

Evidence of price premiums for non-GM grains in world markets

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Abstract

World markets for a number of grains (soybeans, corn, canola and cottonseed) have become differentiated into GM, certified non-GM and organic segments, which has created opportunities and challenges for grain market participants.

This paper summarises the evidence to date on the extent of price premiums for non-GM products throughout the world. A broad economic framework is employed to explain the observed pattern of price premiums.

The key conclusion of the analysis is that world grains markets for which there are GM variants are dominated by GM grains, but there are niches for certified non-GM and organically produced grains, for which price premiums are paid. With some certified non-GM grains for a specific purpose, price premiums appear to be increasing.

Apart from consumer attitudes, the key drivers of price premiums are mandatory labelling of GM products in some key grain consuming countries (particularly high income countries), higher production costs for non-GM crops and the cost of identity preservation.

1 Introduction

Modern technologies for manipulating the genetic structures of plants and animals offer the prospect of more rapid rates of productivity growth in global agricultural production systems. However, these gene technologies have also raised concerns among some consumers on environmental and food safety grounds.

To date, the most important commercialised GM crops have been grains, specifically canola (rapeseed), corn (maize), cotton and soybeans. Because some consumers still have doubts about the environmental effects and safety of consuming GM crops, markets have arisen for products that are certified to be non-GM in nature.

The doubts of some consumers over GM products may have also contributed to the recent growth in products from organic production systems because these systems specifically prohibit the use of modern gene technologies.

Guiding the differentiation of the world grain market has been price signals in the form of price premiums for certified non-GM and organic crops. Government policies have been important in shaping the pattern of price premiums in world markets.

The aims in this paper are to: describe the nature of the differentiated world grain market; report the current evidence for price premiums for non-GM grains; and provide broad reasons for the existence and sustainability of price premiums.

2 Differentiation of the world grain market

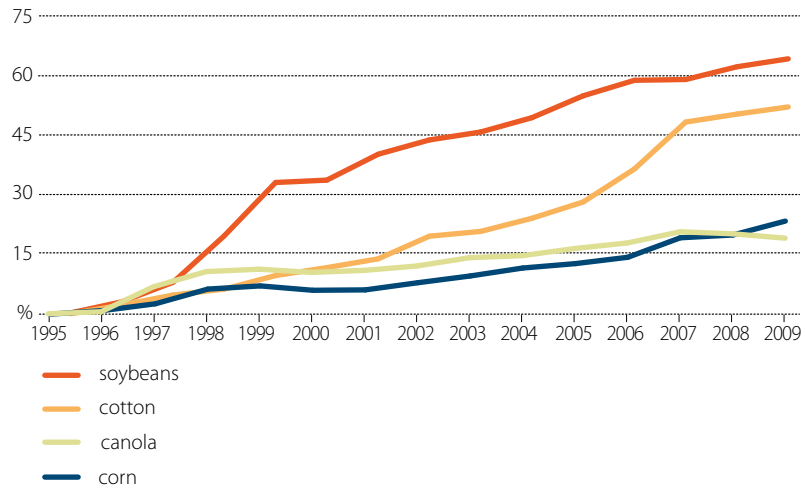
There has been rapid adoption of GM grains throughout the world (figure a). Of world crop areas harvested in 2009, GM varieties made up an estimated 19 per cent of canola; 21 per cent of corn; 52 per cent of cotton; and 63 per cent of soybeans. The European Union has only a small adoption of GM corn, while India and China have adopted GM cotton but not any GM varieties of food grains.

Organically produced grains are a small but rapidly growing part of the world grain market. The standards for organically grown grain differ from country to country but universally prohibit the use of genetically modified organisms. A survey of 135 countries reported in von Willer, Minou and Sorensen (2008), found that 30.4 million hectares were managed organically in these countries in 2006, which was equivalent to 0.65 per cent of their agricultural land. Around two-thirds of the total organic agricultural area was permanent grasses and around one-quarter was cropland.

Organic agriculture was most prevalent in the European Union, where the area managed organically in 2006 was 6.8 million hectares, which was 4 per cent of the total agricultural area (von Willer, Minou and Sorensen 2008). Of this area, plantings to organic cereals and oilseeds were 1.1 and 0.1 million hectares, respectively.

According to von Willer et al. (2008), demand for organic produce is growing rapidly, with global sales of organic produce in 2006 estimated at US\$38 billion, more than double the estimated US\$18 billion in 2000. The most important import markets for organic produce are the European Union, Japan and the United States.

a GM shares of world area harvested
by crop type

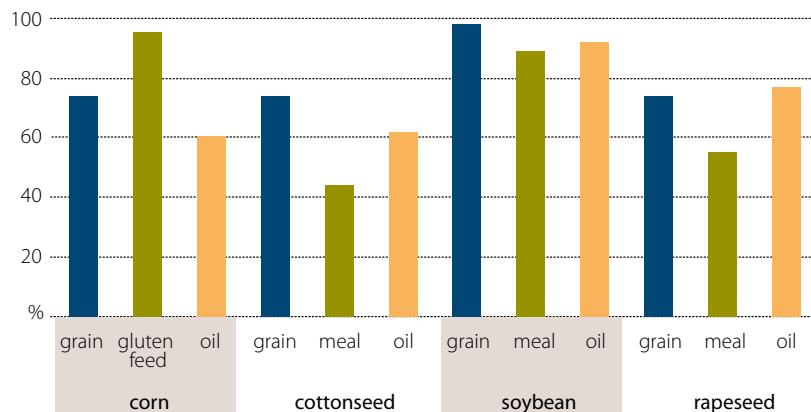


Source: ABARE estimates.

World export markets for grains for which there are GM variants are dominated by GM grains producing countries (figure b). This is particularly the case with soybeans, where countries producing GM soybeans supplied around 98 per cent of world exports of soybeans over the five years to 2009, 88 per cent of soybean meal and 90 per cent of soy oil.

The data reported in figure b overstate the shares of non-GM grains exported worldwide because there are significant exports of non-certified grain from countries that have mixed production systems of GM and non-GM grain. For ease of exposition, the term 'mixed grain' is used throughout this paper to refer to mixes of GM and non-GM grain.

b Shares of GM grains producing countries in world exports
of key grain products ^a



^a Excluding intra-European Union Trade.

Source: US Department of Agriculture (2009a); ISTA Mielke (2009).

Certification of non-GM products is often necessary because, in a mixed production system of GM and non-GM grain, it is difficult to ensure there is no unintended presence of GM material in non-GM products. This unintended presence can arise through cross-pollination in the field or through commingling in the grain handling and storage system. A system of tolerances that allows grains to be certified as non-GM, even if there is a small unintended GM presence, has evolved in the world grain market, although tolerances vary from country to country and according to end use.

The process by which certified non-GM grain is delivered to market specifications is termed identity preservation. The process involves keeping grain with desired traits separate from other grains and contaminants, from the planting seed stage through to end use. Identity preservation requirements can impose significant additional costs in grain supply chains (see Foster 2006).

Government policies have been important in shaping the diversification in world markets. First, most countries have approval processes for GM crops before they can be imported. Second, mandatory labelling of products containing GM material has been introduced in many key grain consuming countries.

Most countries have policies of zero tolerance for the presence of unapproved GM varieties. There have been a number of cases where unapproved GM varieties have disrupted world trade in grains, including the StarLink corn episode in the early 2000s and LibertyLink rice episode in 2006. More recently, in 2009 consignments of soybeans to the European Union from the United States were rejected because of the presence of small quantities of a GM maize variety not approved by the European Union.

The lag between commercialisation of GM grain varieties in the producing country and import approval in consuming countries has been an issue in world grain trade. This is particularly the case in the European Union where its approval process was successfully challenged by the United States in 2006 under World Trade Organization rules. The European Union has partly addressed this problem through implementing a tolerance of 0.5 per cent for unintended presence of GM material not yet approved for import by the European Union, but which has been assessed by the European Food Safety Authority as safe for consumption.

Generally, the mandatory labelling regimes in each country recognise that it is prohibitively costly to ensure complete absence of GM material and, hence, have thresholds for unintended presence of GM materials before the labelling requirement is triggered. The thresholds range from zero in China, 0.9 per cent in the European Union, and 5 per cent in Japan. Importantly, labelling regimes in most countries do not require labelling if modified DNA is not detectable in the product, with the key exceptions being China and the European Union. Only the European Union requires labelling of GM feedstuffs for livestock, with the same threshold as with food. No country yet requires labelling of products from animals fed with GM feedstuffs.

Some countries' organic standards allow for the unintended presence of GM material. For example, the European Union allows 0.9 per cent unintended presence of approved GM material in organic products. The National Organic Program in the United States requires that 'as long as an organic operation has not used excluded methods [including genetic modification] and takes reasonable steps to avoid contact with the products of excluded methods as detailed in their approved organic system plan, the unintentional presence of the products of excluded methods should not affect the status of an organic product or operation'. However, in Australia, the various organic standards have zero tolerances for unintended GM presence.

3 Evidence of price premiums in world grain markets

Apart from the futures contract for identity preserved soybeans on the Tokyo Grain Exchange, there are no transparent markets for certified non-GM or identity preserved grains. The US Department of Agriculture has only been regularly collecting data for organic grains since January 2007 and for non-GM corn and soybeans since March 2004. The approach adopted in this paper is to report the various claims of price premiums for non-GM grains—both certified non-GM and organic—in world grains markets. Comparisons of world grain trade flows known to be GM or non-GM are used to confirm the claims.

Soybeans

The main markets for certified non-GM soybeans are in the European Union and Japan. The main suppliers of identity preserved non-GM soybeans are Brazil, the United States and Canada. China, India and Australia supply non-GM soybeans because GM soybean has not yet been commercialised in these countries.

Brazil is the main country that can supply certified non-GM soybeans to world markets. Around one-third of Brazilian soybean production in 2008 came from non-GM varieties, implying non-GM soybean production of around 20 million tonnes. However, only 2.6 million tonnes of soymeal and 0.5 million tonnes of whole soybeans were formally certified as being non-GM in 2008, down from the peak of 4.1 million tonnes of soymeal and 1.4 million tonnes of whole soybeans in 2005 (Cert ID 2009).

Price premiums on offer to growers in the US state of Illinois for non-GM soybeans and corn since 2004 are shown in table 1. The February and March prices are quoted as forward premiums to be paid over and above normal cash prices for grain at harvest time in autumn in the United States; the October prices are harvest time premiums. The premiums for non-GM soybeans have been generally increasing since 2004.

1 Price premiums to growers of non-GM corn and soybeans in the United States ^a

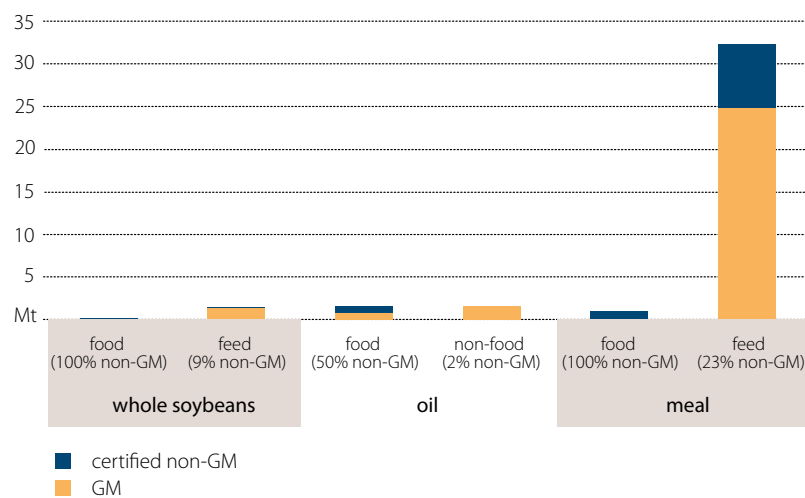
	February 2004 \$/t	March 2005 \$/t	March 2006 \$/t	October 2006 \$/t	October 2007 \$/t	March 2008 \$/t	October 2008 \$/t	March 2009 \$/t
Corn	1.84 to 2.94	1.84 to 3.67	1.84 to 5.51	2.94 to 7.35	7.35 to 11.02	14.70 to 18.37	14.70 to 23.88	22.05 to 25.72
Soybeans	13.78 to 19.68	11.81 to 21.65	11.81 to 37.40	15.75 to 25.59	25.59 to 33.46	47.24 to 51.18	39.37 to 51.18	66.93 to 70.86

^a Based on annual surveys of Illinois corn and soybean growers.
Source: Agricultural Marketing Service (2009 and previous issues).

Meyer (2008) provides estimates of GM and non-GM soybean use in the European market (figure c). Meyer claims all whole soybeans and soybean meal used for food purposes are certified non-GM (figure c). However, Meyer concludes that GM soybeans are more widely accepted in non-food purposes. For example, non-GM soybeans make up only 23 per cent of total soymeal use in animal feed and virtually all non-food uses of whole soybeans and oil. The non-GM component of the soymeal demand arises because some supermarket chains in the European Union require that the livestock products they sell come from livestock that are not fed GM feedstuffs.

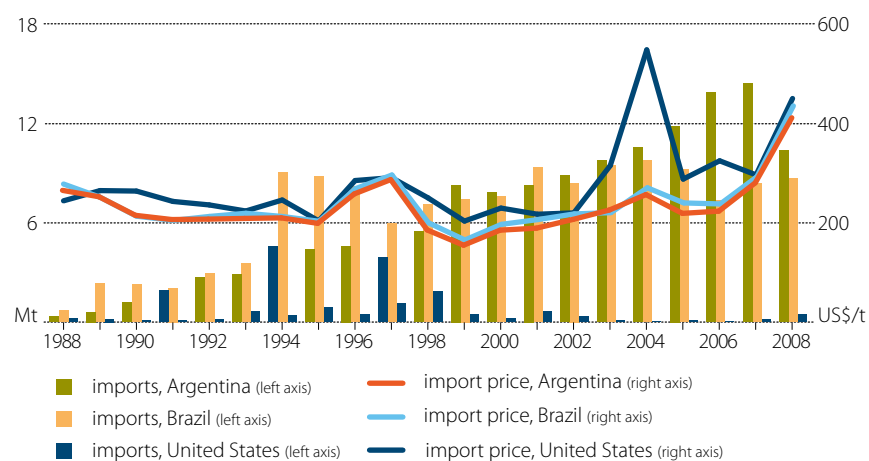
The European Union livestock feed market is a protein deficit one, a situation exacerbated by the imposition of bans on feeding meat meal to animals, following the 'mad cow' disease scares. This deficit requires substantial imports of vegetable protein for livestock feed, particularly soymeal from Brazil. Delays in the approval of new GM varieties and zero tolerances for unintended presence of unapproved GM varieties is putting pressure on the competitiveness of European Union livestock producers because of disruptions to trade (Directorate-General for Agriculture and Rural Development 2007).

C European consumption of soybean products: GM (mixed) and certified non-GM



Source: Meyer (2008).

d EU imports and import prices for soybean meal by country



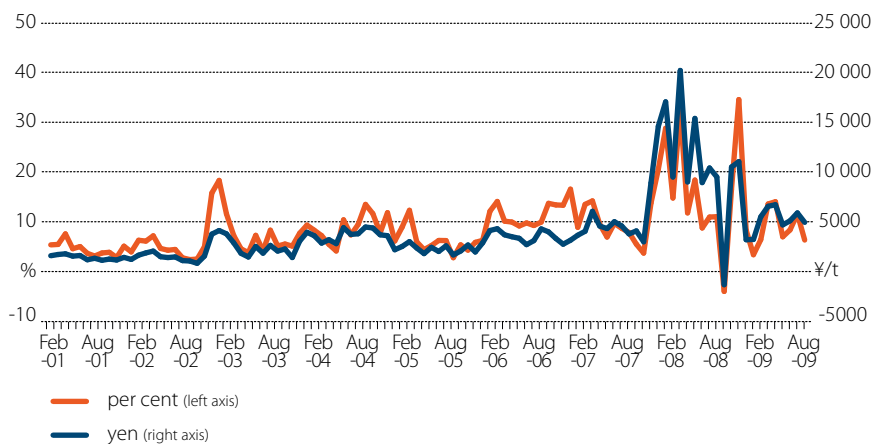
Source: United Nations Statistics Division (2009).

The main suppliers of EU imports of soybean meal are Argentina (57 per cent of total EU soymeal imports in the five years to 2008), Brazil (40 per cent) and the United States (1 per cent). Brookes, Craddock and Kniel (2005) put the price premiums for certified non-GM soymeal exported to the European Union from Brazil in the range 2 to 8 per cent. This is broadly consistent with recorded trade data (UN Statistics Division 2009) that show that imports prices for Brazilian soymeal into the European Union market have averaged 4 to 9 per cent higher than soymeal imports from Argentina (figure d). Almost 100 per cent of Argentina’s soybeans come from GM varieties.

In Japan, soybean imports for food purposes (tofu, natto, miso, soy sauce and other cooked food) are around 1.05 million tonnes (Foreign Agricultural Service 2008). Virtually all soybeans used in Japan for food production are non-GM, because of a strong aversion to GM products by Japanese consumers and mandatory labelling of GM soybean products other than oil and soy sauce. Around 42 per cent and 12 per cent, respectively, of Japan’s soybean imports go into tofu and miso manufacture and only identity preserved non-GM soybeans are used (Japan Tofu Association 2009; Japan Federation of Miso Manufacturers Cooperatives 2009). In 2008, the United States supplied more than 80 per cent of Japan’s import requirements of 3.2 million tonnes of food grade soybeans, with Canada (10 per cent) and China (3 per cent) being the other main suppliers (Japan Federation of Miso Manufacturers Cooperatives 2009). GM varieties account for slightly more than 40 per cent of total soybean plantings in Canada, but almost all of Canada’s soybean exports to Japan are believed to be identity preserved non-GM soybeans (Foreign Agricultural Service 2008).

Some indication of the price premiums on offer in the Japanese market for identity preserved non-GM soybeans can be obtained by comparing the price for the non-GM soybean future contract on the Tokyo Grain Exchange with the price for the conventional soybean futures contract on the same exchange. The non-GM contract has been offered since August 2001. As can be seen in figure e, where the premiums are presented in per cent and yen terms, the price premium started out at around 5 per cent but has gradually trended up since the introduction of the contract.

e Price premium for non-GM soybeans on the Tokyo Grain Exchange



Source: Tokyo Grain Exchange (2009).

Canola (rapeseed)

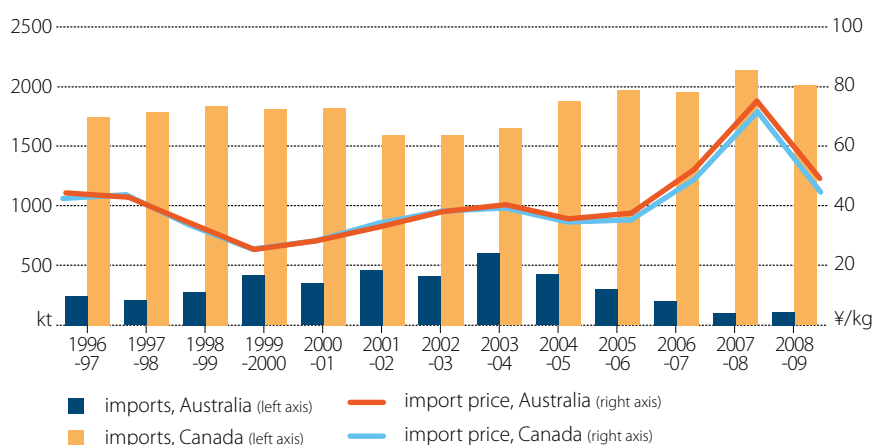
Some indication of price premiums for non-GM canola in world markets can be obtained by comparing landed prices for Canadian (GM) and Australian (non-GM) canola in key import markets. Although around 8 per cent of canola plantings in Canada are non-GM varieties, there appears to be no segregation of non-GM canola in the grain handling and storage system. In the five years to 2008-09, Canada supplied 72 per cent of world trade (excluding intra-European Union trade), while Australia and Ukraine supplied 9 per cent and 11 per cent, respectively (US Department of Agriculture 2009a).

Though GM canola was commercially released in Australia in 2008, this was only in New South Wales (21 per cent of Australian production in the five years to 2007-08) and Victoria (20 per cent). Non-GM canola can still be readily sourced from the other major producing states of Western Australia (43 per cent), South Australia (16 per cent) and Tasmania (less than 1 per cent). Commercial plantings of GM canola will be allowed in Western Australia from 2010, following trial plantings of around 860 hectares in 2009 that demonstrated to the state government's satisfaction that successful cultivation and segregation of GM canola are possible.

Foster and French (2007) concluded that there was little evidence in the major import markets for canola of a willingness to pay extra for Australia's non-GM canola compared with Canada's GM canola. They concluded that 'the best prospect for the development of more widespread premiums for conventional canola is through the reduction in export availabilities of conventional canola arising from the commercialisation of GM canola in Australia' (Foster and French 2007, p. 6).

A key market for Australian canola is Japan, which accounted for 35 per cent of Australia's total canola exports in the five years to 2008-09. Import prices for Australian and Canadian canola were tracking closely between 1996, when GM canola was introduced in Canada, and 2003. However, the gap has grown in favour of Australian canola since 2003 (figure f). Australia and Canada are the main exporters of canola to Japan, accounting for 4.4 per cent and 95.5 per cent, respectively, in 2008.

f Japanese imports and import prices for canola from Australia and Canada ^a

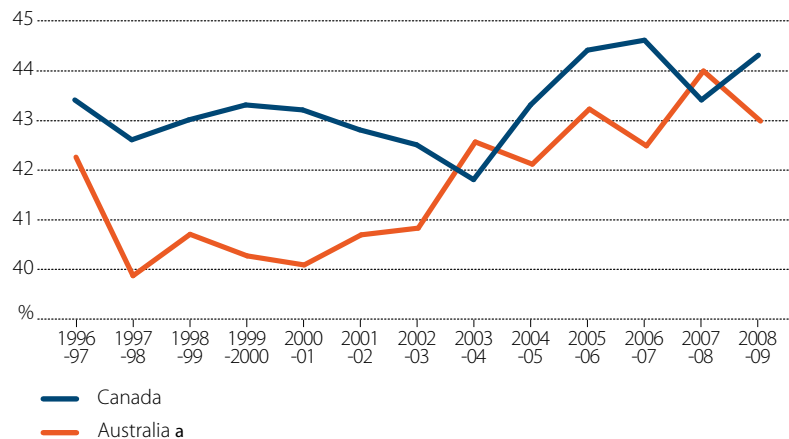


^a October-September year.
Source: Japan Customs (2009).

One explanation for the emerging gap between Australian and Canadian canola prices in the Japanese import market in the past few years is the improvement in oil content of Australian canola exported to this market, relative to Canadian canola (figure g). There are a number of different quality characteristics with canola, but oil

content is the main one. In Australia, the industry rule for oil yield bonuses to canola producers has for many years been that each one percentage point increase in oil content attracts a 1.5 per cent price bonus (see for example, Grain Pool of Western Australia 2009).

g Australian and Canadian canola oil content



a State canola oil yields, weighted by each state's canola exports to Japan.
Sources: DeClerq (2008); Seberry, Mailer and Parker (2009).

There is little evidence of Australian canola earning price premiums in the European Union market because of its non-GM status. Canada was an important supplier of canola to the European Union before the release of GM canola in Canada in 1996-97 but now exports almost no canola to this market. Initially this was because the European Union had not approved imports of GM canola, but since April 2007 the major GM canola varieties grown in Canada have all received import approval. Canadian canola exports to the European Union appear to have resumed in late 2009, following an agreement between the two governments in July 2009, with total exports to Portugal of 95 000 tonnes in November and December 2009.

Because there have been almost no European Union imports of Canadian canola since 1997, it is not possible to make import price comparisons between Australian and Canadian canola in this market. However, export data for canola from Western Australia, which provides virtually all Australia's exports to the European Union, suggest that price premiums are small or non-existent. The reason for this is that in every year in which Western Australia has been a substantial exporter to the European Union, the average export return to the European Union from this state has been almost the same as its average export return to Japan (figure h).

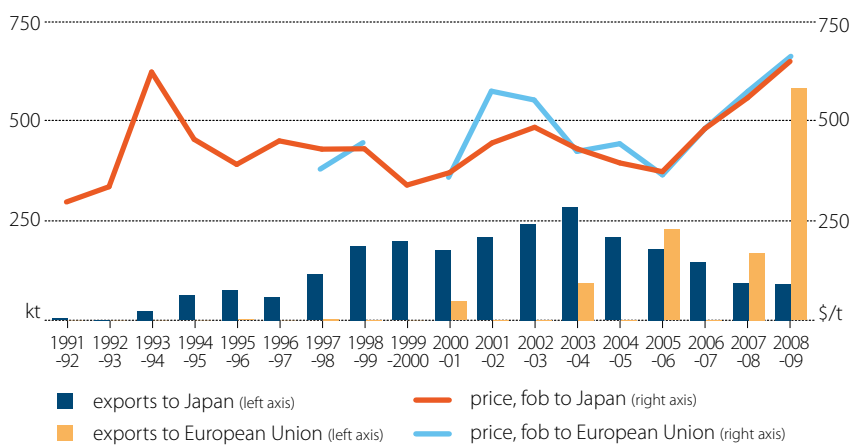
GM canola varieties are estimated to have made up 9 per cent of total canola planting in New South Wales and Victoria in 2009-10, but only 0.1 per cent in Western Australia. In New South Wales, there are two canola segregations in 2009-10: non-GM canola (less than 0.9 per cent unintended presence of GM canola) and commingled GM and non-GM canola. In Western Australia, GM canola is kept separate from conventional canola.

Cash prices on offer for GM and non-GM canola by the main grain marketers in Australia were monitored between November and December 2009 in New South Wales, Victoria and Western Australia. The premiums for non-GM canola over this period ranged from 0 to 3 per cent. Price premiums on offer at 10 December 2009 are shown in table 2. The other major marketers—ABB Grain, AWB, Elders Toepfer Grain and Grainpool of Western Australia—were only quoting prices for non-GM canola. As indicated earlier, Australia is at the early stage of GM canola adoption. It is too early to conclude whether these price premiums will persist into the future.

2 Price premiums for non-GM canola in Australia, 10 December 2009

Marketer	State		
	New South Wales	Victoria	Western Australia
Cargill Australia, via Australian Grain Accumulation Services	\$5/t (equivalent to a 1.4% premium) at The Rock	\$5/t (around 1.25%) at Melbourne, Geelong, Horsham, Lillimur and Murchison East	Same price at Esperance (0%)
Emerald Alliance (Emerald Group, Southern Quality Produce Cooperative and Southern Ag Grain)	\$5/t (around 1.3% premium) at 20 sites including Grenfell	\$5/t (1.2%) at Geelong, Melbourne and Portland	\$7/t (1.6%) at Albany, Esperance, Geraldton, and Kwinana
Graincorp	\$10.75 (2.8%) at Lockhart	\$11/t (2.9%) at Murchison East \$10/t (around 2.7%) at Horsham, Lillimur, Warracknabeal South and Westmere	

h Canola exports from Western Australia to Japan and the European Union



Source: ABS (2009).

Corn

Price premiums on offer to Illinois growers of non-GM corn in March 2009 for harvest delivery were US\$22 to US\$26 a tonne (table 1). Generally, the price premiums for non-GM corn have been increasing since 2004.

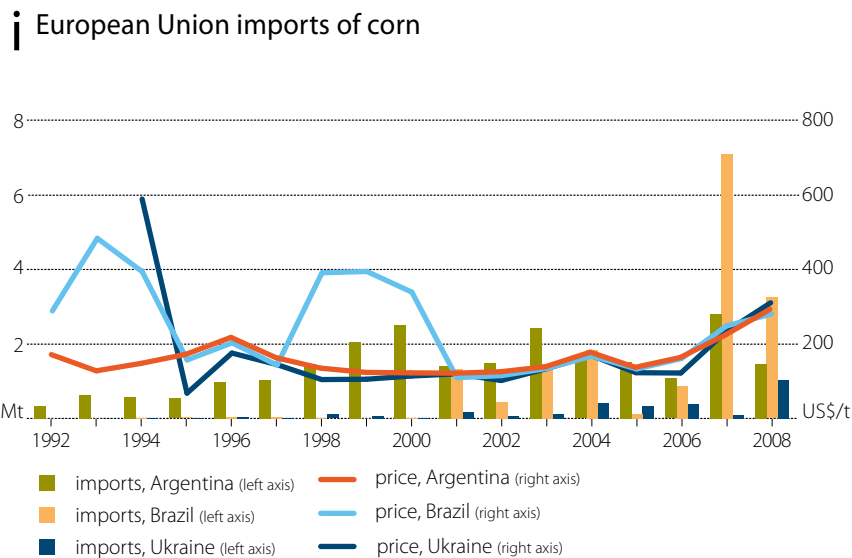
According to US Grains Council (2006), non-GM corn is mostly grown in the United States for the export market, mainly to Japan. Plantings were steady at around 200 000 hectares in the period 2002 to 2005 (more recent production data are not available). This compares with an average planting of GM corn of around 3.6 million hectares in the five years to 2008-09.

To avoid the separation issue in exporting corn to the European Union, Argentina and Brazil have only commercialised GM corn varieties that are approved by the European Union. This has enabled Argentina and Brazil to become the dominant suppliers of EU corn imports. The United States has almost disappeared as a supplier of EU corn imports, probably because it is difficult to ensure that there is zero presence of unapproved GM corn varieties. The United States supplied 75 per cent of the total corn imports of the European Union in the three years to 2006, but only 0.5 per cent in the three years to 2008.

An emerging supplier of the European Union corn market is Ukraine, which has not approved the use of GM corn varieties. The comparison of EU import prices of corn from Argentina, Brazil and Ukraine in figure i does not indicate that Ukraine's non-GM corn is earning price premiums in this market.

Cottonseed

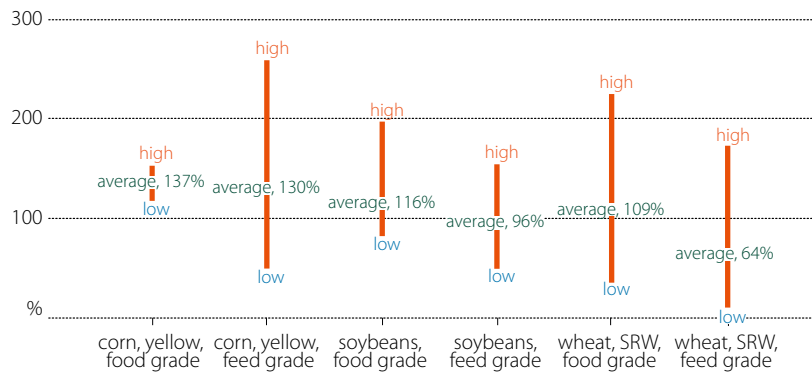
No evidence was found of price premiums paid for non-GM cottonseed. An important international ginner and marketer of cotton with operations in Australia, Brazil and the United States—Queensland Cotton Limited—said recently ‘there is no evidence of material market bias against the products emanating from this [GM] technology’ (Haire 2009). In most countries, cottonseed oil is not subject to mandatory labelling requirements and the meal is almost solely used for non-food purposes, mainly as a protein feed for livestock.



Organic grain

Data for organic grains have been collected by the US Department of Agriculture on a biweekly basis since January 2007. Price premium ranges for organic corn, soybeans and wheat, calculated using monthly data for the period April 2007 to September 2009, are reported in figure j. The estimated average organic premiums were more than 100 per cent, except for organic feed wheat.

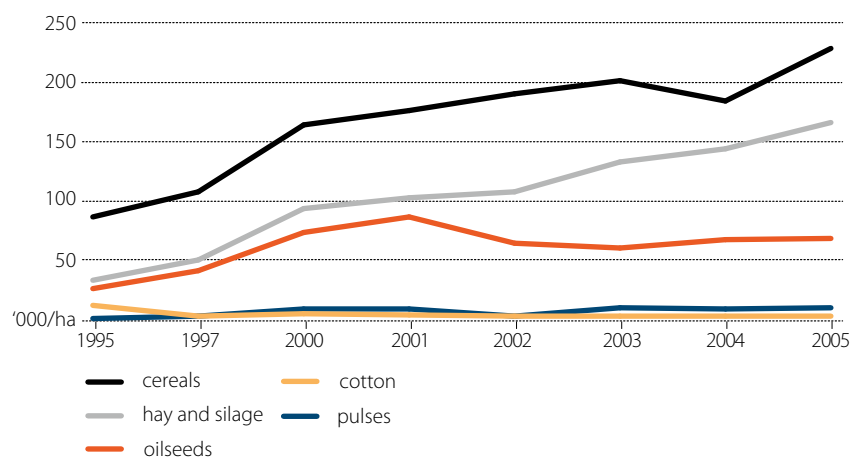
j Price premium ranges for organic grains in the eastern cornbelt of the United States



Source: US Department of Agriculture (2009b).

The total US area of certified organic broadacre crops almost tripled between 1995 and 2005 (the latest year for which official data are available), but is estimated to have still been only 1 to 2 per cent of total US broadacre

k US area of certified organic broadacre crops



Source: US Department of Agriculture (2008).

crops in 2009. Most of the growth has been for cereals (mainly wheat, corn and oats) and hay and silage. Soybeans account for more than 70 per cent of the total area of certified organic oilseeds, with flax (linseed) the other major crop.

4 Reasons for price premiums

The evidence discussed in the previous section can be used to advance some broad reasons for the existence (or non-existence) and sustainability of price premiums for non-GM grains.

If GM grains were perfectly substitutable in consumption with non-GM grains, there would be no price premiums for non-GM grains. The share of each grain type in world markets would simply be determined by its supply cost, which includes production and identity preservation costs.

Canola and cottonseed appear to be grains where the GM varieties are highly substitutable in consumption with the non-GM varieties. Premiums for certified non-GM canola or cottonseed were either small or non-existent.

There are a number of reasons for the high substitutability between GM and non-GM canola and cotton. Canola and cottonseed are crushed to produce oil and meal. In most countries, mandatory labelling is not required with the oil, because there is no detectable DNA. The meal of cottonseed and canola has virtually no food use, only feed use for animals.

If GM and non-GM grains are not perfectly substitutable in consumption, this can mean differentiated markets and differences in prices between the different markets. Organic grains and non-GM soybean and corn for food purposes are examples of differentiated markets where price premiums exist.

In the case of organic soybeans, price premiums for organic grains mostly reflect higher production costs. McBride and Greene (2008) estimated that the total economic costs for growing organic soybeans in 2006 in the United States was US\$6.20 a bushel (US\$228 a tonne) higher than with conventional soybeans. The average farm-gate price for soybeans in 2006 was \$6.43 a bushel (US\$256 a tonne) (National Agricultural Statistics Service 2009).

The market niche for organic grain is being sustained in the face of high production costs by growing demand, as consumer incomes and preferences for organic produce grow (Greene, Dimitri, Lin, McBride, Oberholtzer and Smith 2009; von Willer, Minou and Sorensen 2008).

In the case of certified non-GM corn and soybeans for food, the evidence suggests these premiums are increasing over time. On the supply side, this is probably because availabilities of non-GM corn and soybeans for export are declining as adoption of GM varieties increases in the main corn and soybean exporting countries. It appears that growers of non-GM corn and soybeans in exporting countries are requiring continual increases in prices to forego the benefits of employing GM technologies and to meet identity preservation costs.

It is difficult to determine how demand factors are contributing to rising premiums for non-GM corn and soybeans. On the one hand—as with organic grains—increasing consumer incomes could mean growing preferences for non-GM food corn and soybeans. This preference is being heightened by mandatory labelling that draws attention to the presence of GM material in products. On the other hand, consumer acceptance of GM food soybeans and corn could be growing, as GM foods become more prevalent in the food chain and consumer knowledge of GM foods increases.

The current generation of GM grains covered in this paper deliver largely agronomic benefits. The next generation of GM crops is likely to have improved quality traits that command higher prices in world grain markets. These include oilseeds with oil profiles altered to include higher proportions of healthy oils such as

omega 3. The ability to patent these traits could mean that the owners of the technologies have the ability to influence supply of the enhanced quality grains to maintain their prices above world prices for conventional grains. However, patents are only granted for a period of 20 years.

5 Conclusions

Globally, the evidence is that certified non-GM grains (excluding organic grains) occupy only niches, mainly with soybeans and corn that would be used for human food in some markets. These niches are mainly in the high income regions of Japan, Western Europe and North America.

Government policies have been important determinants of price differentiation in world grain markets. Premiums for certified non-GM grains (as distinct from organic grains) largely exist only where mandatory labelling requires products to be identified as containing GM materials.

There is some evidence of global markets for certified non-GM grain contracting, as consumer acceptance of GM grains grows, but significant niches are likely to be sustained into the future, mainly with soybeans and corn. There is also some evidence of increasing price premiums in recent years, as the availability of non-GM grains throughout the world declines and the opportunity cost of not using GM technologies increases.

The limited price information available for organic grains suggests premiums of around 100 per cent over conventional and GM grains, which largely reflects higher production costs of organic grains. Demand for organic grains appears to be increasing rapidly, albeit from a small base of less than 1 per cent of world grain use in 2009. Again, the markets for organic grains are mainly in the high income regions of the European Union, Japan and North America.

References

Australian Bureau of Statistics (ABS) 2009, *International Trade*, cat. no. 5465.0, Canberra.

Agricultural Marketing Service 2009, *Value Enhanced Grain Summary*, US Department of Agriculture, Springfield, March (www.ams.usda.gov/mnreports/gx_gr118.txt).

Brookes, G, Craddock, N and Kniel, B 2005, *Global GM Market: Implications for the European Union Food Chain*, PG Economics Ltd, Frampton, United Kingdom (www.pgeconomics.co.uk/pdf/Global_GM_Market.pdf).

Cert ID 2009, *One Decade of Cert ID's Non-GMO Certification Success Story Provides Basis for European GMO-Free Claims*, Fairfield, Iowa (www.cert-id.com/News/September-2009/One-decade-of-Cert-ID's-Non-GMO-certification-succ.aspx).

- DeClercq, D and Daun, D 2005, *Canadian Canola Quality parameters: Comparison of Results from Harvest and Export Surveys*, Paper no. 891, Canadian Grain Commission, Grain Research Laboratory, Winnipeg.
- DeClercq, D 2008, *Report on the Quality of 2008 Western Canadian Canola*, Grain Research Laboratory, Canadian Grain Commission, Winnipeg.
- Desquilbet, M and Bullock, D 2009, 'Who pays the costs of non-GMO segregation and identity preservation?', *American Journal of Agricultural Economics*, vol. 91, no. 3, pp. 656–72.
- Dimitri, C and Oberholtzer, L 2009, *Marketing US Organic Foods: Recent Trends From Farms to Consumers*, Economic Information Bulletin Number 58, US Department of Agriculture, Washington DC, September (www.ers.usda.gov/Publications/EIB58/EIB58.pdf).
- Directorate-General for Agriculture and Rural Development 2007, *Economic Impact of Unapproved GMOs on EU Feed Imports and Livestock Production*, European Commission, Brussels (ec.europa.eu/agriculture/envir/gmo/economic_impactGMOs_en.pdf).
- Food and Policy Research Institute (FAPRI) 2009, *FAPRI 2009 US and World Agricultural Outlook*, FAPRI Staff Report 09-FSR 1, Ames, Iowa, February (www.fapri.iastate.edu/outlook/2009/text/OutlookPub2009.pdf).
- Foreign Agricultural Service 2008, *Japan Oilseeds and Products, Annual Report*, Gain Report no. JA8026, US Department of Agriculture, May (www.fas.usda.gov/gainfiles/200805/146294661.pdf).
- Foster, M 2006, *GM Grains in Australia: Identity Preservation*, ABARE research report 06.25 prepared for the Australian Government Department of Agriculture, Fisheries and Forestry and the Grains Research and Development Corporation, Canberra, December.
- Foster, M and French, S 2007, *Market Acceptance of GM Canola*, ABARE research report 07.5 prepared for the Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, March.
- Grain Pool of Western Australia 2009, *Canola Oil and Admixture Premiums/Discounts Calculation: Addendum to page 14 and 15 of the Grain Pool Harvest Guide 09-10*, Perth (cbh.com.au/media/120928/canola_payment_calculation_0910.pdf).
- Green, C, Dimitri, C, Lin, B, McBride, W, Oberholtzer, L and Smith, T 2009, *Emerging Issues in the US Organic Industry*, Economic Research Service Economic Information Bulletin no. 55, US Department of Agriculture, Washington DC, June.
- Haire, R 2009, *The economics of cotton coexistence in Australia*, presentation to the Fourth International Conference on Coexistence between Genetically Modified (GM) and non-GM based Agricultural Supply Chains, Melbourne, 10–12 November.
- ISTA Mielke GmbH 2009, *Oil World*, Hamburg.
- Japan Federation of Miso Manufacturers Cooperatives 2009, *Food Grade Soybean Prices and Soybean Imported Volumes*, Tokyo (zenmi.jp/Eng-testfolder/statistics/Rawmaterials/Eng-Soymarketpriceqty.pdf).
- Japan Customs 2009, *Trade Statistics of Japan*, Tokyo (www.customs.go.jp/toukei/info/index_e.htm).
- Japan Tofu Association 2009, *Variety and Production Technique*, Tokyo (www.tofu-as.jp/english/tofu/index.html).

Koester, J 2008, *Supplying Raw Materials for GM-free Animal Products*, TraceConsult, Geneva, September.

McBride, W and Greene, C 2008, 'The profitability of organic soybean production', paper presented to the American Agricultural Economics Association Annual Meeting, Orlando, Florida, 27–29 July (ageconsearch.umn.edu/bitstream/6449/2/465035.pdf).

Meyer, L 2008, *Sustainable and non-GM soy market in Europe*, presentation to the 2nd Non-GM Soy Summit, 7-9 October, Brussels.

National Agricultural Statistics Service 2009, *Crop Values 2008 Summary*, US Department of Agriculture, Washington DC, February (usda.mannlib.cornell.edu/usda/current/CropValuSu/CropValuSu-02-13-2009.pdf).

Sahota, A 2008, 'The Global Market for Organic Food and Drink', in H von Willer, Y Minou and N Sorensen (eds), *The World of Organic Agriculture: Statistics and Emerging Trends 2008*, International Federation of Organic Agriculture Movements and Research Institute of Organic Agriculture, Bonn.

Seberry, D, Mailer, R and Parker, P 2009, *Quality of Australian Canola 2008*, Australian Oilseeds Federation, Sydney (www.australianoilseeds.com/___data/assets/pdf_file/0008/5849/2008_Quality_of_Australian_Canola_Book.pdf).

Soil Association 2009, *Organic Market Report 2009*, Bristol (www.soilassociation.org/LinkClick.aspx?fileticket=GPyfnoJoPh0%3D&tabid=116).

Streff, N and Dobbs, T 2004, '*Organic' and 'Conventional' Grain and Soybean Prices in the Northern Great Plains and Upper Midwest: 1995 through 2003*, Econ Pamphlet 2004-1, South Dakota State University, Economics Department, Brookings, June (ageconsearch.umn.edu/bitstream/32035/1/ep040001.pdf).

Tokyo Grain Exchange 2009, *Trading Data: Monthly*, Tokyo (www.tge.or.jp/english/trading/tra_m01.shtml).

United Nations Statistics Division 2009, *UN Comtrade (United Nations Commodity Trade Statistics Database)*, New York (comtrade.un.org).

US Department of Agriculture 2008, *Certified Organic and Total US Acreage, Selected crops and Livestock, 1995-2005*, Economic Research Service, Washington, DC (www.fas.usda.gov/psdonline).

US Department of Agriculture 2009a, *PSD Online*, Foreign Agricultural Service, Washington, DC (www.fas.usda.gov/psdonline).

US Department of Agriculture 2009b, *Livestock and Grain Market News Portal*, Agricultural Marketing Service, Washington, DC (marketnews.usda.gov/portal/lg).

US Grains Council 2006, *Value Enhanced Grain Report 2006*, Washington DC (www.agmrc.org/media/cms/USGC_Value_Enhanced_Corn_Report_200_08C7959C2B1E6.pdf).

Von Willer, H, Minou, Y and Sorensen, N (eds) 2008, *The World of Organic Agriculture: Statistics and Emerging Trends 2008*, International Federation of Organic Agriculture Movements and Research Institute of Organic Agriculture, Bonn.