GM Crop Market Dynamics: the Example of Soya Beans

- *Use of soya in human food & animal feed*
- *GM-derived soya use in the EU*
- *Market dynamics of non-GM soya and derivatives*
- *What will happen to prices and who will pay them?*

EUROPEAN FEDERATION OF BIOTECHNOLOGY

TASK GROUP ON PUBLIC PERCEPTIONS OF BIOTECHNOLOGY

The use of genetic modification (GM) in Europe is currently controversial. As a result of strong campaigns against GM technology, retailers in much of the EU have sought to eliminate GM ingredients from foods manufactured for direct human consumption. More recently the focus of attention has turned to the use of GM-derived ingredients (notably soya) in livestock production systems. In 2001, a number of supermarket chains in several EU countries indicated that a main part of their livestock product range (notably pigmeat, poultrymeat and eggs) are to be sourced from animals fed exclusively on non-GM-derived feed.

This briefing paper discusses some of the key issues and market dynamics* associated with this developing segmentation of markets into GM-derived versus non-GM-derived materials. It concentrates on the example of herbicide tolerant soya beans which is the most widely grown GM crop globally and has been the primary focus of debate surrounding the issue of GM crop acceptability in Europe. The initial text was authored by Graham Brookes, an expert on the topic, and reviewed by scientists, industrialists and public interest group representatives from throughout Europe. The aim of the paper is to provide information and does not represent the views or policy of the European Federation of Biotechnology or any other body. The overall aim is to provide balanced information and to advance public debate.

Use of soya in human food & animal feed

Soya bean usage can be broadly broken down into food, industrial and animal feed uses. These derive from the three distinct categories of soya bean products: whole beans, soya meal and soya oil, although the meal and oil produced by crushing the beans are the main forms used.

Soya meals

Within the EU, animal feed dominates total usage of meals (about 95% of total soya protein usage). Meals derived from oilseeds are widely used as an ingredient of animal feed mainly as a source of protein. Consequently most protein sources are considered to be largely interchangeable and hence price tends to be the key determinant influencing which meals are used. Nevertheless, different oilmeals have different nutritional values, and some (notably soya) are considered to be a necessary ingredient in certain compound feeds, whilst others tend to be used only when price considerations allow. Total annual consumption of soya meal in the EU is about 27-28 million tonnes, of which 25.5-26.5 million tonnes are used in animal feed. To the feed industry, soya meal has been, and is, the main source of protein used in feed manufacture. Over 50 million tonnes of protein material annually are used in EU animal feed manufacturing of which about half is soya meal. Whilst there are some potential substitutes such as other vegetable proteins, the main reason for the dominance of soya meal is its relatively high protein content of 44%-50%. Almost all EU soya meal used is imported either directly as meal or as beans crushed in the EU. The main sources of supply are the USA (mainly as beans), Brazil and Argentina (both beans and meal).

Soya Oil

Soya oil is used mostly in a wide range of foods notably for baking, frying, cooking, in salad dressings and in margarine. The EU uses annually about 1.9-2.0 million tonnes of soya oil mostly derived from imported beans crushed in the EU. As with meals, vegetable oils from a variety of oilseeds are available as ingredients. Use of specific oils depends largely on the characteristics of the

* refers to market developments and changes within markets, particularly to supply, demand and prices.

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12

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constituent fatty acids, hence there is not complete substitutability between oils. There are also differences in taste and shelf life. However, many food products can be re-formulated to use different types of oil and consequently there are few guaranteed or vegetable oil-specific markets, that is, the level of substitutability is considerable. This means the use of soya oil tends to be very responsive to price changes of different competing oils.

GM-derived soya use in the EU

The extent to which GM-derived soya has been, and is, used in the EU is largely a function of where EU food manufacturers and feed compounders source their raw materials from, given the important requirement of using the most competitively priced ingredients within nutritive limits for the feed sector and product-specific functionality in the food sector.

Soya beans for crushing and soya meal have to be largely imported. In two of the main supplier countries (the US and Argentina), GM-derived varieties account for the majority of crop plantings whilst in the third, Brazil, GM varieties have to date not yet officially been permitted for planting. There is evidence of a significant volume of illegal plantings having taken place in the last couple of years. Various sources put this at anywhere between 15% and 40% of total plantings in 2001. This means that the majority of globally traded soya beans and meal may be derived from GM seed. Unless pro-active systems to segregate or identity preserve non-GM-derived supplies have been initiated by EU users in the human food and animal feed sectors, the majority of soya beans and meal currently used in the EU are GM-derived.

Market dynamics of non-GM-derived soya beans and derivatives in the EU food and feed sectors to date

Market dynamics in the human food sector

The GM versus non-GM ingredient issue first arose in the EU in 1998. The spotlight initially fell on the use of soya-based ingredients in the manufacture of foods for direct human consumption. Key points to note in how the market developed were:

- Where possible the European food industry switched to using alternative non-GM-derived ingredients by re-formulating the mix of ingredients used. This was possible for a number of food products where the soya-based ingredient was not essential (eg, in some confectionery and ready-made meals) and where soya ingredient levels were low (eg, 1%);
- If soya usage could not be readily replaced, non-GM-derived sources of supply were sought. This focused mainly on Brazil and involved the initiation of identity preserved (IP) supply lines to ensure non-GM-derived supplies to customer-specific tolerances were adhered to;
- The additional cost involved in obtaining non-GM-derived supplies varies according to uses, nature of demand, tolerances and the relative importance in a final product. It also varies with time according to factors such as the volume of material subject to segregation/IP and whether dedicated plant/machinery and supply lines are used. Empirical evidence to date suggests the additional cost involved has been and is within a very wide range of +10% to +150% of the farm-gate price of soya, although the more commonly quoted range of additional cost is 10%-30%. The highest % cost increases are where a zero detectable level of GM material has been the stated requirement;
- Where IP sources of non-GM-derived soya were used, the supply chain has largely absorbed any additional costs. This preparedness has mainly occurred because the soya ingredient in most human foods is very low (eg, less than 1% for soya lecithin in a chocolate bar). The net effect to the consumer has been no change in the price of end products.

Market dynamics in the feed sector

Since the latter half of 2000 the GM versus non-GM ingredient debate in Europe has largely moved onto the animal feed and livestock production sectors mainly as a result of the removal of GM soya and derivatives as an ingredient in foods for direct human consumption. This is so although there is no experimental or epidemiological evidence that products from animals fed GM-soya are of a lesser quality than others or represent a threat to human health. To date, the demand-side strategies discussed above in relation to the market for non-GM-derived soya used in human food have been followed largely by a number of the European retail groups for their supplies of livestock products. Hence:

- The sourcing of soya meal for use in animal feed has focused on countries that currently do not (legally) permit the planting of GM soya varieties, i.e. Brazil and, to a lesser extent, India;
- Much of this demand has been based on the use of ‘soft IP’ systems, in which the non-GM-derived beans or meal have been certified as coming from non-GM growing regions within Brazil, but are often not subject to testing verification or are not accompanied by guarantees/certification as to the precise non-GM. Clearly ‘soft IP’ systems have much lower costs than ‘hard IP’ systems in which there is strict IP of non-GM soya from point of production through the supply chain, the setting of strict tolerance levels for adventitious contamination with GM-derived material and regular testing through the supply chain to ensure that supplies meet buyer specifications;
- It has been reasonably easy for the European buyers, driven largely by the retail sector, to identify and obtain supplies of non-GM-derived soya beans and soya meal at ‘competitive prices’ i.e. similar or no more than a 5% price premium relative to commodity traded soya (i.e. non-segregated that may contain GM-derived soya). This has been mainly because of the use of ‘soft IP’ systems and the total volume required in the EU having been significantly below the supply availability in the non-GM producing countries such as Brazil and India;
- The additional costs of non-GM-derived material for use in the livestock sector have been absorbed in the supply chain. Some of the UK’s leading supermarket chains have explicitly stated that any additional costs will not be passed onto consumers and that suppliers will not have to bear any additional costs;
- Some producers of relatively high value livestock products have been sourcing non-GM-derived soya direct from EU soya growers with premia of up to 20% relative to commodity-based, GM-derived soya reported. Despite the payment of such premia, producers of these high quality livestock producers have largely absorbed the additional costs themselves. This willingness to do so mainly reflects the lower importance of feed costs in the total costs of production relative to mainstream livestock production systems.

Future market dynamics of using non-GM-derived soya beans and derivatives in the EU food and feed sectors

2002 and beyond

Whilst the above market dynamics highlight recent developments in the market for non-GM-derived feed ingredients in the EU, this is a market development very much in its early stages of development. Looking forward to 2002 and beyond, the implications of delivering these demands are likely to result in different market dynamics and end results than those which evolved in the human food sector. In 2001, the market for non-GM soya beans, meal and oil in the EU food and feed sectors probably accounted for up to a quarter of total soya beans and meal used. Supplies of non-GM-derived ingredients have been considered to be reasonably easily obtainable at limited additional cost relative to GM-derived alternatives and mostly sourced from Brazil.

During the next period, fundamental changes in the markets of GM and non-GM-derived soya beans are likely to develop:

- On the demand side, the key question is how many other mainstream retailers will follow the lead of some of those in the UK to go 'non-GM' on livestock products? Since the first UK retailer announcements in early 2001, there have been some followers and it is likely that the total demand in the EU is building for non-GM-derived feed ingredients. As this demand grows, demand for non-GM-derived soya meal will begin to reach the level of available global stocks. Current global demand for non-GM-derived soya meal is probably about 13-16 million tonnes relative to a global supply of about 28-30 million tonnes. If the demand in the European feed sector were to double in the next year to about 50% of total usage of soya meal, this would take global demand for non-GM-derived soya meal to about 22-25 million tonnes . Add to this the growing demand in Asian countries, this may well push the level of demand towards 30 million tonnes, at which point, the 2001 available supply of non-GM-derived material from such as Brazil and India is exceeded unless strict (hard) IP systems are used;

- On the supply side, the coming year may also deliver a decreased availability of non-GM-derived soya beans and meal. Given the popularity of Roundup Ready soya beans amongst farmers in the US, Argentina and, more importantly, in Brazil and Paraguay (both where illegal plantings have risen dramatically), it is probable that the availability of non-GM-derived soya may fall to perhaps 20-25 million tonnes. Forecasting the availability of non-GM soya material from Brazil is, however, difficult because the rapid expansion in plantings and production of soya beans in Brazil over the last few years has made an important contribution to increasing the global availability of non-GM material. Furthermore, forecasts for the 2002 Brazilian crop suggest that production may increase by an additional 2.5 million tonnes relative to 2001. If the vast majority of this additional production were to be non-GM, then limited additional global demand for non-GM material might be accommodated from existing global supplies. This highlights the dynamic nature of this market and key to how the market develops will be the level of additional plantings in Brazil and what proportion of these are to illegal GM varieties;

- On balance, it is likely that there will be a rising level of global demand for non-GM-derived soya relative to, at best, a static or, possibly declining supply of non-GM-derived material, from the 'cheaper' sources such as Brazil;

- An important consequence of this will be a probable need amongst a greater number of buyers of non-GM-derived material to look to a broader supply base amongst the GM-growing and exporting countries and to initiate the use of 'hard IP' systems for sourcing. In turn this will contribute to increasing the cost of obtaining the non-GM-derived soya, although economies of scale of greater volumes of non-GM-derived material through the supply chain should counterbalance some of these additional costs.

What will happen to prices?

The price differential between GM-derived and non-GM-derived soya beans is likely to widen because:

- global demand will probably rise to a level where it is equal to or exceeds available supplies;

- there will be additional costs of initiating 'hard IP' systems to ensure that supplies of non-GM material meet buyer specifications. For those previously operating 'soft IP' systems, this will represent an extra cost, whilst for those already operating 'hard IP' systems, economies of size associated with the supply of greater volumes will contribute to lowering the average unit cost of IP systems. The net overall effect on the average cost of delivering identity-preserved non-GM-derived soya beans and meal is probably higher;

- of the cost-reducing impact of GM agronomic herbicide tolerant technology on the price of GM-derived soya beans and meal. This has already probably contributed to reducing the real price of soya beans and meal and is likely to exert further downward pressure as global adoption rates increase.

Forecasting the likely level of differential over the near future is extremely difficult due mainly to uncertainties about the relative levels of demand and supply. It is, however highly likely that the differential levels of up to 5% referred to by some European supermarket retailers in 2001 may not survive for long. Higher differentials of 10% plus (possibly as high as 30%) are more likely. Differentials are only likely to remain at the 5% level if global demand for non-GM material does not rise significantly and if illegal GM plantings of Brazilian soya do not exceed the 2001 levels.

Who will bear any of this additional cost?

In 2001 European retailers have indicated a willingness to absorb some or all of the additional costs of using non-GM-derived soya beans and meal in the rations of livestock from which they derive their meat, eggs and dairy products. However, as the price differential between GM-derived and non-GM-derived is likely to widen in the next year, the willingness of European retailers to absorb the additional costs will probably decrease because of the adverse implications for profitability. This points to one of two alternative outcomes:

- The additional cost is passed on to consumers in the form of higher prices of meat and other livestock products although most retailers are reluctant to take this course of action. Historic recording of consumer buying patterns in such circumstances have shown that in most cases the cheaper alternative is chosen;

- The additional costs are borne through the supply chain through feed producer, livestock producer and to the retailer. Whilst the supply chain upstream of retailers was prepared to absorb such costs in the case of soya and derivatives used in human food, mainly because of soya's low incorporation rates, the position on the livestock side is different. The animal feed compounding industry operates on relatively low margins and feed accounts for a significant part of the total production costs of meats such as pork and chicken. Therefore it is difficult to see how the supply chain upstream of European retailers can absorb any additional costs of using non-GM-derived feed ingredients. Furthermore it is difficult to see how feed compounders will reject lower cost (GM) alternatives unless their customers are also prepared to pay for this element of premia. Despite these fundamental differences between the food and feed sectors, the market power of most large retail chains relative to their suppliers in the livestock sector points to the bulk of the cost of non-GM-derived feed being pushed back down the supply chain onto slaughterers, processors, egg packers, pig and poultry farmers and feed compounders.

Perceptions by some in the EU that the use of non-GM-derived soya might add only single figure additional % costs to total livestock product costs of production, therefore loses sight of the fact that such additional cost burdens without compensatory higher prices from buyers will effectively push many in the livestock production sector from being marginally profitable into loss making. Should this occur to any significant degree, it will result in decreased levels of production of livestock products in the EU and a greater reliance on imports.

This potential threat to margins and the production base in the EU may therefore result in lower levels of income and employment in the EU livestock production and allied industries, and the export of EU employment to third countries taking up the shortfall in EU production. If this occurred it would also have an additional ironic consequence if livestock products from sources outside the EU were treated differently from EU producers. Thus if EU retailers were to impose a non-GM-derived feed requirement only on EU livestock and feed suppliers then they will still be sourcing and selling livestock derived from animals probably fed GM-derived feed elsewhere. It is also possible that, even if the same conditions were applied to EU and third country suppliers, enforcement of feed ingredient requirements on some third countries is likely to be more difficult than on domestic suppliers. The implication of such a development would be that third country suppliers might increase their EU market share at the expenses of EU suppliers. In other words EU retailer actions could lead to the export of livestock-related jobs from the EU.

Looking to the future

As the price differential between GM-derived and non-GM-derived soya may widen, this may affect the planting decisions of soyabean farmers. Some will consider switching back from growing GM to non-GM varieties. Their willingness to do so will, however, depend upon the financial incentives offered to do so and the associated costs of initiating any segregation/IP systems.

Although the level of demand for non-GM-derived soya has been increasing over the last 2-3 years, there has been no sign of any significant move by farmers growing GM varieties to switch back to non-GM varieties. This probably reflects a combination of the benefits that farmers perceive they derive from growing GM soya beans in terms of cost savings and more intangible benefits associated with greater management flexibility, ease of operations and convenience and the low level of premium offered to farmers to plant non-GM varieties. For example, in the US the price differential was 3%-8% of the farm-gate price of ‘commodity’ (GM) soya beans up to mid-2000 and the current premia offered by a large US-based crusher is only 4.4%, an increase of 50% on its offers from the previous year.

For farmers to switch back to growing non-GM varieties, they will inevitably require an additional price to compensate for the additional costs of production, loss of ‘convenience, ease and flexibility’ and any additional IP/segregation costs involved. Given that the production cost benefits to US farmers are of the order of \$15-\$25/hectare (or equal to 3.5%-5.75% of the average 2000/1 US farmgate price) and IP costs can add anywhere between 5% and 30% to the cost, it is likely that the non-GM soya bean price will have to trade at a premium of at least 10% and possibly as high as 30% relative to GM varieties.

Forecasting the potential development of non-GM plantings into 2002/3 is highly speculative as it will ultimately depend on the relative price difference between GM and non-GM-derived soya beans and individual farmers’ perception of how much difference is required to induce a switch in planting behaviour. It is however reasonable to assume that as the difference may increase in the coming year, there may be additional incentive for some of the more marginal producers of GM soya beans to switch back. This incentive will have to be carried forward nevertheless in the form of forward contract prices for farmers before many will be willing to switch crop types.

Conclusions

If demand for non-GM-derived feed ingredients continues to rise at the same rate of expansion as occurred in 2001, global demand is likely to reach or exceed the level of available supply from the main non-GM growing countries of Brazil and India. This rising level of demand may also be compounded by an, at best, static, or possibly, declining supply of non-GM-derived material as an ever increasing proportion of plantings (including in Brazil) are to GM varieties. The consequences of this probable market development in 2002 are:

- Buyers having to broaden their supply base into GM growing countries such as Argentina and the USA;
- Greater use of ‘hard IP’ systems for sourcing;
- An increase in the average cost of procuring identity preserved, non-GM supplies, as ‘soft IP’ systems become less acceptable, partially offset by economies of size in supplying greater volumes of IP non-GM materials;
- Additional downward pressure on the global price of soya beans and meal as a result of the higher global adoption levels of the cost reducing, herbicide tolerant technology;
- A widening differential between the prices of GM-derived and non-GM-derived soya beans and meal;
- The additional costs of supplying non-GM material possibly being passed on to consumers in the form of higher prices, or, the more likely outcome, of these costs being pushed onto the EU feed and livestock sectors;
- Pressure on margins in the EU feed and livestock sectors that could result in a net reduction in EU production and greater reliance on imports.

These potential developments will not materialise if the level of demand for non-GM material does not increase significantly and/or the share of plantings of GM varieties in countries such as Brazil does not rise.

Looking to the future, any sustained widening of the GM versus non-GM price differential may encourage some soyabean farmers currently planting GM varieties to switch back to growing non-GM varieties. However, the price differential required to trigger a significant shift in planting is likely to be within the range of 10% to 30%, compared to current differentials of 5% or less.

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