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Control freaks
- the GMO exporters

by **Greg Muttitt** additional research by **Dirk Franke**.

"U.S. grain-exporters continue to insist that GMOs be sold despite the desire by overseas customers for non-GMO products. Instead of giving the consumer what they want, the attitude and arrogance of US exporters and some domestic farm organizations is forcing overseas buyers to turn their backs on U.S. corn [maize] and soybeans." - Gary Goldberg, CEO of the American Corn Growers Association[1]

Across much of the world, people have overwhelmingly opposed the genetic modification of crops for food production. Yet production and use of genetically-modified (GM) crops continue to expand. Two little-known companies - Cargill and Archer Daniels Midland (ADM) - have been instrumental in the introduction of the technology. These two companies, principally involved in distribution and primary processing of commodities, are responsible for around two thirds of US soya and maize exports.

In some countries the food industry has succeeded in sourcing non-GM ingredients (such as soya and maize) in the relatively small quantities used in food manufacture. Now public concern is spreading to the use of GM crops to feed animals for meat and dairy production. In the UK, food retailers are trying to obtain animal products not reared on GM crops, but have found supply unavailable - this is largely due to the exercise of market power by Cargill and ADM, both of which stand to benefit from the technology.

One of the most disturbing threats from genetic modification of crops is the trend toward greater corporate control of the food supply. Yet these two corporations have controlled the food supply for years. Both have clear corporate strategies for taking advantage of the technology, and in the process consolidating their dominance.

Two supplements come with this report, giving general, background information on the two companies, their cultures and activities, and their UK presences:

- **Cargill - Arrogance, Incorporated**
- **ADM - Supermarkup to the World**

[1] American Corn Growers Association press release, 13/3/00, 'Corn growers question need to sacrifice export markets due to genetically modified crops', www.acga.org/news/2000/031300.htm

CONTENTS

This report examines the role of these companies in the biotech 'revolution'. It begins by looking at the agricultural distribution system, from farmer to consumer, and how supply of non-GM crops falls short of demand for them. It goes on to document the responses of Cargill and ADM - and their smaller competitors - to growing demand for non-GM foods. To explain these responses, and place them in the context of the companies' longer-term aims for GM technology, the report then analyses the companies' cultures and strategies. Finally it projects possible future developments, and how campaigners might influence these. In three appendices, more detail is given on supply-chain economics, in relation to supply of non-GM crops.

This report deals with the ways in which Cargill and ADM control the supply of GM vs non-GM crops, largely in industrialised countries (in North America, Europe and East Asia). It does not attempt to address the impacts of their operations on food supply or agriculture in the global South[2].

The study focuses on soya and maize, the two largest GM cash crops, although many of the considerations are transferable to the smaller GM crops cotton and oilseed rape, and others. It also deals mainly with production and distribution in the USA, which is by far the world's biggest producer of GM crops.

[2] for excellent reading on those subjects, see: Brewster Kneen, 1995, Invisible Giant, pub. Pluto Press (London); UK Food Group (London), 1999, Hungry for Power; Research Foundation for Science, Technology & Ecology (New Delhi), 1998 - Cargill, the Giant Among Grain Merchants; Lucy Michaels, Devlin Kuyek & Helena Paul, 2000, Feeding the Hungry Transnationals, pub. Econexus (Brighton)

I - BACKGROUND

Who wants it? - Demand for GM and non-GM crops

In the UK, public rejection of genetically-modified (GM) foods has been overwhelming. Between spring and autumn 1999, all of the major British supermarkets responded to consumer pressure by removing GM ingredients from their own-brand products. They were quickly joined by the big food manufacturers, such as Unilever and Nestle, and fast food outlets like McDonald's. As a result, almost all food use in Britain of soya and maize - the two main crops of which GM varieties are currently grown - now uses conventional, non-GM varieties of these crops, or has substituted them with other oilseeds or grains. This situation has now spread across much of Europe; similar patterns are being seen in Asia; and even in the USA some food companies have started to remove GM ingredients.

However, food use is just the tip of the GM iceberg. Far greater quantities of soya and maize go into animal feed (see below), and this too is controversial. Surveys conducted by opinion pollsters NOP in June and September 2000 found respectively 63% and 67% of the British public opposed the use of GM crops to feed animals.[3]

In response to growing consumer concern, British supermarkets have since autumn 1999 been attempting to stop the use of GM feed in the production of their meat and dairy products. Yet they have made very little progress (see table 1). One year on, some of the supermarkets now stock one or two non-GM-fed lines; most claim to be still in discussion with their suppliers.

The supermarket which has got furthest is Iceland, which from 31st September 2000 guarantees that its chickens (for both meat and egg production) are fed on entirely non-GM diets, and other livestock for primary (non-processed) meat are fed non-GM for the few weeks immediately before slaughter[4]. Yet after Iceland announced its intention to phase out GM animal feed in February 2000, its suppliers said they had difficulty obtaining non-GM feed, and Iceland had to buy 10,000 tonnes of non-GM soyameal itself, to sell to its own meat producers[5].

Now many of the meat producers are also looking into non-GM feed. They too have had difficulty. At the end of 1999, one of the UK's largest poultry producers complained that "we were strongly considering a total switch a few weeks ago but we were unable to secure non-GM supply for forward cover already on the buying book. The intermediaries who market the soya are unwilling to make the change to wholly non-GM in their crushing plant".[6]

All this clearly shows that the demand for non-GM crops (for animal feed) far outstrips supply. (See table overleaf)

Towards the end of 2000, many other companies which sell meat and dairy products - including McDonald's and Unilever - have expressed an intention to use non-GM feed. In fact, the rush to make such declarations has been comparable to that for non-GM food ingredients in summer 1999. However, judging by the supermarket experience on animal feed, this new demand might have difficulty finding adequate non-GM supply.

[3] NOP poll commissioned by Friends of the Earth, interviewed 1996 people between 20th and 25th June 2000, see FoE press release, 5/10/00, 'Iceland's livestock goes GM-free', www.foe.co.uk/pubsinfo/infoteam/pressrel/2000/20001005000259.html; and NOP poll commissioned by Greenpeace, telephone interviews with 1001 adults between 1st and 3rd September 2000, see Greenpeace press release, 25/9/00, 'British public reject meat, eggs and dairy products from animals fed on GM crops', on www.greenpeace.org.uk - GM foods section

[4] The 'finishing phase', lasting 70 days for beef, 60 days for pork and 45 days for lamb. Iceland's next priority is to switch to non-GM feed for production of processed meats, such as minces, dices and ready meals, and then to move animals onto non-GM diets for their entire lifetime, by 2001 for pork, 2002 for lamb and 2003 for beef.

[5] Iceland plc press release, 5/10/00, 'Iceland hits non-GM feed target'

[6] quoted by Paul Marsden MP, 30/11/99, when cross-examining Cargill representatives, in minutes of evidence, House of Commons Agriculture Select Committee, for its 3rd Report, 'The Segregation of Genetically Modified Foods', www.parliament.the-stationery-office.co.uk/pa/cm199900/cmselect/cmagric/71/9113013.htm

Table 1 - Top 6 UK supermarkets - policies and practice on GM crops fed to animals for their meat and dairy products, Oct-Dec 1999 and Aug 2000

	Oct - Dec 1999[7]	Aug 2000[8]
Tesco	"Our target is the eventual complete elimination of GM ingredients from animal feed... I have therefore asked our suppliers to begin the process as the next Brazilian soya crop becomes available in Spring 2000"[9] (10/12/99)	A small number of meat and dairy lines produced using non-GM feed. "Tesco have been working hard over the last two years to find ways to reduce and ultimately eliminate GM ingredients from the rations fed to our livestock. We are trying to find ways to achieve this without passing on any cost to either our customers or to our farmers"[10]
Sainsbury	"Now that [the elimination of GM ingredients from own-label products] has been completed, it was inevitable that we should turn our attention to the presence of GM constituents in animal feedstuffs"	Planning to introduce a limited range of non-GM-fed meat and dairy products. "We are currently carrying out an extensive investigation into cost and practicalities of GM removal from animal feed for all parts of the supply chain."
Asda / Walmart	"We are aware of moves within the industry, and are working with partners in the industry to see what the opportunities and implications are for removing GM in animal feed" (25/11/99)	"Although it is difficult to commit to timescales and it will prove a challenge, ASDA is committed to removing GM from animal feed. We are working as fast as we can to introduce a range of dairy, meat, poultry and fish fed on non-GM animal feed which, most importantly, doesn't add cost to customers"
Safeway	expanding their organic range and also expanding non-GM options, but won't give specifics	a non-GM-fed chicken has now been introduced; otherwise only organic products.
Somerfield	"We have reviewed the position with regard to animal feedingstuffs with our suppliers and we are looking to see what options may be available for the future. With regard to the particular animals and animal feedstuffs then we believe it will be easier to make changes in some areas than others" (4/10/99)	"Our policy is to currently allow the use of genetically modified crops as animal feed subject to ongoing discussions with our suppliers... We have one supplier of products who is currently avoiding the use of genetically modified ingredients in animal feed"
Marks & Spencer	"In an extremely positive step, we have also become the first high street retailer to start removing genetically modified soya and maize ingredients from our animal feed." (10/9/99)	Free-range product lines use non-GM feed. "We have stated our intention to ensure that diets of our beef, lamb, pork, milk and poultry are non-GM. We are actively working with the feed industry and our suppliers to achieve this and would hope to have made good progress by the end of the year"

[7] reported in Greenpeace UK, Media briefing, 31/1/00, 'Sun Valley goes GM-free in animal feed', www.greenpeace.org/Multimedia/Live/FullReport/898.PDF
[8] all except Tesco (Aug 2000) from survey by Greenpeace UK, 25/9/00, reported in news release, 'Survey shows supermarkets stampeding out of GM-fed animal products', www.greenpeace.org/Multimedia/Live/FullReport/2358.PDF
[9] Martin Cooke (Strategic Technical Development Manager Fresh Food Division, Tesco Stores), 10/12/99, letter to Cargill, ADM, National Farmers Union and UKASTA
[10] Karen McDermott (Customer Service Manager, Tesco Stores Ltd), 12/10/00, pers.comm.
[11] 72% - C James, 1999, 'Global Review of Commercialized Transgenic Crops: 1999', ISAAA Briefs No.12: Preview, pub. ISAAA (International Service for the Acquisition of Agri-biotech Applications) (Ithaca, NY), www.isaaa.org/Global%20Review%201999/briefs12cj.htm
[12] US Department of Agriculture (USDA) statistics, cited in United Soybean Board, SoyStats 1999 - soybean production, www.unitedsoybean.org/99soystats/page_34.htm; and USDA Foreign Agricultural Service, Feb 2000, World coarse grain production, consumption and stocks, www.fas.usda.gov/grain/circular/2000/00-02/cgra_tbl.pdf
[13] James, 1999, op.cit.11

From field to factory - Production, consumption and distribution of GM crops

At present almost three quarters of the world's genetically modified (GM) crop acreage is in the USA[11]. The USA is also by far the world's largest grower of both soya (48%) and maize (known in the USA as corn) (40%) as a whole[12] - the two biggest GMO cash crops. The USA is thus the most important country in production of GM crops.

We shall focus in this report on the US crops of soya and maize, which between them account for 64% of the global area planted to GM crops[13]. The piecharts below show that the majority of the crops is used in animal feed. (See pie chart opposite)

The US agricultural distribution system is geared towards handling maximum quantities of bulk, which give significant economies of scale. When a farmer harvests his crop, he will take the harvest to a local 'elevator' - a storage depot which accumulates goods from several farms until it has enough to be worth transporting (by truck, barge or train). These local elevators then deliver to larger elevators.

The crops may then either be processed in the States (for domestic use or export), or be exported as 'crude' grains / seeds / beans. [See also the Corporate Watch briefing on how the supply chain works - 'From test tube to tummy'].

Where does it go?

Chart 1 - US 1998 maize crop[14]

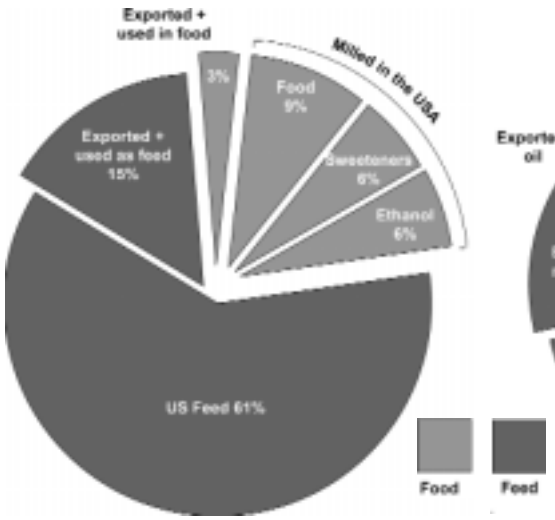
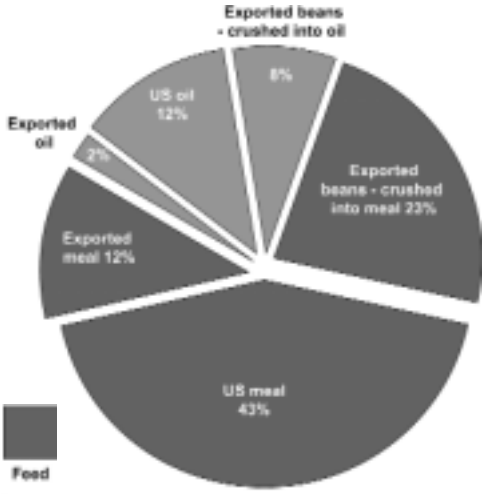


Chart 2 - US 1998 soya crop[15]



MAIZE: Feed may be fed either processed or unprocessed. The remainder is put through either wet milling or dry milling, producing food products, sweeteners (such as high-fructose corn syrup) and ethanol (which is used either in industry or in beverages). A further by-product of this process is corn gluten feed, which is fed to animals.

SOYA: The majority of the soyameal goes into animal feed, and the majority of the oil into human food. However, the food / feed distinction is less important in soya than in maize. With soya, meal and oil both come out of the same processing process. So if the entire market for oil switched to non-GM, meal would go with it (because both oil and meal would be coming from the same non-GM beans). However, moves in this direction are limited by the fact that oil doesn't contain protein / DNA (that is all contained in the meal), so it can't be detected (other than through monitoring supply channels) whether oil is from GM source or not. Much of the GM labelling legislation around the world has excluded oil produced from GM beans.

EXPORTS: By far the most important country for food use of soya protein is Japan, which accounts for 6% of the US crop[16]. A survey by Dow Jones in October 1999 found that 65% of Japanese food processors were planning to switch to non-GM grains[17]. Most of the USA's major export destinations for both soya and maize are quite strongly anti-GMO, or at least moving in that direction: Japan, Mexico, the EU, Korea. This relates mainly to food use, although there are the beginnings of a rejection of GM animal feed. Similarly, the USA is just beginning to reject GMOs in food use.

But since the markets for non-GM soya and maize are almost entirely the non-US food markets, they as yet are quite small (up to about 5% of the US crop), but have the potential to grow considerably bigger if the animal feeds market and the US food market switch to non-GM.

To the lay onlooker, it might seem that with strong market demand for non-GM products (especially in Europe and Asia), a sensible solution would be to separate GM produce from non-GM. It is here that one of the most important battles over 'first-generation[18] GM crops is taking place.

But before we explore this further, let us first introduce two concepts reflecting different ways of keeping non-GM crops separate from GM[19]:

• One option is **segregation**, which involves creating two entirely distinct distribution and marketing channels - using different storage silos, processing plants, trucks, ships etc. This is essentially how two different crops are kept apart (eg maize from soya). In this approach, the economics of the separate streams are independent, and prices are determined for each by supply of and demand for that product.

[14] based on FAPRI 1999 World Agricultural Outlook, cited in Bruce Babcock & John Beghin (Iowa State University economics department), 30/9/99, 'Potential market for non-GMO corn and soybeans', in Economic Perspectives on GMO Market Segregation, www.econ.iastate.edu/research/webpapers/NDN0060.pdf . We have ignored the change in stocks and seed saving, and looked just at the proportions of beans in use.

[15] FAPRI 1999 World Agricultural Outlook, ibid. That gives: domestic [ie US] meal 37%; domestic oil 10% (14.6% of this is exported); exported beans 27%; exported meal 10%; exported oil 2%; seed 6%; change in stocks 8%. Soya consists of 79% meal, 18% oil, 3% by-products [source: Allan Buckley (Wye College), Dec'98, 'Economics of identity preservation of GM crops', pub Food Biotechnology Communication Initiative]. However, these aren't exactly the proportions created in processing, as there are other products along the way, such as soya flour (which comes out before separation of oil and meal). You can certainly assume (from the export figures above) that most of the exported beans are milled, and at least 2/3 of this will make meal - so meal will be at least 37 + 10 + 18 = 65%.

[16] Robert Wisner (Dept of Economics, Iowa State University), 15/9/99, 'Evolution of the demand for non-GMO corn and soybeans', www.econ.iastate.edu/faculty/wisner/Wisner/Pages/gmomarci.pdf

[17] Nikkei newswire (Dow Jones), 31/10/99, 'Japan label rule to cause switch to non-GMO food'

[18] the first generation of GM crops has focused on 'input traits' such as herbicide-tolerance and insect-resistance ie qualities of GM seed which make it beneficial for the farmer / producer. We contrast this with the second generation which will focus on 'output traits' such as lower fat content, longer shelf life, higher vitamin content ie qualities of the end-product which are beneficial to the consumer. The science of input trait modification is simpler than that of output traits, so it is this form of GM which is in our food now; it will be some years before the second generation hits the supermarket shelves in a big way.

[19] note that these two terms are used differently by different

• The alternative is **identity preservation**, which is used to deal with crops for specialist markets - ie in relatively small quantities. This uses the existing infrastructure for the specialist crops, but cleans out storage, transportation and processing equipment in between uses for the bulk and specialist crops. Usually the specialist crop is containerised for export (rather than being carried in the ship's hold). The batch can be traced through the supply chain to ensure that that particular crop, with its particular qualities, reaches its market. The specialist crop (in this case, non-GM) incurs extra costs from cleaning and monitoring, and there are no economies of scale; distribution is thus necessarily more expensive than that of the bulk crop.

The differing costs of these two approaches are analysed in Appendix 2.

Force feeding - Cargill and ADM control the market

Two corporate giants - Cargill and ADM - dominate distribution and primary processing of crops. No sector of the food supply chain is more concentrated than this middle link, between farmer and food manufacturer.

Cargill is the largest privately-owned corporation in the world. Its interests range from supplying seeds to farmers, to receiving the harvests, to transport, processing, export, animal feed manufacture, rearing and processing animals for meat, and producing and marketing packaged food products, not to mention its consultancy, financial and professional services.

ADM is involved in these same stages of the supply chain, but with more of a focus on processing than Cargill. It is a smaller company than its rival, lacking both Cargill's sprawling interests in steel, salt, petroleum etc and Cargill's presence in Asia and Africa, but in its core commodities of soya and maize, and in the Americas and Europe, it matches Cargill in scale.

Cargill's and ADM's shares of the different stages of the supply chain are shown in detail in Appendix 3.

The elevator market (i.e. storage immediately after leaving the farm) in the USA is actually quite decentralised, with most facilities owned by small local companies, co-operatives and families. Thus Cargill only directly owns 10-13% of that market, and ADM a similar proportion. However, these local elevators sell on to larger elevators and primary processing plants, where Cargill and ADM have a far greater share. ADM is America's largest processor of soya and maize, and a major player in transporting the commodities across the country. In 1998/1999 Cargill vastly expanded its empire by buying out its second largest competitor, Continental Grain[20].

Export is the most concentrated of all, with Cargill accounting for 42% of US maize export volume and 31% of soyabeans. The top 3 companies, Cargill, ADM and Zen Noh, now control 81% of maize exports and 65% of soyabean exports[21].

With such a large share of world supply of the commodities passing through the hands of Cargill and ADM, the two companies have a substantial degree of control over whether that supply is genetically modified or not. In contrast to a farmer, who really has to accept the market as it is, Cargill and ADM have a large amount of influence over the nature and direction of the market. For example, Cargill has guaranteed that it will accept GMOs from the 2000 harvest: this announcement reassured farmers that they could sell what they planted, and so much of the crop is indeed GMO. Conversely, in 1999 when ADM called on suppliers to separate GM from non-GM harvests, the resulting uncertainty led farmers to decrease the amount of GM crops they planted, after four years of strong increase.

people - so our introduction here serves as a definition for our purposes.

[20] Continental Grain (now ContiGroup), press release, 8/7/99, 'Cargill to proceed with modified continental acquisition', www.contigroup.com/pr_1999_07_08.html

[21] GIPSA (Grain Inspection, Packers and Stockyards Administration, part of USDA) data, cited in table 4, Marvin Hayenga and Robert Wisner, January 1999, 'Cargill's Acquisition of Continental Grain's Grain Merchandising Business', Staff paper #312, Department of Economics, Iowa State University, www.econ.iastate.edu/outreach/agriculture/marketing/hayenga/ (figures for fiscal year 1998)

II - THE COMPANIES' RESPONSE

Arrogance Incorporated - Cargill refuses to segregate

Some companies within the food industry privately regard Cargill as the major block to ensuring GM-free ingredients[22]. Initially Cargill refused to supply non-GM crops at all. Under strong pressure from its food company customers, Cargill later began supplying non-GM, but through specialist identity-preserved channels. As a result, the economies of scale of commodity buying and bulk transport and storage are lost, so that non-GM crops are made more expensive than GM. The alternative - segregation - Cargill opposes outright, and quite vocally[23].

Cargill knows that consumers in Europe are reluctant to pay extra for their food to be non-GM. The company also believes that public concern over GMOs will calm down within a few years. Thus the company can weather the storm of the GMO controversy without giving ground on non-GM availability; all it needs to do is be patient. According to Dan Dye, Vice President of Cargill's North American Grain Group,

> *"The biotech debate has made the job … more challenging and more complex in the short term. But I believe the market ultimately will sort out the signals. We just need to keep our heads"*[24].

Brewster Kneen, Cargill's unofficial biographer, opens his ground-breaking 'Invisible Giant' with the observation "Patience is characteristic of the Cargill culture. As a private transnational corporation with very deep pockets, Cargill can not only afford to take a long view, it can make it a key strategic concept"[25].

Even after ADM asked its suppliers to keep their GM harvests separate (see below - p.9), Cargill maintained that non-GM supply was impossible for the 1999 harvest[26]. It later emerged that Cargill had supplied non-GM to some Japanese customers in 1999; and now the company openly advertises the availability of non-GM through its identity-preserved channels. This story lends further weight to the interpretation that Cargill wanted opponents of GM technology (especially in Europe) to believe there was no alternative.

In autumn 2000, Cargill launched its Innovasure brand of non-GM maize products. As its website (www.innovasure.com) shows, the system is very much one of identity preservation rather than segregation, and is very much targeted at a specialist niche market: crops are traced in individual batches from the farm to the final consumer; facilities are all cleaned in between batches. As the website boasts, "We go to excruciating lengths to ensure that the identity of our corn products remains intact from the time the seed is selected, until InnovaSure products arrive at your door". And, no doubt, excruciating costs too...

European food manufacturers have largely accepted the extra cost of non-GM, as in most products soya and maize make up only a tiny fraction of the ingredients (whether oil, lecithin, thickeners etc). Animal feed is different: feeds are heavily based on soya and maize and form a significant proportion of total input costs for rearing animals. Furthermore, margins are far tighter in meat production than in food processing. Now in the UK, supermarkets have mostly been unable to find affordable supplies of meat and dairy products produced using non-GM feed. Cargill can take much of the blame for this situation.

[22] Greenpeace UK, 31/1/00, op.cit.7
[23] Cargill plc, Oct '99, memorandum submitted to House of Commons Agriculture Select Committee (op.cit.6), para 27, www.parliament.the-stationery-office.co.uk/pa/cm199900/cmselect/cmagric/71/9113012.htm
[24] Speech by Dan Dye (Vice President North American Grain Group, Cargill Inc), 24/2/00, 'How grain shipping and processing firms are handling bioengineered products', www.cargill.com/today/speeches/00_02_14dye.htm
[25] Brewster Kneen, 1995, op.cit.2
[26] Reuters, 30/9/99, the Hague, interview - 'Non-GM soy supply unlikely this season', by Eric Onstad.

Credible Bulk? - Is Cargill's description of supply chain economics convincing?

Cargill argues that IP is a market-based solution, whereas segregation operates by external regulation, so the former is more likely to be effective and practicable. In its submission to the British House of Commons Agriculture Select Committee, the company wrote[27]:

> *"Segregation often appears to imply a separation of the normal bulk commodity flow, perhaps government imposed, which is not end-user specific. It suggests two or more supply chains in place, each with unspecified volumes, and with additional costs somehow integrated into both chains, without any clarity as to who bears such costs… A separation requirement would seem absurd for genetically modified crops which have been authorised as safe to consume".*

But this description of segregation doesn't stand up to scrutiny. Segregation is a market-based solution, in which GM soya and non-GM soya are treated as two distinct markets (and so are GM and non-GM maize); suppliers attempt to meet customer demand in each. In fact, under segregation the non-GM stream would become more responsive to the laws of supply and demand than through IP - as the economics would operate freely, rather than being tied to another commodity (GM or mixed crop).

Looking beneath the surface, Cargill is trying to argue two things here:

1) that the decision as to how to supply non-GM crops should be left to the likes of Cargill: that Cargill is a market player, so its method must be a market-based one, and anyone else's idea of the best method could only be achieved by an intervention in the operation of the market;

2) that large-scale handling of undifferentiated bulk commodities maximises economic efficiency, and segregating crops into GM and non-GM streams would increase prices for the consumer.

The fallacy in the first argument lies in neglecting Cargill's oligopolistic position. Cargill is not fully subject to economic forces, because it controls such a large share of the market - so its preference for identity preservation does not necessarily mean 'the market' prefers that solution. The second argument focuses only on the supply side of the equation (indeed it is true that economies of scale make it cheaper to produce in larger quantities), but ignores demand economics (that consumers make decisions based on what they want, as well as on price).

The Select Committee asked Cargill officers how it's possible to segregate maize from soya, for example, but not GM soya from non-GM soya. They argued that in the former case[28],

> *"they have a different functional use, whereas, for the soyabean market, whether genetically modified or not, the functional use is the same, and a large number of customers of those soyabeans will accept both because they have equivalent function, whereas some people are concerned, that they do not want genetically modified soyabeans, but it is only a part of the market".*

This concept of "functional use" is rather contrived. If Cargill were genuinely responsive to market forces, it would be more consistent for the company to treat two goods differently if there are separate markets for them (ie they have different equilibrium prices, and are wanted by different consumers), as in the case of GM and non-GM. This definition is not undermined by the two goods being substitutable by some consumers or for some uses - indeed, maize and soya are substitutable for each other in some animal feeds. PG Economics, an agricultural economics consultancy, points out that[29]:

[27] Cargill plc, op.cit.23
[28] Graham Secker (Managing Director of Cargill plc), 30/11/99, comments in witness examination by House of Commons Agriculture Select Committee (op.cit.6), para 146, www.parliament.the-stationery-office.co.uk/pa/cm199900/cmselect/cmagric/71/9113014.htm
[29] PG Economics, Oct '99, memorandum submitted to House of Commons Agriculture Select Committee (op.cit.6), www.parliament.the-stationery-office.co.uk/pa/cm199900/cmselect/cmagric/71/71ap08.htm

"there may be a tendency for those who are unconvinced of the need to undertake segregation to overstate the magnitude of the costs. This was evident in the case of herbicide resistant soyabeans where in 1997-98 the initial pronouncements of global traders and suppliers of soyabeans (mainly from North America) was that at first it was simply not possible to segregate. Later this changed so it was possible but extremely expensive and more recently in mid 1999 there can now be found large scale traders and crushers of soyabeans offering to supply segregated (non GM) soyabeans, if required".

Cargill's perverse economics are also illustrated by the fact that in 1999 and 2000, most of Cargill's elevators will accept GM maize varieties that have been given regulatory approval in the USA but not the EU[30], so cannot be exported. These varieties will obviously have to be kept separate (with cleaning of facilities after handling them). While segregation obviously incurs fewer costs if the produce stays in the USA rather than being exported, it will still incur *some* costs due to loss of economies of scale. So Cargill is prepared to handle *GM* crops at some extra cost, but when it comes to *non-GM*, the company claims it can only do what the market allows....

Profits and PR - ADM calls for separation

Like Cargill, ADM initially denied the possibility of supplying non-GM goods. Since then it has made some moves towards non-GM supply.

In spring 1999, ADM said it would pay a premium price for harvests of DuPont's STS soyabeans, which are not genetically modified[31]. Then in April 1999, ADM and fellow processor AE Staley announced that they would not accept GM maize varieties not yet approved for sale in the European Union (EU)[32]. A few farmer organisations commented that this sent the wrong signals, but it only affected an estimated 3-7% of the maize crop[33]. Most analysts and said the move was expected, and it was very clearly motivated by marketability, rather than casting doubt on the technology as a whole. 25% of ADM's sales are in Europe[34], so the company did not want to risk this market. Cargill did not follow the move[35].

ADM gave the industry a far bigger shake-up on 31st August 1999, when it asked its suppliers to separate GM from non-GM harvests. It explained:

"While ADM remains supportive of the science and safety of both biotech development and traditional plant breeding methods,... as a key link in the food system we must produce products that our customers will purchase. Some of our customers are requesting and making their purchases based upon the genetic origin of the crops used to manufacture their products. If we are unable to satisfy their requests, they do have alternative sources for their ingredients."[36]

This announcement had a significant influence on US farmers' decisions on what varieties to plant. The following year, the popularity of GM crops among US farmers started to fall for the first time. Prior to ADM's announcement, GM crops had achieved record speed for the uptake of a new technology. With farmers attracted by cost-saving and yield-boosting advantages from herbicide tolerance and insect resistance[37], by 1999 57% of soya planted in the USA was GM, and 33% of maize[38] (the crops were first introduced in 1996). In 2000 the proportions of GM fell to 52% for soya and 25% for maize.

There are three strategic reasons behind ADM's announcement:
• the immediate advantage is gaining market share in Asia, especially Japan. Japan is by far the largest market US soya, and is also a large market for US maize. When the Japanese government announced in April 2000 that from April 2001 suppliers would have to prove that GM foods met the Japanese Health Ministry's strict safety standards, Larry Cunningham, ADM's senior vice president for corporate affairs, said the ruling could create

[30] Cargill Inc, 7/12/99, position on biotechnology, posted on American Soybean Association website, www.oilseeds.org/asa/documents/cargill-1299.htm
[31] Decatur Herald & Review, 1/9/99, 'ADM asks suppliers to separate genetically altered crops', by Paul Brinkman, www.herald-review.com/03/adm0901-9.html
[32] Reuters, 15/4/99, 'ADM to avoid non-EU approved modified corn'
[33] Charles Hurburgh, 2000, 'The GMO controversy and grain handling for 2000', Iowa Grain Quality Initiative, Iowa State University, www.masoncitynet.com/farmexpo2000/pages/GMOGRAIN.HTM
[34] ADM 3rd quarter '98/'99 results, reported in Prompt, 1/5/99, Industries In Transition
[35] Its position is that farmers should warn Cargill elevators if they are going to deliver non-EU approved varieties, so that Cargill can find a domestic market for them. [Cargill Inc, 7/12/99, op.cit.30]
[36] Archer Daniels Midland Company, 31/8/99, 'ADM statement to suppliers regarding genetically enhanced crops', www.admworld.com/news/docs/137.htm
[37] The economic advantages of GMOs for farmers have been questioned in some recent studies; however, the technology remains popular with farmers, suggesting that there are significant gains in most cases. Some of the studies suggest that herbicide-resistant crops actually require a greater volume of herbicide than conventional varieties. See note 144
[38] USDA, National Agricultural Statistics Service, 31/3/00, Prospective Plantings - Farmer Reported Biotechnology Varieties, http://jan.mannlib.cornell.edu/reports/nassr/field/pcp-bbp/pspl0300.txt

opportunities for ADM: "We do have systems in place with a network of barges and grain elevators that we can segregate the different types of seed to satisfy their requirements"[39]. Even before it made the segregation announcement, ADM had a deal with Japanese trading house Marubeni Corp to supply non-GMO US soyabeans to Japanese food processors through a strict IP system[40];

• it is useful for ADM to expand its experience and expertise in segregated distribution channels and identity preservation, primarily for ADM's future niche in a food market where each crop needs to be separated into many varieties for different uses (see below - p.13);

• ADM may be concerned about the risk of suffering the same fate as Monsanto, in terms of being seen as a public villain; ADM has vegetarian food brands which could be impacted, and needs to be seen as progressive. Having under former CEO Dwayne Andreas' 30-year reign (see supplement) had no regular public relations agency or even internal staff, his replacement Allen Andreas has appointed a PR officer, and also an external agency (BSMG), to modernise ADM's image[41]. The company devotes much attention in its website and annual report to discussing how its operations benefit consumer choice, health, the environment and the world's poor and starving.

Despite the call for separation, ADM still accepts GMOs at all of its elevators[42]. It is not clear whether it is employing an identity-preservation (IP) type of approach to non-GM supply (ie only accepting non-GM crops at particular times) or whether it is a limited form of segregation (accepting non-GM only at its larger elevators, and putting them in different bins from GM - indeed, ADM does possess a number of large elevators). A full form of segregation would create lower add-on costs for non-GM than either of these approaches, but cost the company flexibility in terms of which farms it could source from, and possibly even lose it some of its suppliers. The IP approach is geared towards small levels of supply of non-GM, and uses the same mechanisms as ADM has used for several years for (non-GM) speciality crops (see below - p.15).

The industry has been constantly talking about ADM's announcement ever since, including in agricultural press, financial press and newspapers within the American corn belt, and in the statements of companies, analysts and agricultural consultants and academics. It seems perhaps the biggest impact of the statement was more psychological than economic: for the first time a big player strayed from the industry's united position of 'GMO=normal; non-GMO=expensive niche product', and talks about them as equal. And it woke up farmers to how big the issue is outside the US.

In January 2000, there were press reports that ADM had backtracked on its position. In fact however, ADM did not change its *policy*, rather it changed its public *opinion* (of the future success of first generation GM crops). It noted that less than 5% of its customers asked whether its product was genetically modified. ADM still asks its suppliers to keep GM and non-GM harvests separate[43]. Again, the impact was psychological - despite no actual concrete changes, ADM sent a message of reassurance to farmers.

The IP / segregation policy should not be seen as more than short-term opportunism. In the long-term, ADM is as committed as Cargill to the GMO project, and is investing significantly in developing a number of products and processes that depend on GM technology (see below - p.15).
Perhaps part of the reason for the January statement was that ADM had recognised the political impact of its previous announcement in affecting farmer confidence, and it wanted to reverse that.

At ADM's annual general meeting in 2000, a shareholder resolution calling on the company to stop accepting GM crops was strongly resisted, and only got 2% of the vote. Senior vice president Martin Andreas commented, "The problem is when you ask a company like ADM to stop using GMOs, it's like stopping progress"[44].

[39] Reuters, Chicago, 27/4/00, 'Japan GMO ruling not seen hurting US exports', by Julie Ingwersen
[40] Reuters, Tokyo, 15/7/99, 'Japan firms smell opportunity in non-GMO foods', by Aya Takada
[41] Decatur Herald-Review, 5/2/00; and PR Week (US), 10/7/00, p.9, 'Archer Daniels Midland taps BSMG for multimillion-dollar PR push', by John Frank
[42] Associated Press, 20/11/00, 'Farmers warned to be careful what type of corn they plant next season', by Jay Hughes
[43] Company chairman G. Allen Andreas told the Chicago Tribune that the company had reconsidered its September warning, and said to Reuters that he thought "the pendulum is beginning to turn back" on the controversy surrounding the crops. He also confirmed that ADM would not turn away GM grains [Reuters, Chicago, 28/1/00, 'ADM changes tack on genetically modified crops']. This was rather ambiguous, with no clear statement that it would not require separation - just that it had rethought its position. And the company had never suggested that it would not accept GMOs - only that it would keep them separate. The following month, ADM Vice President Lew Batchelder said, "ADM's export-oriented grain elevators will accept all commodities. ADM continues to believe in the segregation of grain in order to maximise its value" [Decatur Herald & Review, 'ADM still wants altered crops separated', 2/2/00, by Ron Ingram, www.herald-review.com/01/adm0202-0.html].
[44] Associated Press, 27/10/00, 'ADM votes to still take genetically modified crops'

III - CORPORATE GOALS AND STRATEGIES

Scale vs specialism - Cargill's and ADM's differing strategies

Cargill's whole way of operating is based around the handling of bulk goods, where crops from many farms are mixed throughout storage, processing and transport. The company is opposed to handling smaller quantities of more different products, as that would be less economically efficient. In the absence of premium prices, ADM too prefers a single stream for each crop, with the corresponding economies of scale. But ADM's calls for its suppliers to keep GM harvests separate show it to be far more opportunistic than Cargill: once a market incentive is there, ADM will take advantage of it.

This difference in approach to non-GM supply reflects more general structural and strategic differences between the two companies.

Cargill pursues a deliberate strategy focused on scale. Its activities may yield relatively small rates of return, but profits come from large sales volumes. Its size gives it an advantage over its competitors through four mechanisms:

1) economies of scale reduce costs of storage, transport and distribution;

2) by far outweighing its suppliers (farmers and small elevators) in economic power, Cargill is able to push down its purchase prices and dictate terms and conditions which suit it (monopsony);

3) by outweighing its customers (food processors, feed manufacturers, farmers etc) in economic power, Cargill is able to push up its selling price and dictate terms and conditions (monopoly);

4) by controlling a significant proportion of countries' food supplies (and indeed economies), Cargill is able to influence governments' laws, policies and programmes to its advantage.

Thus through sheer size, Cargill aims to gain economic and political power. By setting its profit-making in the long-term context, Cargill in effect becomes a political actor more than economic, in that its immediate, short-term behaviour is not governed by the laws of supply and demand. Thus it is able to resist current market pressures (ie economic forces) for non-GM supply, in an effort to achieve the long-term political aim of ensuring the success of the GMO project.

Traditionally, Cargill's culture is typical of the grain trading industry. Most of its competitors are also secretive, family-run private firms, who succeed by emphasising scale and exploiting their economic and political power. ADM too comes from this same culture, and is still certainly secretive, but it has gone through a process of 'modernisation' earlier than its rivals, and this head-start will give it an advantage now as they start to follow.

ADM is a cunning player, and uses brain to match Cargill's brawn. It was infamous for the political power it always wielded through the personal connections of Dwayne Andreas, who was chairman and CEO for over 30 years until 1997, and which enabled it to get extremely favourable subsidies, tax breaks and other government support [see ADM supplement]. However, he has been replaced now by his nephew Allen,

who is less well-connected, and has adopted a more innovative strategy. What's more, in 1995 ADM was discovered to have exploited its economic power in gross contradiction of competition law, by price-fixing, and was fined $100 million [see supplement]. Shareholder pressure resulting from this scandal also forced changes in the management style, moving away from the arrogant and closed approach of the past.

The emphasis now is on 'adding value', through processing crops into high-value products, or handling valuable products in small quantities, keeping them separate from lower-value goods. ADM is suited to being involved in specialist markets, where the volumes are smaller but the margins high. Thus while Cargill tends to play a long game, accumulating market power, ADM focuses on immediate short-term profitability.

In connection with these cultural / strategic differences between the two companies, there are a number of important structural differences:

• ADM's facilities are smaller but more numerous and more diverse than Cargill's, thus lending themselves to supplying small quantities of many distinct products. Cargill has 311 US grain-handling facilities[45], with 632 million bushels storage capacity[46]. ADM has 669 facilities[47] (far more than any other company), with 611m bushels capacity[48].

• ADM has more interests than Cargill in primary processing, reflecting a focus on profit mark-up. ADM is the largest soyabean crusher in the USA, with 39 plants[49], and 31% of output[50], and also the US' largest wet maize miller, and 3rd largest dry maize miller[51].

• ADM (turnover $14 billion) is a smaller company than Cargill (turnover $50 bn)[52]: it has a similar level of involvement in oilseeds and grains (and hence GM crops), but covers fewer other business areas. As a result, it cannot afford to sustain short-term losses in the way that Cargill can, being covered by its other income.

• ADM's shares are openly traded, so must produce a competitive short-term return, otherwise its shareholders will switch their capital to another company. Cargill is privately owned, so its shareholders are able to take a longer view.

While ADM aims to gain extra profitability from GMOs in the long-term, the emphasis on adding value also leads ADM to see opportunities now in selling non-GM crops at a premium (over GM crops) - hence the 1999 announcement to suppliers. Of course all companies need to maximise both their margins and their sales volume. But to some extent there is a trade-off between these two aims, and ADM emphasises the former, while Cargill emphasises the latter.

It should be noted that while (in the short-term) ADM treats non-GM demand as a higher-value market opportunity (much as it does high-oil corn for example), it does not have anything to gain from the whole market moving back to conventional crops, nor in the extra cost of conventional crops coming down. In either of these scenarios it would lose its opportunity for extra earnings. Thus, while it can benefit from a niche market in non-GM, it would like to see the size of that contained.

The longer game - Second generation GM crops

So far, almost all of the GM foods that have hit the supermarket shelves involve genetic modifications creating 'input traits', which give advantages to the growers - such as herbicide tolerance or insect resistance.

[45] Hayenga and Wisner, op. cit.21 (see Appendix 3)
[46] ibid (see Appendix 3)
[47] ibid, citing Milling & Baking News
[48] DW Larson, PW Gallagher, RP Dahl (Ohio State University) (eds), Structural Change and Performance of the US Grain Marketing Industry, 1998; and Grain & Milling Annual 1999 (pub. Milling & Baking News), pp.21-22; both cited in Hayenga and Wisner, ibid
[49] Financial Times 1/3/00, 'ADM to cut soybean crush on poor margins'
[50] Forbes, 17/11/97, 'Vindication', by Bruce Upbin, www.forbes.com/forbes/1997/1117/6011052a_2.html
[51] National Farmers Union, 20/10/99, Testimony prepared for the House Judiciary Committee Hearing on Concentration, www.house.gov/judiciary/nfu1020.htm
[52] 1998/99 figures, Hoovers Online company capsules, www.hoovers.com/co/capsule/4/0,2163,10124,00.html (Archer Daniels Midland) and www.hoovers.com/co/capsule/9/0,2163,40079,00.html (Cargill)

Over the next few years we will see a second generation of GM crops, which will have 'output traits' - ie advantages to the consumer or food manufacturer (as opposed to the producer / farmer advantages of the current generation). Functional foods, one element of the second generation, will have built-in nutritional or flavour characteristics, and the industry hopes these will win it public acceptance of GM technology. In 10 years' time, according to the GMO vision, there will be a wide range of GM varieties of each crop, all with different consumer-beneficial output traits, to meet different markets, and all being sold for a premium.

The commodity system faces major restructuring to deal with these changes. This trend toward fragmentation of distribution streams is one of the major reasons behind Cargill's takeover of rival distributor Continental Grain in 1999, as it gave Cargill more flexibility through owning a greater number of handling facilities. Continental's infrastructure was well-suited to handling specialist crops, and already had identity-preserved contracts for high-oil maize, which involved separating the different varieties.

In many ways the trend towards smaller-volume specialist crops suits ADM far better than Cargill. Cargill has had to evolve structurally (such as through the Continental acquisition) and think creatively about how to use the changes, whereas for ADM the structures were already in place. But both companies have developed strategies for participating in the second generation, in line with their differing corporate cultures - Cargill to enhance its control over the supply chain; ADM to increase its margins.

Soy story - Cargill's vision of a GM future

Cargill's most direct involvement in GM technology is in Renessen, a joint venture with Monsanto, formed in May 1998, to develop crops specifically designed for 'improved' animal feeds. Renessen's first GM products will appear in 2003, and include maize, soya and wheat with enhanced animal nutrition characteristics (eg improved proteins, or oil nutrition altered to help animals more effectively convert feed to energy) and products designed to increase the processor's profitability (eg designed to increase milling efficiency, or with added constituents to reduce the need for feed supplements). Renessen has headquarters in Chicago, and works in Argentina, UK, Singapore, Missouri, California, and Minnesota[53]. It currently has 50 employees, plus 130 scientists, mostly at Monsanto, working on adding the new traits to crops[54].

Cargill operates at every stage of the agricultural food supply chain, from seed to packaged end product. It is this vertical integration, together with its vision of contract farming, which explains its extreme keenness for GMOs. For example[55]:

- A grain farmer buys all his inputs as a 'package', including seeds from Renessen, Monsanto's herbicide and Cargill's fertiliser. He signs a contract, which determines the growing and handling conditions, to deliver the produce to Cargill at a specified price and quality;
- the farmer sells the harvest to a Cargill elevator (storage facility);
- Cargill processes the harvest into animal feed;
- Cargill ships the animal feed to Thailand;
- there it is fed to poultry, by a farmer under contract to Cargill (as with the grain farmer);

[53] www.renessen.com; and Monsanto Annual Report 1998, www.monsanto.com/monsanto/investor/report/98/build/default.htm

[54] Information Systems for Biotechnology, August 2000, ISB News Report, ' "New" Cargill remains committed to biotech', by Tracey Sayler, www.nbiap.vt.edu/news/2000/news00.aug.html#aug0006

[55] see e.g. speech by Ernest Micek (then Cargill chairman), 18/5/99, 'Preserving the environment and raising living standards through an open food system', www.cargill.com/today/speeches/micek3.htm; and also Economist 25/3/00, 'SURVEY - Growing pains'

• Cargill buys the poultry and processes, cooks and packages it;

• Cargill ships the packaged product to Europe, and sells it to McDonald's or a supermarket.

The above model reduces the farmer to a simple contract worker, while Cargill has all the control. Furthermore, because Cargill has enormous market power, with many farmers competing to sell it their harvests, it is able to squeeze their margins, while protecting its own profits, and to ensure that the terms of the contract suit its own interests.

The GMO will fit into this model well: a seed genetically modified first so that it works with (and only with) Monsanto pesticide and Cargill fertiliser, and modified secondly so that it contains all the vitamins, proteins, nutrients and antibiotics necessary for poultry feed, to Cargill's precise specifications (although Renessen will also supply other animal feed producers). On top of this, GM grain behaves more predictably, so is easier to grow, easier to handle and easier to store (Cargill's main interest is to handle vast amounts of commodities as simply as possible). GMOs are lower in production costs, have improved product functionality, and hand over more control to Cargill.

This is agribusiness paradise....

As an indication of the importance of GM to Cargill, one of its board members is president for biosciences (held by Robert Parmelee)[56]. To monitor and help determine Cargill's role in the biotechnology revolution, Cargill's former Chairman Ernest Micek appointed a Biotechnology Quality task force headed by Research Director Austen Cargill. One of the task force's roles, according to the company is "to explore biotechnology opportunities that would raise living standards and help Cargill to change the world"[57].

To put it in Cargill's words:

> *"Few corporations will feel more fallout from this [biotech] revolution than Cargill, a company that is virtually unique in covering every aspect of agriculture from developing seed to processing consumer-ready food products - and doing it on a global basis.… Biotech companies don't work directly with the big food companies around the world. We do. We can help marry the technology with what customers want.… Of any of the companies that are equipped to be good stewards of biotechnology, Cargill is in the best position."*[58]

The giant and its bean talk - Cargill's GM spin

Cargill's position statement on biotechnology states:

> *"genetically enhanced crops … offer many benefits to farmers, the environment and consumers - and we have just begun to scratch the surface of this promising new technology. We plan to work with farmers and our food and feed customers to bring more of those benefits to market"*[59].

The ag-biotech industry is not known for its honesty and straight talking, and Cargill is no exception. But when it comes to the finer points, on Cargill's relationship with farmers and consumers, the spin is so opposed to the reality that one wonders if the company is actually being deliberately ironic:

[56] Cargill Inc, website, 'Management' - corporate officers and elected officers, www.cargill.com/about/manage.htm
[57] Cargill News International, Genetic engineering pt.4, www.cargill.com/today/gmo4.htm
[58] Cargill News International, Genetic engineering pt.1, www.cargill.com/today/comp1.htm
[59] Cargill Inc, 8/12/99, position on biotechnology, www.cargill.com/today/releases/biotechnology2.htm

• Randy Jeppson, Cargill's general manager of worldwide seed, said, "If consumers and our customers know the facts, they'll demand these products. Ultimately the customer makes the decision"[60].

• According to Linda Thrane, Cargill's manager of corporate and public relations, Cargill's position on GM crops has been to "go to bat" for American farmers[61]. And executive vice president Fritz Corrigan adds, "Cargill has supported farmers' desires to plant and market genetically enhanced crops since the first enhanced soybean and corn [maize] varieties were approved and commercialized in the United States in 1996"[62].

In reality, Cargill has used its extreme market power to ensure that the market is GM, against consumer opinion. This is illustrated by another remark by Corrigan: "Our position is that we'll find a market for whatever is grown"[63] - note that he did not say the converse, that Cargill would find a source for whatever consumers demand. And the greatest victim of the GMO controversy - and in particular of Cargill and ADM's positions on it - has been the farmer. According to Gary Goldberg, CEO of the American Corn Growers Association, "As a result of exporter arrogance to ship GMOs, American farmers have lost over one billion dollars in lost sales... The big loser in this fight to save the biotechnology industry is domestic grain producers [ie farmers] who are seeing their exports drop to next to nothing"[64]. For Cargill to claim that its position is driven by consumer and farmer choice adds insult to injury.

Cargill's understanding and presentation of biotech issues is clearly appreciated by the rest of the industry: in September 2000, Linda Thrane was appointed executive director of the Council for Biotechnology Information in Washington DC, representing Aventis, BASF, Bayer, Dow, DuPont, Monsanto, Syngenta, the Biotechnology Industry Association (BIO) and the American Crop Protection Association. The Council has a $50 million budget next year to try to win over public opinion for GM food and crops[65].

Cargill has now joined the rest of the biotech industry in its strategy of creating doubt about the safety of organic foods. In May 2000, then chairman Ernest Micek said, "There is some evidence that food grown organically is not as healthy as food grown using conventional, high-yield agriculture, including biotechnology"[66].

Brain vs brawn - ADM's interest in GMOs:

ADM says on its website:

> *"Biotechnology [is] all for the purpose of creating the improved, more useful hybrids of the future. And since improved hybrids will mean more food and better food, it's clear that the mission of biotechnology fits in perfectly with our own."*[67]

The company notes that "as biotechnology companies develop more seeds that are genetically modified for specific trait advantages, ADM is in a pre-eminent position to capture a large share of this potential market growth"[68]. ADM has a large number of facilities (for both storage and processing) relative to the volume it handles, to deal with these new varieties. Specially designed crops present both new "value-adding" opportunities (in what can be created from crops) and new cost-saving production methods for processors. ADM is the USA's largest primary processor of crops.

Already ADM claims to be the world leader in distribution of (non-GM) speciality grains, such as food soyabeans, speciality barley and food grade yellow corn[69]. Growmark, the huge US farmer co-operative which has a partnership with ADM, is also encouraging its members to grow speciality products[70].

[60] Cargill, op.cit.58
[61] AgWeek (www.agweek.com), 27/12/99, 'Genetically Enhanced Crops Give Food for Thought', by Brian Rustebakke.
[62] Dan Dye, 24/2/00, speech to Agricultural Outlook Forum 2000, 'How grain shipping and processing firms are handling bioengineered products', www.cargill.com/today/speeches/00_02_14dye.htm
[63] 'Promoting sustainable development', speech by FW Corrigan to Goldman Sachs investors conference, New York, 17/2/00, www.cargill.com/today/speeches/00_02_17corrigan.htm
[64] American Corn Growers' Association, news release, 13/3/00, 'Corn growers question need to sacrifice export markets due to genetically modified crops', www.acga.org/news/2000/031300.htm
[65] Associated Press, 22/9/00, 'Cargill exec to lead campaign for genetically modified foods'
[66] Reuters, 16/5/00, 'Organic food may be more risky than biofoods - Cargill', by Julie Vorman, available on website of Western Crop Protection Association, www.wcpa.org/html/na60200n.htm
[67] Archer Daniels Midland website, 'Technology', www.admworld.com/home/tech.htm
[68] Archer Daniels Midland Annual Report, 1998, p.17
[69] ibid
[70] Lakeland FS Inc, website, 'What's New - Biotech adds value to farm commodities', www.lakelandfs.com/WhatsNew/biotech.htm

Development is nearing completion of a new GM maize variety, which ADM will process to produce isoleucine, an important amino acid for animal feedsl[71]. ADM is also involved in developing nutraceuticals (medicines and nutritional supplements) from soya oil, which in the future will be increasingly produced using GM technology. A GM variety of maize has been developed from which ADM extracts biotin, a B-vitamin used in the treatment of diabetes and brittle nails. In July 2000, ADM, biotech company Aventis, chemical company SKW Trostberg and life sciences merchant bank Burrill & Co jointly set up a $30 million venture capital fund, the Burrill Nutraceuticals Capital Fund, to provide start-up companies with funds "to fully exploit the application of novel, bio-based technologies"[72].

ADM's vice president (technology), Paul Caswell, is chair of the board of the New Uses Council, an industry grouping which promotes industrial and non-food uses of agricultural crops[73]. ADM for example produces plant-based lubricants, plastics and biodiesel. Genetic modification is a key technology in creating new crop varieties containing the required constituents in larger quantities which can easily be isolated[74].

Enter the supporting cast - Smaller grain companies

While Cargill and ADM control the majority of the market, there are a number of other players with significant market shares, such as ConAgra, Zen Noh, Bunge and Cenex Harvest States.

(For comparison:
Cargill 1999 turnover $50 bn; profit $597m; employees 84,000[75];
ADM 1999 turnover $14 bn; profit $266m; employees 23,603[76])

ConAgra

(2000 turnover: $25.4 bn; profit: $413m; 1999 employees: 80,000[77])
ConAgra is a giant in the food industry. Like Cargill, it is vertically integrated through the food supply chain, with interests ranging from fertiliser and seed, through grain processing and distribution, to meat, to food manufacture. In the USA it has larger operations than Cargill or ADM (although smaller globally), but unlike them a significant proportion of its business is in brand-name food manufacture. It has over 198 million bushels of grain storage capacity at its handling facilities in the USA (2% of the total, and the third largest share, after Cargill and ADM)[78]. ConAgra controls 7% of US grain exports[79]. (See appendix 3 for comparison with Cargill and ADM).

Biotechnology is a major element of ConAgra's strategy, announced as part of a strategic overhaul of the company in June 1998[80]. ConAgra's biotech-related activities include sale of GM seed, and matching crop protection products[81], and distribution / marketing of GM crops[82]. It didn't reply to a Friends of the Earth Europe survey of food companies' policies on GMOs in 2000[83].

ConAgra bought all varieties of maize in 1999 and expects to do the same in 2000. According to John Jacobson, vice president of the grain division, "We have no difficulty finding markets, and it's safe to say our competitors have no difficulty finding a market, either.... We don't see a big growth in demand for nonbiotech crops."[84]

In June 1996, ConAgra signed a marketing agreement with Monsanto, in which it agreed to accept varieties of GM maize not approved for export, to keep them separate from export grains, and to find markets for them in the USA, all at no extra cost.

[71] Paul Caswell (Vice President - Technology), 1999. 'New uses from existing crops', pp. 70-73. in: J. Janick (ed.), Perspectives on new crops and new uses, pub. ASHS Press (Alexandria, VA), www.hort.purdue.edu/newcrop/proceedings1999/v4-070.html
[72] Chemical Business Newsbase, press releases, 31/7/00, 'Aventis CropScience, Archer Daniels Midland and SKW Trostberg invest in the Burrill Nutraceuticals Capital Fund'
[73] New Uses Council Inc, website, 2000 Board of Directors, http://newuses.org/EG/EG-20/NUCBoard00.html
[74] Caswell, 1999, op.cit.71
[75] Hoovers Online company capsule - Cargill, www.hoovers.com/co/capsule/9/0,2163,40079,00.html
[76] Hoovers Online company capsule - Archer Daniels Midland, www.hoovers.com/co/capsule/4/0,2163,10124,00.html
[77] Hoovers Online company capsule - ConAgra Foods, www.hoovers.com/co/capsule/8/0,2163,10388,00.html
[78] Hayenga and Wisner, op.cit.21, citing Structural Change and Performance of the U.S. Grain Marketing Industry; Milling and Baking News Grain and Milling Annual, 1999, pp. 21-22; Cargill
[79] GIPSA data, cited in table 5, Hayenga & Wisner, op.cit. 21
[80] ConAgra press release, 29/6/98, 'Agri-products leader to focus on international business and biotech'
[81] ConAgra, Annual Report, 1998, business review
[82] ConAgra, press release, 3/6/99, 'ConAgra to accept biotech corn'
[83] FoEE (Friends of the Earth Europe) press release, 8/3/00, 'European food manufacturers shun GMOs but consumers urged to keep up the pressure', on M2 Presswire
[84] UMI , Successful Farming (Iowa Edition), Jan 2000, 'Confronting the backlash'

After ADM's segregation announcement, ConAgra Chief Executive Bruce Rohde said ConAgra is still evolving its strategy on GMOs. He expects a drawn-out debate in the USA over the merits and risks. ConAgra began working with maize producers this summer to try to segregate GMO grain, even though he said, "there is a real question about whether anybody has the technology to check every kernel. Still, if you don't segregate it, you can't market to get the cost benefit out of it"[85].

Thus although so far it has favoured biotech as much as ADM and Cargill, ConAgra is clearly keeping its options open. The strongest evidence of this is that in October 1999 ConAgra bought up a number of internet domain names which included both pro-GM names such as gminfo.com and gefoods.net and anti-GM names such as no-gmo.com and bt-free.com. None of these is in use as yet. Karen Savinski, ConAgra's Director of Corporate Relations, said, "As a food company we consider ourselves responsible for safe food, food choices and educating our consumers. Owning a site such as [no-gmo.com] could play into our future plans."[86].

Zen-Noh

(1995 turnover Y6,300 bn ~ US$ 57 bn; employees 3,560[87])
Zen-Noh is the Japanese National Federation of Agricultural Cooperative Associations. It serves farmers through 2,382 primary-level agricultural cooperatives and 61 federations, and both supplies inputs to farmers and markets and distributes their products[88].

It has export facilities in the USA, where it is the third largest exporter of both maize and soya in the USA, after Cargill and ADM[89]. Its sole role in the USA is to export to its farmer members in Japan, largely for feed.

While the Japanese human food market has shifted strongly to non-GM, animal feed has less so. However, Zen-Noh tends to prefer non-GM: it has threatened to stop sourcing maize from the USA if GMOs are not segregated[90], and has also warned Australian exporters about the introduction of GM crops[91]. Zen-Noh has worked jointly with Aventis in Japan to develop oxadichlomefon, a rice herbicide, but this partnership does not extend to crop modifications[92].

Thus Zen-Noh segregates GM from non-GM crops, and supplies a greater proportion of non-GM than any of the other US traders.

Zen-Noh and Japanese trading house Itochu jointly own Consolidated Grain and Barge (CGB), which has 60 elevators. At least 60% of CGB's grain and oilseeds flow directly to Zen-Noh[93]. CGB was one of the first companies to develop segregation and identity preservation of speciality grains. When it comes to GMOs, the policy is mixed. On the one hand, CGB notes that "we know some importers have bought grain from non-US origins because they were uncertain about the GMOs in US commodity shipments. We encourage growers to recognise the risk of losing market opportunities if we do not respect the buyer's restrictions." CGB has some contracts for speciality non-GM crops, and refuses to accept StarLink maize. CGB called for farmers to separate non-GM crops, very shortly after ADM's similar announcement. On the other hand, CGB still accepts approved GMO varieties, and helps growers find markets for unapproved grain[94]. It employs a segregation approach, with some facilities used exclusively to store non-GM crops, although previously in 1999 it used IP, where GM and non-GM crops would be delivered to its facilities at different times or on different days[95].

Bunge

(1999 turnover: $10 bn; employees: 27,000[96]).

[85] Reuters, Omaha, 20/9/99, 'Conagra CEO sees brighter times ahead for ag'
[86] CropChoice News, 6/6/99, 'ConAgra Hedges its Bet on Biotech', www.cropchoice.com/leadstry.asp?recid=116
[87] Zen-Noh, Fact Book 1995-96, www1101.zennoh.or.jp/ENGLISH/ALACALTE/Fact3.htm Currency converted at interbank rate, 26/11/00
[88] ibid, www1101.zennoh.or.jp/ENGLISH/ALACALTE/Fact1.htm
[89] GIPSA data, cited in table 4, Hayenga & Wisner, op.cit.21
[90] Reuters, Monterey (California), 15/2/00, 'US farmers need to segregate GM grains - Japan firm'
[91] Australian Financial Review, 29/3/00, 'Export body allays fears over grain', by Ray Moynihan, p.9
[92] Japan Chemical Week, 26/10/00, 'Aventis CropScience Japan Targeting Y50 Bn in sales'
[93] Farm Journal, September 1997, 'Consolidated cultures', by Pam Henderson, www.cgb.com/FarmJournal.htm
[94] Consolidated Grain and Barge Co, GMO statement, 20/10/00 update, www.cgb.com/gmo.html
[95] Reuters, Tokyo, 7/9/00, 'Itochu to segregate non-GM food soybeans', and Farm Industry News, vol.33 no.4, 8/2/00, 'GMO-free zone?', by Joan Olson, at www.homefarm.com/archives/2000/fin/000208.htm
[96] Hoovers company capsule - Bunge, www.hoovers.com/co/capsule/8/0,2163,58878,00.html

Bunge is a vertically integrated company, sourcing agricultural products from North and South America. It has 170 million bushels of grain storage capacity, the 5th largest in the USA[97]. It is the largest dry maize miller in the US, the 3rd largest soyabean crusher[98], and the 4th largest grain exporter, with 4% of the market[99]. Bunge has sold off all its consumer food processing companies, except Santista Alimentos, which is a leading margarine producer[100].

It is a privately-owned, family company. According to Hoovers, "Commonly described as secretive, Bunge is held by more than 100 shareholders, mostly members of five families descended from Johann Peter Gottlieb Bunge, who founded Bunge & Co. in the Netherlands in 1818"[101].

Bunge sits on the fence in its GMO policy:

> *"Bunge Corporation does not have a specific opinion for or against GMOs. While cognizant of the potential direct and indirect long-term benefits that GMO technology may represent for growers, processors and consumers (lower production costs, enhanced environmental sustainability and improved product functionality), Bunge Corporation recognizes that consumer resistance in the near-term to the use of GMOs in certain markets both in the US and abroad may necessitate segregation for specific commodities…. Bunge remains committed to respond to the needs of growers, food processors and consumers and will undertake all practical and economically reasonable measures to assure that these needs are met. Bunge has adopted a strategy that devolves responsibility for handling GMOs to each operating division so as to effectively meet the demands of various markets"*[102].

This position is an example of the company's decentralised management style, on which it prides itself. Bunge has entered into joint operating and marketing agreements with Zen-Noh[103], which are likely to involve some non-GM grain and soyabeans.

Cenex Harvest States

(1999 turnover: $6.4 bn; profit: $86m; employees: 2,600[104])
Cenex Harvest States is a the second largest US agricultural cooperative with 325,000 farmer members, mainly in the Midwest and Northwest. It is looking to expand through consolidation. Its main businesses are grain trading and agricultural merchanting (supplying seed, fertiliser, fuel etc), and it also processes soyabeans into salad oils, margarine and animal feed[105]. It has 146 million bushels of grain storage capacity, the 6th largest in the USA[106]. The coop controls 3% of US ship loading of grain[107].

Cenex Harvest States has been a keen advocate of biotech crops, refuting activist and consumer concerns about their safety, and indeed arguing that they can help tackle disease[108]. It has lobbied the US government both for more research into biotechnology, and for less restrictions on trade in GM crops[109]. When Cenex merged with Harvest States, part of its mission was explicitly to "directly link the rapid advances in biotechnology to the end-user's specific need for identity-preserved grain with unique processing, nutritional or pharmaceutical value"[110]. Cenex Harvest States has a marketing relationship with Land O'Lakes and Farmland Industries which has been involved in sales of and research into GM maize, soyabeans, alfalfa, sunflower, rape and sugarbeet with herbicide tolerance, insect resistance or output traits[111].

The cooperative's message to its members is, "Plant what makes sense for you, and we will find a market for it"[112]. It handled a small amount of IP non-GM crops in 2000, but did not offer premia. Its main aim in operating the non-GM IP systems is to develop expertise for the coming second generation of GM crops, where there will be profits to be made in separating crops with different properties[113].

[97] Hayenga and Wisner, op.cit.78
[98] Hoovers, op.cit.96
[99] GIPSA-USDA figures, cited in table 5, Hayenga & Wisner, op.cit.21
[100] Hoovers, op.cit.96
[101] ibid
[102] Bunge Corporation, 4/2/00, statement on GMOs, www.bunge.com/000204.htm
[103] Bunge Corporation, press release, 21/10/98, 'Bunge and Zen-Noh Grain enter into joint export operating and marketing agreements', www.bungecorp.com/981021.htm
[104] Hoovers company capsule - Cenex Harvest States, www.hoovers.com/co/capsule/8/0,2163,57218,00.html
[105] Hoovers company capsule - Cenex Harvest States, www.hoovers.com/co/capsule/8/0,2163,57218,00.html
[106] Hayenga and Wisner, op.cit.78
[107] GIPSA figures, cited in table 5, Hayenga & Wisner, op.cit.21
[108] Salt Lake Tribune, 27/2/00, 'Consumers wary of gene-altered crops, farmers told'
[109] Cenex Harvest States, 1999 annual meeting, adopted resolutions on farm policy (www.cenexharveststates.com/aboutus/99res-16.html) and on agriculture and food trade (www.cenexharveststates.com/aboutus/99res-17.html)
[110] Cenex Harvest States, Annual Report 1998 - Board and Management Report, 'Growing value - today and tomorrow', www.cenexharveststates.com/news/annualreport-bmr.html
[111] Cenex Harvest States, website, 'About us', www.cenexharveststates.com/aboutus/factsheet2.html
[112] Minneapolis Star Tribune, 18/1/00, 'Ag giant tries to calm market beset with GMO fears', on www.agweek.com/docs/0117/118cargill.htm
[113] Farm Industry News, 8/2/00, op.cit.95

IV - FUTURE OUTLOOK

Think again - Will the grain traders extend their non-GM supply?

The extent (and method) of non-GM supply for each of the grain traders will be influenced by the economics, although to differing degrees. First, on the demand side, the three major factors which will affect decisions on degree of non-GM supply are:

(i) size of markets for non-GM vs GM;

(ii) relative prices for which GM and non-GM goods can be sold;

(iii) expectation of future size of markets and prices.

Since non-US human food markets for soya and maize are relatively small (see above - p.5), the most significant changes in demand for non-GM would be in animal feed usage (in Europe and elsewhere), and in the US market (in food and feed).

Second, supply-side economics are explored below. Third, the companies will be influenced by what their rivals do, as none wants to lose market share. If eventually the non-GM market does get large enough, there will be an obvious strategic advantage to whichever company prepares itself first.

Cargill

Cargill is the least influenced by economics. It has decided that non-GM is a niche market, which can be serviced through specialised (and more expensive) identity-preserved distribution channels; this greater cost ensures that demand for non-GM remains small. In other words, Cargill is less susceptible to immediate market forces, and chooses instead to pursue the longer-term goals of undermining public resistance to GM technology.

However, there are limits to its ability to do this. For example, as the market for non-GM food grew, Cargill was forced to retreat from its initial position (that non-GM supply was impossible). And the more the non-GM market does grow, the more concessions Cargill will be forced to make.

Several Cargill businesses have been forced by market demand to switch to non-GM crops. For example, Cargill's UK poultry subsidiary Sun Valley has switched to using non-GM feed well ahead of its competitors[114]. While this has sent out entirely the wrong political message for Cargill, Sun Valley had no choice because its customers - including McDonald's, Marks & Spencer and Iceland, were asking for non-GM-fed chicken, and Sun Valley could not afford to their custom.

As further examples, during summer 2000 Cargill will crush 70-80,000 tonnes of non-GM soyabeans from Brazil in the Netherlands[115]. Another Cargill subsidiary, Illinois Cereal Mills, is increasing its contracts for non-GMO crops, as it supplies maize to Kellogg's and Frito Lay, both of which require non-GM[116]. In late 1999, Cargill Soja France announced it was considering an identity-preserved system. Shortly afterwards, Cargill announced that this may be extended Europe-wide[117]. Cargill supplies clients in Britain with non-GM maize products from France, such as glucose, starch and maize oil[118].

[114] For more on Sun Valley's position, see Greenpeace, op.cit.7
[115] Reuters, Amsterdam, 4/4/00, 'Interview-Cargill Europe gears up to crush non-GM soy', by Eric Onstad
[116] Guardian, 2/2/00 (the longer original version of the same article appeared in January in the Chicago Tribune); and Merrill Lynch, 13/3/00, Monthly Fertilizer Focus
[117] Reuters, 1/12/99, 'Cargill eyeing non-GM soy for European customers', at www.connectotel.com/gmfood/re011299.txt
[118] ibid

ADM

As we have noted, ADM is more responsive than Cargill to opportunities to enhance profitability. On the other hand, it does not want the premium price for handling non-GM to disappear; and it certainly does not want the general, long-term acceptance of GM technology to be undermined. It is treading a fine path here, and risks opening the floodgates to non-GM. If that did happen, ADM might supply non-GM for the remainder of the first generation of GM crops, and hope that public opinion is won back by the second generation.

Other players

It is the smaller grain traders which are most responsive to economic opportunities to supply non-GM crops. Zen-Noh already employs a segregation approach in some areas. And while Cenex Harvest States seems committed to GMOs, the balance of power is held by Bunge and ConAgra. They might see a niche in supplying non-GM crops more cheaply, in order to steal market share from Cargill and ADM. The US grain system suffers from large over-capacity, so most distributors have the facilities to increase the quantity they handle, if they can find a market for it.

The worm turns - The impact of the StarLink fiasco

In September 2000, the US food system was hit by one of the most significant events in the whole GMO debate. A coalition of campaign organisations found traces of the StarLink variety of maize in a brand of taco shells on sale in supermarkets. StarLink is approved only for use in animal feeds, due to concerns over potential allergenicity of the maize. Kraft, the makers of the original taco shell, was forced to recall it; as more foods were tested, eventually nearly 300 products were recalled. The problem was that Aventis, the developer of StarLink, and other seed companies selling StarLink under license, had not made it sufficiently clear to farmers that the crop had to be carefully segregated, to keep it out of the food supply. By the time the scandal was uncovered, harvest was well under way, and StarLink had been delivered to many elevators, and contaminated numerous foods.

A few weeks later, StarLink was found in shipments of maize arriving in Japan. There have been conflicting reports on whether there has been an impact on US maize exports. In mid-November, US Agriculture Secretary stated that US maize imports had suffered as a result of StarLink[119]. USDA data revealed that two major importers of US maize, Japan and South Korea, both decided to use different sources, for fear of StarLink contamination. But a Reuters report cited traders from the Chicago Board of Trade as saying that South Korea and other parts of Asia had reacted little, with the exception of Japanc[120]; Cargill and ADM claimed their Japanese sales were unaffected[121].

Cargill remained characteristically unphased by the issue. Said Cargill's Bob Kohlmeyer, "StarLink probably is not going to change US export prospects in any noticeable way. For people who want to buy corn, there really isn't much choice but to come to us"[122]. And certainly, the USA controls by far the majority of world maize trade.

AE Staley made the most radical announcement in response to the problem: "just as StarLink corn has changed our corn purchasing operation this year to, among other things, require testing, nothing can be assumed or taken for granted as seed choices are made for spring planting... The only truly safe seed selection will be seed corn free of any genetic modification"[123]. Staley is a subsidiary of British company Tate & Lyle, and is far smaller than Cargill or ADM. It was Staley that had been the first (in April 1999) to publicly announce that it would not take maize unapproved for marketing in Europe, followed immediately by ADM.

[119] Reuters, Washington, 16/11/00, 'USDA says US corn exports hurt by StarLink chaos'
[120] Reuters, Buenos Aires, 27/10/00, 'StarLink debacle, Spain may hike Argentine corn sales', by Robert Elliott
[121] Wall Street Journal, 30/10/00, 'Japan asks that imports of corn be StarLink-free', by Yumiko Ono & Scott Kilman
[122] Des Moines Register, 15/11/00, 'StarLink raises concerns of corn export losses', by George Anthan
[123] Associated Press, 20/11/00, 'Farmers warned to be careful what type of corn they plant next season', by Jay Hughes

This time, ADM did not follow. While it would not accept StarLink, it stated that it remained supportive of biotechnology. In fact, while ADM was one of the first hit by the problem - it co-owns Azteca Milling, which runs the mill in Texas from which maize for the first discovered Kraft taco shells was produced. Azteca's other co-owner, Mexican Gruma SA, also spent millions of dollars on recalling contaminated taco shells[124]. Gruma is 22% owned by ADM[125]. But ADM (also characteristically) saw opportunity in the crisis. Within three weeks of the first discovery of StarLink in food, ADM had employed dozens of extra staff to test harvests as they arrive at all its facilities, and it was the first company to achieve this. It will demand compensation from Aventis to cover its costs, estimated at tens of thousands of dollars a day[126], and failing that will sue Aventis[127]. But it also beat its competitors to supply guaranteed non-StarLink-contaminated maize to Japan, achieving this well before even USDA had its testing regime in place[128].

ConAgra was hit by StarLink contamination. Its only corn mill, in Kansas, was forced to close for a week in October for cleaning and testing, and in November it had to recall large quantities of baking ingredients (including bags of flour, grits, polenta, cornmeal and binders) from restaurants and institutions.

The whole StarLink problem has really undermined confidence in the agricultural distribution system. Following all the recalls, an opinion poll found 33% of Americans thought farmers should not be allowed to grow GM crops at all[129] - a massive swing in opinion. This feeling, combined with further fears of collapsing markets and of being turned away at elevators, may lead farmers to reduce their GMO plantings again next spring. And according to Bob Zelenka, executive director of the Minnesota Grain and Feed Association, the experience could set back identity preservation due to lack of trust[130].

Elevators too have been hit hard, with costs of up to tens of thousands of dollars, including testing and segregation costs, plus loss of markets and customers[131]. They too will hope to be reimbursed by Aventis; and the experience may push them towards non-GM supply in future.

How to do it - Options for non-GM supply

We have introduced the concepts of segregation and identity preservation (IP), as two different mechanisms for separating GM and non-GM crops. There is one other possible scenario: it is possible that some of the distributor companies could go even further, and turn their bulk commodity supply streams to exclusively non-GM (rather than having two separate streams).

So, in summary, there are three possible ways in which each company could supply non-GM, and each has its advantages and disadvantages for the company:

- **Identity preservation:** the company uses the same infrastructure for GM and non-GM varieties, with cleaning in-between; batches of a crop are traced through the supply chain, to preserve their identity.

- **Segregation:** the company uses two entirely separate sets of supply-chain infrastructure for each crop, one for GM and one for non-GM varieties, so no cleaning is required.

- **Non-GM bulk stream:** the company only has one set of infrastructure, through which is puts non-GM crops.

[124] Wall Street Journal, 3/11/00, 'Corn recall cost could reach into the hundreds of millions', by Sarah Lueck, Amy Merrick, Joel Millman & Stephen Moore
[125] Financial Times, 23/8/96, 'Mexico City: News Digest'
[126] Des Moines Register, 4/11/00, 'StarLink tests costly', by Jerry Perkins
[127] Wall Street Journal, 2/11/00, 'Biotech corn problems lead to recall of 300 products, disrupt farm belt', by Sarah Lueck & Scott Kilman
[128] Reuters, 7/11/00, 'US corn going to Japan - StarLink tests under way', by Bob Burgdorfer
[129] Reuters, Chicago, 3/11/00, 'Many Americans say stop planting gene-altered crops', by Brad Dorfman
[130] Feedstuffs, 6/11/00, 'Grain elevators, handlers caught in middle of StarLink confusion', by Sarah Muirhead
[131] ibid

Obviously, as the market for non-GM expands, options 2 and eventually 3 become more appealing to the companies. The economics of each are summarised below; for more detail, see Appendix 2.

Identity preservation

In the IP approach, all add-on costs (including cleaning, testing and management) are put on non-GM (as GM / mixed crops would not require cleaning or testing etc), and the main commodity system enjoys maximised economies of scale and flexibility - so companies are able to supply the bulk commodity at the most competitive price. This approach can add $0.27 - $0.61 per bushel to the post-farm gate cost of handling maize ($0.70 for unseparated commodity crop), and $0.51 - $0.94 to the cost of handling soyabeans ($1.60 for commodity crop)[132].

Segregation

Were it to occur, the effect of a shift from an IP-based system to a segregation-based system would be to reduce the consumer price differential between GM and non-GM crops. As Appendix 2 shows, extra post-farm gate costs of supplying non-GM are considerably lower for a segregation approach than for IP: $0.02 - 0.06 per bushel of maize, and $0.04 - 0.06 for soya (these costs are largely from testing).

The costs of cleaning equipment are removed, as is the supply chain rigidity currently incurred in avoiding commingling. In the segregation case, the 2 major factors differentiating cost of GM supply from non-GM would be:

(i) Farmer costs. While there is regional variation, farmers' growing costs are on the whole lower for GM than for non-GM crops; non-GM also carry some management or separation costs (see Appendix 1).

(ii) Processing and distribution costs. These are largely dependent on economies of scale, so obviously as the non-GM market grows, these differentials will be diminished. Add-on costs associated with loss of flexibility are shared between GM and non-GM; but both streams lose some flexibility, relative to the situation where the stream constitutes the bulk of supply. As the non-GM market grows, it gains greater economies of scale, so its cost comes down. As the GM and non-GM crops approach equal shares of the total market, their economies of scale equalise.

With a segregation system, the non-GM market would be allowed to grow freely, rather than being tied to the GM market. As the production of non-GM crops increases, their price will fall. (Meanwhile, GM crops will conversely increase in price).

Non-GM bulk stream

For a company to treat non-GM crops as its bulk stream would maximise economies of scale for non-GM supply - and any company that did this would be able to supply non-GM more cheaply than its competitors. Where such a company would lose out however would be that it couldn't accept harvests from certain farmers who produce GM - and according to some analysts GMO approval is likely to become a competitive issue among grain handlers[133]. This loss of flexibility must be offset against any gains from the enhanced economies of scale.

Where next? - Moving towards segregation

The use of identity preserved supply streams is certainly on the increase, in response to growing demand for non-GM food.

George Henni, Cargill's Protein Manager for Europe, estimated that about 500,000 tonnes of non-GM soyabeans using strict IP systems were expected to be available worldwide in summer 2000 from Brazil, and up to 2 million tonnes from the United States in winter 2000/01[134] (out of total US soyabean exports of 20 - 25 million tonnes).

[132] From Appendix 2: spread opportunity costs range from $0.07 - 0.22; storage margin opportunity costs from $0.06 - 0.15; so total indirect costs (excluding grind margin opportunity costs) range from $0.13 - 0.37. Add these to direct costs of $0.14 - 0.24 for maize; and $0.38 - 0.57 for soya.

[133] Hurburgh, op.cit.33

One block to separation of non-GM in 1999 was confusion over testing procedures and tolerance standards[135]. Cheap test kits have now become widely available, and the US Agriculture Department has said it will open a special laboratory in its Kansas City office to evaluate and standardise the procedures[136].

As we have shown, companies like ADM and Cargill are quite determined to supply the non-GM market using identity preservation, rather than segregating the supply channels. As long as the demand for non-GM remains only for the human food market, which uses relatively small quantities of soya and maize, this will continue to be the case. But the industry acknowledges that if the animal feed market also goes non-GM it may not be possible[137].

According to PG Economics, an agricultural consultancy, "it is highly likely that to make [separation of GMOs] practicable, some degree of specialisation of growing, storage and processing facilities will develop—either within or between firms and between regions. Thus particular plants (maybe at particular times) may only accept GM or non-modified crops"[138]. In Canada too, agricultural analysts believe eventual segregation is inevitable[139].

Indeed, segregation has now started to be applied. A survey of the 2000 harvest, commissioned by seed company Pioneer Hi-Bred, found that 12% of elevators would not accept GM soya, and 20% would not accept GM maize[140]. In other words, these elevators are being dedicated to non-GM (a clear segregation approach). A later survey, by the American Corn Growers Foundation, found that 42% of elevators require on-farm separation, and 31% separation at the elevator gate[141] - some of these will be employing segregation (using separate facilities within the elevator for GM and non-GM), although the majority will be IP (using the same facilities, and cleaning in-between). [see appendix 2]

Japanese customers are prepared to pay a premium price for non-GM crops [see appendix 2] - and this could be what shifts the strategic position. At present, the Japanese non-GM market is showing strong growth; the human food market is significant (unlike Europe), due to consumption of tofu and other soya products, and there are some signs of animal feeds shifting too. What's more, the Tokyo Grain Exchange this year started trading in non-GM soyabeans, a move which gives non-GM a large degree of price independence from GM. As the Japanese market grows, the economics can only favour further segregation, as against IP. Once a segregation system is in place for supply to Japan, it becomes easier to expand this to meet European demand, rather than having to make the (costly and risky) first step.

There may still be a problem with short-term pricing of non-GM crops, which could undermine growth in demand. If the current increase in demand for non-GM coincides with a decrease in available supply (as more countries licence the growing of GM varieties), the relative price of non-GM could be pushed higher. In this scenario, ADM's and Cargill's strategy of refusing to offer non-GM crops other than as expensive IP specialist products could succeed in killing the demand.

But much depends on what the big traders say. A survey by the American Corn Growers Association in June 2000 found that 64% of farmers said their decisions on how much GMO corn to plant would be influenced if the grain industry requires segregation[142].

On the other hand, there have been efforts by the big biotech interests to reassure the American agricultural market. Seed companies such as Monsanto are obviously committed to the success of GMOs, and they can have a significant influence on farmers by dropping the price of GM seed, or offering better terms.

[134] Reuters, 4/4/00, op.cit.115
[135] Chicago Tribune, 31/10/99 'Farmers Face Harvest Headache Segregating Gene-Altered Crops',
[136] Reuters, Washington, 12/11/99, 'USDA to set testing standards for biotech crops'
[137] see eg Chemical Week, 15/12/99, 'Biotech battle - Waging a war for public approval'
[138] PG Economics, Oct '99, op.cit.29
[139] Globe And Mail (Toronto) 10/01/00, 'Farmers face a growing problem', by Heather Scoffield
[140] Survey of 1,200 elevators throughout the corn belt. Over 78% do not sell grain overseas. Pioneer Hi-Bred International, 'Elevator biotech grain acceptance survey - 2000', at www.pioneer.com/usa/biotech/asta/accept_survey.htm
[141] Survey of 1100 elevators in 9 states. CropChoice, 5/10/00, 'Corn Growers: Elevators Demanding Segregation', www.cropchoice.com/leadstry.asp?recid=180
[142] Survey of 500 farmers in 15 states. Error margin +/- 4.5%. ACGA news release, 22/6/00, 'Corn growers commission new national survey on genetically modified crops', www.acga.org/news/2000/062200.htm

Perhaps the most important factor is the competitive dynamic between the grain traders, especially from the smaller players - ie the advantage of selling non-GM more cheaply, by using segregation.

Thus there are many factors at play. What is clear is that for campaigners to have any hope of defeating GM, they have to win the animal feeds market, and at least part of the US food and feed market. If this is combined with some of the other factors we have discussed going in campaigners' favour, we could see a move from IP into segregation in one or more of the companies, and if that happens, competition will force other companies to follow.

What? You mean we could win? - The end of GM crops

The first generation of GMOs (herbicide tolerance, insect resistance) is all about modifications to give benefits (mainly increased profitability) to farmers, rather than to consumers. In the absence of any perceived benefit to the consumer (and with many consumers actively avoiding them), GM foods will only sell if they are the same price as - or cheaper than - non-GM. In other words, if the price of GM were to exceed that of non-GM, it would be the end for first generation GM crops.

The discussion above attempts to show how as markets for non-GM increase; and as distribution companies move from IP to segregation, and possibly to non-GM bulk supply, the non-GM supply price will fall relative to the GM supply price. With ADM and Cargill controlling the market, and both resistant to expanding their non-GM supply too far, economies of scale could still rest with the GM varieties. But if the smaller rivals start supplying non-GM more cheaply than Cargill and ADM, the two larger companies might be forced to get more involved, to avoid losing market share. This is where the price differential would really start to swing.

We have noted that both Cargill and (especially) ADM have more interest in the second generation of GMOs than in the first - ie in crops modified to have different properties in use, rather than in production. These 'output traits' will have a profound effect on the crop distribution system, as the production of many different varieties of each crop to meet the needs of different end users will cause a move away from handling of single, homogenous bulk commodities.

This future scenario has helped anti-GM campaigners in relation to the first generation of GM crops, in that it gives companies like ADM and Cargill an incentive to set up differentiated and identity preserved distribution streams in preparation.

However, the considerations above - outlining how campaigners could defeat the first generation crops through markets campaigning - do not apply to the second generation. Our argument relies on the key fact that if first generation GM crops become more expensive than non-GM, no-one will buy them. This is not the case for crops with consumer-friendly output traits. The battleground will be very different here: while to date consumer rejection has been because the perceived risks on GM foods outweigh any price advantages, in the future, consumers will reject GM foods if perceived risks outweigh perceived benefits (eg health benefits, as well as price).

Furthermore, the future introduction of GM crops with output traits (and in particular, 'stacking' of input and output traits in the same organism) gives campaigners a race against time - to defeat first generation crops and thereby damage the biotech companies, before they have an easier way of introducing the technology.

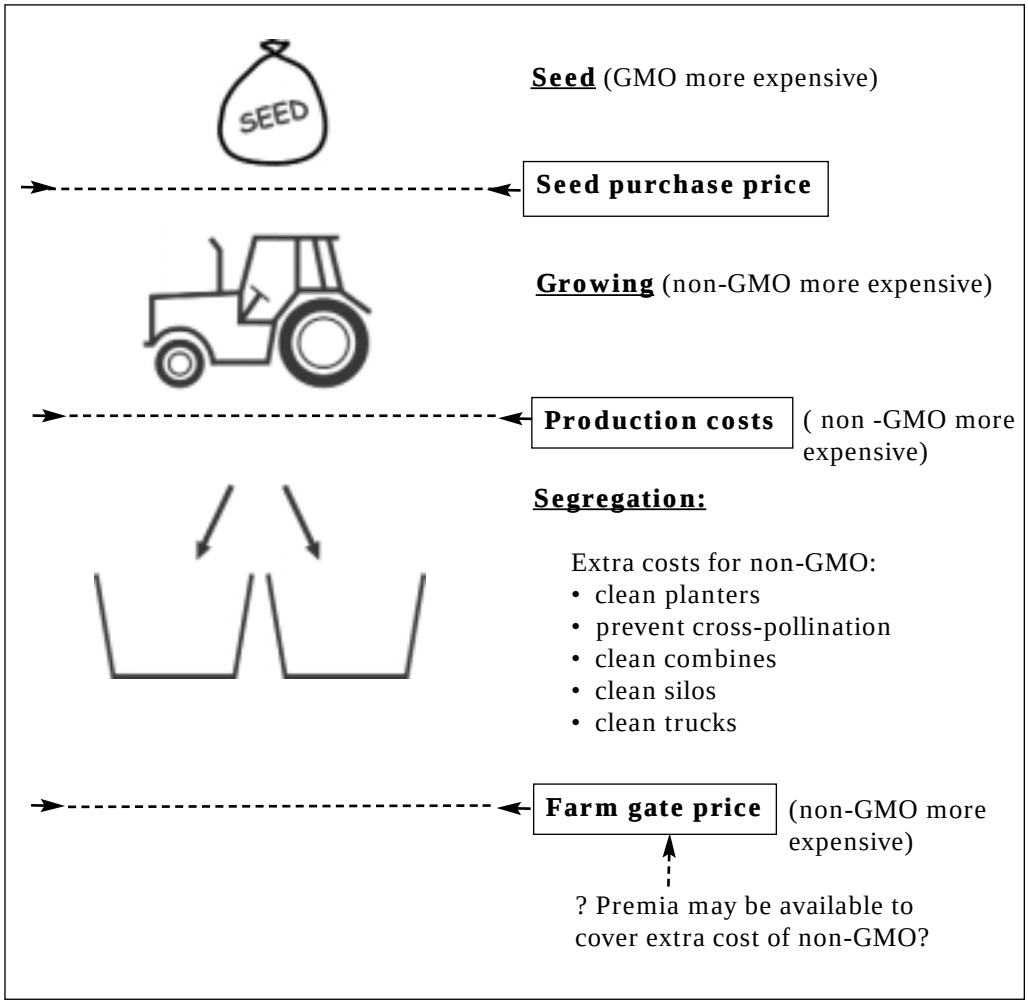
APPENDICES

Appendix 1 - Economics of separating GMOs on the farm

"Increasingly, GMOs are, in our opinion, becoming a liability for farmers. A two-tier market for grain may develop, where the GMO 'improved' grains will trade at a discount to non-GMO product…. If GMOs trade to a discount, the price premium for the seed may collapse, and they would trade at a discount to traditional varieties and hybrids. That would be an earnings nightmare for Pioneer Hi-Bred and, we would guess, for Monsanto as well" - Deutsche Bank report 'GMOs are dead' [143]

Soyabeans: 1 tonne = 36.6 bushels	**Maize:** 1 tonne = 39 bushels
Average farm-gate price: $3.20 / bu = $117 / t	Ave farm-gate price: $1.60 / bu = $62 / t
Ave export price: $4.80 / bu = $175 / t	Ave export price: $2.30 / bu = $90 / t
(1999 prices)	

There are three stages on the farm in which non-GM crops might get contaminated by GM crops: in seed, growing and separation. And in each of these stages non-GM crop production incurs costs which differ from those of GM production - as the diagram below shows.



[143] Timothy Ramey, 21/5/99, 'GMOs are dead', Deutsche Bank Alex Brown

[144] 1) Better return ?:
(i) Despite the premium farmers had to pay for GM seed and despite having to promise not to replant it from their harvest, they did benefit. According to a study by Greg Traxler and Jose Falck-Zepeda, of Auburn University in Alabama, gains from planting Bt cotton amounted to $200m in 1997, of which 42% went to farmers, 35% to Monsanto and 7% to consumers. [Economist, 25/3/00, Survey - 'Growing pains'.]
(ii) Nicholas Kalaitzandonakes, a professor of agribusiness at the University of Missouri reckons that the benefits to farmers of GM soyabean technology alone were in the order of $400m-$1 billion in 1999. [Economist, 15/1/00, 'Genetically modified crops - To plant or not to plant']
(iii) According to USDA's Economic Research Service's survey of 1997 crops, increases in adoption of herbicide-tolerant cotton were associated with significant increases in yields and variable profits, and unchanged herbicide use. Increases in adoption of herbicide-tolerant soybeans were associated with small increases in yields and variable profits, and significant decreases in herbicide use. Increases in adoption of Bt cotton were associated with significant increases in yields and profits and decreased insecticide use. [www.econ.ag.gov/whatsnew/issues/gmo]
[NB returns from the new technology will improve in later years, as farmers learn how best to use it]
2) Worse return ?:
(i) A survey of Iowa farmers' 1998 crops by the Leopold Center for Sustainable at Iowa State University found that GM soyabeans gave lower yields (of 49.26 bushels per acre, compared to 51.21 for non-GM); herbicide costs were 30% cheaper, but this was mostly absorbed by higher seed costs. Bt corn did have higher yields than non-GM (160.4 bushels per acre, compared to 147.7), and fewer farmers used insecticides (12% of fields, compared to 18%); however Bt seed cost $39.62 per acre, while conventional seed cost $29.96; the result was an extra $3.97 of earnings per acre for Bt, which is not considered statistically significant. The survey included interviews with about 800 farmers. [Leopold Centre news release, 22/9/99, '1998 crop survey shows equal returns for GMO, non-GMO crops',

Seed and growing costs

GM seeds are more expensive than conventional seeds (although non-GM seeds will become more expensive, the lower the allowable tolerances of GM content). Seed companies hope to recoup the large investments they have made in research and development of the new varieties.

In turn, it is expected that farmers will justify the extra seed expenditure through higher incomes (from greater yields), and lower other input costs (such as herbicide and pesticide). Some recent studies indicate that this may not be the case, and show either increased herbicide / pesticide requirements or lower yields associated with the GM varieties, or alternatively show that the increased income is smaller than the net increase in input costs.[144] It is clear that the overall effect of GM on production varies between different growing regions, in particular depending on an area's weed and pest profile. But the high rate of uptake by farmers of the new crops indicates that in many cases the GM crops do indeed increase the farmers' margins.

Separation costs

On top of the differences in the intrinsic economics of growing GM or non-GM crops, farmers will incur costs in keeping the two separate. These costs have been estimated by researchers from the University of Illinois.[145] The study reckons that cleaning a planter takes one hour, with a labour cost of $15. If he just cleaned once (ie did all GM plantings, then cleaned, then did all non-GM plantings), for a crop of 500 acres of soyabeans yielding 40 bushels per acre, the extra cost would be just 0.08 cents per bushel ie negligible. In harvesting, using a 'flush' method (running non-GM through combine harvester to clean out leftover GM grains, then sell this run-through as GM), the combined cost of labour and lost premia on the flush add up to 0.09 cents a bushel. The types of trucks used to take grain from farm to elevator are designed to easily dump and easily sweep clean; the situation in which this stage might create extra costs is if there are longer queues at the elevator due to GMO testing, in which case he might have to stop the harvest while waiting for the truck to return.

Thus cleaning of equipment introduces no significant extra costs although it may be inconvenient by requiring extra work at the two times when the farmer is at his busiest, planting and harvest. If harvests are stored on-farm, capital expenditure may be necessary for more bins. US Secretary of Agriculture Dan Glickman has called for federal loans to support farmers investing in new bins for GMO segregation. Some farmers have now decided not to grow GM at all, so they avoid the need to segregate altogether.

Perhaps the biggest problem is the risk of cross-pollination of maize, over which the farmer has limited control - it depends on his neighbours. He can either grow large barrier crops or lose flexibility in where he can plant (his non-GM crops will have to be away from neighbours' GM varieties).

Opportunities for contamination of non-GM crop

Below are listed the stages at which contamination of a non-GM crop may occur, together with estimates (analysed by Dr Charles Hurburgh of Iowa State University) of how significantly it might be contaminated if care is not taken (most of these %ages will be reduced by extra effort or cost)[146]:

1) Seed: Soyabean seed 0.1 - 0.2% contamination. Maize seed 1% contamination (seed company confident estimates)[147]. Soya (being self-pollinating) is far easier to keep separate than (wind-pollinated) maize.

www.leopold.iastate.edu/9-22-99gmorel.html].
(ii) Agricultural economist Charles Benbrook says that after analysing thousands of comparative soybean yield trials, there was an average 6 -7 % decrease in yield for fields planted with Monsanto's "Round-up Ready" GM seeds. This probably cost farmers 3-5 bushels per acre, "From a historical point of view, this has been the biggest step backwards in soybean production," he says. "When you combine the higher cost for Round-up Ready seed with losing these bushels per acre, this has really become a hidden tax on the income of the American farmer." [IPS Newsfeed, 27/9/99, 'US farmers rethink future of bio-tech crops', by Danielle Knight, Washington, Global Information Network]
(iii) A 2-year study by researchers at the Nebraska University Institute of Agriculture and Natural Resources showed Roundup Ready soybeans yield 6% less than their closest relatives and 11% less than high-yielding soybean varieties - and this reduction is due to the gene insertion process. [Associated Press State & Local Wire, 17/5/00, 'Study shows genetically altered soybeans produce lower yields', www.connectotel.com/gmfood/ap170500.txt]
(iv) According to the OECD's annual report on the state of world agriculture, confusion about whether transgenic crops offer a clear benefit to farmers is arguably the biggest factor in whether these novel products will really take off. The report says that no overall conclusion on profitability can be made. With the exception of cotton, which had a "positive and significant" impact on the bottom line, the profitability of herbicide-resistant crops has been mixed. This is because crops in some areas have required more spraying than expected and there have been differences, year to year and region to region, in the intensity of the pest problem. [Agence France Presse, 26/4/00, 'Uncertain Outlook for Genetic Food, Says OECD Report', Richard Ingham, www.connectotel.com/gmfood/af260400.txt]
However, on balance most farmers seem to think that they're better off with. The rate of farmer uptake is a good indication that they expect better profitability.
[145] David Bullock, Marion Desquilbet & Elizavet Nitsi,

2) Planting: suppose 500 seeds remaining in a planter box (not properly cleaned) à 0.6% contamination.

3) Cross-pollination: maize pollen can easily travel a few hundred metres. Allow 0.3 - 0.5% contamination if separation distances are greater than that (and much higher if distances are lower).

4) Harvest: combine harvester may contain 3-5 bushels (bu) if not fully cleaned.

5) Wagons: 1 bu remaining in wagon à 0.2% contamination of 500 bu load.

6) Storage bins: 30 bu remaining à 0.3% contamination of 10,000 bin.

7) Elevator: 10-100 bu contamination depending on size of equipment à 0.1% in 10,000 - 100,000 bu bin.

8) Accidental mixing: one 800-bu truck à 1% of an 80,000 bin.

9) Export elevator: 0.1%

There should be minimal contamination in railcars, barges and ships, as these are cleaned out before each use, whatever the cargo.

If this level of contamination with GM crops occurs at each of these levels, the final crop will arrive at the processor containing 3.8% GMO.

Premia

Since production of non-GM does involve extra effort and cost for the farmer, and potentially less favourable growing economics, he will need an incentive. Thus some elevators pay farmers a premium price for non-GM harvests, or equivalently, discount the GM crop price. The farmer of course wants to maximise his profit, so will weigh the size of premia against production costs.

Estimates of the premia paid at the farm gate (by Cargill, ADM and others) in 1999 vary from 3-10% - depending on the growing region, target market etc. This is for post-harvest separation (ie with no growing contract), to meet demand from Japan for crops that were at least 95% non-GM.[148] For tighter tolerances, according to agricultural consultancy PG Economics, estimated costs cited range from 15-25% of the farm-gate price for tolerances of 1-2% GMO, to 150% where the tolerance set is no detectable residue (in reality equal to about 0.01 per cent tolerance which is about the limit of current commercial testing).[149]

Contract growing

Often non-GM crops are grown under contract between farmer and either elevator, exporter or customer (food processor / packager), where the contract sets a pre-determined price to be paid for the harvest. Up till now, the majority of the contracts have been with the customers (especially in Japan). This has necessitated an identity-preservation form of supply, rather than segregation, as a specific batch of produce must travel from the farm to the buyer who has ordered it. However, we should expect to see an increase in contracts between elevator and grower, and between exporter / processor and elevator, and these will favour a segregation-based approach, with a larger, continuous flow of non-GM grain. There are also moves towards contract-free supply of non-GM on an open market - as in for example the Tokyo Grain Exchange selling non-GM soyabean futures. This too leads to segregation

rather than IP. Cargill, which favours identity preservation over segregation, has all of its IP non-GM crops grown under contract.[150]

In 2000, 1.5 million acres non-GM soyabeans were grown under contract through DuPont Speciality Grains, representing 2% of US plantings.[151] In these cases, Consolidated Grain and Barge, ADM and Protein Technologies International (a DuPont subsidiary) signed contracts with both growers and elevators, specifying the production practices required (keeping seed receipts, cleaning equipment, training staff, applying clear segregation or IP systems etc) and the premia (10-30 cents a bushel at farm gate, plus about another 5 cents for the elevator).

Risk management

Since a farmer must decide what to plant at least six months before he tries to sell it, he carries a lot of risk, and the uncertainty in the GM debate has a major impact on farmers. It is in this way that the farmer has been a victim of the controversy. On the one hand, there is the risk that rejection of GM crops will increase (eg by expanding into animal feeds), so if the farmer plants GM he may find there is no market for his harvest. On the other hand, he might opt for non-GM, incur the extra costs, and then discover that there are no non-GM premia available; and with margins in farming already extremely tight, this is an outcome the farmer simply cannot afford.

Growing contracts for non-GM crops provide one way out of this risk.

Farmers will also look to ease their uncertainty from guarantees by the large grain-handling firms. For example, Cargill promised farmers that for crops planted in 1999 and 2000, all of its grain elevators would accept GM maize and soyabean varieties[152], and this did much to calm farmers' nerves over GMOs. The ADM announcement calling for separated non-GM supplies in September 1999 had the opposite effect.

Summary

In summary, the feasibility of non-GM production depends principally on three regional / environmental factors:

1) the degree of weed and pest problems (and hence the degree of economic advantage to GM crops);

2) the planting decisions of neighbouring farms (determining the potential for cross-pollination);

3) the availability of premia for non-GM from local elevators.

Thus GM and non-GM supplies may perhaps be achieved most efficiently - especially for maize where the potential for cross-pollination is high - by the dividing up producing countries into regions where GM is allowed and regions where it is not.

21/10/00, 'The economics of non-GMO segregation and identity preservation', University of Illinois, Department of Agricultural and Consumer Economics, http://w3.aces.uiuc.edu/ACE/faculty/dallasbu.PDF

[146] Hurburgh, op.cit.33

[147] Bullock et al, op.cit 145, citing pers.comm. with David Langer of Pioneer Hi-Bred International

[148] PG Economics, Oct '99, op.cit.29; Cargill plc, 12/1/00, supplementary memorandum to House of Commons Agriculture Select Committee (op.cit.6), www.parliament.the-stationery-office.co.uk/pa/cm199900/cmselect/cmagric/71/71ap28.htm; St. Louis Post Dispatch, 13/5/99, 'ADM (Archer Daniels Midland Co) pays more to non-biotech bean growers', by Robert Steyer, http://home.intekom.com/tm_info/rw90521.htm#01; GrainNet, 22/9/99, 'ADM Reportedly Paying Premium for Non-GMO Corn', www.grainnet.com/ArticleLibrary/articles.html?ID=4819

[149] PG Economics, Oct '99, op.cit.29

[150] Information Systems for Biotechnology, August 2000, op.cit.54

[151] Bullock et al, op.cit 145, citing pers.comm. with David Young of DuPont, 8/6/00, USDA National Agricultural Statistics Service, prospective plantings, 31/3/00

[152] Cargill Inc, 7/12/99, op.cit.30

Appendix 2 - Supply chain economics of segregation and identity preservation (IP)

It is widely agreed that the greatest costs of segregation or identity preservation occur post-farm gate.

How many elevators segregate?
One of the biggest bottlenecks in the supply chain is the elevator sector, and a number commentators have suggested that most elevators will not be able economically to separate GM from non-GM harvests. However, the number of elevators which keep non-GM separate has been steadily rising.

• A survey during the 1999 harvest by commodity research company Sparks Companies Inc found that 8% of Midwest grain elevators separated soyabeans and 11% maize. 3% were paying a premium for non-GM soya, and 1% for maize.[153]

• A survey of the 2000 harvest, commissioned by seed company Pioneer Hi-Bred International, found that 25% of elevators said they would separate GM from non-GM maize, and just over 20% soyabeans. 10% would pay a premium for non-GM maize, and 15% for soya. What's more, 12% of elevators will not accept Roundup Ready soya at all, and nearly 20% won't take Bt or LibertyLink maize.[154]

• Later in 2000 a survey by the American Corn Growers Foundation found that 42% of elevators require or suggest on-farm segregation; 31% require or suggest separation at the elevator gate; and 22% are paying non-GMO premia.[155]

Mechanics of separation at the elevator
Elevators have been designed for single streams of each crop, and some have had difficulty separating non-GM. Part of the problem is that the elevator business operates to very small margins, so relies on large volume turnover, and segregation (in particular testing) will slow operations down. Also, it obviously gets extremely busy at harvest time, and so adding the new complication will be difficult.

While cleaning out pits (into which farmers empty their trucks) and bins (in which grains are stored) before handling non-GM crops is quite possible, cleaning 'legs' (the mechanical conveyor system with built-in buckets / shovels, which lifts grain from pits to bins) is much more difficult, as there are many working parts in which grains can get stuck. Preserving crop identity within a low level tolerance for GM contamination may not be economically feasible by cleaning, as it would probably require dismantling the leg's many parts, and there is not time for this at harvest. Depending on the layout and mechanics of the elevator, it may be possible to flush GM grains out of the leg by running a quantity of non-GM grain through it into the standard, GM / mixed bin, before beginning the non-GM run.

One option for handling non-GM crops is to accept only non-GM on certain days of the week, to avoid the need for two separate queues of farmers, and to reduce the risk of commingling. This approach lends itself to IP, where the same facilities are used for both GM and non-GM, and cleaned in-between.

Direct costs of segregation and IP at the elevator
Segregation of non-GM crops is a new activity, and there is still insufficient information available to accurately describe the economics. Estimates of the costs vary widely, as do the available premia. However, recently a number of studies have been published,[156] and this is certainly a growing area.

[153] Survey covered 100 elevators across the corn belt. Monsanto news release, 23/9/99, 'Few grain handlers are segregating non-biotech crops', www.monsanto.com/monsanto/investor/news/99/99sep23_grain.html
[154] Survey of 1,200 elevators throughout the corn belt. Over 78% do not sell grain overseas. Pioneer Hi-Bred International, 'Elevator biotech grain acceptance survey - 2000', at www.pioneer.com/usa/biotech/asta/accept_survey.htm
[155] Survey of 1100 elevators in 9 states, CropChoice, 5/10/00, op.cit.141
[156] Bullock et al, op.cit.145; William W. Lin, William Chambers, and Joy Harwood, April 2000, 'Biotechnology: U.S. Grain Handlers Look Ahead', in Agricultural Outlook, pub. USDA Economic Research Service, http://151.121.66.126/epubs/pdf/agout/apr2000/ao270h.pdf; Karen Bender, Lowell Hill, Benjamin Wenzel & Robert Hornbaker, Feb '99, 'Alternative market channels for specialty corn and soybeans, Dept of Agricultural & Consumer Economics, University of Illinois at Urbana-Champaign, www.ngfa.org/specialtybk.html ; Richard Maltsbarger & Nicholas Kalaitzandonakes (of Economics & Management of Agrobiotechnology Centre, University of Missouri-Columbia), 28/8/00, 'Study reveals hidden costs in IP supply chain', in Feedstuffs; available at www.biotech-info.net/hidden_costs.html; House of Commons Agriculture Select Committee hearing (op.cit.6), especially submissions of Cargill (+ supplementary memo), Strategic Diagnostics Inc, PG Economics

One attempt to estimate the extra cost of IP, based on semi-empirical data, is shown in the table below. This excludes premia paid to farmers - ie the table shows post-farm gate costs. Researchers at the University of Illinois surveyed 35 elevators in spring 1998[157] for their estimates of the costs of IP for high-oil corn (maize) and STS soyabeans (both non-GM speciality crops). A study by the Economic Research Service of the US Department of Agriculture[158] then applied theoretical considerations to translate these figures into the costs of IP for non-GM.

Table - extra cost (in US $) per bushel at a grain elevator of identity-preserved handling of non-GM soyabeans and maize.

Cost	Soyabeans	Maize
storage (per month)	0.02	0.01
handling / segregation	0.06	0.03
risk management	0.08	0.01
analysis / testing - country elevator	0.01	0.04
- river / export elevator	0.01	0.01
marketing	0.02	0.01

Most non-GM crops are still exported, as most demand for non-GM is outside the USA. A large number come from farms near rivers, so they are taken by truck from the farms to river elevators, then by barge to an export elevator, where they are loaded onto a ship. Some others are delivered from the farm to a country elevator, from which they are then carried by train to a river elevator. Obviously, segregation or IP incur more costs with the three-elevator process than with two elevators. Assuming the per bushel costs above are applicable to each of the three different types of elevator[159], we add up the *elevator cost* (ie not including premia paid to farmers, nor transportation or processing costs) of IP in the table below.

The elevators able to handle non-GM grains most efficiently will be those which are able to dedicate some facilities to GM and some to non-GM; or even dedicating whole elevators, by dividing all the elevators in a locality between GM and non-GM - ie employing a segregation approach. These latter elevators, by specialising, will avoid the extra storage, handling and marketing costs of IP, leaving just testing and risk management costs. What's more, the original University of Illinois study showed that by specialising, risk management costs fall to zero for maize and $0.01 for soyabeans.

The former segregation approach (dedicating facilities within each elevator) will incur extra costs somewhere between those of IP and those of dedicated whole elevators.

Table - total extra costs ($ / bu) at all elevators through supply chain, of segregation or IP of non-GM crops

Cost	Soyabeans	Maize
Identity preservation		
3 elevators	0.57	0.24
2 elevators	0.38	0.14
Segregation (where elevator dedicated)		
3 elevators	0.06	0.06
2 elevators	0.04	0.02

[157] Bender et al, ibid. They also surveyed speciality grain firms, which we don't use here. It is not clear what tolerance of GM contamination this relates to. Standards are far more stringent for STS soyabeans than for high-oil corn. Some handlers allow a few per cent contamination of high-oil corn (as it is the measured oil content in the final product which determines price, and eg a 5% contamination may have a greater proportional impact on the handling costs than on selling price). However this isn't always the case - Consolidated Grain and Barge company claims to export high-oil corn at 99.2 - 99.3% purity, and STS soyabeans at 99.97% [Bullock et al, op.cit.145, citing pers. comm. with John Haas of Consolidated Grain and Barge]

[158] Lin, Chambers & Harwood, op.cit.156

[159] the original study (Bender et al) included a mixture of country and terminal elevators, but did not state the proportions of each, not differentiate between them in terms of costs

Indirect costs of segregation or IP at the elevator

On top of the direct costs outlines above, there may be hidden, opportunity costs to handling IP non-GM crops, arising from the loss of flexibility. These have been analysed by two researchers at the university of Missouri-Columbia[160], and consist of three types:

1) storage margin opportunity cost. The elevator sector in the USA has massive over-capacity, meaning that a large quantity of storage space is just not being used.

Maximisation of the proportion of an elevator's available capacity which is actually used is therefore a major competitive issue. Clearly, handling a greater number of distinct types of grain (eg GM and non-GM) will reduce an elevator's ability to fully fill its bins.

2) grind margin loss. Margins in elevator storage are small, so some elevators try to boost their margins by grinding some of their stored crops into feed, which they then sell on to local livestock farms. Feed demand in the USA is mostly serviced by the bulk commodity crop, so grinding of more valuable non-GM crops for feed would write off their extra value.

3) spread opportunity cost. One of the important skills an elevator manager uses to make his profits is exploiting 'spreads' in the market - in other words, holding onto stocks when the expected future price of the commodity is higher than the sum of the current price and storage and lost interest costs. Since most non-GM crops are sold under contracts, which specify delivery times, the elevator manager loses his ability to hold grain for spreads.

The study looks at three different elevator configurations, and estimates that spread opportunity costs can range from $ 0.07 to 0.22 / bu, and storage margin opportunity costs can range from $0.06 to 0.15 / bu.

However, it should be noted again that for an elevator specialising in non-GM only, there is no storage margin opportunity cost. Probably also, assuming a dedicated elevator has some flexible supply and sale (ie does not only sell through contracts), spreads will still be possible too, although opportunities for spreads will be smaller for smaller markets. Thus in the segregation case the major hidden cost is the loss of grind margin.

Transportation

Like with elevators, much extra cost in the transportation phase of separating non-GM is due to loss of flexibility, rather than extra physical work or resources being required[161]. Railcars, barges and ships are used for a wide range of different cargoes, so are routinely cleaned out in between, whatever they are carrying. Thus cleaning adds no extra costs to segregation / IP for non-GM grains. Testing costs, as we have noted are low.

Barges do not have segregated holds, so cannot simultaneously carry both GM and non-GM grains. Capacity tends to be around 55,000 bushels of soyabeans or maize (elevator storage bins hold about 100,000 - 400,000 bushels). Extra costs will arise from partially filled barges eg a small elevator with 130,000 bushels each of GM and non-GM will require six barges (three for each), whereas 260,000 unsegregated will only require five.

Ships, on the other hand, often do have separate holds, each hold generally carrying

[160] Maltsbarger & Kalaitzandonakes, op.cit.156
[161] see Bullock et al, op.cit.145

200,000 - 300,000 bushels, or 5000 - 8000 tonnes. Again, the export company will aim to fill each hold as full as possible, which should be possible, as processors' orders will tend to be around 50,000 tonnes - as long as this matches the storage capacity in the destination country.

Premia

We noted differing values of farm-gate premia for non-GM crops. There is even more variation in estimates of the add-on costs of IP through storage and transportation.

George Henni, Cargill's protein manager for Europe, reports that non-GM soyabeans, delivered at Rotterdam at a 1% tolerance, are currently demanding premiums of $12-17 per tonne ($0.33 - 0.47 per bushel), or about 5-10 % of the price[162]. GMO testing company Strategic Diagnostics Inc puts the price rather higher, at approximately $16 per tonne ($0.44 / bu) over the Chicago Board of Trade price, PLUS another $10-15 per tonne ($0.28 - 0.41 / bu) in transport costs[163]. John Haas, premium grains specialist at Consolidated Grain and Barge, is the least optimistic, and states that in 1999 exporters received premia from foreign processors of $8 per tonne ($0.22 / bu) for non-GM soyabeans[164].

Cargill's UK subsidiary reckons that for both soyabeans and maize, Japanese buyers were prepared to pay premia (for crops with 5% GMO tolerance) of up to $18 dollars per tonne (delivered Japan) - a fairly mid-range estimate, equivalent to 20% extra on maize, and 10% on soya[165].

Note that these premia need to cover extra elevator costs, transportation costs, and farm-gate premia.

We can see that the premia comfortably cover the costs of segregation, but will only cover IP costs in some cases.

Really?

There are suspicions that costs are being over-estimated, in order to squeeze the non-GM market, as we noted earlier. We now see for example, Cargill's own poultry subsidiary Sun Valley is now selling chickens reared on non-GM feed (to the European standard) at no extra cost[166].

Since Cargill and ADM control so much of the supply chain, both horizontally and vertically, it is difficult to find out what the real costs are. The recent academic studies examining these economics, on which these appendices have drawn heavily, acknowledge that this is a new area, and much more study is needed, as well as practical experience.

The most significant study we have referred to was based on a questionnaire for elevator managers. It may be that their costs will fall below those that they gave here, as they discover how to more efficiently run segregation and IP systems. Much of the cost of IP is incurred in setting up new supply chains - sourcing, training, testing etc.

Summary

It is difficult to accurately estimate the costs of separating non-GM crops through the distribution system, as there is so little experience available. We can conclude however that segregation is a significantly cheaper approach than identity preservation, and that additional costs tend to be more attached to loss of flexibility, or hidden opportunity costs, than to extra real physical inputs.

[162] Reuters, 4/4/00, op.cit.115
[163] Strategic Diagnostics Inc, 9/12/99, memorandum to House of Commons Agriculture Select Committee (op.cit.6), www.parliament.the-stationery-office.co.uk/pa/cm199900/cmselect/cmagric/71/71ap19.htm
[164] pers.comm., cited in Bullock, op.cit.145
[165] Cargill plc, 12/1/00, op.cit.148
[166] Greenpeace UK, 31/1/00, op.cit.7
[167] Seedquest press releases, 29/6/98, 'Monsanto Agrees to Purchase Cargill International Seed Operations In Central and Latin America, Europe, Asia, Africa', www.seedquest.com/News/Press%20releases/Monsanto/N1119.htm
[168] Financial Times, 17/5/00, 'Cargill settles with Pioneer'
[169] Cargill News International, Genetic engineering pt.2, www.cargill.com/today/gmo2.htm
[170] Farm Central, Seed Variety Update, www.farmcentral.com/s/rr/seed/s4rcvzzzz.htm
[171] Cargill News International, Genetic engineering pt.3, www.cargill.com/today/comp3.htm
[172] Cargill News International, op.cit.169
[173] Cargill's 243 facilities + 73 new locations from Continental Grain (+ 10 CG facilities at the same locations as Cargill ones). [Source: Hayenga and Wisner, op. cit.21] 5 facilities had to be divested in the merger [source: National Farmers Organisation, 14/7/99, 'Merger adds to grain producer uncertainty', www.nfo.org/carg799.htm]
[174] This is sum of Cargill's 463 and Continental Grain's 169 [Hayenga and Wisner, op.cit.78]. The actual figure will be slightly less than this, due to divestitures forced by the merger regulators.
[175] This excludes joint ventures and partnerships.
[176] Hayenga and Wisner, op. cit.21
[177] Hayenga and Wisner, op. cit.21
[178] Hayenga and Wisner, op. cit.78
[179] G Allen Andreas (CEO of ADM), 18/1/00, interview with the Wall Street Transcript, www.twst.com/notes/articles/jae603.html
[180] ADM Annual Report

Appendix 3 - Cargill and ADM's share of the market

ADM has a major focus on processing, especially high-value end-products. Thus it has more interests than Cargill in secondary processing, including animal feed, ethanol, and soya-based vegetarian foods. It is also a large player in animal feeds (especially in Europe), but not especially in meat production.

	Cargill	ADM
Seed	Cargill's main involvement in GM seed is its Renessen partnership with Monsanto (see above). In 1998 Cargill sold most of its seed businesses to Monsanto - including seed research, production and testing facilities in 24 countries, and sales and distribution operations in 51 countries. The deal did not include American, Canadian or British seed businesses[167]. Shortly afterwards, Cargill struck a deal to sell AgrEvo (now Aventis) its North American seed business, Cargill Hybrid Seeds. The deal however was postponed when Pioneer Hi-bred (a DuPont subsidiary) sued Cargill Hybrid Seeds for theft of its patented seed, and AgrEvo eventually pulled out altogether in February 1999. Cargill finally settled with Pioneer for $100m in May 2000, which left it clear to try again to sell the division. It is currently looking for a buyer[168]. Cargill Hybrid Seeds began selling Bt maize and Roundup Ready soyabeans in January 1997[169]. Through subsidiary Inter Mountain Canola, it also supplies Roundup Ready canola (oilseed rape)[170]. InterMountain Canola, based at a research station in Fort Collins, Colorado, is developing oilseed rape varieties with output traits - including oil that has stability, health and flavor advantages[171]. While the oilseed rape research station at Fort Collins is Cargill's biggest biotechnology lab, the company also researches maize (particularly accelerated breeding) at a seed research station in Aurora, Illinois, and sunflower and canola breeding (to improve disease resistance) at Boissay, France[172].	No direct involvement in GM seeds. Like all distributors, ADM does enter into agreements with seed companies and cooperatives as to which varieties it will market post-harvest.
Storage and distribution	Cargill has 311 US grain-handling facilities (3% of the total)[173], with 632 million bushels storage capacity (6-7%)[174], the capacity of any single company[175] in the USA. These account for 10-13% of the actual grain handled (the US system has over-capacity)[176]. Cargill greatly expanded its storage and distribution capacity when it acquired the grain businesses of rival Continental Grain in 1999.	ADM has 669 US grain-handling facilities (6.4% of the total)[177], far more than any other company. These give it 611 million bushels storage capacity (6%)[178]. (This includes both elevators and processing plants). Globally, ADM has 750 elevators[179]. In South America it has 82 elevators with 1.3m tonnes storage capacity, plus leasing arrangements giving it a further 0.5m tonnes[180]. In addition to this, ADM adopts a strategy of forming joint ventures and partnerships with other storage and distribution companies, especially co-operatives, to extend the volume of grain it has access to. These include Growmark, Countrymark and United Grain Growers. Growmark, for example, is made up of more than 270 member-owner co-ops in grain marketing (plus over 120 in farm supplies retail)[181]. ADM owns 1000 trucks, 15,000 railcars and 2,200 river barges, mainly in North and South America[182]. ADM has the 2nd largest fleet in the USA, after Artco, and followed by ConAgra subsidiary Peavey; these 3 companies control 53% of US covered barges[183]. On top of all this, it uses 5 million trucks and 500,000 railcars belonging to other companies each year[184]. The ADM / Countrymark partnership is one of the largest suppliers of feed grains and soyabeans to the southeast USA market[185]. ADM has taken on joint ventures and acquisitions in South America the last few years; their purchase of subsidiaries of rival Glencore in Brazil and Paraguay, for example, gave a 4% increase in their share of the world soyabean trade[186].

1998, p.5
[181] Hoovers Online company capsule - Growmark Inc, www.hoovers.com/cp/capsule/9/0,2163,40189,00.html
[182] Andreas, 18/1/00, op.cit.179
[183] Feedstuffs, Sept '95, cited in Dr W Heffernan (Dept of Rural Sociology, Uni of Missouri), 5/2/99, 'Consolidation in the food and agriculture system', report to National Farmers Union, www.calfu.org/whstudy.html
[184] ADM Annual Report 1998, pp.11, 17
[185] Archer Daniels Midland, website, 'ADM / Countrymark', http://grain.admworld.com/countrymark/
[186] Feedstuffs 9/6/97, cited in Heffernan, 5/2/99, op cit.183
[187] Feedstuffs 22/9/97, cited in Dr W Heffernan , 5/2/99, op cit.183
[188] Cargill press release 13/2/97, 'Salzgitter Vegetable Oil Refinery Earns ISO 9002 Certificate', www.cargill.com/today/releases/e02131997.htm
[189] Euro PA, Food & Drink Statistics 1998, Table 2.41: Summary of UK Oilseed Company Results, www.europa.co.uk/files/guide/CH2TAB.HTM
[190] European Commission, 3/2/99, decision on Cargill and Continental Case, No. IV/M.1376
[191] Financial Times 1/3/00, 'ADM to cut soybean crush on poor margins'
[192] Forbes, 17/11/97, op.cit.50
[193] Feedstuffs 22/9/97, cited in Heffernan, 5/2/99, op cit.183
[194] Directory of Multinationals 1999
[195] ADM Annual Report 1998, p.5
[196] Caswell, 1999, op.cit.71
[197] National Farmers Union, 20/10/99, Testimony prepared for the House Judiciary Committee Hearing on Concentration, www.house.gov/judiciary/nfu1020.htm
[198] Caswell, 1999, op cit.71
[199] ADM Annual Report 1998, p. 6
[200] letter from Dan Glickman (US Secretary of Agriculture) to Department of Justice, based on USDA inspections, cited in Hayenga & Wisner, op cit.21 NB These percentages do not necessarily refer to the quantity of grain owned by Cargill: it may have just provided loading facilities for another company.
[201] Cargill originally had 6 [AV Krebs, 12/11/98, 'It is plain, Cargill's reign in the

Processing	In the USA, Cargill is the second largest soyabean crusher, with 16 plants. The top 4 crushers (ADM, Cargill, Bunge and AGP) account for 80% of the market[187]. It is also one of the leading players in maize milling. Cargill and its subsidiaries operate more than 40 oilseed processing plants worldwide. European operations include 11 crushing plants and 10 refineries, plus two bottling facilities, a hardening and a protein plant[188]. Cargill is the largest oilseed processor in the UK[189], and in Europe (25-35% market share)[190].	ADM is by far the largest soyabean crusher in the USA, with 39 plants[191], and 31% of output[192]. The top 4 crushers (ADM, Cargill, Bunge and AGP) account for 80% of the market[193]. ADM has 9 oilseed crushing plants outside the USA, including the world largest soyabean processing faculty in Rotterdam, and a majority interest in the world's largest multi-seed complex in Hamburg[194], plus 5 soyabean crushing plants in South America[195]. The 48 plants have total throughput of 72,000 - 84,000 tonnes per day[196]. ADM is also the US' largest wet maize miller, and 3rd largest dry maize miller[197]. It runs three maize wet mills and two dry mills in the US that process 1.6 million bushels a day[198]. Globally, ADM has more than 355 processing operations[199].
Export	Cargill accounts for 42% of US maize (maize) export volume and 31% of soyabeans[200]. Cargill has 8 US export terminals[201]. Together, Cargill, ADM and Bunge have 59% of port facilities[202]. Cargill controls 37% percent of the delivery points for the Chicago Board of Trade (i.e. the depots and facilities where all the goods traded on the exchange have to be actually delivered)[203]. The CBOT is by far the largest futures exchange in the world for grains and oilseeds; its prices are used as reference prices elsewhere in the world. Cargill owns 50% of storage capacity on the Illinois River (the delivery area for CBOT soya contracts), and 31% of capacity in the northern part of the river (delivery area for CBOT maize)[204]. Cargill also accounts for 25% of Argentina's maize, soya and wheat exports[205]. According to the European Commission, Cargill sells less than 10% of soyabeans, and 10-20% of rapeseed, although these figures only include the beans and seed traded as such, and not those which are processed 'in-house'[206]. Cargill subsidiary Hohenberg Bros is one of the world's largest cotton merchants, and sells cotton to ginners, buyers and textile mills in over 50 countries on all six continents[207].	Globally, ADM operates 10 major export terminals[208]. It has 100 chartered ships, and 50 international sales offices[209]. ADM container operations now originate shipments from 11 countries and deliver them to 85 countries around the world[210]. ADM owns 75% of trading company AC Toepfer International, which conducts about 40m tons of trade from 43 offices worldwide[211]. Between them, ADM, Cargill and Zen Noh account for 81% of US maize exports, and 65% of soyabean exports[212]. Together, Cargill, ADM and Bunge have 59% of US port facilities[213]. ADM controls 33% percent of the delivery points for the Chicago Board of Trade (ie the depots and facilities where all the goods traded on the exchange have to be actually delivered)[214]. The CBOT is by far the largest futures exchange in the world for grains and oilseeds; its prices are used as reference prices elsewhere in the world. It owns 25% of storage capacity on the Illinois River (the delivery area for CBOT soya contracts), and 25% of capacity in the northern part of the river (delivery area for CBOT maize)[215]. ADM Investor Services is a full service futures commission merchant, fully represented on the main US markets[216]. ADM has 2 export facilities in South America, where it is the largest exporter of soyabeans[217].
Feed	In the early 1990s, Cargill was the largest animal feed company in the USA (no up-to-date figures available)[218]. In 1997, Cargill took on ADM in the lysine (a feed additive) market[219]. Cargill is the largest European producer of crude oilseed meal, with 25-35% of total European production (although much of this is sunflower meal, which is non-GM)[220].	ADM has also used joint feed ventures with co-operatives such as Goldkist and Ag Processing Inc (AGP). In the early 1990s, Consolidated Nutrition, the ADM / AGP joint venture, was the 4th largest feed company in the USA (no up-to-date figures available)[221]. ADM and AC Toepfer International (see above) have a 10-20% share of the European animal feed market (which includes grain, oilseed meals, maize gluten, animal meal, fishmeal, citrus pulp etc), and a 20-30% share of the oilseed meals market. This includes 25-35% of the rapeseed meal market[222]. ADM and AC Toepfer subsidiary Arkady Feed (UK) are the 3rd and 5th largest feed companies in the UK. While it is difficult to calculate their market share due to both companies also being involved in other businesses, together with ABN (the 4th largest) the 3 companies have between 20% and 24% of the market[223].

grain has become profane', in Agribusiness Examiner #9, www.ea1.com/CARP/agbiz/agex-09.html]; Continental Grain had 6, but had to divest 4 of these as ordered by merger regulators [National Farmers Organisation, 14/7/99, op.cit.173]

[202] Grain & Milling Annual 1997, cited in Heffernan, op cit.183

[203] US Commodity Futures Trading Commission, report, cited in European Commission, 3/2/99, op.cit.190. NB The delivery points are being changed in 2000, to exclude Toledo (Ohio), and instead have all delivery points on the Illinois River. Some say this will decrease the concentration of ownership, as there will be a greater number of delivery points [eg EC]; others say it could increase concentration, as Cargill was especially strong in the Illinois River area [eg Krebs]

[204] USDA data, analysed in Hayenga & Wisner, op cit.21

[205] Cargill Argentina press release, cited in Haynega & Wisner, op cit.21

[206] European Commission, 3/2/99, op.cit.190

[207] Hohenberg Bros Company, website, www.hohenbergbros.com/

[208] ADM Annual Report 1998, p. 6

[209] Andreas, 18/1/00, op.cit.179

[210] ADM Annual Report 1998

[211] Arkady's parent, A.C. Toepfer, is owned equally by ADM and INTRADE holding company. ADM now owns a 50% interest in INTRADE. (ADM news release, 1999, 'ADM increases interest in AC Toepfer International Group', www.admworld.com/financial/docs/21.htm)

[212] GIPSA data, cited in Hayenga & Wisner, op cit.21 NB These percentages do not necessarily refer to the quantity of grain owned by the companies: it may have just provided loading facilities for another company.

[213] Grain & Milling Annual 1997, cited in Heffernan, op cit.183

[214] US Commodity Futures Trading Commission, op.cit.203

[215] USDA data, analysed in Hayenga & Wisner, op cit.21

[216] ADM Investor Services Inc, website, www.admisi.com/admisusa.html

[217] ADM Annual Report 1998, p.5

[218] Feedstuffs, 28/10/91 and 21/2/94, cited in Heffernan, op

Oils	Cargill has a 20-30% share of the European crude seed oil market. It is the market leader for rapeseed oil, with 25-35% of the marketcccxxiv. It has 30% of the UK bottled vegetable oils market[225].	ADM has a European market share of 20-30% in all crude seed oil, with 30-40% in soya oil. To a minor extent, ADM sells seed oil to end-users such as McDonald's[226]. It has 35% of the UK bottled vegetable oils market, the market leader[227].
Maize products	Cargill is the US no. 5 in ethanol production, with 6% of the market[228]. It produces some maize products such as dextrose, starch, syrups and sweeteners, and soya products such as soya flour and textured vegetable protein[229]. However it has much less involvement in these processing markets than rival ADM.	ADM has major interests in producing high-value processed products from the bulk raw materials it handles. ADM is the USA's largest producer of ethanol, with 46% of the market[230], which is used both in industrial applications and in drinks. ADM is the USA's largest producer of the grain alcohol used to make gin, vodka, and liqueurs[231]. Products manufactured for use by the food and beverage industry include syrup (eg maltodextrin), starch, glucose, dextrose, crystalline dextrose, high fructose sweetener, crystalline fructose and grits[232]. ADM's sweeteners form the 2nd largest ingredient (after water) in Coca-Cola[233]. In 1996 it paid $258 million for 22% of Mexico's Gruma S.A., the world's biggest maize flour maker[234]. ADM also produces the amino acids lysine, tryptophan, and threonine (used in animal feeds); the organic acids citric, lactic and glucono delta lactone; the industrial and food thickener, xanthan gum; and the vitamins C and riboflavin[235].
Soya products		Products from soya include soya milk, soya flour, food additives (eg, lecithin), animal feed ingredients (eg protein concentrates and isolates) and nutraceuticals (including vitamin E, isoflavones, sterols (a feedstock for steroid production))[236]. It is also very involved in soya-based vegetarian foods (ADM invented textured vegetable protein, TVP). In the USA, ADM owns the major vegetarian food brand Worthington Foods. UK ADM subsidiary Haldane Food has 4 factories; Haldane claimed in spring 1997 that its products were non-GM, but testing by the Daily Mail found GM ingredients in Haldane's RealEat and So Good ranges[237]. ADM's protein enhancers are common in pet foods[238].
Meat	Cargill is the 4th largest pork packer and the 4th largest turkey producer in the USA[239]. Cargill subsidiary Excel Corp is the 3rd largest US beef packer with 19% of the market[240]. It has a 12-15 year joint venture with Nippon Meats, producing broiler chickens in Thailand. Cargill owns Sun Valley, the largest poultry producer in the UK, with interests also in France and the Netherlands[241]. Cargill also has major poultry production in Thailand.	ADM has a stake in IBP, the largest US beef packer and 2nd largest pork packer, which also has pork production and processing interests in China[242]. Consolidated Nutrition (ADM / AGP joint venture) is involved in pig production in the USA.

cit.183
[219] Hoovers Handbook of Private Companies 1998, p.84
[220] European Commission, 3/2/99, op.cit.190
[221] Feedstuffs 28/10/91 and 21/2/94, cited in Heffernan, op cit.183
[222] European Commission, 9/11/99, Case No COMP/M.1348 - Archer Daniels Midland / Alfred C Toepfer International / Intrade, pp.4-5, http://europa.eu.int/comm/dg04/merger/closed/m13/en/m1348.pdf
[223] Key Note report, Animal feedstuffs, 1999, p.24
[224] European Commission, 3/2/99, op.cit.90. The other major oilseeds are soya and sunflower.
[225] USDA Agricultural Trade Reports, 15/6/98, UK - Oilseeds and Products Report, ASIA Intelligence Wire
[226] European Commission, op cit.190
[227] USDA Agricultural Trade Reports, 15/6/98, op.cit.225
[228] Renewable Fuels Association, 'Ethanol industry outlook, 1999 and beyond', www.ethanolrfa.org/outlook99/99industryoutlook.html#capacity
[229] Hoovers company profile - Cargill, 1/11/00
[230] Renewable Fuels Association, op.cit.228
[231] Mother Jones, 1995, 'Dwayne's world', by Dan Carney, www.motherjones.com/mother_jones/JA95/carney.html
[232] Directory of Multinationals, 1999
[233] Mother Jones, 1995, op.cit.231
[234] Forbes, 17/11/97, op.cit.50
[235] ADM Annual Report 1998; Caswell, 1999, op.cit.71
[236] ibid
[237] ADM Annual Report 1998; Daily Mail 27/2/99, cited on www.connectotel.com/gmfood/gmwho.html
[238] Mother Jones, 1995, op.cit.231
[239] National Hog Farmer, March 1998, and Turkey World, Jan / Feb 1999, both cited in Heffernan, op cit.183
[240] Beef Today, Nov / Dec '98, cited in Heffernan, op cit.183
[241] www.hereford.uk.com/youth/sponsors/sunvalley/youth, cited in Greenpeace UK, 'Smuggling GM in through the back door', www.greenpeace.org.uk/Multimedia/Live/FullReport/1226.PDF
[242] Beef Today, Nov / Dec '98; National Hog Farmer, Mar '98; IBP Annual Report; all cited in Heffernan, op cit.183

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