
Staying competitive in the global and European maize market

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Executive summary and conclusions

This paper outlines the key factors affecting competitiveness in the global and European maize markets up to 2012. It also explores the possible role and impact of using genetic modification (GM) technology in the maize sector to maintain/enhance Hungarian competitiveness.

Key market features

In 2004, the EU 25 produced and consumed 53.9 and 53.8 million tonnes of grain maize respectively. In descending order, the leading producers were France, Italy, Hungary, Spain and Germany. The main consumer was the animal feed sector (78% to total use). The vast majority of maize used is derived from domestic EU production with imports amounting to only 5% of total consumption¹. Imports are mainly into the animal feed sectors of Spain and Portugal, where price is the key factor influencing sources of supply.

EU maize farm level prices have been about 20% higher than US and Argentine farm level equivalents in the last four years but broadly similar to world market levels². Hungarian farm level prices have tended to be a little below the average in the leading EU producing country, France.

The share of the EU maize market that requires supplies to be certified as being from non GM origin is within a range of 23% to 27% of total usage.

Future market developments

Global demand for, and supply of, maize is forecast to increase by up to 10% between 2005 and 2011/2012. World maize prices are also forecast to rise by about 10% to 15% over the same period.

Within the EU 25, maize production in 2012 is forecast to be broadly similar to current levels and consumption is expected to rise slightly. The EU market will, however probably become more 'open' and subject to the influences of world markets largely because of commitments likely to be agreed at the World Trade Organisation (WTO) relating to reduced levels of import protection and domestic agricultural support, and elimination of export subsidies.

In relation to the GM versus non GM maize markets:

- The majority of EU maize production is likely to remain non GM in the next 1-3 years, although a slow expansion in the area planted to GM cultivars can be expected;
- Those requiring certified non GM will have little difficulty in procuring supplies, with little or no price differentials between the two origins (at best a marginal differential of 1% to 2% in favour of non GM and this post farm gate rather than a farm level differential);
- Beyond 2008, the levels of EU consumer opposition to GM technology will probably recede slowly as a result of greater levels of awareness and understanding of the technology (in particular recognition, from empirical studies of the environmental benefits, associated with reduced pesticide use and reduced greenhouse gas emissions). In addition, crops containing GM quality traits are likely to become commercially available by 2010 – these latter innovations being ones that consumers can more readily associate with direct benefits;
- Farmers choosing to plant GM cultivars will find plenty of buyers for their production, both currently and in the future (mainly in the feed sector which dominates consumption).

¹ Sources: European Commission (2005), Strategie Grains (2005)

² Export basis (Fob USA)

Competitiveness issues

Maize is currently one of the most profitable arable crops grown in the EU 25. It is also the most profitable crop in new member states like Hungary. Average profitability levels in the new member states are, however significantly lower than in the leading maize producing countries of the EU 15. This derives from a combination of lower levels of (current) support payments and lower levels of productivity (ie, lower average yields).

Looking forward to 2012, this will be a period of implementation of the 2003 Common Agricultural Policy (CAP) reforms, transition to the full CAP in the new member states and implementation of the next WTO trade agreement. The key points of relevance for profitability and competitiveness arising from these changes, coupled with the expected changes in global maize markets referred to above, are:

- Levels of support for agriculture will be lower than at present in the EU 15. However, in the new member states these will be higher than prior to accession. The receipt of direct aids will provide additional income and should lead to higher investment in agriculture, both in terms of fixed assets (eg, machinery, crop storage) and more efficient use of variable inputs (eg, new varieties and pesticides). As a result, levels of technical performance should improve and an element of ‘closing the productivity gap’ with longer standing EU member states should occur over a number of years;
- The EU market will be open to increasing levels of competition from world markets. This will apply to all sectors;
- The EU agricultural market will probably be subject to greater variability in prices (reduced role of policy support mechanisms and increased openness of markets);
- Demand for crops in non food sectors (notably bio-fuels) can be expected to increase across the EU. Agri-environmental schemes may become more attractive to some producers, especially if national governments choose to channel additional rural development funding from modulation into such schemes. Nevertheless, the majority of agricultural policy support will continue to be delivered via market measures and direct payments;
- In order to remain competitive in the EU marketplace, many producers will increasingly explore all forms of new technology that can assist them (eg, through yield enhancement and cost reduction³) or ways of reducing production and price risk. Others may focus on higher value, niche product production, such as organics, where cost is less of a market driver or ‘care’ goods (eg, environmental set-aside, membership of agri-environmental schemes that target the delivery of environment and landscape goods for the wider public). Lastly, some may choose to exit from the sector.

Possible role of using GM cost reducing technology in maize in Hungary

In the next few years, some GM traits may become available to Hungarian maize growers. Those most likely to become available first are herbicide tolerant (GM HT) and insect resistant (GM IR) maize. Maize resistant to the European corn borer already has EU-wide approval for planting.

Drawing on a review of literature (see references) and recent analysis⁴ of the potential impact in Hungary, Table 1 summarises the likely impact of using GM HT and GM IR maize in Hungary. The analysis assumes that the GM technology is brought through for regulatory approval, the approvals are received, seed companies make the technology available in leading varieties adapted to Hungarian agronomic conditions and Hungarian farmers are able to make choices about whether to plant GM crops according to technical and agronomic performance criteria and market requirements. As such, this assumes that practical, proportionate and science-based co-existence conditions for the planting of GM crops in Hungary are in place.

³ Including in the new member states, where despite the increases in levels of agricultural support, accession is likely to result in the real increases in the costs of land and labour inputs

⁴ Demont et al (2005)

The key points to note are as follows (see section 5):

- yield gains are likely from using GM IR technology where currently farmers experience economic losses from the European corn borer and corn rootworm pests;
- The impact on the costs of production varies by trait used. Users of GM HT maize are likely to experience reduced levels of costs even after paying for the technology. With regard to GM IR technology, some users may find that average variable costs decrease whilst for others costs increase (this will depend upon whether insecticides or seed treatments have traditionally been used to combat pest attacks or not);
- An increase in average gross margin profitability of between +€18/ha to +€28/ha is likely to arise for users;
- At the national level the positive farm income impact is likely to be between 28.11 and 31.16 million euros;
- The technology offers additional intangible benefits such as increased management flexibility and simplicity;

Overall, important benefits are likely to be derived from using the technology, if it is made available in leading varieties adapted to Hungarian agronomic conditions. Against a background of an increasingly open and competitive marketplace, both domestically and in export markets, application of this technology has the potential to make an important contribution to maintaining and enhancing Hungarian competitiveness.

It is, however important to note that as weed and pest infestation levels and farm performance vary by farm and year, so will the impact of using GM technology. Some farmers may not derive benefits from using the technology, in some years. The analysis of impact on farm performance does, however suggest that most farmers stand to benefit financially from using the traits examined.

Table 1: Potential commercial farm level impact of using GM technology (per hectare) on grain maize crops in Hungary (2012 and beyond)

	Herbicide tolerant (grain) maize	Insect resistant (grain) maize
Yield	No expected impact: possibly small improvement	+4.5% to +6.3% where economic losses currently incurred
Variable costs of production	A decrease of between 17% and 19% from lower costs of herbicides	An increase in variable costs of between 5.6% and 8.4% (the seed premium for the technology being greater than any costs savings from reduced insecticide use)
Gross margin profitability	+6.3% to +7%	+3.8% to +4.8% GM IR targeting the corn borer and +3.2% GM IR targeting corn rootworm
Other impacts	Increased management flexibility and better weed control	Increased management flexibility, reduced production risk, lower levels of mycotoxins
Possible adoption % (in terms of total grain maize crop)	40%	10% for GM IR targeting the European corn borer, 460,000 ha for GM IR targeting corn rootworm
National level impact on farm income (baseline 2004)	+17.5 to +19.47 million euros	+2.26 to +3.34 million euros: GM IR targeting corn borer +8.35 million euros: GM IR targeting corn rootworm

Sources: Based on data used in Demont et al (2005), Brookes (2002 & 2005b), NCFAP (2003), Rice (2004) and drawing on conventional farm income data in Brookes (2005), which itself draws on data from the Hungarian Institute of Agricultural Economics (AKII)

Notes:

1. GM maize traits: GM HT (to glyphosate) and GM IR to the European Corn Borer and Corn Rootworm
2. Yield gains for GM IR crops based on Brookes (2002) and Rice (2004)

3. Cost of the technology (charged as a seed premium) based on Demont et al (2005) and/or cost currently charged in Spain (for GM IR maize targeting the ECB: original source: Brookes 2002). For further details see Appendix 3
4. Impact on costs of insecticides and herbicides, based on Demont et al (2005), Brookes (2002 & 2005b), NCFAP (2003) and Rice (2004): see Appendix 3
5. Adoption levels based on Demont et al (2005)

Implication of not using GM maize technology: servicing the non GM maize market

A constraint to using GM technology in the EU often cited relates to whether a sufficiently large market exists for GM maize and what might be foregone in terms of possible loss of sales into markets that require certified non GM maize?. Whilst there is a current market segment that requires certified non GM maize, it is important to recognise the following points:

- finding outlets for GM derived maize crops is likely to be fairly straightforward, especially in the feed sector. This sector accounts for 78% of total grain maize usage in the EU 25, and 85%-90% of this usage has no requirement for non GM maize. The EU feed sector also currently makes widespread use of other GM derived ingredients, notably soymeal and the majority of animal feed sold in the EU is positively labelled as containing GM derived ingredients;
- whilst markets currently exist in which there are non GM requirements, these account for a minority of uses and are found mostly in the human food sector. In these markets, quality is an important criteria influencing sources of supply and usually requires supplies to be fully traceable. Servicing this market therefore requires investment in quality assurance and traceability systems, which is an aspect of competition that the Hungarian maize sector probably lags behind most of its EU counterparts;
- over the next few years, the distinct market for non GM maize and derivatives is expected to decrease in size;
- the non GM maize market should be approached in the same way as looking to supply any market segment. To be successful, suppliers need to be competitive. Currently Hungarian maize struggles to compete in the EU 25 maize market regardless of whether its maize is GM or not. The most important export markets in Europe are within the feed sector in countries such as Germany, Greece, Slovenia, Austria and Spain, where price is the most important factor influencing buying decisions and where GM derived ingredients are widely used. In the Spanish market, Hungarian maize has to compete on price with both EU origin maize and imports, including GM maize from Argentina. This highlights the importance of price competitiveness with both non GM and GM derived maize;
- there have been no price differentials between GM and non GM 'equivalent' crops at the farm level in most GM growing countries (including Spain, the main EU country where GM crops have been planted since 1998). Consequently, farmers are unlikely to realise any price premia for producing non GM maize.

1 Introduction

Maize is the most important cereal crop grown in Hungary and a significant export earner for the country. Hungarian agriculture is now part of a wider EU 25 competitive market, and is in transition to full adoption of the EU's Common Agricultural Policy (CAP).

Against this background, the present paper outlines the key drivers for maintaining competitiveness in the global and European maize markets up to 2012. It also explores the possible role and impact of using genetic modification (GM) technology in the maize sector to maintain/enhance Hungarian competitiveness.

The work is based on desk research/analysis of relevant current/recent global and European markets, and economic data, including published forecasts of likely market developments from bodies such as the United States Department of Agriculture (USDA) and the European Commission.

The paper⁵ is structured, after this introduction, as follows:

- Section 2: current features of the global and European markets, including an overview of the nature of market differentiation between products derived from GM maize and non GM maize
- Section 3: likely future direction of world and EU markets to 2012
- Section 4: issues affecting current and future competitiveness for EU producers
- Section 5: the possible role and impact of using GM cost reducing technology and the implications of not using GM technology.

2 Current global and EU market features

2.1 Global production and consumption

Global maize production and consumption in 2004/05 were about 706 and 680 million tonnes respectively (Table 2). The main usage is as animal feed (69%), with the equivalent of about 11% of global production exported/traded onto world markets⁶.

Table 2: World maize supply and usage 2004-05

Area (million hectares)	143.1
Average yield (tonnes/ha)	4.93
Production (million tonnes)	706
World trade (million tonnes)	75.3
Total consumption (million tonnes)	680.5
Consumption as feed (million tonnes)	467.6
End stocks (million tonnes)	125.9

Source: USDA 2005

⁵ The author acknowledges funding for the research came from Monsanto Europe SA. The contents of the paper are, however the independent and objective views of the author and have not been influenced by Monsanto – this was a condition of undertaking the work

⁶ Maize is an important subsistence crop in many parts of the world and hence the majority of production is consumed within the country of production

2.2 EU production and usage

In 2004, the EU 25 planted about 11.34 million hectares to maize of which 6.44 million hectares (57%) were grain maize and the balance forage maize. Within the grain maize sector, total production was about 53.9 million tonnes⁷. Within this the leading producers were France, Italy, Hungary, Spain and Germany with 16, 10.7, 8.7, 4.8 and 4 million tonnes respectively in 2004⁸.

In terms of usage, the EU 25 consumed about 53.75 million tonnes of grain maize, of which the majority (78%) is used as an animal feed source. Starch and sweetener production accounts for about 14% of total usage and other food uses for about 7%. The vast majority of maize is derived from domestic EU production with imports (mostly into Spain and Portugal) amounting to only 2.6 million tonnes, equal to about 5% of total consumption. The main source of imported maize is South America, with Argentina being the primary supplier. The limited share of imports in the EU market partly reflects the level of protection imposed on maize imports into the EU (currently equal to about €50/tonne) which effectively makes imported maize uncompetitive with domestically produced maize (see Appendix 1 for further details about the import regime). The primary usage sector of imported maize is the animal feed sector, for which (low) price is the key factor of influence for determining sources of supply.

Table 3: European Union (25): key grain maize supply and usage features 2004-05 (million tonnes)

Opening stocks (October 2004)	3.08
EU production 2004	53.92
Imports	2.62
Supply availability	59.62
<i>Usage</i>	
Animal feed	42.15
Starch & sweeteners	7.5
Other food uses	3.6
Seed	0.5
Exports	2.81
Closing stocks ⁹	3.06

Sources: Strategie Grains, EU Commission, Coceral

In Hungary, domestic production of grain maize was about 8.32 million tonnes in 2004 and total usage was 3.9 million tonnes. The main usage sector was animal feed which accounted for about 3.2 million tonnes usage. Human food and starch usage was around 0.6 million tonnes and exports were approximately 1.96 million tonnes. About 1.89 million tonnes were sold into public intervention storage in 2004¹⁰. Within exports, Spain has been an important destination market, especially in 2005 where the primary customer base has been the animal feed sector. The animal feed sectors in Germany, Greece, Slovenia and Austria have also been the other most important export markets.

2.3 Prices

Recent trends in the price of maize on global markets and within the EU are shown in Figure 1. This highlights:

- the fluctuating nature of both global and EU maize prices;

⁷ The 2005 estimated plantings are about 6.04 million hectares

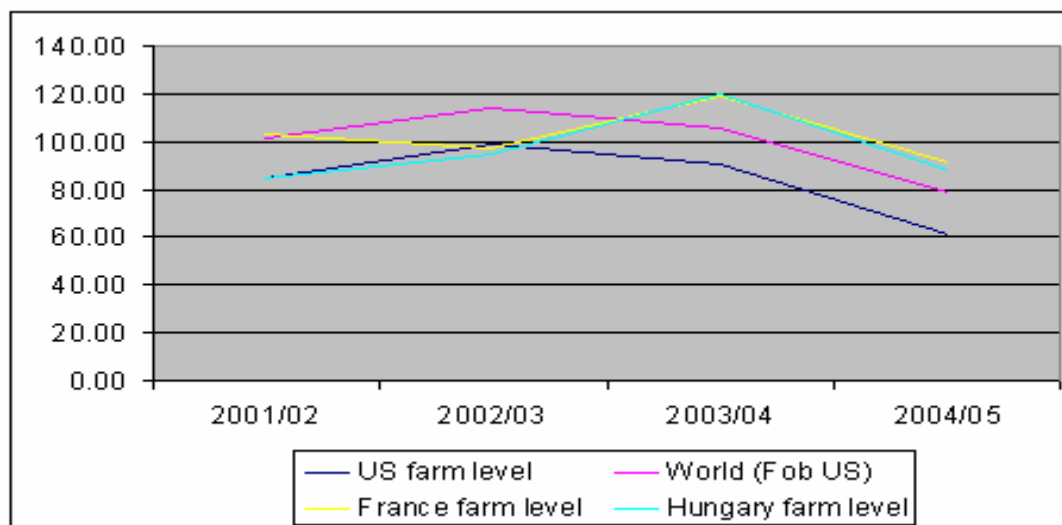
⁸ Sources: European Commission, Strategie Grains and Coceral

⁹ Includes about 2 million tonnes in intervention

¹⁰ Source: Strategie Grains. The balance was accounted for by seed production (about 0.32 million tonnes), other food uses and closing (private) stocks

- EU farm level prices have been about 20% higher than US and Argentine farm level equivalents in the last four years but broadly similar to world market levels¹¹. This fairly close relationship of EU prices with world market prices largely reflects the increasing ‘openness’ of the EU grain market and the need for EU prices to reflect global price levels, if exports of grains are to be facilitated without the need for export subsidies¹²;
- Average Hungarian farm prices having been a little below average farm price levels in France (the leading EU producer) since 2001.

Figure 1: A comparison of World and EU maize prices 2001-2005 (Euros/tonne)



Sources: USDA, ONIC, Hungarian Central Statistical Office

2.4 The market for GM versus non GM maize

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. It focused largely on soybeans/soy derivatives and, to a 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 market development have been (Table 4):

- *In the human food sector, a switch to using alternative non-GM derived ingredients (e.g. 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 possible GM derived ingredient incorporation levels were low (e.g. 0.5 - 1%). This course of action has been more difficult to take in the animal feed sector because of higher incorporation levels (eg, broiler feeds, where typical incorporation rates for soymeal are 20%-25%). This market development has, however mainly been associated with soy usage rather than maize usage;
- *If the GM crop or derivative could not be readily replaced, non-GM derived sources of supply were sought.* For maize, this was relatively easy and focused on domestic EU origin sourcing. The need to initiate identity preserved (IP) supply lines has been limited because of the absence of GM maize material in the vast majority of EU supplies. Only in Spain (where 25,000 hectares of GM IR maize were grown annually in the period 1998-2002 and 58,100 hectares were planted to GM IR maize in 2004) has a (potential) need for

¹¹ Export basis (USA), which is the benchmark price for world maize market prices

¹² Which are limited by WTO commitments, both in value and volume terms

greater attention to segregation/IP been relevant. However, the majority of GM IR 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. Also, even where some buyers (eg, the starch industry) located in the main GM growing regions have requirements for certified non GM maize (sometimes with a maximum threshold for GM adventitious presence of 0.1%), no difficulties in sourcing this non GM material from local supplies have arisen;

- *GM derived crop ingredients have largely been removed from most products directly consumed (by humans).* The user sectors requiring certified non GM maize represent a minority, with the feed sector being the primary user of maize (79% of total use¹³). Overall, about 23%-27% of total current demand for maize in the EU-25 (12.3-14.4 million tonnes) is probably required to be certified as non-GM;
- *as non-GM maize accounts for 97%-98% of EU maize supplies¹⁴, 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 a threshold of 0.9% or sometimes to 0.1%), price differentials have tended to be in the range of 0% to 3% (ie, non GM maize prices have been the same or marginally higher than GM maize prices). These price differentials have been post farm-gate with no price differential at the farm level;
- *any 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 respect of soybeans in Brazil (the focus of non-GM supplies of soybeans), there has, to 2004-05 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). In the EU maize market, there has been no noticeable farm level price differential between GM and non GM origin maize.

Table 4: Estimated GM versus non-GM maize use 2004 in the EU 25 (million tonnes)

Product	Market size	Non GM share	Non GM share (%)
<i>Maize</i>			
Food & starch	11.1	7.77	70
Feed	42.15	4.22-6.32	10-15
Seed	0.5	0.35	70
Total	53.75	12.34-14.44	23-27

Source: derived from PG Economics and Strategie Grains

Note: The non GM share refer to the proportion of usage required to be certified as non GM. A much higher proportion of actual usage is non GM, although for many buyers (especially in the animal feed sector) there is no requirement for the maize supplied to be certified as coming from a non GM origin.

The range for the estimated share of non GM demand in the animal feed sector reflects the broad range of views and limited research in the sector

Overall, current EU requirements for non-GM ingredients of maize (ie, where buyers actively request that supplies are certified as being non-GM) accounts for about 23% to 27% of total maize use.

¹³ The balance is accounted for by seed

¹⁴ The GM share comes from Spanish production of about 0.58 million tonnes (2004) and annual imports of between 0.6 and 1.4 million tonnes from Argentina

At the global level, it should be noted that the leading exporting nations of maize are countries which grow GM maize (the US, Argentina, South Africa and Canada), with these GM growing countries accounting for 81% of global trade. Assuming that the proportion of production in these countries that was GM in 2004 is also exported, then 45% of globally traded maize was GM, although if it is assumed that there is no active segregation of exported maize from these countries into GM versus non GM product (ie, exported maize is likely to comprise a mix of both GM and non GM maize) then the GM share of global exports can reasonably be expected to have been 81% in 2004. As there has been limited development of a GM versus non GM maize market (mostly in the EU, and to a lesser extent in Japan), which has necessitated some segregation of exports into GM versus non GM supplies, the likely share of global trade accounted for by GM maize exports is within the range of 45% to 81%, but closer to the higher end of this range.

3. Maize markets to 2012

This section examines the likely future developments in the global and European maize markets to 2012.

3.1 General maize market developments to 2012

This sub-section draws on annual forecasts made by organisations such as the USDA, the EU Commission, OECD and FAPRI – the latter two of which are summarised in the latest EU Commission analysis of 2005 (see references). The material presented gives a perspective of possible future developments based on specific sets of assumptions and circumstances¹⁵. The forecasts therefore represent one possible long term outcome to 2012 that presumes a continuation of current support and trade policies and no major weather or political shocks.

Demand

Population growth, continued urbanisation, rising real incomes and associated increases in levels of meat consumption (of between 1% and 1.3% annually), particularly in developing countries (notably China, Latin America, North Africa and the Middle East) are expected to be important drivers of higher levels of demand for feed grains on a global basis over the next 7 years (global demand for coarse grains are forecast to increase by between 8.5% and 10.2% to 2011: source EU Commission 2005).

As maize is the most important feed grain traded in international markets (78% of the total), global trade in maize is therefore expected to increase by between 15% and 30% (+11 and +22 million tonnes) by 2011.

Supply

The additional demand for coarse grains is expected to be met by between a 9.3% to 10.5% increase in global production by 2011 (source: EU Commission). The supply is expected to be provided through a combination of additional domestic production in most maize growing countries and increased export-oriented production in the US and Argentina. For example, the 2005 USDA forecasts US maize production rising from about 272 million tonnes in 2005 to 308 million tonnes in 2012 and US maize exports increasing from 55 to 72 million tonnes over the same period. The USDA also forecasts maize exports from Argentina increasing from 11 million tonnes in 2004 to 15 million tonnes by 2012.

¹⁵ It is not possible to provide a comprehensive view of all macroeconomic and policy assumptions adopted by each of the forecasting organisations. These can be found in the documents highlighted in the references

Prices and stocks

Global cereal stocks have fallen significantly in the last three years (for coarse grains from about 190 million tonnes in 2001 to about 120 million tonnes in 2003) and are expected to remain at this level for the foreseeable future. Combined with the projected global increase in cereal demand referred to above, the stock to use ratio is expected to remain fairly low, maintaining an upward pressure on world cereal prices over the period to 2012. Thus world maize prices (basis US export prices from the Gulf of Mexico) are projected to rise from current levels of about €79/tonne to between €87/tonne and €93/tonne¹⁶.

3.2 EU maize market developments to 2012

3.2.1 General

Drawing on the EU Commission's maize market projections to 2011¹⁷ that take into account the 2003 CAP reforms and the impact of enlargement, EU 25 production is forecast to be about 51.8 million tonnes in 2011, broadly similar to the production level in 2003/04. Consumption is forecast to increase from about 51.8 million tonnes in 2004¹⁸ to 52.3 million tonnes in 2012 (a 1% increase). This small increase in consumption is predicted to come from additional demand in the animal feed sector and be supplied mostly by imports rather than any expansion in EU production.

Within the new member states, the Commission forecasts that production will stabilise around the 10-10.5 million tonnes level (2004 being an above-average production year). Production growth is, however, expected to grow in the short term (to about 10.9 million tonnes by 2007) before set-aside requirements begin to apply from 2009 and lead to some cut back in the rate of production growth. In the short to medium term high transport costs and the lack of important storage facilities will continue to be significant limiting factors in the development of the competitiveness of new member states and their access to EU domestic and/or world markets. This should constrain any additional expansion in production (in excess of the increase forecast), mainly because relatively low price levels and price volatility are expected to remain key factors of influence. With increased investment in transport and storage infrastructure, improved competitiveness and greater price stability are expected in the medium to long term.

Consumption of maize in the new member states is predicted to increase from about 8.8 million tonnes in 2004 to 10 million tonnes by 2011, with feed maize benefiting from increased substitution of barley in total feed demand. Accession is forecast to lead to a general expansion of markets, with production, consumption, imports and exports all increasing. The additional trade is expected both within the EU 25 and to third countries.

Hungary, as the largest producer and a major consumer of maize in the new member states, is likely to continue to be an important exporter. Maize production is expected to increase to about 7 million tonnes by 2008. Set-aside is then expected to reduce Hungary's production by about 0.45 million tonnes in 2009. Domestic use is forecast to expand from 4.8 million tonnes in 2004 to 5.3 million tonnes in 2011.

The main factor not taken into account in the forecasts presented above relates to possible commitments negotiated as part of the next WTO trade round of agreements. Whilst it is not possible to ascertain the details, the nature of principles so far agreed and the general thrust of the negotiations point to:

¹⁶ Sources: FAPRI & OECD – based on US dollar forecasts of \$107-\$114/tonne converted to euros at the average 2004 exchange rate of 1 euro = 1.225 dollars

¹⁷ Source: EU Commission (DG Agriculture: 2004) Prospects for agricultural markets in the EU. See appendix 2 for details of key assumptions underpinning this analysis

¹⁸ This usage figure derives from the Commission's forecasts for 2004/05 (ie, was an ex ante forecast made in 2004) and therefore differs from the current estimated usage figure of 53.75 million tonnes reported in section 2.2

- Elimination of export subsidies;
- Additional reductions in the level of import protection;
- Additional reductions in the overall level of agricultural support.

In the context of the EU maize market, this suggests an even more 'open' domestic EU market in which EU maize producers will find additional import competition and influence of world market price changes. The phasing out of export subsidies will also contribute to ensuring that EU cereal prices are in line with world market prices.

3.2.2 The future GM versus non GM maize market

How these market segments for maize will develop will be determined by how the balance of supply and demand for each category of product changes.

Summary of the current market

As indicated above, the development of distinct markets for GM versus non-GM maize has been much less marked in the EU than the market for soybeans, due largely to the virtual self sufficient nature of the EU market for maize (as distinct from soybeans/derivatives, which are much more dependent on imports):

- Consumption is mostly derived from EU origin maize, of which 99% was non-GM in 2004. As such, sourcing non-GM maize has not been difficult and possible concern about GM adventitious presence being found in non-GM maize supplies has largely been confined to some parts of Spain, where GM maize has been grown. Here, the GM maize has mainly been sold for use into the animal feed sector. Those users requiring certified non-GM maize (mostly the food using sector, including the starch sector) have not experienced difficulties in sourcing non-GM material even in the regions where GM IR maize production is concentrated. Price differentials, where they have arisen, have only been between 0% and 2% (ie, the same or marginally in favour of non-GM maize);
- Regarding maize imports, of the 2.6 million tonnes of maize that the EU annually imports, the majority of this has been for use in the feed industry (mostly in Spain and Portugal) where there has been no requirement for certified non-GM material. As such, a significant proportion (eg, about 60% in 2003) of these imports has consisted of GM maize from Argentina. The primary category of maize imports with a certified non-GM requirement has been flint maize (mostly imported from Argentina) used in the manufacture of breakfast cereals. As GM traits have not been available in this specialist maize, accessing non-GM flint maize has not been a problem;
- Lastly, the EU animal feed sector annually uses 5-7 million tonnes of imported maize gluten (a by-product of starch manufacturing). These imports are almost all sourced from the US and hence likely to be derived from GM maize (or from non-GM maize that has been mixed with GM maize prior to processing). To date, the use of this GM-derived ingredient in animal feed has not led to any significant development of a GM versus non-GM maize gluten market because the main livestock product sectors in which a demand for non-GM derived protein feed ingredients has developed (fresh poultry and eggs) do not traditionally use maize gluten in rations¹⁹.

The future market

Our analysis of current non-GM supply availability, trends in plantings to GM versus non-GM maize (globally and separately in the EU) and the approvals process for growing GM maize in the EU, suggests the following:

¹⁹ The main feed user sector of maize gluten is the dairy sector. Demand for use non-GM derived protein ingredients in the dairy feed sector has been very small and hence any move away from the use of maize gluten as a feed ingredient because of its probable GM origins has also been minimal

- Currently, the EU allows the importation and use of several types of GM maize and its derivatives. In the next 2-3 years, it is expected that additional import approvals will be forthcoming. In addition, there is likely to be continued expansion of the global area planted to GM maize, further increasing the share of globally traded maize (and derivatives) accounted for by GM cultivars. The net effect will be increased availability of GM maize/derivatives and decreased availability of non-GM maize/derivatives. Those wishing to procure and use non-GM maize and derivatives are likely to find limited, additional difficulty in accessing certified non-GM sources of supply. As a consequence, the differential between GM and non-GM maize prices traded on global markets may increase but will probably continue to remain fairly small (0% to 2%).
- Domestically, the EU has already approved the planting of GM IR maize. Over the next 2-3 years, plantings of this maize are likely to see modest increases from the 2004 baseline (58,100 ha in Spain), as additional plantings occur in Spain, and some small scale plantings occur in other EU member states, as national/regional level co-existence arrangements are finalised. However, by 2008, the vast majority of EU maize is still likely to be non-GM, and therefore accessing supplies of certified non-GM maize and derivatives from within the EU is not likely to be problematic. Price differentials between GM and non-GM maize/derivatives may increase marginally (reflecting an increased need to check the non-GM status and to ensure segregation) but can be expected to remain no higher than 1% to 2%;
- Beyond 2008, we expect the levels of EU consumer opposition to GM technology to recede slowly compared to current levels. In effect it is likely that there will be a 'trickle effect' relating to GM acceptance, with opposition levels declining slowly as each year passes. This may occur as a result of greater levels of awareness and understanding of the technology and in particular recognition, from empirical studies of the environmental benefits, associated with reduced pesticide use and reduced greenhouse gas emissions. In addition, crops containing GM quality traits are likely to become commercially available by 2010 – these latter innovations being ones that consumers can much more readily associate with direct benefits. As a result of decreasing opposition to GM technology *per se*, we perceive that the market segment based on demand for non GM maize and derivatives will decline to a fairly small, niche element, akin to the current organic market segment²⁰.

4 Competitiveness issues

4.1 Recent trends in production

The area planted to grain maize in the EU 25 has increased by 18% since 1995. This represents an increase in plantings of nearly one million hectares and compares with a 5% increase in wheat plantings (+1.1 million hectares) and an 8% decrease in the area planted to barley (-1.1 million hectares: see sub-section 4.2 for a discussion of reasons for these changes). Within the current area, about 0.97% (58,500 hectares in 2004) were planted to GM IR varieties.

The increase in maize plantings across the EU 25 has occurred both within the EU 15 (+7%) and the maize growing new member states, where the largest increases in plantings have occurred in Poland, Hungary and the Czech Republic.

4.2 Margins

This sub-section examines the profitability of growing grain maize in the main EU producing countries.

²⁰ It may well, by 2012 become a part of the organic market niche

There are several key factors that influence farm-level profitability for a particular cropping system:

- Short term profit factors (eg, crop yield, output prices, input costs);
- Dynamic factors (short to medium term): these include impacts on subsequent crop yields due to current fertiliser use, weed control, tillage method, crop disease incidence;
- Sustainability factors (eg, pesticide resistance, soil degradation);
- Risk factors (eg, yield and price variability, system flexibility, farmer attitude to risk);
- Whole farm factors (eg, machinery capacity, finance availability and cost, labour, farmer objectives, knowledge and experience).

How these factors impinge on individual farmers ultimately determines the way in which farms and farming systems are used. Not surprisingly, due to variation in the above five factors, the economic performance of farms can vary widely, both between and within regions. Also, it is important to recognise that when considering different possible rates of application of farming inputs to a crop, there may be a reasonably wide range of input levels either side of the ‘economic optimum’ that delivers profit levels that are only marginally different from that attained at the optimum. In other words, there can be a reasonable margin for error, and scope for flexibility in choosing input levels, without substantially reducing profits.

Against this background, Table 5 summarises and compares the average gross margins for grain maize and the other main cereal and oilseed crops in the leading EU producing countries of France, Italy, Spain, Germany, Poland, Czech Republic and Hungary. This highlights the following key points:

- In France, maize has tended to be the second most profitable cereal crop after soft wheat. It also has had a lower level of average return than oilseed crops over the last four years;
- In Italy, maize has been consistently the most profitable cereal or oilseed crop. The margins derived from maize, for most farmers, have been significantly higher than the returns derived from other cereal and oilseed crops;
- In Germany, soft wheat and maize have been the most profitable cereal crops; However, oilseed rape has been the most profitable of both cereal and oilseed crops. The returns from maize have been, on average, similar to returns from wheat, although the above average maize growers derive returns that are higher than above average wheat performers;
- In Spain, maize has been the most profitable arable crop over the last four years;
- In Hungary, Poland and the Czech Republic, maize has also consistently been the most profitable arable crop;
- The trend of increased plantings to wheat and maize in most parts of the EU (see section 4.1) is closely related to the level of (higher) returns derived from these crops compared to most alternatives, especially in the three new member states;
- The level of gross margins earned in the leading EU 15 countries is significantly higher than the average margins earned in the new member states. This derives from a combination of higher levels of support payments and higher levels of productivity (ie, higher average yields).

Table 5: Arable crop gross margins 2001-2004: in key maize growing member states (euros/hectare)

	Grain maize	Soft wheat	Barley	Oilseed rape	Sunflower	Soybeans
Hungary	133-774	82-477	42-420	75-535	108-505	110-588
France	419-612	661-698	492-562	647-744	600-786	669-883
Italy	585-838	266-503	N/a	N/a	117-271	84-457

Germany	396-572	372-643	325-468	397-722	N/a	N/a
Spain	785-1,461	291-362 (dry), 513-640 (irrigated)	213-301	N/a	100-278 (dry), 224- 497 (irrigated)	N/a
Poland	306-369	11-308	-17 to +252	219-315	N/a	N/a
Czech Republic	141-430	49-206	47-295	2-431	49-298	N/a

Sources: European Arable Crop Profit Margins 1st to 4th editions (2001/02 to 2004/05)

Note: Gross margins include provision for variable costs of production and area payments. The latter have been relevant in the new member states only in 2004

4.3 Future margins

4.3.1 The 2003 Mid Term Review (MTR) policy reforms

The 2003 policy reforms provide the current base for EU support to the arable cropping sectors²¹.

The main policy changes implemented by the MTR reforms relate to decoupling and cross compliance. Since the reforms introduced in 2000, area payment rates have been largely set at a uniform level for most arable crops (supplements for durum wheat, rice and protein crops excepted). The MTR changes have largely decoupled these direct payments and made as a condition for receipt of payment, compliance with mandatory environmental standards (related to keeping all land in good agricultural and environmental condition and abiding by the specific requirements of 18 existing EU Directives and Regulations covering environmental protection, public, animal and plant health and animal welfare). De-coupling effectively means that farmers no longer have to plant crops in order to receive the direct payments, except for ensuring that the land on which the payments are made is kept in good agricultural practice.

All area payments are in the process of being replaced by a single decoupled payment (known as the single farm payment (SFP)), based on aids received in the 2000-02 reference period, with the exception of direct payments related to:

- Seeds;
- Up to 25% of arable crops (ie, member states can, if they wish, continue to production link 25% of arable crop direct payments), except durum wheat and rice where 40% (the supplement) and 75 euros/ha are respectively production linked;
- Decoupling does not apply to the energy crop aid, the protein crop supplement and support for flax and hemp.

Land on which decoupled direct payments are made is also not allowed to be used for growing fruit, vegetables or potatoes.

Modulation (reductions) of the above area payments can, however occur and the amount of SFP receivable by farmers will be subject to reductions from several quarters:

- Compulsory modulation: 3% in 2005 rising to 5% in 2007 (farms claiming less than about €5,000 annually will be exempt from this). This modulation money is to be used to fund additional rural development measures;
- Financial discipline: this is related to the EU budget limits for the period 2007-2013. Due to the costs of the latest EU enlargement (which increases as the new member states accede gradually to full support payments by 2013/2014: see below) and likely funding requirements for reforms in sectors like sugar, olive oil and wine, it is expected that

²¹ For the purposes of the legislation, arable crops include cereals, oilseeds, pulses and flax. It does not include potatoes and sugar beet

additional cuts in the level of SFPs will be required each year from 2007. Drawing on EU Commission forecasts of developments in the main agricultural sectors over the period to 2013 and expected budgetary requirements, it is likely that an additional 5% minimum will be deducted in 2007 and this could increase further (towards 10%) by 2013. In addition, the requirements to fund the accession of Romania and Bulgaria, possibly from 2007, and their transition to adoption of the SFP mechanism will require to be funded. The adoption of the SFP system in these countries is estimated to require an additional €8 billion from the EU budget (after transition) and therefore it is possible that by the period 2010-2014, a further 5% modulation may be required from the EU 25 agricultural support payment budget;

- Member State discretion to impose additional cuts in modulation (national envelopes) of up to 10% for the purposes of encouraging specific types of farming that are important for the protection of the environment or improving the quality and marketing of agricultural products. For example, these funds could be channelled into supporting specific types of farming (eg, organic), agri-environmental schemes or the production and marketing of higher quality products.
- Establishment of a national reserve of 3% (for dealing with cases of farmers which have undergone changes to ownership and size of farms during or after the base reference period of 2000-2002).

In total, this means that the level of reduction applicable to SFPs could be within a range of 5% to 33%. Given the almost inevitability that there will be cuts for financial discipline reasons, a likely level of compulsory cut across all member states by 2013 is 20%, with the scope for an additional 13% on a voluntary basis.

4.3.2 New member states accession to the full CAP

All of the new member states are in transition to adoption of the full payment levels of the SFP. This transition is scheduled for completion in 2013/14, when the level of SFP received should be based on the same (full) rates applicable in the EU 15 (Table 6). This implies that the level of support payments made available to farmers in the new member states is set to increase each year until 2013/2014 and points to increasing levels of farm income (in the absence of decreases in market prices or lower than average yields being obtained).

However, the expected levels of SFP receivable by farmers in the new member states during the latter years of transition are subject to some uncertainty and are likely to be fall relative to the full (expected) rates from 2010/2011 onwards. This reflects the complex nature of the rules relating to modulation and the new member states accession. More specifically, until the completion of the transition, the modulation rules applicable in the EU15 are not applicable in the new member states. However, the maximum amount of SFP payable in the new member states cannot, during transition, be greater than the levels of SFP payable in the EU 15, net of compulsory modulation and financial discipline cut backs.

From 2007, EU 15 member states are likely to be subject to at least a 10% compulsory modulation rate of their SFPs and this could rise to 20% by 2013. This suggests that by 2012 (and possibly by 2011), the level of SFP received in the new member states will have peaked and may subsequently fall as the costs of paying for the accession of Bulgaria and Romania increase during their ten year transition period.

Table 6: Transition payments to full SFP in most of the new Member States

Year	% of direct payments receivable
2004/05	25
2005/06	30
2006/07	35
2007/08	40

2008/09	50
2009/2010	60
2010/2011	70
2011/2012	80
2012/2013	90
2013/2014	100

Note: During the transition period, the new member states can top up the level of single farm payment from national resources, equal to a maximum of 30% of the full amount receivable in 2013/14. For example if the full single farm payment payable is €300/ha, then in 2004/05 the transition payment payable from EU resources is €75/ha, with scope for new member states adding another €90/ha as a top up (ie, paying a total SFP in 2004-05 of €165/ha)

4.3.3 Impact of the MTR policy changes on maize and other arable crop margins

The key points to note relating to the impact of the MTR policy changes and EU enlargement on arable crop profit margins are that the levels of direct support payments (SFP) will probably decrease from 2007 resulting in decreased levels of gross margins in EU 15 countries (Table 7). Thus gross margins could fall by between 10% and 23% by 2013. However, in the new member states, margins are likely to increase during the early years of transition, before the financial pressures on the EU budget in the post 2011 period, lead to possible reductions in the level of support and crop margins. Despite this ‘peaking’ of support payments and gross margins in the period 2010-2012, the level of gross margin earned in 2013 (when modulation will fully apply) will still be higher than 2004 levels by about 13% to 15% (Table 7).

Table 7: Impact on maize gross margins of the MTR policy changes: 2004 and 2013: €/ha (bracket figures = 2013)

	Area payment/Single Farm Payment	Total revenue inclusive of SFP	Total variable costs	Gross margin
France	488 (390)	1,255 (1,158)	836 (836)	419 (322)
Germany	474 (379)	1,332 (1,237)	898 (898)	434 (339)
Hungary	155 (234)	782 (860)	214 (214)	567 (646)
Italy	544 (436)	1,486 (1,377)	735 (735)	751 (642)
Poland	114 (154)	640 (680)	334 (334)	306 (346)
Czech Republic	107 (176)	794 (863)	344 (344)	450 (519)
Spain	383 (306)	1,571 (1,494)	786 (786)	785 (708)

Source: derived from Brookes (2005) European arable crop profit margins 2004-05

Notes: 2004 prices, yields and costs are assumed for 2013, 2013 SFP based on 20% modulation. In 2004/05 direct payments to new member states equal to 25% of full post transition entitlement plus any national top-up

As the MTR policy changes primarily impact on the provision of direct support payments (the SFP), the increasing levels of modulation that are likely to occur will impact equally (in absolute terms) on all arable crop profit margins. Thus the underlying profitability levels of all cereals, oilseeds and pulses in the EU 15 can be expected to decrease by 2013 and the underlying profitability in the new member states to increase (until about 2010/2011).

4.3.4 Other key factors of influence on future margins

With the policy changes referred to above (decoupling and reduction of support payments in the EU 15 and increase in level of support payments in the new member states), the primary factor of influence on farmers’ planting choices will be the underlying profitability of different crops (excluding support payments). Thus the economics of production (costs of production relative to prices and yields) will become the most important driver of planting decisions.

This mix of factors of influence have been taken into account in the analysis of the likely direction of maize plantings and production in both the EU 25 and globally presented in section 3. This forecasts that EU 25 maize production is likely to be broadly similar in 2012 to current levels mainly because:

- Maize will continue to be one of the most profitable cereal crops, especially in southern EU countries. Farm level response to declining general profitability levels in the EU 15 will be to focus more on the most profitable crops (like maize) and diverting additional (marginally profitable) land into voluntary set-aside. In the new member states focus is also likely to be more on the more profitable crops like maize, although compulsory set-aside requirements will constrain plantings from about 2009;
- The increasingly 'open' nature of the EU grain market will re-enforce the influence of world markets on the EU market, contributing to possible increased volatility of prices. This increase in the level of uncertainty and competitiveness may constrain the expansion of plantings, hence counter balancing the positive influence referred to above and therefore contributing to no significant change in the overall EU maize area forecast for 2011/2012.

4.3.5 Summary of influences on future margins

Overall, the key points of relevance for EU maize crop profitability over the period to 2012 are:

- The agricultural sector will be operating within a larger and more competitive internal EU marketplace;
- Levels of support for agriculture will be lower than at present in the EU 15. However, in the new member states levels of support will be higher than existed prior to accession. The receipt of direct aids will provide additional income and should lead to higher investment in agriculture, both in terms of fixed assets (eg, machinery, crop storage) and more efficient use of variable inputs (eg, new varieties and pesticides). As a result, levels of technical performance should improve and an element of 'closing the productivity gap' with longer standing EU member states should occur over a number of years;
- The EU market will be open to increasing levels of competition from world markets. This will apply to all sectors;
- The EU agricultural market environment will probably be subject to greater variability in prices (reduced role of policy support mechanisms and increased openness of markets);
- New demand for crops in non food uses (notably bio-fuels) can be expected to increase across the EU. Agri-environmental schemes may become more attractive to some producers, especially if national governments choose to channel additional rural development funding from modulation into such schemes. Nevertheless, the main share of agricultural policy support will continue to be delivered via market measures and direct payments;
- In order to remain competitive in the EU marketplace, many producers are likely to increasingly explore all forms of new technology that can assist them (eg, through yield enhancement, cost reductions²²) and ways of reducing production and price risk. Others may focus on higher value, niche product production, like organics, where cost is less of a market driver or on the production of 'care' goods (eg, environmental set-aside, membership of agri-environmental schemes that target the delivery of environment and landscape goods for the wider public). Lastly, some others may choose to exit from the sector.

5 The possible role of using GM cost reducing technology in maize, in Hungary

Currently, no commercial genetically modified (GM) crops are planted in Hungary. In the next few years, some GM traits may become available to Hungarian growers, if products are brought through for regulatory approval, the approvals are received and seed companies develop varieties containing these products suitable for Hungary. Those most likely to become available first are

²² Including in the new member states, where despite the increases in levels of agricultural support, accession is likely to result in the real increases in the costs of land and labour inputs

GM herbicide tolerant (HT) and insect resistant (IR) maize. Maize resistant to the European Corn Borer already has EU-wide approval for planting.

5.1 Potential impact of using GM maize technology at the farm level

Drawing on a review of literature (see references), including recent analysis which specifically examined the potential impact of GM technology in Hungary (eg, Demont et al (2005), Table 8 summarises the likely impact of using GM HT and GM IR maize in Hungary. The analysis assumes that GM technology is made available in leading varieties adapted to Hungarian agronomic conditions and Hungarian farmers are able to make choices about whether to plant GM crops according to technical and agronomic performance criteria and market requirements. As such, this assumes that co-existence conditions for the planting of GM crops in Hungary are practical, proportionate and based on science.

The key points to note are as follows²³:

- yield gains are likely from using GM IR technology where currently farmers experience economic losses from the European corn borer (ECB) and corn rootworm pests. Clearly the extent to which yield gains may arise will depend upon the level of pest infestation, which varies by locality and year. ECB is also not currently a problem for many farmers in Hungary;
- The impact on the costs of production varies by trait used. Users of GM HT maize are likely to experience reduced levels of costs even after paying for the new technology. With regard to GM IR technology, some users may find that average variable costs decrease whilst for others costs increase (this will depend upon whether insecticides or seed treatments have traditionally been used to combat pest attacks or not);
- An increase in average gross margin profitability is likely to arise for users of GM HT maize of +€36/ha to +€40/ha (+6.3% to +7%). For users of GM IR technology (which currently suffer economic losses from the corn borer and rootworm pests) the gross margin gains are likely to be in the range of +€18/ha to +€28/ha (+3.2% to +4.8%). Clearly, the impact on profitability of using GM IR technology will vary according to the level of pest pressure and the assumed price of the technology (in terms of a seed price premia). For some farmers the gains may be higher than these average values, whilst for others the gains could be lower (including a possible negative impact for some, if for example, the yield gains are less than the seed premia charged for the GM IR trait);
- At the national level the positive impact on farm income is likely to be between 28.11 and 31.16 million euros;
- The technology offers benefits to farms of all sizes. Small farms have been some of the most enthusiastic adopters of GM traits (eg, in Spain) due to their simplicity and very low capital costs. This is important in the Hungarian context where there is a wide range of farm sizes;
- The technology offers additional intangible benefits such as increased management flexibility and simplicity.

Overall, the analysis of possible impact at the commercial farm level shows that important benefits are likely to be derived from using the technology, if it is made available in leading varieties adapted to Hungarian agronomic conditions. Against a background of an increasingly open and competitive marketplace, both domestically and in export markets, application of this technology has the potential to make an important contribution to maintaining and enhancing Hungarian competitiveness.

Average performing Hungarian maize growers that adopt the technology have the potential to gain more from adoption than their average performing EU 15 counterparts because they are starting

²³ For details of all assumptions used, refer to Appendix 3

from a lower average level of technical efficiency (eg, in terms of average levels of weed and pest control). Therefore they will potentially derive greater productivity (notably yield) gains. As such, the technology offers scope for accelerating the process of ‘productivity catch up’ post EU accession, enabling average performing Hungarian producers to compete more effectively, and earlier than they might otherwise have been capable of, if they did not use GM technology²⁴.

It is, however important to note that as weed and pest infestation levels and farm performance vary by farm and year, so will the impact of using GM technology. Some farmers may not derive benefits from using the technology, in some years. The analysis of impact on farm performance does, however suggest that most farmers stand to benefit financially from using the traits examined.

Table 8: Potential commercial farm level impact of using GM technology (per hectare) on grain maize crops in Hungary (2012 and beyond)

	Herbicide tolerant (grain) maize	Insect resistant (grain) maize
Yield	No expected impact: possibly small improvement	+4.5% to +6.3% where economic losses currently incurred
Variable costs of production	A decrease of between 17% and 19% from lower costs of herbicides	An increase in variable costs of between 5.6% and 8.4% (the seed premium for the technology being greater than any costs savings from reduced insecticide use)
Gross margin profitability	+6.3% to +7%	+3.8% to +4.8% GM IR targeting the corn borer and +3.2% GM IR targeting corn rootworm
Other impacts	Increased management flexibility and better weed control	Increased management flexibility, reduced production risk, lower levels of mycotoxins
Possible adoption % (in terms of total grain maize crop)	40%	10% for GM IR targeting the European corn borer, 460,000 ha for GM IR targeting corn rootworm
National level impact on farm income (baseline 2004)	+17.5 to +19.47 million euros	+2.66 to +3.34 million euros: GM IR targeting corn borer +8.35 million euros: GM IR targeting corn rootworm

Sources: Based on data used in Demont et al (2005), Brookes (2002 & 2005b), NCFAP (2003), Rice (2004) and drawing on conventional farm income data in Brookes (2005), which itself draws on data from the Hungarian Institute of Agricultural Economics (AKII)

Notes:

1. GM maize traits: GM HT (to glyphosate) and GM IR to the European Corn Borer and Corn Rootworm
2. Yield gains for GM IR crops based on Brookes (2002) and Rice (2004)
3. Cost of the technology (charged as a seed premium) based on Demont et al (2005) and/or cost currently charged in Spain (for GM IR maize targeting the ECB: original source: Brookes 2002). For further details see Appendix 3
4. Impact on costs of insecticides and herbicides, based on Demont et al (2005), Brookes (2002 & 2005b), NCFAP (2003) and Rice (2004): see Appendix 3
5. Adoption levels based on Demont et al (2005)

5.2 Implication of not using GM maize technology: servicing the non GM maize market

Whilst the analysis presented in section 5.1 above shows that technical and economic benefits are likely to arise for most Hungarian maize farmers who adopt GM technology, an additional constraint often cited relates to whether a sufficiently large market exists for GM maize and what might be foregone in terms of possible loss of sales into markets that require certified non GM maize?. Whilst there is a current market segment that requires certified non GM maize, it is important to recognise the following points:

²⁴ There are above average performing maize producers in Hungary, many of which are found on larger than average sized farms that are as technically and economically efficient as leading EU 15 maize producers. For this category of Hungarian maize producer, the ‘productivity catch up’ argument does not apply and the main benefit from adopting GM maize comes from the yield gains and cost savings that contribute to maintaining competitiveness

- finding outlets for GM derived maize crops is likely to be fairly straightforward, especially in the feed sector. This sector accounts for 78% of total grain maize usage in the EU 25, and 85%-90% of this usage has no requirement for non GM maize. The EU feed sector also currently makes widespread use of other GM derived ingredients, notably soymeal and the majority of animal feed sold in the EU is positively labelled as containing GM derived ingredients;
- whilst markets currently exist in which there are non GM requirements, these account for a minority of uses and are found mostly in the human food sector. In these markets, quality is an important criteria influencing sources of supply and usually requires supplies to be fully traceable. Servicing this market therefore requires investment in quality assurance and traceability systems, which is an aspect of competition that the Hungarian maize sector probably lags behind most of its EU counterparts;
- over the next few years, the distinct market for non GM maize and derivatives is expected to decrease in size (see section 3.2.2);
- marketing to the non GM maize market should be approached in the same way as looking to supply any market segment. To be successful, suppliers need to be competitive;
- currently Hungarian maize struggles to compete in the EU 25 maize market regardless of whether its maize is GM or not. The most important export markets in Europe are within the feed sector in countries such as Germany, Greece, Slovenia, Austria and Spain, where price is the most important factor influencing buying decisions and where GM derived ingredients are widely used. In the Spanish market, Hungarian maize has to compete on price with both EU origin maize and imports, including GM maize from Argentina. This highlights the importance of price competitiveness with both non GM and GM derived maize. It also re-enforces the current poor competitive position of Hungarian maize relative to other sources of supply in that transport subsidies have had to be provided by the EU Commission in order to facilitate the sale of Hungarian maize stocks held in intervention stores onto the Spanish market;
- there have been no price differentials between GM and non GM 'equivalent' crops at the farm level in most GM growing countries. For example, in Spain the farm level price of GM and non GM maize has been the same each year since 1998 when GM maize was first planted. Sometimes small price differentials in favour of non GM maize have developed (eg, 1% to 2% in favour of non GM) but these have been post farm level and largely reflect any additional costs associated with segregation, testing and certifying the non GM status of supplies to buyers. Consequently, farmers are unlikely to realise any price premia for producing non GM maize.

Appendix 1: EU import arrangements

Due to the operation of the Common Agricultural Policy (CAP), EU imports of maize are subject to the imposition of import duties. These are set according to rules agreed as part of the 1995 Uruguay Round Agreement. Import duties are set on a variable basis that reflects differences between reference world prices for maize and what is known as a maximum duty paid import price – the maximum duty paid import price is set at a level equal to the intervention support price for maize in the EU plus 55% (set at the level of €157.03/tonne). The world reference price for maize is US yellow corn number 3, quoted on the Chicago Board of Trade plus an allowance for transport to Rotterdam.

On the basis of this mechanism the current/recent level of import duty applicable on maize imports into the EU is/has recently been about €50/tonne.

Although the above mechanism applies to ‘general’ imports of maize into the EU, the majority (80% plus) of EU imports benefit from the existence of an import duty concession for up to 2.5 million tonnes of maize that can enter Spain and Portugal²⁵. This import duty concession was originally granted as compensation to third country suppliers for the loss of export competitiveness in Spain and Portugal when both countries joined the EU in 1986 and adopted the protective import regime of the EU’s Common Agricultural Policy. The main features of the import duty concession are:

- The 2 million tonnes for Spain and 0.5 million tonnes for Portugal are the maximum volumes that can benefit from an import duty concession;
- The volumes allowed for import are reduced according to the volume of maize gluten (that enters the EU duty-free) that is imported into these two countries;
- The maximum duty that can be charged within the concession is €50/tonne in Portugal (in practice it is lower) – there is no maximum duty applicable to imports into Spain;
- The concession only applies to dent maize – flint maize is excluded;
- Imports must be into Spain and Portugal – the concession does not apply to imports into other EU countries. This is facilitated by the requirement for importers to pay a security deposit on application for an import licence that is only re-paid when they (the importers) can show documentary evidence that the maize has been processed or used in Spain/Portugal (within 18 months of import);
- The import duty concession is administered on a tender basis. Each importer wishing to benefit from the concession bids a maximum duty concession it wishes to receive and the EU Commission then decides periodically (eg, every week when a tender has been opened) which tenders to accept. In practice, the Commission sets a maximum duty level at which all bids at, or lower than this level are accepted, with bids for higher levels rejected. For example, tenders into Spain for the period 8-14 July 2005 set the maximum duty concession accepted at €20.96/tonne and the volume that this concession applied to was 2,800 tonnes.

²⁵ The concession is for 2 million tonnes entering Spain and 0.5 million tonnes entering Portugal

Appendix 2: Underlying assumptions to the EU Commission's analysis presented in 'Prospects for agricultural markets in the EU'

1. Annual inflation rate of 1.9% from 2005/056 to 2011/12
2. Euro to \$ exchange rate: €1 = \$1.15 for the period 2005/06 to 2011/2012
3. The introduction of the 2003 CAP reform – the introduction of the single farm payment and reduction in the level of support in the cereal sector (mainly affecting rye and durum wheat) are expected to lead to a slight decline in the cereal area and to a rise in voluntary set aside as land with low profitability moves out of production
4. A compulsory set aside rate of 10% is assumed to apply in all years from 2005
5. The slowdown in cereal yield growth observed in the EU over the last few years is expected to persist to 2011/12
6. Contrary to the past decade which was characterised by a steady development of the white meat sector (and subsequent gains in cereal feed usage), the period to 2011/12 is projected to exhibit a marked slowdown in the production growth in the pig meat, poultry meat and egg sectors. This should then translate into more moderate demand prospects
7. World market (price) conditions for cereals are forecast by most international organisations to be moderately favourable, with notably an expanding world (import) demand in South East Asia
8. The lack of important storage facilities is a significant limiting factor in the development of the competitiveness of some new member states and their access to EU domestic and/or world markets. Increased investment in transport and storage infrastructure will become a crucial factor for the competitiveness of the crop sector in new member states like Hungary. As these investments will take time to effectively influence production and trade patterns, the economic perspectives for crop production as expressed in levels and volatility of producer prices are likely to improve only slowly.

Appendix 3: Farm level impact of using GM technology in Hungarian maize

Impact of using GM IR grain maize on farm profitability in Hungary (€/ha)

Baseline 2004	Conventional: average performance	GM IR targeted at the European corn borer	GM IR targeted at the corn rootworm
Price (€/tonne)	88	88	88
Yield (tonnes/ha)	7.12	7.569	7.44
Sales revenue	626.56	666.07	654.72
Single farm payment	155	155	155
Total revenue	781.56	821.07	809.72
<i>Variable costs</i>			
Seed	69	81-87	79
Fertiliser	62	62	62
Crop Protection	58	58	58
Other variable costs	25	25	25
Total variable costs	214	226-232	224
Gross margin	567.56	595.07 to 589.07	585.72

Source: Conventional performance data derived from Brookes (2005a), which itself draws on data supplied from the Hungarian Agricultural Economics Institute (AKII)

Notes:

1. Assumed yield impact is for GM IR maize targeting the ECB +6.3% and for corn rootworm +4.5% based on Rice (2004)
2. Price of maize based on average farm level prices October 2004-June 2005
3. Cost of technology (seed premium) assumed to be between +€12 (based on Demont et al (2005) to +€18/ha (based on typical current premia paid by Spanish farmers using the technology) for GM IR maize targeting the ECB. For GM IR maize targeting the corn rootworm, based on Demont et al (2005) & Rice (2004)
4. Cost of insecticides: for GM IR targeting the ECB, it is assumed that no insecticides are currently used. For GM IR maize targeting the corn rootworm, although insecticides and/or seed treatments have, historically rarely been used (because of the recent introduction of this pest to Hungary), saving in 'hypothetical' future costs of €50/ha are assumed, although this is counterbalanced by a technology cost of €40/ha, hence a net additional cost to the seed cost presented of +€10/ha. This data/assumptions are based on Demont et al (2005) & Rice (2004). Hence, all crop protection costs shown relate to herbicides.

Impact of using GM HT maize on average Hungarian grain maize gross margins (€/ha)

	Conventional: average performance	GM HT
Price (€/tonne)	88	88
Yield (tonnes/ha)	7.12	7.12
Sales revenue	626.56	626.56
Single farm payment	155	155
Total revenue	781.56	781.56
<i>Variable costs</i>		
Seed	69	77-81
Fertiliser	62	62
Crop protection	58	10
Other variable costs	25	25
Total variable costs	214	174-178
Gross margin	567.56	603.56-607.56

Source: Conventional performance data derived from Brookes (2005a), which itself draws on data from the Hungarian Agricultural Economics Institute (AKII)

Notes:

1. Assumed yield impact is zero: based on NCFAP (2003) & Demont et al (2005)
2. Price of maize based on average farm level prices October 2004-June 2005

3. Cost of technology (seed premium) assumed to be between +€8 and +€12/ha (based on NCFAP 2004, Brookes & Barfoot 2005 forthcoming)
4. Cost of herbicides: based on Brookes (2005b) which assumes that the GM HT crop uses 4 litres of glyphosate at €2.5/litre – that draws on commercial experience of usage levels in the US and trials in Europe

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