ECONOMICS OF GM CROP CULTIVATION

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Abstract: Asynchronous approval of new GM crops across international jurisdictions is of growing concern due to its potential impact on global trade. Different countries have different authorisation procedures and, even if regulatory dossiers are submitted at the same time, approval is not given simultaneously (in some cases, delays can even amount to years). For instance, by mid-2009 over 40 transgenic events were approved or close to approval elsewhere but not yet approved – or not even submitted – in the EU. Yet, like some other jurisdictions, the EU also operates a zero-tolerance policy to even the smallest traces of nationally unapproved GM crops (so-called low-level presence). The resultant rejection of agricultural imports has already caused high economic losses and threatens to disrupt global agri-food supply chains. The risk that feed supplies could be affected by a low-level presence of non-EU approved GM material could be resolved if the EU allowed a tolerance for this, rather than operating a strict zero tolerance as now. The Commission has undertaken to come forward with a non-legislative technical solution to address the difficulties created by a strict zero tolerance policy. To what extent this would be helpful will depend on the nature of the proposed solution.

Key words: crop cultivation, GM, supply chain of commodity crops

Introduction

The commercial cultivation of genetically modified (GM) crops began in 1996 and has been continuously expanding ever since, both in industrialised and developing countries. By 2009 it had reached a global area of 134 million hectares, cultivated by 14 million farmers in 25 countries [*James,* 2010]. However, acceptance of GM crops is very heterogeneous. Public opinion in Europe is mostly seen to be critical (whether because of a lack of perceived personal benefits, ideologically motivated judgements, emotional responses or diffuse mistrust of governments and the media), while most people in the rest of the world are rather indifferent or (if they are farmers) increasingly in favour of GM crops [*Brook Lyndhurst,* 2009].

Differences also exist regarding both the number of GM crops authorised in different countries and the timing of their authorisation. The major GM crops – soybeans, maize, cotton and rapeseed – are also those crops that are the most heavily traded internationally, providing vital export revenues for many countries and industries but also providing a crucial supply of cheap feed and fibres for many importing countries, including the member states of the European Union (EU). For climatic and agronomic reasons, the EU is unable to produce most of the oilseed meal and other protein-rich feedstuffs required to feed its livestock. In fact, the EU imports about 80% of its protein needs. Protein-rich soybean meal, as well as Corn Gluten Feed (CGF) and Distillers Dried Grain with Solubles (DDGS), are needed by livestock producers in the EU to achieve a balanced diet for their animals, especially as far as protein is concerned. There is no prospect for developing large scale domestic production of protein rich plants. Even with the increased land sown to oilseeds for biofuels and stepping up production of protein crops such as field peas, field beans and sweet lupins to provide alternatives to soybean, at most they could only replace between 10–20% of EU imports of soybeans and soybean meal. Without an adequate supply of these feed ingredients, the EU's livestock production will lose competitiveness and European livestock producers will lose market share. All EU imports of meat are produced from animals which may legally be fed with GM plants not yet authorised in the EU [EC, 2007].

The supply chain of commodity crops (e.g. soya and maize) is complex. The EU livestock sector uses imported soybean, soybean meal and maize by-products as animal feed. Countries exporting these crops are growing both EU-authorised and non-EU-authorised GM crops, as well as non-GM crops. The EU decision-making regime for GM products is relatively slow in comparison with the rest of the world (asynchronous GM approvals). The supply of non-GM commodity crops is decreasing as a consequence of an increase in the volume of GM crops being grown and the potential for non-EU authorised GM varieties to enter the non-GM supply chain as adventitious presence is becoming greater. Combined with the EU's zero tolerance for unauthorised GM products, this threatens to create a situation where traders are reluctant to import any commodity into the EU (GM or non-GM) that might have a trace level of unapproved GM material. Organic livestock farmers are legally required to use non-GM feed. Brazil has been the main source of non-GM soya, for which a variable price premium has applied over recent years. There is concern within the EU feed and food sectors that it is becoming increasingly difficult and costly to maintain a non-GM supply chain, and that it may become unsustainable at some point in the future.

1. Global status of commercialised GM crops in 2009

Since 1996, when the first GM soybean was harvested, biotechnology and its adaptations by the food industry have become one of the most controversial and most disputed topics. However, the adoption of GM crops is occurring at a rapid pace. The global area planted to GM crops in 1996 was approximately 1.7 million hectares. GM crop production has increased each year since then, with an estimated 134 million hectares of GM crops planted in 2009. The United States is the leading producer of GM crops accounting for 64 million hectares of the total GM crop area. Brazil is second, producing GM crops on 21.4 million hectares. Argentina had 21.3 million hectares of GMO area in 2009. Brazil displaced Argentina to become the second largest grower of biotech crops in the world *(Table 1)*.

Table 1. Area of GM crops by country (2009)

Million hectares

Country	Area	GM crops
USA	64.0	Soybean, maize, cotton, canola, squash, papaya, alfalfa, sugarbeet
Brazil	21.4	Soybean, maize, cotton
Argentina	21.3	Soybean, maize, cotton
India	8.4	Cotton
Canada	8.2	Canola, maize, soybean, sugarbeet
China	3.7	Cotton, tomato, poplar, papaya, sweet pepper
Paraguay	2.2	Soybean
South Africa	2.1	Maize, soybean, cotton

* 8 biotech mega-countries growing at leat 2 million hectaresof GM crops
Source: James [2010]

Almost all of the global biotech crop area consists of soybeans, maize, cotton and canola *(Figure 1)*. In 2009, GM soybeans accounted for the largest share (52%), followed by maize (31%), cotton (12%) and canola (5%).

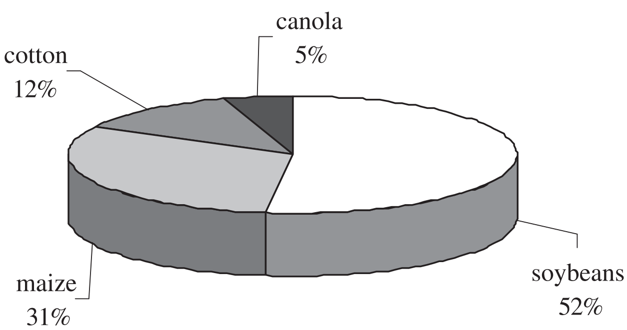

Figure 1. GM crop plantings 2009 by crop
Note: * base area: 133 million hectares; additional GM crop plantings accounted for 1 million hectares
Source: James [2010]

In 2009, GM crops were cultivated on about 14 million farms in 25 countries. The main producers of GM crops are, with the exception of the United States and Canada, all developing countries, i.e., Brazil, Argentina, India, China, Paraguay and South Africa. Developing countries have continued to increase their share of global GM crops by planting 61.5 million hectares, or 46% of the global area of 134 million hectares. In 2009, of the 27 countries in the European Union, six – Spain, Czech Republic, Portugal, Romania, Poland and Slovakia – planted Bt maize on 95 thousand hectares compared with a 2008 total of 108 thousand hectares. The decrease was associated with several factors, including the economic recession, decreased total plantings of hybrid maize and disincentives for some farmers due to onerous reporting of intended plantings of Bt maize.

Despite the severe effects of the 2009 economic recession, record hectarages were reported for all four major biotech crops occupying 133 million hectares. For the first time, biotech soybean occupied more than three-quarters of the 90 million hectares of soybean globally, biotech cotton almost half of the 33 million hectares of global cotton, biotech maize over one-quarter of the 158 million hectares of global maize and biotech canola more than one-fifth of the 31 million hectares of global canola. In terms of the share of total global plantings to these four crops, biotech traits accounted for 77% of soybean plantings. For the other three main crops, the biotech shares in 2009 were 49% for cotton, 26% for maize and 21% for canola *(Figure 2)*. In November 2009, China issued biosafety certificates for biotech varieties of rice and corn. As rice is the most important food crop globally, feeding half of humanity, and maize is the most important feed crop in the world, these biosafety clearances can have enormous implications for future biotech crop adoption in China, Asia and the world.

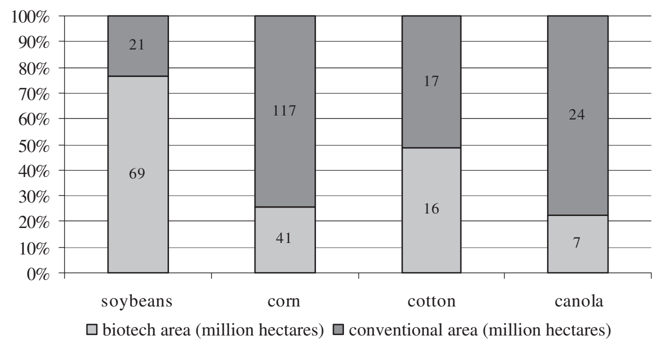

Figure 2. Share of GM crops in global plantings of key crops in 2009*
Note: * base area: 133 million hectares; additional GM crop plantings accounted for 1 million hectares
Source: James [2010]

The percent adoption of biotech crops continued to grow in 2009, for example, for GM maize to 85% in the USA, to 50% in Argentina and to 30% for the summer maize and 53% for the winter maize in Brazil. The adoption rate of GM soybean was 98% in Argentina, 91% in the USA and 71% in Brazil. Percent adoption of GM canola increased to 93% in Canada. The percentage of exports of transgenic soybean from the USA, Argentina and Brazil is growing from year to year, in proportion to the rate of adoption of GM soybean by farmers in the soybean exporting countries. This means that the animal compound feed industry in the EU is gradually replacing conventional soybean for its GM counterpart, without any serious repercussions in the market. In the USA, the relative share of conventional soybean cultivation amounts to around 9% of the total soy plantings, while in Argentina the comparative figure is around 2% for the past four years. In Brazil there is still room for more transgenic soybean expansion, as the current relation between GM and conventional varieties in production amounts to 29% *(Table 2).*

Table 2. Adoption rate of GM crops in the leading exporting countries of maize and soybean (2009)

GM crops	Country	Adoption rate (%)
Soybean	USA	91
	Argentina	98
	Brazil	71
Canola	Canada	93
Maize	USA	85
	Argentina	50
	Brazil*	30–53

Notes:* In Brazil the cultivation of GM maize (MON 810, Liberty Link) was approved in February 2008 (adoption rate in 2009: summer: 30%; winter: 53%)
Source: USDA [2010], ISAAA [2010]

The economic benefits of genetically modified (GM) crops are undeniable and with adoption only likely to increase, and the commercial pipeline suggests that product quality traits will be increasingly prominent if seed companies are going to maintain decent margins from the technology. The claim by GM critics that yield increases over conventional varieties are not there, thus undermining their economic benefits, is too simplistic. The economic gains are not necessarily in direct yield gains, they come from easier agronomy, better protection from insects and lower input costs. If you had 30% loss from insects, then you add protection, there is your gain. The economic bottom line is undeniable. The economic gains worldwide split almost equally between developed and developing countries as the latter have caught up in terms of adoption. But there is a significant premium in seed prices too [*Brookes and Barfoot,* 2010].

2. Effects on the feedstuff market in the EU

Maize and maize-byproduct imports

The United States grows about 40% of the maize world production (around 800 million tonnes a year). Other major maize producing countries include China, the EU, Brazil, Mexico, India and Argentina. The United States is not only the world's top maize producer, but also the top exporter. On average, about 20 percent of U.S. corn is exported. **The United States, Argentina and Brazil are the the world's three largest maize exporters with above 80% share of world maize trade**. The U.S. share of global maize trade is around 60%, Argentina with a small domestic market is the world's second largest maize exporter. In the last several years, Brazil has targeted the EU's demand for non-genetically modified maize. This marketing situation is assumed to decline as Brazil continues to expand the planting of GM maize varieties *(Table 3).*

Table 3. Global maize trade

Million tonnes

	2009/2010	2010/2011*
Global trade	86.0	88.5
Exporters		
USA	49.5	50.8
Argentina	12.0	13.0
Brazil	7.5	7.0
Ukraine	5.0	5.0
South Africa	2.5	2.5
Importers		
Japan	16.3	16.3
Mexicó	8.0	9.1
South Korea	7.8	8.6
Egypt	5.0	5.4
EU-27	2.5	2.5

*Forecast
Source: USDA [2010] és Toepfer International [2010]

In fact, **the EU has not been able to import maize from the United States since 1997** because there has not been a harmonisation of approvals in the EU and the United States. Other countries, primarily Argentina, have provided a substitute for the previous exports from the United States. However, in 2007 there were also substantial problems with the **importation of maize from Argentina** for the starch industry as well as for the feed sector due to a GMO trait (event GA21 or "Herculex") not approved in the EU. Until this trait was approved in 2008 maize could only have been exported from Argentina to the EU if the Argentinean authorities had issued an analysis certificate for each shipment confirming the absence of GA21. This time demand for maize in the EU was concentrated on maize from Brazil, which has intensified the **acceleration in prices on the feedstuff market.** The compound feed producers in the EU had to pay up to 50 €/t more for maize from Brazil.

The EU used to import significant quantities of maize by-products from the USA for use as animal protein feed (CGF and DDGS). However, this trade declined sharply from 2007 because the USA adopted new GM maize crops before they were cleared for EU import. This was the first example of an asynchronous GM approval problem for the EU feed and livestock industries. The reduced import of US maize by-products has been replaced by the use of other feed materials, at a cost to feed compounders and livestock farmers, especially in the ruminant sector.

Protein feed imports

Many countries with limited opportunity to expand oilseed production, such as China and some countries in South Asia, have invested heavily in crushing capacity in recent years. As a result, import demand for soybean and other oilseeds has grown rapidly. China's expansion of crushing capacity changes the composition of world trade by raising global import demand for soybeans rather than for soybean meal. Argentina, Brazil and the United States account for 90% of world export of soybean and soybean meal.

The **USA, Brazil and Argentina dominate soybean cultivation worldwide accounting for 80 to 85% of global production** (250 million tonnes a year). Other significant producing countries are India, with an output of 7 to 8 million tonnes (3%) and the People's Republic of China with 16 million tonnes (7%) a year. China is not at all of significance as an exporting country; it is instead by far the leading soybean importing country. Imports into China amounted to 46 million tonnes in 2009/10, or 54% of world soybean trade. While China has generally no exports, India exports 3 to 4 million tonnes of soybean meal a year mainly to the Asian region. Thus, **there are no real alternatives to imports from the three large producing countries.** Soybean global trade is about one third of its total production. The **USA, Brazil and Argentinia contribute 90% of total world soybean exports.** Besides China and India, all the other soybean and soybean meal producing and exporting countries have for the most part switched the cultivation of soybeans to the GMO varieties *(Table 4)*.

Table 4. Global soybean trade

Million tonnes

	2009/2010	2010/2011*
Global trade	85.4	87.9
Exporters		
USA	39.6	36.7
Brazil	28.4	28.9
Argentina	7.5	12.5
Paraguay	5.4	4.8
Importers		
China	46.0	49.0
EU-27	13.0	12.6
Japan	3.6	3.6
Mexico	3.5	2.5
Taiwan	2.5	2.3

*Forecast
Source: USDA [2010] és Toepfer International [2010]

Soybean meal is the most used vegetable protein feed as an animal feed ingredient. Soybean meal is considered premium to other oilmeals due to its high protein content. **The USA, Brazil, Argentina and India are the world's major producers and exporters of soy meal**. The USA is the biggest producer but Argentina is the leading exporter followed by Brazil and the USA. The United States also has a big domestic demand whereas Argentina has limited local demand. Soybean meal world production was 161.6 million tonnes in 2009/2010. Generally, the United States, Argentina and Brazil contribute 55% of the world soybean meal production, while China imports soybeans from these countries in huge and increasing quantities for crushing. In recent times China has overtaken the U.S. in soybean meal production.

Soybean meal world trade is around 56 million tonnes, which is approximately one third of its total production. **Argentina, Brazil and the USA**, the world's first, second and third largest meal exporters, **account for 85 to 90% of total world soybean meal exports**. Argentina exports around 98% of its soybean meal production. N**o real alternatives exist to imports from the three large producing and exporting countries** since South East Asian countries are major markets of Indian soybean meal. India has a freight advantage over American countries for supply to Asia *(Table 5)*.

Table 5. Global soybean meal trade

Million tonnes

	2009/2010	2010/2011*
Global trade	56.0	56.6
Exporters		
Argentia	26.0	29.3
Brazil	12.0	11.8
USA	10.2	8.0
India	2.2	3.1
Importers		
EU-27	22.5	23.5
Vietnam	2.6	2.7
Indonesia	2.5	2.6
Thailand	2.2	2.2
Japan	1.9	1.9
South Korea	1.9	1.9

*Forecast
Source: USDA [2010] és Toepfer International [2010]

EU-27 imports more than 40% of the soybean meal available in world market. Though China is a biggest consumer of soybean meal it does not directly import meal but beans for crushing. EU-27 is the major destination for Argentinian and Brazilian soybean meal. The **EU imports soybeans and soybean meal from the three large soybean producing countries.** Of total imports in 2009 the amount of 12.9 million tonnes of soybeans, 8.9 million tonnes came from Brazil (69%), 2.2 million tonnes from the USA (17%) and just 0.1 million tonnes from Argentina (1%). The remaining 1.7 million tonnes were imported mainly from other South American countries. Dominating **soybean meal exports** into the EU is Argentina and Brazil. Of total imports of 20.7 million tonnes, 11.2 million tonnes (54%) came from Argentina and 8.7 million tonnes (42%) from Brazil. The USA supplied only 0.3 million tonnes *(Table 6)*.

Table 6. EU-27: Imports of soybeans and soybean meal, by country

Megnevezés	2007 (million tonnes)	2008 (million tonnes)	2009 (million tonnes)	2009 (%)
Soybeans	**15.1**	**14.4**	**12.9**	**100**
thereof: Brazil	9.5	8.5	8.9	69
USA	3.3	3.7	2.2	17
Argentina	0.3	0.3	0.1	1
Soybean meal	**23.6**	**23.2**	**20.7**	**100**
thereof: Argentina	14.6	13.2	11.2	54
Brazil	8.5	9.1	8.7	42
USA	0.2	0.5	0.3	1

Source: Eurostat [2010]

The world's largest producer of GM-free soy is still Brazil. In 2009, 29% of Brazilian soybean production in 2009, or 17 million tonnes, was cultivated as GM-free. Of this quantity, 9.4 million tonnes, or 16.3% of the Brazilian soybean harvest, of soybeans certified as GM-free (NON-GMO-Standard) – i.e. with guaranteed traceability with respect to origin and purity –were available. The discrepancy between the quantities of soybean cultivated as GM-free and the quantities of GM-free certified soya is a result of the fact that products that have undergone the certification process are more costly and only if traders are certain that they can pass on the price surcharge to their customers will they subject their harvest to such a process. If there is no specific demand for GM-free soya, then it may simply be mixed with GM soy and sold as genetically modified. How much GM-free soy is actually delivered to the EU depends on local needs, i.e. on European producers of animal feed and food, on food retailers and on demand from farmers and consumers [*Céleres,* 2008].

Besides grain, **oilmeals** also play an important role for the feedstuff supply. In total, 56 to 58 million tonnes of protein-rich feedstuffs are used in the EU in a marketing year. To a large extent, the oilmeals are not produced in the EU but rather imported from third countries. Of this, soybean meal alone accounts 30 million tonnes, or 53%. Around 21 million tonnes are imported directly as soybean meal, while 13 million tonnes come from the processing of soybeans into soybean meal and soy oil in the EU. The use of rapeseed meal is also expected to increase further from the current 12 million tonnes. In addition, 7 million tonnes of sunflower seed meal is used as feed in the EU *(Table 7)*.

Table 7. EU-27: Feedstuff balance

Million tonnes

	Total domestic use 2008/2009	Total domestic use 2009/2010	Imports 2008/2009	Imports 2009/2010
Total oilmeals, grain byproducts, citrus, beet, pulp pellets, pulses, tapioca	82.6	85.0	35.6	34.7
Oilmeals	56.2	57.8	30.4	30.4
Grain byproducts (CGF, DDGS, corngermmeal, wheat bran)	12.6	13.8	0.5	1.0
Citrus/Beet pulp pellets	5.3	5.9	1.4	1.3
Pulses (peas, feedbeans, lupins)	2.4	2.4	0.3	0.2
Molassis	5.9	5.2	2.8	1.8

Source: Toepfer International [2010]

Hungary is a large exporter of maize without any imports. Presently, no GM crops are produced in Hungary due to the introduction of a moratorium on the production of GMOs in 2005. Most of the protein feed used in Hungary is imported. Soybean meal accounts for 0.7 million tonnes a year *(Table 8)*. Demand for non-GMO soybean meal is negligable (petfood producers are the only customers of a small quantity of non-GMO meal) since the premium of 50 US$/t is not paid by the market**.**

Table 8. Hungary: Imports of feedstuff

Tonnes

	2007	2008	2009
Bran, sharps etc from working cereals and leg plants (2302)	420	1 031	2 964
Residues of starch mfr or sugar mfr or brewing etc (2303)	22 024	25 785	42 676
Ssoybean oilcake and other solid residue, wh/not ground (2304)	831 571	796 139	654 648
Oilcake etc nesoi, from veg fats and oils nesoi (2306)	92 441	54 730	74 408
Cereal groats, meal and pellets (1103)	374	1 463	2 176
Flour and meal of oil seed & olea fruit (no mustard) (1208)	5 390	4 183	3 979
Rutabagas, hay, clover and other forage products (1214)	3 743	3 708	796

Source: Hungarian Central Statistical Office [2010]

As can be seen from the example of "Herculex" (GA21), delays in the approval process have already had significant effects on the feedstuff supply in the EU. Due to the delayed approval process for "Herculex", imports into the EU of CGF and DDGS started to decline dramatically. While 2.6 million tonnes of CGF and 0.7 million tonnes of DDGS had been imported in the 2005/2006 marketing year, it was only around 0.5 million tonnes of CGF and 0.5 million tonnes of DDGS in 2009/2010. The products imported were those produced from maize grown in 2006 and exported from the USA to the EU until December 2007 *(Table 8)*. Anothe example was the new herbicide-tolerant soybean (MON89788, known as Roundup Ready 2 or RR2 soybean), which was submitted in 2006 for approval to United States and EU authorities. Problems of asynchronous approval in soybean imports with significant increases in feed expenditure costs were expected for the case of RR2 soybeans, thus avoiding the expected problem of low-level presence in soybean imports to the EU RR2 was authorised by the European Commission rather quickly at the end of 2008 [EC, 2008].

Together with the Corn Refiners Association in the USA, the exporter and importers created an action plan that attempted to ensure that no Herculex GMO would be found in any delivery of CGF and DDGS into the EU. However, in two thirds of all samples tested, Herculex corn was found. This confirms the high sensitivity of the specific testing method (basically a single changed gene in a sample is sufficient to result in a positive signal) and that in spite of the greatest possible separation of the flow of goods, **absolute zero tolerance cannot be guaranteed**. In addition to CGF and DDGS, rapeseed meal also could not be imported into the EU in 2008 because the approval had not yet been received for a trait that was cultivated in Canada. In the past, the EU imported up to 0.6 million tonnes of rapeseed meal from Canada [Toepfer International, 2008].

In the case of CGF and DDGS, it will be possible to once again import larger volumes in 2010 following the approval of three maize events by the EU Commission in November 2009. The volume of imports depends heavily on the competitive pricing of these commodities. The amount of feedstuff imports to the EU will also depend in the future on further developments in the area of green genetic engineering. In particular this affects maize and soybean imports from North and South America. Since 2006, genetically modified maize events have been grown in the USA and Canada which until November 2009 were not approved in the EU. Thus importing maize and maize byproducts (corn gluten and DDG) from the USA was only possible until this time at high risk. With the approval of three maize events (MON 89034, MON88017 and MIR604) in October and November 2009, imports of corn gluten and DDG once again became possible [Toepfer International, 2010]. However, new events, for example “stacked" event (a combination of multiple events) will be available in the future for cultivation that has not yet successfully passed the EU approval procedure. The rule on **complete zero tolerance** continues to apply to such **GMOs that have not yet been fully approved in the EU** so that even the smallest, non-quantifiable traces of non-approved GM events result in a marketing ban. That was the case in 2009 when traces of the triffid linseed event were proven to be in Canadian linseed.

Against this backdrop, European associations in the food and animal feed chain have asked the EU Commission to come up with a proposal for a technical solution as soon as possible. Otherwise trade distortions and competitive disadvantages once again threaten the EU's agricultural and food industry. In addition the approval procedure, as originally provided for in the legislation, must be placed on a purely scientific basis in order to speed up the approval process and achieve greater harmonisation with approvals in the export countries. Binding regulations on the existence of minor traces of genetically modified materials (low-level presence) are also urgently needed. This is the only way of sustaining the EU agricultural and food industry in the long term and of maintaining the highest possible level of domestic food production.

3. The authorisation process in practice

The problem with GM is the way it has been introduced, primarily as a way of maintaining the sales of pesticide companies. In less than three decades, a handful of multinational corporations have engineered a fast and furious corporate enclosure of the first link in the food chain. The concentration of corporate power in commercial seed and agrochemical production is unprecedented, as is its crossover with the powerful US-based commodity trading corporations Cargill, ADM and Bunge. In 2007, intellectual property rights have been applied to 67% of the global seed market *(Table 9)*. Three companies – US-based Monsanto, DuPont and Swiss-headquartered Syngenta – controlled nearly half of the total global market in proprietary seeds. Just six companies – the above three plus Bayer, BASF and Dow AgroSciences – control over two-thirds of the global agrochemical market [ETC Group, 2008].

Table 9. World’s Top 10 seed companies

Company	2007 seed sales (US$ millions)	% of global proprietary seed market
1. Monsanto (US)	4,964	23
2. DuPont (US)	3,300	15
3. Syngenta (Switzerland)	2,018	9
4. Groupe Limagrain (France)	1,226	6
5. Land O’ Lakes (US)	917	4
6. KWS AG (Germany)	702	3
7. Bayer Crop Science (Germany)	524	2
8. Sakata (Japan)	396	<2
9. DLF-Trifolium (Denmark)	391	<2
10. Takii (Japan)	347	<2
Top 10 Total	**14,785**	**67%**

Source: ETC Group [2008]

Every GMO that is allowed to be placed on the market in the EU is **required to be labelled** if it contains more than 0.9% GMO. If it has less than 0.9% GMO, it does not have to be labelled, provided that this amount is either adventitious or technically unavoidable. In the USA, Canada, Japan and Taiwan, food with a content of up to 5% of approved GM material can be classified as "non-GM"; however, in Australia, New Zealand, South Africa, Brazil or China, all food with more than 1% approved GM material has to be labelled as "GM" [*Ramessar* et al., 2008].

Although the approval process for a GMO is subject to clear rules and regulations, time and again these rules and regulations are more or less overridden. This does not apply to the **scientific risk assessment**. Article 18, Section 1 of Regulation 1829/2003 stipulates that the EFSA (European Food Safety Authority) should attempt to give its opinion within a period of six months from receipt of a valid application. However, the EFSA does at times take an extremely long time to complete the risk assessment. There have also been cases in which delays were due to incomplete applications received from the companies. However, to a large extent it is the EU Member States who are contributing to the delays in the approval process. An example of this is the "Herculex" corn: The Commission granted the approval for "Herculex" corn (DAS 59122-7) effective October 24, 2007 two years and nine months after the application had been filed [DG AGRI, 2007]. The EU GMO approval system takes more time than in other countries (average of over 30 months compared to 15 months for example in the USA *(Table 10)*.

The commercialisation of GM crops is a regulated activity, and countries have different authorisation procedures. New GM crops are not approved simultaneously. This asynchronous approval in combination with a zero-tolerance policy towards low-level presence of nationally unapproved GM material in crop imports is of growing concern for its potential economic impact on international trade. There is an obvious **difference between traces of nationally unapproved GM material due to asynchronous approval and isolated foreign approval or due to the accidental presence of research events**: in the former two cases the source of the traces is a GM crop that – somewhere – presumably has passed some kind of safety evaluation and has been authorised for commercial use. By contrast, traces of research events necessarily come from crops that are not authorised for commercial use anywhere [*Stein and Rodríguez-Cerezo,* 2010b]:

Table 10. Asynchrony of first approvals of GM crops for any use between the United States and the EU (2009)

GM crop	USA	EU	Delay (years)
Roundup Ready soy (MON 40-3-2), Monsanto	1994	1996	2
Bollgard cotton (MON531), Monsanto	1995	1997	2
Roundup Ready cotton (MON1445), Monsanto	1995	1997	2
NaturGard KnockOut maize (Bt176), Syngenta	1995	1997*	2
LibertyLink maize (T25), Bayer	1995	1998	3
YieldGard CB maize (MON810), Monsanto	1996	1998	2
Agrisure CB maize (Bt11), Syngenta	1996	1998	2
Agrisure GT maize (GA21), Syngenta	1997	2005	8
LibertyLink canola (T45), Bayer	1998	1998	0
LibertyLink soy (A2704-12), Bayer	1998	2008	10
Roundup Ready canola (GT73), Monsanto	1999	1996	-3
InVigor canola (MS8xRF3), Bayer	1999	1999	0
LibertyLink rice (LLRICE62), Bayer	2000	Assessment	Current AA
SeedLink canola (MS1xRF1), Bayer	2002	1996*	-6
SeedLink canola (MS1xRF2), Bayer	2002	1997*	-5
TOPAS19/2 canola (HCN92), Bayer	2002	1998*	-4
Roundup Ready 2 maize (NK603), Monsanto	2000	2005	5
Herculex I maize (1507), Dow/Pioneer	2001	2006	5
Bollgard II cotton (MON15985), Monsanto	2002	2003	1
YieldGard RW maize (MON863), Monsanto	2002	2006	4
LibertyLink cotton (LLCotton25), Bayer	2003	2008	5
Widestrike cotton (210-23x24-236), Dow	2004	Assessment	Current AA
Herculex RW maize (59122), Dow/Pioneer	2005	2007	2
Roundup Ready sugar beet (H7-1), KWS/Monsanto	2005	2007	2
YieldGard VT maize (MON88017), Monsanto	2005	Assessment	Current AA
Roundup Ready Flex cotton (MON88913), Monsanto	2005	Assessment	Current AA
Mavera High Value maize (LY038) Renessen/Monsanto	2006	Assessment	Current AA
Roundup Ready 2 soy (MON 89788), Monsanto	2007	2008	1
Agrisure RW maize (MIR604), Syngenta	2007	Assessment	Current AA
Amylase maize (3272), Syngenta	2007	Assessment	Current AA
YieldGard VT PRO maize (MON89034), Monsanto	2008	Assessment	Current AA
Optimum GAT maize (98140), Pioneer	2008	Assessment	Current AA
Optimum GAT soy (356043), Pioneer	2008	Assessment	Current AA
3 events in soy and cotton	Submitted	Submitted	(0)
1 event in potato (BASF's amflora)	Not submitted	Approved	Isolated foreign approvals
7 events in maize, soy, cotton, and alfalfa	Submitted	Not submitted	
>60 events in maize, soy, cotton, canola, potato, rice, and sugar beet	Approved	Not submitted	

Notes: (i) Apart from asynchronous approval (AA) and isolated foreign approval of GM crops between the United States and the EU, there is also a rising number of GM crops from other countries (China, India) that contribute to this issue.
(ii) Differences in approval time can also be due to the timing of the submission of the respective dossiers by the developer.
(iii) Approvals in the EU that are marked with an asterisk (*) have already expired and no renewal has been sought by the developer.
(iv) In the case of canola, which is of less importance in US agriculture, there are also cases where the event was approved in the EU first.
Source: Stein and Rodríguez-Cerezo (2009b)

1. There can be “asynchronous approval”, i.e., at least one cultivating country has already authorised a GM crop while other (importing) countries have not.
2. There can be “isolated foreign approval” (or “asymmetric approval”), i.e. a cultivating country has authorised a GM crop but its developer does not seek approval in (potential or unattractive) importing countries.
3. There can be “low-level presence” of research events, i.e., a country has authorised the cultivation of a GM crop in field trials only but, due to accidental admixture, traces end up in the commercial crop supply.

Another question is what level of nationally unapproved GM material constitutes a "low" level that, depending on the country, may be tolerated in crop shipments or not. In the United States, for instance, GM crops as such are not regulated; it is rather their use (e.g. as food or as pesticide) that may require their approval. As long as a GM crop is similar to a conventional crop, no authorisation is needed for its cultivation or use; only if the crop fulfils, for example, the function of a pesticide (as insect-resistant or herbicide-tolerant crops do) does it need to be regulated as such. Hence, if traces of a GM crop are detected that has not been submitted to the regulatory agencies, the latter determine on a case-by-case basis whether the GM crop could pose a risk and take proportionate measures [USDA, 2007]. In Switzerland traces of unapproved GM material of up to 0.5 per cent are tolerated in food if the respective GM crop is already authorised in another country where comparable procedures are followed or if a danger to human health can be excluded after an ad-hoc science-based evaluation [Federal Authorities of the Swiss Confederation, 2008].

And even in the EU the unintentional presence of other substances is treated differently. For instance, for certain chemical substances that are present in the environment as pollutants, levels higher than zero have been set to protect public health [EC, 2006]. However, there are no tolerance thresholds for the presence of unapproved GM events, and in practice low-level presence of unapproved material is associated to the detection level of laboratory tests. Recently the introduction of a technical solution for the allowance of measurement errors has been suggested by Fischer Boel, the former EU Commissioner for Agriculture to instill confidence into the detection methods and to avoid false positives [*Fischer Boel,* 2009]. At present any traces of unapproved GM material above the detection level are considered to represent low-level presence.

Strict regulations in politically powerful or economically relevant countries may have a detrimental impact on the development of potentially welfare-enhancing crops. If developing countries even have to fear the loss of markets for economically important export crops because of possible but unavoidable traces of unrelated GM crops, these countries may become still more hesitant to adopt GM crops for domestic use that could potentially enhance productivity and farmers' welfare [*Graff* et al., 2009].

Low-level presence problems can be expected to intensify when more new GM crops are commercialised in the coming years in more countries. By 2015 there could be over 120 different transgenic events in commercialised GM crops worldwide – compared with over 30 GM events in commercially cultivated GM crops in 2008 *(Table 11)*. Although the commercialisation of the crops shown may be technically possible by 2015, the practical – or rather regulatory – feasibility may be more questionable (e.g. for rice in particular), given that in some of the developer countries no GM (food) crops have been authorised so far [*Stein and Rodríguez-Cerezo,* 2010b].

Table 11. Events in commercial GM crops and in pipelines worldwide, by crop

Crop	Commercial in 2008	Commercial pipeline	Regulatory pipeline	Advenced development	Total by 2015*
Soybeans	1	2	4	10	17
Maize	9	3	5	7	24
Rapeseed	4	0	1	5	10
Cotton	12	1	5	9	27
Rice	0	1	4	10	15
Potatos	0	0	3	5	8
Other crops	7	0	2	14	23
All crops	33	7	24	61	124

Notes:* The total number of GM crops by 2015 represents an upper limit, given that by then some of the current GM crops may have been phased out.
Source: Stein and Rodríguez-Cerezo [2009a]

Another development with GM crops is the emergence of more players. While currently private companies from the United States or Europe develop most of the GM events and crops (which are generally first authorised and cultivated in the United States), over the next few years more GM crops will be supplied by private and public entities from Asia in particular from China and India *(Table 12)*. In the longer term, even more developing countries may commercialise GM crops [FAO, 2009]. Hence, while in the past GM crop adoption spread from North America to other parts of the world (with asynchrony of approvals following the same path), in the future the adoption pattern may change fundamentally, with more new GM crops being adopted first in Asia and then potentially spreading from there.

Table 12. Events in commercial GM crops and in pipelines worldwide by region of origin

Developer country*	Commercial in 2008	Commercial pipeline	Regulatory pipeline	Advanced development	Total by 2015
United States/ Europe	24	7	10	26	67
Asia	9	0	11	34	54
Latin America	0	0	2	1	3

Source: Stein and Rodríguez-Cerezo [2009a]

This changing pattern, with more new GM crops coming from Asia, has consequences for the issue of low-level presence. In Asia, GM crops are usually developed for domestic consumption and not for export and therefore the respective events are less likely to be submitted for approval in the EU or the United States. Hence, incidents due to isolated foreign approval or asymmetric approval could become more common *(Table 13)*. However, as has been seen in the recent cases where traces of GM maize in soybeans led to the rejection of the soybean shipments, under certain regulatory settings (in particular zero tolerance towards low-level presence) the cultivation of one type of crop may even affect the marketability of other types of crops. This means that if third countries want to authorise GM varieties of crops that are welfare-enhancing for their societies, in future they may also consider the potential impact of cross low-level presence in different, but export-relevant, crops. The extent to which this situation shapes the approval and development of future agbiotech innovations remains to be seen. Unfortunately, past experience with the use of GM crops shows that irrational fear of export losses represents a significant impediment to biosafety policymaking [Stein and Rodríguez-Cerezo, 2010b].

Table 13. Asynchronous and isolated foreign approvals as potential sources for low-level presence

Crop	**Asynchronous approvals***	**Isolated foreign approvals#**	**Total sources for low level prsence**
Soybeans	2	1	3
Maize	6	5	11
Rapeseed	0	1	1
Cotton	3	9	12
Rice	1	4	5
Potatoes	0	2	2
Other crops	0	8	8
All crops	**12**	**30**	**42**

Notes: * Number of individual events authorized for commercial use in at least one country worldwide, and submitted but not yet authorised in the EU.
Number of events not submitted for authorisation in the EU but already in the regulatory pipeline in at least one country worldwide.
Source: Stein and Rodríguez-Cerezo [2009a]

By 2009, there were already more than 40 individual GM events that may become potential sources of low-level presence. And although some of the major exporters of agricultural commodities – like Argentina and Brazil – so far have considered trade implications when authorising new GM crops, it is by no means guaranteed that this situation will last. Other countries, like China could gain importance as importers of these commodities (of soybeans in particular), or the advantages of cultivating certain new GM crops in exporting countries could simply outweigh the potential loss of sensitive markets. Moreover, increasing biotechnology know-how in emerging economies themselves can strengthen “South-South” technology transfers, which could boost the acceptance and adoption of GM crops in cultivating countries. In this case, the number of alternative suppliers of non-GM crops decreases, thereby making it more and more difficult to simply redirect trade flows by matching exporters of GM crops with “easy” importing countries and letting the remaining exporters supply the more sensitive markets [*Vaidyanathan,* 2010].

In the early days there was no concept of using GM to improve product quality; this would be the way for the future, including traits that improve water use, nitrogen uptake, salt and drought tolerance, as well as better nutritional properties such as Omega-3 or fat profiles. In addition to the increasing number of new GM events, there is also the tendency to generate new products by combining different GM traits in one plant, i.e. through the stacking of already approved GM events. When individual authorised GM events are “stacked” by conventional crossing, the resulting new plant may have a different regulatory status in different countries. For instance, the EU requires each stacked GM crop to go through the regulatory system as a new GM crop, irrespective of whether the parental GM events were already authorised or not. Given the increase of individual GM events that are to come to market in the next years, eventually hundreds of combinations of these events can be quickly developed by stacking – meaning that the number of GM crops that could be submitted for approval could increase dramatically.

4. How real is the threat of a major feed supply problem?

The **profitability of livestock production** is influenced by many factors. While its success depends in part on the demand for the produced products, the operating costs influence the success or failure of production. Operating costs refer mainly to feedstuff costs but also to transaction costs such as environmental regulations, labelling and animal welfare requirements. In 2008 200,000 tonnes of conventional animal feed – mainly soy and maize – were refused entry to the EU when they were found to contain small amounts of GM maize varieties. Then linseed from Canada was found to contain traces of a GM variety named CDC Triffid that was withdrawn from commercial sale in 2001. Following a ban on linseed more than 100 shipments were rejected, but trade is slowly resuming. The rejected volume is only a fraction of the 35 million tonnes of feed imported each year. But it leads to delays to subsequent consignments, higher prices and a reluctance by importers to risk further shipments.

Although the EU depends much less on imports for maize than for soybeans, the experience with Bt10 and the Herculex maize has shown that low-level presence in maize can still have considerable economic repercussions throughout the EU’s supply chain. Following the detected presence of GM maize variety Bt10 (not authorised in the EU) in imports from the USA in 2005, and more recently the potential for the accidental presence of the unauthorised GM maize Herculex, the feed industry has stopped importing CGF and

DDFS from the USA. Where cargoes have been rejected due to the presence of unauthorised GM varieties these have been re-directed to other markets. Alternative cereal proteins have been sourced but at an additional cost to livestock producers. Moreover, especially for maize the stacking of events can quickly generate more crops that are considered new GMOs under the EU's regulatory framework.

A possible situation of asynchronous approval of RR2 soybeans was avoided by their approval by the European Commission before first commercial plantings took place. Soybean imports are vital for the EU agrifood sector: more than 90% of the soybeans used in the EU are imported, and more than 80% of these imports come from only two suppliers, namely Brazil and the United States. Therefore, asynchronous approval in soybeans could not only result in economic losses for traders and users of soybeans, but in combination with zero tolerance towards traces of unapproved GM material, it could pose a real threat to the EU supply of food and feed. However, the approval of the RR2 soybeans has not solved the problem of asynchronous approval in soybeans in the long run as there are several new GM soybeans in the regulatory pipeline and much more in the advanced R&D pipeline worldwide. Future problems due to low-level presence in soybeans cannot be excluded.

In 2007, the first approvals were granted in the USA for the planting of the **second generation of transgenic soybean, namely** Roundup Ready 2 (RR2). The farmers had shown a great deal of interest in the new varieties. These imports were at risk because the three traits had not been approved in the EU until the end of 2008. Consequently, a large part of the protein feedstuff needed in the EU would heve be absent but also the supply of soy oil and lecithin as raw materials for the food industry would heve been severely endangered. Significant increases in feed expenditure costs were expected for soybeans but the problem was solved by the timely authorisation of RR2 soybeans by the European Commission [EC, 2008].

With the continued increase in GM soya cultivation in the main exporting countries (Argentina's production is already 98% GM, the US's cultivation is about 91% while that of Brazil is 71% and rising) and this is being used in large volumes as a compound feed ingredient in the EU. The EU feed and food sectors are worried that it will become impossible to maintain the current non-GM soya supply chain. The situation is of more immediate concern for parts of the animal feed industry due to the volume of soybean and soybean meal imported for feed use. Certified non-GM soya costs more than GM, with the premium varying according to the supply and demand situation It has been anywhere from US$5/tonne to US$80/tonne in recent years. At the beginning of 2010, the premium was around US$50-60/tonne. Demand for non-GMO soybeans and maize for human consumption fell in Japan and South Korea as well where threshold levels of up to 5% have been set.

The adoption of GM technology by commodity-exporting countries, particularly in North and South America, means that imported feed materials will contain an increasing proportion of GM-derived products. The demand for non-GM feed has been decreasing with parts of the EU livestock industry moving away from organic or identity preserved conventional feed. It was estimated that over 90% of compound feed fed to livestock in the EU contains one or more GM events. According to surveys of Toepfer International around 3 million tonnes of soybean meal are used that are not subject to required labelling [*Toepfer International,* 2008]. Soybean meal not requiring labelling thus has a share of approx. 8.5% of total soybean meal consumption in the EU, so that this can still be referred to as a **niche market**. This soybean meal is used almost exclusively in the broiler sector.

There will be sufficient supply to cover the demand for soybeans not requiring labelling as long as the premium requested by the Brazilians is paid. A prerequisite for this, however, is the authorisation without delay of the new traits of transgenic soybeans in the EU for placing them on the market and processing them. If a non-EU approved GM feed crop is being grown in a supplier country at the same time as non-GM and/or EU-approved GM varieties, the use of strict segregation and Identity Preservation systems can reduce the risk of feed supplies being affected by finding non-approved material, but they cannot eliminate the risk completely.

Economic theory also suggests that changes in price differentials would militate against the use of non-EU approved GM soya lines by Brazil and Argentina. Adoption of non-EU approved varieties would be expected to create two distinct markets, for EU-approved and non-EU approved material respectively. As the price gap for soya products between the EU and the rest of the world widens there would be a strong incentive not to switch to non-EU approved crops, and to invest in Identity Preservation systems to enable EU export sales to continue and to benefit from the much higher prices for EU-approved varieties. In contrast to the above it is highly likely that Brazil and Argentina will in future adopt new types of GM soya before EU clearance is in place. Since developing countries like China have a big and increasing demand for soya imports, the EU is no longer such a crucial market for suppliers, and therefore the EU market demand may no longer dictate what Brazil and Argentina choose to produce. Even if it is unlikely that there will be an asynchronous GM approval problem directly in relation to soya supplies from Brazil and Argentina there is still a risk that as soon as a new GM soya variety is used in the USA it might lead to trace levels being detected in supplies from other countries, because of the possibility that a bulk cargo vessel is used to ship material from both North and South America.

In addition, the EU's significance in world soybean and soybean meal trade is declining. Imports of 2009 into the EU in the amount of around 13 million tonnes of soybeans and 21 million tonnes of soybean meal represent only one fifth of world trade – a declining trend that is continuing due to sharply increasing demand from the Asian region, primarily China. Soybean imports into China in 2009 alone represented 54% of world trading volume. Biosafety certificates for GM rice and maize issued by the Chinese Ministry of Agriculture in 2009 represents one of the most high-profile challenges to China's aggressive policy for the adoption of transgenic crops. Prices will be higher in the future owing to a growing market for American farmers selling crops to China, which accepts mixed shipments. Increasing numbers of GM crop varieties are on the way, making screening trickier than ever. In addition, livestock production, especially in Brazil but also in Argentina, is growing rapidly. Demand for feedstuffs, particularly for soybean meal, will increase and domestic consumption is therefore likely to rise. With international demand for meat growing rapidly at the same time, Brazil and Argentina will attempt to use all advances in production in order to expand the production of soybeans and soybean meal correspondingly. This includes the speedy introduction of new varietes of transgenic soybeans. The supply of non-GM soya to the EU market could be reduced as exporters switch to supplying the rapidly increasing demands in the Chinese and Indian markets.

If low-level presence problems have already occurred in the past, when worldwide only about 30 events were marketed, these are not likely to disappear over the next several years when there may be more than 120 events in the global market. More and more countries will plant genetically modified plants regardless of the length of time necessary for the approval process in the EU. Individual ad-hoc measures like the quick approval of one new GM crop or the other will not and cannot address the underlying structural problem of low-level presence, as has been shown by the recent cross low-level presence of GM maize in soybean shipments. Inevitable more trade disruption will come from the differences in approval processes in the EU and the rest of the world [Hornby and Felix, 2009].

Strict laws designed to keep the European Union free of unauthorised GM crops and products are not working, and are posing problems for the EU's €150 billion livestock industry (production of animal farming in the EU was worth nearly €150 billion in 2008). Under Europe's "zero-tolerance" laws on GM contamination, introduced in 2007, the presence of even a few seeds of unauthorised GM material will rule out an entire shipment. Proposed solutions cover the need to replace the EU's current zero tolerance towards traces of EU unapproved GM material by practical low-level marketing thresholds above the detection limit. A more pragmatic screening approach is setting a threshold – say 0.5 per cent – beneath which GM contamination is tolerated since such "tolerances" operate for other contaminants, including pesticides and heavy metals. So why not for GM material, much of which has been cleared for human consumption elsewhere in the world? Moreover the need to address the current situation is also highlighted where the official testing of imports takes place only once the shipments have already reached the port of destination (thus increasing the economic risks of the rejection of the shipment). Other solutions proposed include the streamlining of the regulatory systems, mutual recognition of risk assessments of new GM crops and the implementation of Codex Alimentarius guidelines.

EU livestock farmers are less dependent on CGF and DDGS feed imports from the USA but much more dependent on soybean and soybean meal feed imports from Brazil, Argentina and the USA. These three countries supply about 90% of EU soybean and soymeal imports. Soya is the most favoured vegetable protein feed because of its nutritional efficiency and competitive cost. If this supply chain were disrupted due to asynchronous authorisations it could have serious adverse effects on the livestock sector (and potentially on consumer prices). A significant reduction in EU livestock production could also have a range of consequential effects on land use and the environment. It is however difficult to predict these with any certainty or precision. The precise impact would depend on the extent and duration of the shortfall in soya imports. If soya imports were halted from Brazil and Argentina, there might be scope to secure alternative supplies of soya from non-GM producer countries like India, but this would not be expected to cover a significant shortfall in the current supply (total EU imports of soya commodities in 2009 were 34 million tonnes, whereas total production in non-GM exporting third countries was about 25 million tonnes).

There is potential for a shortfall in soya imports to be replaced in part by imports of alternative protein crops like oilseed rape from countries such as Russia and the Ukraine, although this would be of a lower nutritional value involving higher costs and reduced productive efficiency. There would be limited scope to replace the use of imported soya by increasing domestic production of other protein feeds – for example co-products from bio-fuel production – in order to reduce the EU feed industry's dependence on imported soya. However, the feed industry's research has shown that EU protein production could only replace 10-20% of the protein supplied by imported soya. What is clear is that soya remains the most important source of protein in animal feed at present. If soya product imports were halted or reduced soya feed would have to be replaced by the use of other, less effective and more costly feed materials. This in turn would impact negatively on the productive capacity and profitability of the livestock sector. The pig and poultry sectors would be affected in particular.

5. General conclusions

Consumer concerns regarding GM tecnology tend to fluctuate with time and may increase particularly in response to increased media coverage. There is a legal requirement to label both GM food and feed ingredients. Consumers therefore are able to make an informed choice regarding GM food ingredients (if these are being used). Many consumers are unaware of the extent to which GM feed is used as there is no legal requirement to label products from animals fed on GM feed. Retailers have differing stated policies regarding the use of the terms 'GM', 'non-GM' and 'GM-free', which can lead to confusion for consumers. Regardless of retailers' policies regarding animal feed for EU livestock, animal products imported from outside the EU are likely to have received GM crop varieties that have not been through the EU approval process in their feed since there is no legislative requirement in the EU to label products from animals fed GM feed. Some products from animals (e.g. meat) imported from third countries, where non-EU authorised GM crops were fed to livestock would undercut EU producers, thus distorting competition. Consumers are unable to distinguish between sources of products from animals and are likely to be unaware that GM feed is widely used. Country of origin labelling would not tell consumers if animals have been fed GM feed. Consumers may feel that they are being misled.

Most people in Europe may be surprised to discover how far GM has already penetrated the food supply. Every year millions of tonnes of soya enter the food chain. About 80% of soya imported into the EU is genetically modified [Céleres, 2008]. The vast majority of this comes from the United States, Brazil and Argentina and is used as animal feed, although most people remain unaware. Shipping in GM soya is perfectly legal so long as the varieties imported are ones that have been authorised by the EU. With so much imported GM soya in the system, it seems increasingly unlikely that food on the shelves in the EU is free of GM. There is just so much GM coming in, the probability is that, if you tested food from the supermarket shelf, you would find traces of GM in it.

Costs of maintaining non-GM supply chains are currently absorbed mainly by farmers and feed compound producers rather than being passed on to consumers. However, in the longer term these costs may result in increases in the price of products from animals (e.g. milk, meat and eggs) for consumers. The rise of the premium for non-GM feed for would eventually restrict consumer choice as products from third countries would be cheaper. The use of non-GM feed by EU producers could therefore be driven out by market forces. It may be timely to inform consumers of the issues surrounding GM and non-GM supply chains so that they have a clear understanding of current science, the status of the non-GM market being reliant on only a few exporting countries, and the steady increase in GM production.

There will always be a niche [market] that wishes to consume non-transgenic soybean, but today more than three-quarters of the population in these countries is consuming GM soybean and have been doing so in a steady form for the past ten years. People mostly consume soybean in the form of meat from livestock that has been fed with compound feed. This consumption has not grown even higher only because of a trend of stabilisation or slight decline of compound feed production in the EU, which was accompanied also by an increase of meat imports from third countries, including from Brazil.

The EU is dependent for more than 80% on imports of vegetable proteins for which there are no substitutes in the short term. GM and non-GM-soya as a source of protein is imported from the USA, Argentina and Brazil. Demands from the EU differ to those from third countries with respect to the GM varieties grown, and which are authorised for import into the EU. This could potentially cause problems where low level adventitious presence of non-EU authorised GM varieties in imports of GM and non-GM feed would result in the entire consignment being illegal under the EC regulatory framework. This presence is likely to arise from material which is being grown as part of field trials. This could cause supply problems for the animal feed industry, and ultimately supply of food to consumers.

While the absence of CGF and DDGS could be absorbed by rapeseed meal, palm kernel meal and grain (at a higher price, however), soybean meal can only to a very small extent be substituted by other protein feedstuffs. The availability of other protein sources on the world market is nowhere near enough to substitute to an appreciable extent for soybean meal. This is true for the animal protein feedstuffs, fishmeal and meat and bone meal, as well as for the alternative plant protein feedstuffs, such as feed peas, field beans, lupins and also rapeseed meal. Also from a nutritional perspective, soybean meal can be substituted only to a small extent because of the optimal composition of essential amino acids. Moreover, it cannot be expected that other countries will be able to provide the substitute for the exports from the South American countries. First of all, the necessary climatic conditions for soybeans limit the number of countries where soybeans can be cultivated. Secondly, it can be assumed that because of the increasing competition between grain and oilseeds (especially soybeans) for hectareage worldwide, soybean acreage will grow only relatively moderately. This makes it all the more important to achieve higher yields on existing crop land. This, too, makes it seem improbable that Brazil and Argentina will make allowances for the EU when it grants the approvals for the new traits of transgenic soybeans.

Asynchronous approval of new GM crops across international jurisdictions is of growing concern due to its potential impact on global trade. Different countries have different authorisation procedures and, even if regulatory dossiers are submitted at the same time, approval is not given simultaneously (in some cases, delays can even amount to years). For instance, by mid-2009 over 40 transgenic events were approved or close to approval elsewhere but not yet approved – or not even submitted – in the EU. Yet, like some other jurisdictions, the EU also operates a zero-tolerance policy to even the smallest traces of nationally unapproved GM crops (so-called low-level presence). The resultant rejection of agricultural imports has already caused high economic losses and threatens to disrupt global agri-food supply chains.

The risk that feed supplies could be affected by a low-level presence of non-EU approved GM material could be resolved if the EU allowed a tolerance for this, rather than operating a strict zero tolerance as now. The Commission has undertaken to come forward with a non-legislative technical solution to address the difficulties created by a strict zero tolerance policy. To what extent this would be helpful will depend on the nature of the proposed solution.

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