not a significant problem for farmers in these regions). Only isolated instances (two) of GMO adventitious presence in organic maize crops were reported in 2001.

6.2 North America

As in the EU, National Organic Standards (eg, in the USA) prohibit the use of GM varieties. However, an important point to note in the US regulations is the recognition that organic growers may need to implement practical procedures to minimise the possibility of adventitious presence of GMOs in their crops occurring and that if an organic crop tests positive for a GM event that occurs unintentionally, the grower should not be penalised either by the down-grading of a crop (ie, loss of an organic price premium) and/or the de-certification of a specific field.

For growers of conventional, non GM crops there is no formal regulatory 'benchmark' for the definition of whether a product should be labelled as GM or not, except where crops/derivatives are exported to countries where labelling legislation does exist (eg, the EU) or buyers set purchasing criteria on commercial grounds.

Relative to this more limited (relative to the EU) regulatory background and interpretation, GM crops have been grown commercially in North America since 1996 and now account for 60% of the total plantings of soybeans, corn and canola in the USA and Canada combined. Against this background, GM crops have co-existed with conventional and organic crops without causing significant economic or commercial problems[29][30]. For example, the US organic areas of soybeans and corn have increased by 270% and 187% respectively between 1995 and 2001, a period in which GM crops were introduced and reached 68% and 26% shares of total plantings of soybeans and corn. Also, survey evidence amongst US organic farmers shows that the vast majority (92%) have not incurred any direct, additional costs or incurred losses due to GM crops having been grown near their crops.

7 Can the EU organic sector co-exist with future GM production?

The evidence to date shows that GM arable crops growing commercially in the EU and in North America have co-existed with conventional and organic crops without economic and commercial problems – only isolated instances have been found of adventitious presence of GMOs occurring in organic crops in Spain and a small number found in North America, even though GM crops dominate production of soybeans, maize and canola in North America. Furthermore, in a number of cases these instances have been attributed to weaknesses in, on and post farm segregation of crops or to failure of organic growers to use organic seed or to test their conventional seed for GMO presence prior to sowing.

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[28] Bt maize accounts for about 15% of total maize plantings in this region

[29] See separate paper entitled 'Co-existence case study of North America: widespread GM cropping with non GM and organic crops' by the same authors, and which can be found on www.pgeconomics.co.uk

[30] This relates to reports of adventitious presence of GM material occurring in organic crops that have resulted in economic losses for organic growers (eg, loss of organic price premium). It does not include instances where trace levels (within the boundaries of very sensitive testing equipment) of GM material may have been detected, but which did not result in any economic loss

For the future, the likelihood of economic and commercial problems of co-existence arising remains very limited, even if a significant development of commercial GM crops (see appendix one for a summary of the likely timing of different GM traits being commercialised in the EU over the next few years) and increased plantings of organic crops were to occur because:

- the GM traits being commercialised in the next few years are in crops for which there is limited demand for non GM material (eg, for forage and grain maize, rapeseed oil and meal). The only possible exception to this is sugar beet, although even here, the development of non food uses of sugar (eg, for bio-ethanol) and policy-change induced competitive pressures may result in greater willingness amongst the EU's sugar processors to use GM sugar beet;
- the organic areas of the three key crops (oilseed rape, sugar beet and maize) are extremely small (only 0.41% of the area planted to these crops in the main producing countries of the EU);
- The organic area of these crops (and other combinable crops) is likely to continue to be a very small part of the total arable crop areas (even if there were a tenfold increase in plantings), with a very limited economic contribution relative to the rest of the EU's arable crops. The likelihood of these (organic) areas expanding is limited due to a combination of adverse agronomic factors (eg, a need for sites with few weed problems and the nutrient demanding nature of crops like oilseed rape), limited demand, and market preference for competing (imported) produce (eg, cane sugar);
- The possibility of gene transfer to related wild and other crop species from any of the GM crops is extremely low[31]- this is also an issue examined before regulatory approval is given;
- EU arable farmers have been successfully growing specialist crops (eg, seed production, high erucic acid oilseed rape, waxy maize) for many years, near to other crops of the same species, without compromising the high purity levels required;
- some changes to farming practices on some farms may be required once GM crops are commercialised. This will however, only apply where GM crops are located near non GM or organic crops for which the non GM status of the crop is important (eg, where buyers do not wish to label products as being GM or derived from GM according EU labelling regulations). These changes are likely to focus on the use of separation distances and buffer crops (of non GM crops) between the GM crops and the 'vulnerable' non GM/organic crop and the application of good husbandry (weed control) practices;
- GM crop planting farmers are already made aware of these practices as part of recommendations for growing GM maize in Spain (co-existence and refuge requirements) provided by seed suppliers in their 'GM crop stewardship programmes'. Few GM planting farmers have however, found themselves located near to 'vulnerable' non GM/organic crops and hence the need to strictly apply these guidelines has been very limited.

The different certification bodies in the EU organic sector can also take action to facilitate co-existence by:

- applying a more consistent, practical, proportionate and cost effective policy towards GMOs (ie, adopt the same policy as it applies to the adventitious presence of other non organic material). This would allow it to better exploit market opportunities and to minimise the risks of publicity about inconsistent organic definitions and derogations for

[31] For example, the FSEs in the UK found no evidence for the transfer of the herbicide tolerance gene from GM oilseed rape to common wild relatives

the use of non organic ingredients and inputs damaging consumer confidence in all organic produce. This latter point is important given that the organic crops perceived to be affected by the commercialisation of GM traits in the next few years account for a very small share of the total organic farmed area in the EU (Table 7). For example in Austria and Germany, the share of the total organic area accounted for by organic oilseed rape, sugar beet and maize was 1.89% and 2.5% respectively; or

- applying the same testing principles and thresholds currently applied to GMOs to impurities (eg, introduce a *de minimis* threshold on pesticide residues and apply a 0.1% threshold on the limit for acceptance of all unwanted materials and impurities)[32]; and
- accepting that if they wish to retain policies towards GMOs that advocate farming practices that go beyond those recommended for GMO crop stewardship (eg, buffer crops and separation distances that are more stringent than those considered to be reasonable to meet the EU labelling and traceability regulations), then the onus for implementation of such measures (and associated cost) should fall on the organic certification bodies and their members in the same way as current organic farmers incur costs associated with adhering to organic principles and are rewarded through the receipt of organic price premia.

Lastly, it is important to emphasise the issues of context and proportionality. If highly onerous GM crop stewardship conditions are applied to all farms[33] that might wish to grow GM crops, even though the vast majority of such crops would not be located near to organic-equivalent crops or conventional crops for which the non GM status is important, this would be disproportionate and inequitable. In effect, conventional farmers, who account for 99.59%[34] of the current, relevant EU arable crop farming area could be discouraged from adopting a new technology, that is likely to deliver farm level benefits (yield gains, cost savings) and provide wider environmental gains (reduced pesticide use, switches to more environmentally benign herbicides, reduced levels of greenhouse gas emissions[35]).

[32] Or alternatively apply the current legal labelling threshold of 0.9% for GM material

[33] For example the setting of substantial separation distances between GM crops and any conventionally grown equivalent

[34] This varies by member state within a range of 99.77% in the UK to 98.07% in Austria

[35] See PG Economics (2003a) for detailed analysis of this: appendix 5

Appendix 1: Possible GM technology use in the EU

Table 8 below summarises our forecasts for when reasonable volumes of seed containing GM traits in the leading arable crops of relevance to the EU are likely to be available to EU farmers. The key point to note is that it is likely to be another 2-3 years before GM seed is widely available to EU producers of crops like oilseed rape and sugar beet and the only GM crop with current commercial availability is insect resistant maize. GM wheat and potatoes are unlikely to be available until after 2010.

Table 8: Forecast GM crop commercial availability for leading agronomic traits in the UK

Crop/Trait	Commercially available to EU farmers
Herbicide (glufosinate) tolerant maize	2005-2006
Herbicide (glufosinate) tolerant oilseed rape	2005-2007
Novel hybrid oilseed rape	2005-2007
Herbicide (glyphosate) tolerant sugar beet	2006-2008
Herbicide (glyphosate) tolerant wheat	After 2010
Fungal tolerant wheat	After 2010
Nematode & fungal resistant potatoes	After 2010
Fungal resistant oilseed rape	After 2010

Source: PG Economics

Note: The glufosinate tolerant trait in maize has received regulatory approval in the EU but seed varieties containing the trait have yet to receive varietal approval for use in any member state

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