

GM crops – Sorting the Wheat from the Chaff

A briefing for Farmers

Over the past months and particularly during the Government's recent GM Nation public debate, fierce arguments have raged between those against and those in favour of growing GM transgenic crops in the UK.

farm believes that those in the front-line, farmers, have been given less of a say in the debate.

The commercialisation of GM crops could, theoretically, occur this autumn – but if the current *de facto* moratorium is lifted, then the first GM crops would be expected to go into the ground in spring 2004.

A decision to commercialise GM crops would have implications for all aspects of the working life of all farmers.

This briefing attempts to set out the facts about GM crops as they will affect practical, working farmers and the markets they produce for, if the Government gives the go-ahead for commercial planting in the UK.

farm is a membership and campaigning organisation for independent & family farmers, but also open to support from the wider public.

Our aims are to:

Build public support and create political pressure to ensure such farmers survive and flourish in the UK and are recognised and valued as:

- Contributing to national food security
- Sustaining local economies, their communities and culture
- Managing the countryside and its wildlife

Expose the root causes threatening the survival of independent and family farms in the UK and globally.

farm

POBox 26094
London
SW10 0XZ

Email: info@farm.org.uk

www.farm.org.uk

Contents

- 3 Executive summary
- 7 Introduction
- 8 Is there a market for GM crops?
- 10 Will the crops proposed for commercialisation in the UK, do what the GM companies claim?
- 14 Are the GM transgenic crops safe for humans or animals?
- 15 What will it mean for your business and management practices to grow the GM crops?
- 19 What's GM really been like for farmers in North America?
- 21 'Freedom to Farm' or 'Big Brother?'
- 23 So perhaps there's no overriding need or demand for GM crops in the UK, but the developing countries desperately need them?
- 24 Are there less controversial, more obviously beneficial applications of biotechnology in agriculture?
- 25 Conclusion
- 27 Appendices

Executive Summary

There is no market for GM foodstuffs

“The customer is where the real power lies. Supermarkets are not going to give shelf space to something that doesn't sell.”

David Southwell of the British Retail Consortium

- 83% of people believe they do not know enough about the long-term health effects of GM food to allow the commercialisation of GM crops¹.
- The Consumers Association has compiled a list of over 30 food retailers with a “No GM” policy. It contains many of the biggest names responsible for the use of the UK's agricultural produce from British Sugar to Unilever, including all the major supermarkets.²

There is a market for GM free foodstuffs

“Consumers are willing to pay substantial premiums for non-GM foods in order to avoid GM counterparts. These premiums may exceed 50% of the discounted prices of GM foods.”

“Consumer Acceptance and Willingness to Pay for Genetically Modified Vegetable Oil and Salmon: A Multiple-Country Assessment” Wen S. Chern, *et al.* 2003

GM crops do not increase yields or cut costs

“UK farmers should not be fooled by promises of higher profits or yields. GM crops have not significantly increased yields or decreased farmers' costs. GM crops are not working for North American farmers and they are even less likely to work for UK farmers. Approving these crops here could be a costly mistake.”

Canadian NFU President Stewart Wells, speaking during visit of Canadian farmers who have been growing GM crops, June 2003

- Trials run by UK's National Institute of Agricultural Botany (NIAB) in 1997 and 1998 showed yields from GM winter oilseed rape and sugar beet were between 5-8% less than high yielding conventional varieties.³
- US data for 2000 shows Round-up Ready maize received on average 30% more herbicide than non GM maize, and four years' worth of data from the US Department of Agriculture show herbicide use on Round-up Ready soybeans is increasing.⁴

GM crops create new weed control problems

- Genes modified to make a crop herbicide resistant can be transferred to related weeds, which then also become herbicide resistant. English Nature has documented more than a dozen cases of weeds in the Canadian prairies that are now immune to three leading brands of weed-killer.⁵

¹ June 2003, Internet Marketing Research Services

² Consumers' Association, 2002 “GM Dilemmas”

³ Farmers Weekly, 4th December 1998

⁴ Benbrook C, 2001, “Do GM crops mean less pesticide use?”

⁵ English Nature, 2002, “Gene stacking in herbicide tolerant oilseed rape: lessons from the North American experience”

- The occurrence of herbicide tolerant 'volunteers' is proving problematic and time consuming for North American GM farmers, who are being forced to revert to more toxic alternatives such as the herbicide Paraquat and 2-4D to control them.⁶

GM crops would bring extra rules, regulations and red tape

“Three-quarters of farmers who have taken part in the Farm Scale Evaluations agreed that the guidelines had imposed some extra effort in terms of record-keeping or practical issues”

SCIMAC, 2003 “Survey of FSE farmers”

- **farm** has identified many additional time consuming and costly activities that farmers choosing to grow GM crops would have to undertake, including: maintaining separation distances; cleaning seed drills and harvesting machinery; setting up segregated storage facilities; monitoring and mapping GM volunteers; negotiating with neighbouring farmers.

GM crops would prevent you or your neighbour from exercising the right to grow the crops you choose to supply the markets you choose

“Co-existence would be impossible...contamination of conventional and organic crops would be inevitable”

Former Environment Minister, Michael Meacher, speaking on the Today Programme, Radio 4, 29/07/03

- The UK Government's official advisers, the Agriculture and Environment Biotechnology Commission, have stated it would *“be difficult and, in some places, impossible to guarantee”* that any British food was GM-free if commercial growing of GM crops went ahead.⁷
- Strict new labelling laws mean that contamination of non-GM crops would bar producers from accessing established, premium 'GM-free' markets.

GM crops have not fulfilled the promises claimed in North America and elsewhere

“In short the 'success' of the introduction of GM crops in the US owes more to marketing hyperbole than it does to objective science and agronomic delivery.”

Norfolk Genetic Information Network, 2002, “USDA Report Exposes GM Crop Economics Myth”

- United States Department of Agriculture (USDA) released its own extensive analysis of the economic performance of GM crops in America. The report goes so far as to conclude, *“Perhaps the biggest issue raised by these results is how to explain the rapid adoption of GE crops when farm financial impacts appear to be mixed or even negative.”*⁸
- There is now widespread opposition to the next generation of GM crops – notably GM wheat produced by Monsanto: The world's largest wheat seller, the Canadian Wheat Board (CWB), said the technology has, “no benefits” for farmers and that, *“...economic harm could include lost access to premium markets, penalties caused by rejected shipments, and increased farm management and grain handling costs.”*⁹

⁶ Soil Association, 2002 “Seeds of Doubt”

⁷ AEBC, 2003 “Is co-existence technically possible?” (website statement)

⁸ United States Department of Agriculture report, 2002 “The Adoption of Bioengineered Crops”

⁹ Canadian Wheat Board, 2003 “Canada asks Monsanto to drop GM wheat application”

They will not deliver environmental benefits

“GM crops can be more damaging to neighbouring flora and fauna than ordinary strains of sugar beet, maize and oilseed rape, the Government’s farm trials have shown.”

The Independent, 2 August 2003

- Instead of offering environmental benefits, herbicide resistant GM crops will facilitate the creation of sterile, weed free fields. Removing food for birds at critical stages in their breeding cycles and reducing plant and insect diversity. This will be coupled with a reversion to older more toxic chemicals to deal with volunteers and resistant weeds.

There are unanswered health concerns

“The BMA believes that insufficient care has been taken with regards to public health and the introduction of GM crops to the UK. We believe there is a greater need for more comprehensive risk assessments which include interactions between GMOs and the long term effects on health and the environment.”

Health impacts of GM crop trials, British Medical Association submission to Scottish Parliament, Nov 2002

- There have been only ten published studies on the health effects of GM food. Several of these found potentially negative changes which have not been explained.¹⁰
- A 2002 study commissioned by the UK's Food Standards Agency (FSA) showed that antibiotic-resistance marker genes from GM foods can make their way into human gut bacteria after just one meal.¹¹

GM crops will not solve world hunger and the developing countries don't want them

“We strongly object that the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly, nor economically beneficial to us ... [GM crops] will destroy the diversity, the local knowledge and the sustainable agricultural systems that our farmers have developed for millennia, and that it will undermine our capacity to feed ourselves.”

Response to Monsanto from Delegates from 20 African Countries to the Food and Agriculture Organisation of the UN. 1998

- GM crops are designed for use on large scale, industrialized farms. They require high annual capital investment and intensify reliance on costly chemical inputs. They produce crops for luxury export markets rather than local staples. They cannot be considered a solution for hunger for cash-poor, small-scale farmers in developing countries.

You can say, ‘No’ to GM transgenic crops, whilst saying ‘Yes’ or ‘Possibly’ to other biotechnology applications in agriculture.

“Within the wheat plant we have a vast reservoir of genes. We also have the advanced analytical equipment necessary to pinpoint the molecular characteristics we need. And the marker assisted systems to reliably build these characteristics into high output varieties through conventional plant breeding”.

Jeff Cox, general manager for Monsanto Northern Europe. Farmers Weekly, 30 Aug 2002

¹⁰ Ian F. Pryme and Rolf Lembcke, Nutrition and Health, 2003, "In vivo studies on possible health consequences of genetically modified food and feed - with particular regard to ingredients consisting of genetically modified plant materials"

¹¹ FSA, 2002, "Evaluating the Risks Associated with Using GMOs in Human Foods"

- Transgenic engineering, responsible for the current generation of GM crops, is only one possible application of recent breakthroughs in genetic science. There are now alternative methods, using different techniques that could offer new crops with significant advantages while avoiding some of the most worrying aspects of transgenics. Marker Assisted Breeding is one technique that offers great potential.

GM crops – Sorting the Wheat from the Chaff

Introduction

We have approached this issue primarily from the perspective of whether or not GM crops offer any real benefits for UK farmers.

Much attention has been focussed on the impacts of GM crops on organic agriculture, but this briefing is intended to be relevant to all farming sectors.

The commercialisation of GM crops could, theoretically, occur this autumn – but if the current *de facto* moratorium is lifted, then the first GM crops would be expected to go into the ground in spring 2004.

A decision to commercialise GM crops would have implications for all aspects of the working life of all farmers. Yet there has been no attempt to pull together all the different strands and answer the key questions as to what this would mean for UK farmers:

- First and foremost, if farmers sow GM crops will there be anyone to sell them to – i.e. is there a market?
- Will the crops proposed for commercialisation in the UK, do what the GM companies claim – i.e. cut farmers' costs, increase yields, make weed management easier?
- Importantly, if a sceptical public is to be won over to GM, are the crops safe and will they deliver environmental benefits?
- If you're convinced that those three questions can be answered satisfactorily, what will it mean for your business and management practices to grow the GM crops?
- Will you or your neighbours still be able to grow non-GM crops for those consumers demanding GM-free produce, if GM crops are given the go ahead?
- What's GM really been like for farmers in North America - 'Freedom to Farm' or 'Big Brother?'
- So perhaps there's no overriding need or demand for GM crops in the UK, but the developing countries desperately need them, don't they?
- Are there less controversial, more obviously beneficial applications of biotechnology in agriculture?

Is there a market for GM crops?

“Farmers are really starting to question the profit enhancing ability of products that seem to be shutting them out of markets worldwide.”

President of Canada’s National Farmers Union, Cory Ollikka, December 2000.

“The customer is where the real power lies. Supermarkets are not going to give shelf space to something that doesn’t sell.”

David Southwell of the British Retail Consortium

The overriding motivation in choosing to grow a new crop is whether there’s a market for it. The market for farm produce is ultimately determined by consumer demand.

There has been consistent consumer hostility to GM products since their arrival on supermarket shelves in the mid 1990’s:

- A Eurobarometer survey in 2001 of consumers across Europe found that 79.9% didn’t want GM foods.¹²
- In June 2003, Internet Marketing Research Services asked 2,400 people whether enough was known about the long-term health effects of GM food to allow the commercialisation of GM crops. 83% stated not.

Current consumer rejection of GM foods is reflected in the reactions of major retailers. The British Retail Consortium (BRC), which represents 90 per cent of High-Street shops, has stated that, while consumer antipathy towards GM foods remains so entrenched, major retailers will resist any move to stock GM products.¹³

The Consumers’ Association has compiled a list of over 30 food retailers with a ‘No GM’ policy (see Appendix). It contains many of the biggest names responsible for the use of the UK’s agricultural produce from British Sugar to Unilever, including all the major supermarkets.¹⁴

Even if retailers changed their stance and stocked GM products, consumers would still be able to identify and avoid them, as the European Parliament has agreed strict labelling laws for foods containing GM ingredients. From now on all products containing more than 0.9% GM content must make this clear on the packaging. These regulations cover animal feed as well as directly consumed foodstuffs. So consumers will be able to act on their concerns and discriminate against GM products, including those from livestock reared on GM feed.

Adding to these UK market forces, there are now 35 countries with either laws in place, or in the pipeline, which impose labelling or import rules on food with GM ingredients. The impacts on markets for farm produce can be quantified:

- The US lost an estimated \$2billion in trade with Europe between 1996- 2001 as a result of the market rejection of GM maize¹⁵.
- An economic study for the New Zealand Government in April 2003 showed that 20-30% of their overseas market would reject New Zealand produce if the country grew GM food crops¹⁶.

¹² “Science and society in Europe – Bridging the gap” Eurobarometer, 6 December 2001

¹³ BRC Food Policy Briefing, October 2002

¹⁴ “GM DILEMMAS– consumers and genetically modified foods” Consumers Association, 2002

¹⁵ “Seeds of Doubt” the Soil Association, September 2002

¹⁶ BERL economics report, April 2003.

- Another reflection of the public mood against GM is the number of counties who have voted in favour of rejecting GM foods from their public services and called for local farmers not to grow GM crops:¹⁷
- Warwickshire County
- South Gloucestershire
- Cornwall County Council
- Cumbria
- North Yorkshire
- East Riding and the Humber
- Somerset
- Shropshire
- Bristol
- All councils in Wales - the Welsh Assembly is pushing hard for a GM-free Wales
- Devon County Council has stated its opposition to GM trials, and along with Dorset has called on the South West Regional Assembly to take a position on GM. (they are considered partially GM-Free)

¹⁷ Friends of the Earth, 2003, "GM-Free Britain Campaign"

Will the crops proposed for commercialisation in the UK, do what the GM companies claim?

“Perhaps the biggest issue raised by these results is how to explain the rapid adoption of GE crops when farm financial impacts appear to be mixed or even negative.”

United States Department of Agriculture report, 'The Adoption of Bioengineered Crops', 28 June 2002

GM companies have subjected farmers across the globe to aggressive marketing campaigns promoting what they see as the potential performance benefits of their GM products. The claims made include:

- higher yields,
- lower agrochemical use,
- easier weed control
- environmental benefits.

On face value this sounds like an attractive package to farmers. But do the claims amount to a more than just marketing hype?

The crops proposed for introduction to the UK are all modified to be resistant to herbicides:

- Round-up Ready Sugar Beet and Round-up Ready Fodder Beet – both created by Monsanto and engineered to be resistant to Round-up (glyphosate) herbicide.
- Liberty Link Winter and Spring Oil Seed Rape – created by Bayer (formerly Aventis) and engineered to be resistant to Liberty (glufosinate ammonium) herbicide.
- Liberty Link Maize– created by Bayer (formerly Aventis) and engineered to be resistant to Liberty (glufosinate ammonium) herbicide.

None of these crops have been engineered specifically to increase yields, benefit the environment, improve nutrition, or extend storage.

For the companies promoting them, the GM crops offer the promise of maintaining or increasing their market share for their herbicides - returns on investment from developing new crop varieties are relatively low compared with agrochemical sales.

Higher Yields?

The GM crops proposed for commercialisation in the UK have not been engineered to increase yields. In fact, there is a growing amount of research indicating that the genetic engineering process may reduce the yield potential of these crops.¹⁸ The theory is that the expression of a new trait such as herbicide tolerance is an energetic drain on the plant and takes away from resources that could be put into increasing the plant's yield.

This aside, the only way in which GM crops can be seen to offer the potential for increased yields is through reduction of weed competition by increased herbicide use. This is exactly what is being attempted in America. Yet despite the increase in herbicide use, GM yields in the US are not higher than conventional varieties, and in fact 3 out of the 4 main varieties have been shown to yield less than their conventional counterparts.¹⁹

¹⁸ "Glyphosate-resistant soyabean cultivar yields compared with sister lines", Elmore RW *et al*, *Agronomy Journal*, 93, 2001

¹⁹ "Seeds of doubt" The Soil Association, September 2002

Iowa State University economist Michael Duffy has shown that when all production factors are taken into account GM soya returns less per acre than non-GM soya. GM soya lost \$8.87/acre while non-GM almost broke even, losing \$0.02/acre.²⁰

Research carried out by the University of Nebraska has also confirmed the poor yield performance of GM herbicide resistant soya. GM soya yielded 6% less than non-GM 'sister lines' and 11% less than high-yielding non-GM soya.²¹

In the UK, yields of GM oilseed rape and sugar beet have been shown to be 5-8 percent less than high-yielding conventional varieties.²²

Environmental Benefits?

The claims that GM crops could bring with them associated environmental benefits hinge on the assumption that only one application of herbicide is made and that the herbicides used are less harmful than possible alternative treatments. In reality the likelihood of farmers using only one application is slim, and has not been the case in the US. Therefore, any potential environmental benefits are unlikely to be achieved within the realities of commercial growing. Conversely, these crops create the potential for an increase in herbicide use.

There is growing concern about the environmental impacts of glyphosate and glufosinate ammonium. Glufosinate ammonium is known to be quite toxic, particularly in water. It is mobile in soil and so able to find its way into water courses. No use is permitted between the end of September and the beginning of March in the UK to reduce the risks of run-off to water over bare ground. Glyphosate has recently been found to be present in ground water in Denmark²³, presenting the threat of it being mobile in the soil and entering drinking water supplies.

Lower agrochemical usage?

The GM crops are being marketed with the promise that effective weed control can be achieved with a single application of herbicide, which could offer farmers simpler weed management, financial savings and associated environmental benefits.

But reliance on a single application of herbicide, without applying a pre-emergence herbicide, means that crops will have to compete with weeds as they emerge, putting them at a disadvantage in competing for light, water and other nutrients.

Competition at this crucial stage can have a significant effect on the final yields, especially with crops such as Maize and Sugar Beet that do not compete aggressively with weeds. In the case of Winter Oil Seed Rape, doing away with pre-emergence applications may be impossible due to the long period between sowing and germination.

farm recently analysed research from Brooms Barns experimental station, which claimed significant savings to farmers from growing GM sugar beet. Our analysis showed that weed competition can reduce yield by between 10-30%. Further, a comparison of our working farmers' on-farm practice showed that the researchers had overestimated the costs of conventional herbicide use by 75%²⁴.

The promise of simplified weed control through single application seems flawed. If farmers have paid out premium prices for these crops based on a hope that they are going to improve their weed control it is unlikely that they are going to restrict themselves to a single application and run the risk of

²⁰ Who benefits from biotechnology?" Duffy, M. presentation at the American Seed Trade Association meeting, December 2001

²¹ "Glyphosate-resistant soyabean cultivar yields compared with sister lines", Elmore RW *et al*, *Agronomy Journal*, 93, 2001

²² Reports of crop trials from the National Institute of Agricultural Botany, in *Farmers Weekly*, 4th December 1998

²³ tests done by the Denmark and Greenland Geological Research Institution (DGGR1) in an as yet unpublished article

²⁴ farm, 2003, Analysis and critique of Broom Barn's Research Station research report: "Economic consequences for UK farmers of growing GM herbicide tolerant sugar beet."

compromising yield potential. The option to make herbicide applications throughout the crop's growth and so reduce weed competition is likely to be a far more attractive proposition.

Experience from US farmers growing these crops commercially shows that, in fact, GM crops create a whole new set of weed control problems. GM volunteers are proving to be a real problem to control due to their resistance to herbicides. And the development of herbicide resistant weeds through cross breeding between GM crops and wild relatives is a worrying and troublesome development. This would be a particular problem with OSR due to the number of wild relatives growing in the UK (such as wild turnip and wild cabbage).

The introduction of GM crops may actually encourage farmers to increase the frequency of applications in the pursuit of higher yields. This has been shown to be the case in the US where they have been growing GM crops for 6 years.

- Data for 2000 shows Round-up Ready maize received on average 30% more herbicide than non GM maize.²⁵
- Four years' worth of data from the US Department of Agriculture show herbicide use on Round-up Ready soybeans is increasing.²⁶

Easier Weed Control?

Previously farmers have been restricted in the herbicides they can use on growing crops and have to strike a balance between effective weed control and damage to the crop being grown. With GM crops comes the promise of being able to use powerful pesticides that will deal with both broad-leafed and grass weeds without damaging the crop plants.

The primary herbicide for use with the GM Maize and Oilseed crops currently undergoing trials in the UK is "Liberty Link", produced by Bayer and whose active ingredient is glufosinate ammonium. However, there are doubts about the effectiveness of weed control that can be achieved with this chemical alone, especially in UK conditions. It has been shown to be less effective without the presence of strong sunlight and it is relatively mobile in the soil which means that there are also concerns about it leaching into water-courses (Glufosinate ammonium is known to have an impact on aquatic life at levels of only 8 parts per million). This would seem to make it a poor choice for weed control in the dark and wet British winters and indeed it is currently only licensed by the UK authorities for use the end of September and the beginning of March to reduce the risks of run-off to water over bare ground.

Nor has this herbicide proved effective in the US, where farmers are being forced to return to older more toxic chemicals to achieve satisfactory results. Bayer in America has accepted that GM farmers aren't able to achieve satisfactory weed control with Liberty alone, putting on sale a product called Liberty ATZ. This is a mix of a little bit of Liberty and a lot of Atrazine – a residual chemical banned in most of Europe.

On top of the problems of effectiveness is the development of tolerance in weeds and the control of herbicide tolerant volunteers. There are already a number of weeds resistant to Round-up. This number can only be expected to increase if farmers rely solely on this chemical and weeds are exposed to it continuously. The problem of controlling herbicide tolerant volunteers will be a real problem with sugar beet and oil seed rape where volunteers are a very common occurrence. Once again tolerance in weeds and the need to control volunteers is driving North American farmers to revert to more toxic alternatives such as the herbicide Paraquat and 2-4D.²⁷

US farmers are concerned about weeds in fields of GM soya that glyphosate cannot control, or which are not controlled at the rates of herbicide application for which they are willing to pay. The need to increase levels of herbicide use is likely to result in the increased incidence of residues in crops. To accommodate

²⁵ "Do GM crops mean less pesticide use?", Benbrook C, Pesticide Outlook, October 2001

²⁶ "Do GM crops mean less pesticide use?", Benbrook C, Pesticide Outlook, October 2001

²⁷ "Seeds of Doubt" The Soil Association, September 2002

this, Monsanto, the major manufacturer of glyphosate, has successfully applied to the EU to raise the maximum residue limit for glyphosate 200 times from 0.1 mg/kg to 20 mg/kg.²⁸

English Nature, the UK government's advisory body on biodiversity, have documented more than a dozen cases of weeds in the Canadian prairies that are immune to three leading brands of herbicide and have predicted, "*herbicide tolerant gene-stacked volunteers of oilseed rape would be inevitable in practical agriculture in the UK.*"²⁹

As in North America, they believe that if similar GM crops were introduced in the UK, farmers here might resort to older herbicides that are highly damaging to wildlife.

²⁸ Pesticides News No.45, September 2000, page 5

²⁹ "Gene stacking in herbicide tolerant oilseed rape: lessons from the North American experience", English Nature, February 2002,

Are the GM transgenic crops safe for humans or animals?

“The BMA believes that insufficient care has been taken with regards to public health and the introduction of GM crops to the UK. We believe there is a greater need for more comprehensive risk assessments which include interactions between GMOs and the long term effects on health and the environment before field trials are taken any further.”

Health impacts of GM crop trials, British Medical Association submission to Scottish Parliament, Nov 2002

No one knows for sure whether GM crops are safe, because there have been very few controlled tests. A study by scientists in Norway and Denmark revealed that to date (2003) there have only been ten published studies on the health effects of GM food or feed.³⁰ The researchers questioned the quality of even these few, as over half were undertaken in collaboration with companies (fully or partially). These found no negative effects on body organs, whilst the independent studies looked more closely at the effects on the gut lining and several found potentially negative changes which have not been explained.

Similar effects on the gut lining were found in the unpublished animal feeding study on the ‘Flavr Savr’ tomato.

A study published by the UK Food Standards Agency (FSA) showed for the first time that a gene inserted in a genetically engineered crop can find its way into bacteria in the human gut. Researchers fed a single meal of a hamburger and a milk shake that both contained genetically engineered soya to study participants. According to the FSA study³¹, a herbicide resistance gene from a Round-up Ready variety of engineered soya was found in bacteria from the small intestines of three out of seven study participants.

Many engineered crops have antibiotic resistance marker genes inserted in them, and there are fears that if material from these marker genes passes into humans, the effectiveness of medical antibiotics may be reduced.

Michael Antoniou, a senior lecturer in molecular genetics at King’s College Medical School, London, commenting on this study said,

“To my knowledge they have demonstrated clearly that you can get GM plant material in the gut bacteria. ... it suggests that you can get antibiotic resistance marker genes spreading around the stomach which would compromise antibiotic resistance. They have shown that this can happen at very low levels after just one meal.”³²

GM companies claim that they have thoroughly tested their GM crops for safety for animals. But this is not the case. In December 1999, the Government’s advisory committee on animal feeds (ACAF) stated that results of feeding trials on rats cannot be extrapolated to cattle as, ***“feeding trials carried out with monogastrics would not be directly applicable to ruminants”***. Rats and mice are ‘monogastrics’ (one stomach) but cows and sheep are ruminants - in other words, they have completely different digestive systems. Yet both Novartis and Aventis have claimed that their GM maize crops are safe for cattle on the basis of feeding trials conducted on mice and rats.

As with GM for human consumption, no one knows whether GM crops are safe for animal consumption. But the situation is worse because there is no legislation or formal procedure for assessing the safety of GM animal feed. There is no requirement to assess its safety either for the animals that eat it, or humans further up the food chain. This gap has been recognised by the EU, and is described by one of its Commissioners as, ***“the missing link in Community legislation on GMOs”***.

³⁰ Nutrition and Health, Professor Ian Pryme, Rolf Lembcke, 2003.

³¹ "Evaluating the Risks Associated with Using GMOs in Human Foods" (pp. 22-27, http://www.foodstandards.gov.uk/science/scientetopics/gmfoods/gm_reports), The Guardian, 32 17.7. 2002

What will it mean for your business and management practices to grow the GM crops?

“Three-quarters of farmers who have taken part in the Farm Scale Evaluations agreed that the guidelines had imposed some extra effort in terms of record-keeping or practical issues”

SCIMAC, 2003 “Survey of FSE farmers”

The Government is promoting and relying on the principle of ‘co-existence’ i.e. that the introduction of GM crops should not impact upon the integrity, choice and diversity of existing GM-free produce and methods of production – conventional or organic.

To attempt to keep GM production contained and prevent contamination of non-GM crops and foods, a new set of regulations and guidelines is proposed to ensure ‘best practice’ in the way the GM crops are grown, while maintaining choice for consumers via identity preservation and co-existence between GM crops and neighbouring non-GM crops.

Farmers need to be aware of the extra demands and costs represented by these guidelines when assessing the claims made by the GM companies that GM crops will make management simpler and cheaper. In contrast, our analysis is that GM crops will bring with them yet more rules, regulations, forms to be filled in and red tape for farmers to contend with.

The guidelines proposed for use with commercial growing of GM crops have been developed by SCIMAC (Supply Chain Initiative on Modified Agricultural Crops), an umbrella grouping of industry organisations along the UK farm supply chain, established in June 1998 to support the introduction of GM crops in the UK. These guidelines have formed the basis for managing the GM crops in the UK Government's three-year programme of farm-scale evaluations.

The SCIMAC guidelines have come under sustained attack for not taking sufficient precautions to allow GM and non-GM crops to co-exist without the threat of contamination.

The separation distances do not make allowances for the distances pollen can travel, current machinery use does not cater for the level of cleaning required to prevent mixing, storage and transportation facilities are not equipped for the levels of scrutiny required, and the voluntary nature of the guidelines does not provide sufficient incentives or threat of sanctions to ensure compliance.

The most expensive consequence of seeking to allow co-existence of the new GM crops with existing conventional and organic crops will be the monitoring required to keep track of the level of contamination occurring and provide proof of GM-free status.

The annual costs for the initial activities of planning and implementing the monitoring system together with the annual costs for internal reviews and external reviews have been calculated to total around £600 per farm and year. For small farms, this would lead to extremely high costs per hectare and per tonne production.³³

Will you or your neighbours still be able to grow the crops you choose to if GM crops are given the go ahead?

‘The hope of the [GM] industry is that over time the market is so flooded [with GM] that there’s nothing you can do about it. You just sort of surrender.’

Don Westfall, vice president of Promar International, US food industry consultancy

³³ European Commission Joint Research Centre, Scenarios for co-existence of genetically modified, conventional and organic crops in European agriculture, May 2002

The claimed main objectives of the SCIMAC guidelines is to ensure the containment of GM crops and thereby guarantee that non-GM crops can continue to be grown without the threat of contamination. The new EU labelling laws mean that farmers will have to be able to maintain a high degree of product purity in order to access the established markets for GM-free products. Any failure in the measures to prevent contamination will directly affect the rights of conventional farmers and consumers.

Contamination of non-GM crops can occur at different phases through the cropping, harvesting, handling, storage and transport of crops.

Potential sources of contamination are cross pollination, GM volunteers, GM hybridised weeds, GM products in seed drills, cultivation equipment, harvesting machinery, transporting vehicles and storage, cleaning, drying facilities. The purity of the purchased seeds influences considerably the contamination level of the harvest.

The problems of contamination will be exacerbated in the UK due to its network of small fields and small farms sharing machinery.

The main consequence of the threat of contamination is that it removes farmers' right to grow the crops they choose and their right to access the markets they wish to.

The threat of contamination will mean that the commercialisation of GM crops will have serious implications for all farmers who choose not to grow GM crops and wish to continue to supply an eager public with GM-free produce – be it conventional or organic.

The shortcomings of the SCIMAC guidelines mean that they will not be able to provide GM-free farmers with the protection they need. Non-GM farmers will be forced to adopt new and potentially expensive farm management practices in order to try and stay GM-free and maintain consumer trust.

The inevitability of contamination

“Coexistence would be impossible...contamination of conventional and organic crops would be inevitable”

Former Environment Minister, Michael Meacher speaking on Today programme, 29/7/03

For all the extra management demands and costs of conforming to the SCIMAC guidelines, it is highly unlikely that they will achieve their claimed objective of enabling farmers to choose to grow GM crops without interfering in the rights of their neighbours to grow GM-free.

It has been clearly stated by leading bodies in the field of GM co-existence that contamination will be an inevitable consequence of the commercialisation of GM crops:

- The National Pollen Research Unit have said the separation distances between GM and non-GM crops will have to be considerably larger than current regulations “otherwise widespread contamination will be inevitable”.³⁴
- The UK government's official advisers, the Agriculture and Environment Biotechnology Commission, have said it would ‘be difficult and, in some places, impossible to guarantee’ that any British food was GM-free if commercial growing of GM crops went ahead.³⁵
- A report by the European Commission's Joint Research Centre warned in May 2002 that if GM crops were widely adopted, preventing contamination of organic food would be ‘very difficult and connected to high costs, or virtually impossible.’³⁶ (the same can be said for conventional food)

³⁴ “Pollen dispersal in the crops Maize, Oil seed rape, Potatoes, Sugar beet , and Wheat” National Pollen Research Unit, January 2000

³⁵ AEBC, 2003 “Is co-existence technically possible?” (website statement)

³⁶ “Scenarios for co-existence of genetically modified, conventional and organic crops in European agriculture” Joint Research Centre, European Commission, May 2002

Recent research has shown how contamination can occur through GM-hybridised weed seeds being transported on tractor tyres and soles of boots to surrounding fields where they can germinate and breed with the crop.³⁷

This just adds to the growing evidence that GMO's cannot be contained within a working farm. They will contaminate their surroundings eventually, and when that occurs the consequences will be widespread and irreversible.

Wider land management considerations

"If GMOs contaminate land clearly this would have an effect on the value of the property, as well as raising the possibility of service of a remediation notice requiring monies to be spent on clean up."

Genetically engineered crops for pest management European Landowners Organisation 'Genetic modification in agriculture' 2003

Agricultural land prices could be affected by the growing of GM crops. The UK's Royal Institute of Chartered Surveyors (RICS) has warned that if land has been used to grow GM crops this may have a negative impact on the price of this land:

'GM crops ... may impact on their future land use decisions and ultimately the value of their property. We must have a system where the location of GM crops is strictly registered, interested parties notified well in advance of planting and the public have full access to all information.'³⁸ In a RICS survey of land managers, 63% stated they believed that previous or present growing of GM crops would make the land harder to sell and 75% would advise landlords not to allow tenants to grow GM crops.³⁹

Prospective buyers may be concerned that former use would jeopardise options for future use, i.e. GM-free production.

Legal and Insurance implications for farmers

"...no-one knows the risks of growing GM crops in this country and it would be irresponsible of us to provide insurance when we are working in the dark."

Sylvia Newton, NFU Mutual, speaking to the Western Daily Press, 2/6/03

This inevitability of contamination and threat to the livelihoods of farmers growing produce for the GM-free markets, means it will be essential to establish clear pathways to attribute liability and obtain compensation prior to any decision on the commercialisation of GM crops.

If a non-GM farmer is unable to sell their crop due to contamination from a neighbouring GM crop, impure seed or post harvest mixing, then they will suffer a financial loss due to no fault of their own. In these circumstances what pathways will be open to the farmer for obtaining compensation for their loss? Who will be seen to be at fault and have to accept liability for their involvement?

Yet farmers have been told by a number of insurance companies that GM crops are 'too dangerous to insure', indeed they have branded genetically engineered plants as risky as war and nuclear accidents.⁴⁰

The only option for reclaiming damages caused by contamination is through legal proceedings. At the moment there is no legal framework for deciding cases of liability for damage caused by GM contamination or for making the GM companies liable. If any environmental, consumer health or

³⁷ Evidence for gene flow via seed dispersal from crop to wild relatives in *Beta vulgaris* (Chenopodiaceae): consequences for the release of genetically modified crop species with weedy lineages J.-F. Arnaud*, F. Viard†, M. Delescluse and J. Cuguen., *Journal of the Royal Society*, 19 March 2003

³⁸ Louis Armstrong, chief executive of the Royal Institute of Chartered Surveyors GM crop trials 'pose threat to property prices', *Daily Telegraph*, 4, June, 2003

³⁹ Agricultural Economic Report 786. Royal Institute of Chartered Surveyors survey published 9 June 1999

⁴⁰ "Farmers told GM crops are 'too dangerous to insure'" *Scottish Herald*, 10 March 2002

economic damage does result from GMOs, neither the US nor the EU have legislation in place for dealing with this contingency.

Instead, liability laws ensure that any costs from GM contamination of crops hit the non-GM grower. It will be down to the affected farmer to try to gain some form of compensation through personal legal proceedings at their own expense. In order to do this they will have to prove exactly where the contamination occurred, and how this contamination was caused through negligence on the part of a third party. A major hindrance to this process is that the SCIMAC guidelines are only on a voluntary footing and therefore cannot give a legal basis for establishing negligence or liability.

The whole situation is unfairly stacked up against the non-GM farmer. The growing of GM crops would force them to make serious changes to their farm management and adopt expensive testing to try and maintain their established GM-free markets. In the likely event of contamination of their produce with GM material, they not only suffer the loss not being able to sell their harvest, but then have to undertake complicated and very expensive legal proceedings.

What's GM really been like for farmers in North America?

"UK farmers should not be fooled by promises of higher profits or yields. GM crops have not significantly increased yields or decreased farmers' costs. GM crops are not working for North American farmers and they are even less likely to work for UK farmers. Approving these crops here could be a costly mistake."

Canadian NFU president Stewart Wells, speaking during visit of Canadian farmers who have been growing GM crops, June 2003

"In short the 'success' of the introduction of GM crops in the US owes more to marketing hyperbole than it does to objective science and agronomic delivery."⁴¹

Norfolk Genetic Information Network, "USDA Report Exposes GM Crop Economics Myth", August 2002

During the marketing of GM crops in this country much has been made of the positive experiences of US farmers growing these crops for the past six years. Many UK farmers are enthusiastic about GM crops because they believe that they have been a resounding success in America. However, the GM companies' PR machines have been selective in the evidence from North America it has presented to British farmers.

In reality, there are a growing number of US farmers who are far from happy with GM crops. Serious problems are coming to light, and the promised benefits are failing to materialise.

Only about 30% of US corn acres are planted to GMO varieties. A recent American Corn Grower Association (ACGA) survey confirmed the reduction in the area of GM maize being grown by its members and identified the reasons why their members were holding back from planting GMO corn:⁴²

70.1% were not planting GMO corn varieties because they felt they threatened US corn export sales

72.7% because they knew consumers in the US and worldwide have health and safety concerns about GMOs.

76.9% felt that patented GMO varieties give GM seed companies too much power over farmers.

74.0% said GMO seed corn varieties were too expensive.

58.5% stated that even when GMO corn varieties did yield more than conventional corn varieties, there was no net income advantage to their farm because of higher seed costs.

This survey confirms the assertion by the Soil Association that GM crops have been an **"economic disaster"** in America, costing £8 billion in lost profits and higher subsidies for taxpayers since 1999.⁴³

The next generation of GM crops are now about to be marketed in the US and it is interesting to see the reaction to these. The main new crop is a GM Round-up resistant wheat produced by Monsanto. The US and Canadian National Farmers Unions, the American Corn Growers Association, the Canadian Wheat Board, organic farming groups and more than 200 other groups are lobbying for a ban or moratorium on the introduction of the GM wheat.

The world's largest wheat seller, the Canadian Wheat Board (CWB), which holds more than 20% of the international market for wheat and barley has asked Monsanto to withdraw its application for approval of

⁴² American Corn Growers Association: Survey of farmer planting intentions for up coming growing season. 2003

⁴³ Seeds of Doubt, North American farmers' experiences of GM crops, Soil Association, 2002

genetically-modified wheat. The CWB said the technology has, **"no benefits"** for farmers and detailed the **"devastating"** economic impact the introduction of Round-up Ready Wheat would have on western Canadian farmers,

'Economic harm could include lost access to premium markets, penalties caused by rejected shipments, and increased farm management and grain handling costs.'⁴⁴

This reaction suggests that after six years of growing GM crops US and Canadian farmers are realising that they hold no benefit for them.

⁴⁴ "Canada asks Monsanto to drop GM wheat application", Reuters, Winnipeg, 27 May 2003

'Freedom to Farm' or 'Big Brother?'

"Biotechnology and GM crops are taking us down a dangerous road, creating the classic conditions for hunger, poverty and even famine. Ownership and control concentrated in too few hands and a food supply based on too few varieties planted widely are the worst option for food security."

Christian Aid Report: "Biotechnology and GMOs" 2000

In the US and Canada, growers of GM crops have had to sign a 'Technology Use Agreement' (TUA) with the companies selling the seed. This is a contract that ties the farmer into legal obligations that have profound implications for farm management and working practice. North American farmers have been shocked by the intrusive nature of these contracts, the amount of control they have been forced to relinquish to the corporations involved, and the serious financial implications of signing the agreements.

The GM companies involved are reluctant to commit as to whether or not these agreements will be used in the UK.

US agreements specify that the farmer has to pay a technology fee to the company for every hectare where their product is grown. UK based research into the growing of Round-up Ready sugar beet has quoted a price for this technology fee of between £20 and £30 per ha.⁴⁵

If technology fees are not used in the UK, then companies will have to obtain all their profits from seed prices, forcing these even higher.

Amongst the restrictions is the clause that ties the farmer to buying their herbicides for use with the GM crop from the same company that produces the seed. The cost of 'Roundup Biactive', the designated herbicide that must be brought for use with Round-up Ready sugar and fodder Beet, has been quoted at the price of £4.43 per litre⁴⁶ compared to the price of the generic of glyphosate, which is currently available from £1.75 per litre. This represents an increased price of 255% over the generic herbicide. It isn't difficult to see why the GM companies are so eager to promote these crops when it secures their market for herbicides, for sales of seed and also brings in an acreage payment.

In the case of Round-Up ready crops the restrictions on using Round-up rather than generic glyphosate could mean an increased cost of £16 per ha.

Despite high-profile court cases in the US, many UK farmers seem unaware of the implications of these technology agreements and many are under the illusion that they will be able to use generic herbicides with GM crops.

Another probable clause in the technology use agreement will be that the farmer is not allowed to farm-save any of the GM seed. In the case of oil seed rape there is a considerable difference between the price of certified seed and the costs involved with processing farm-saved seed:

Certified seed	£30-£50 per ha.
Farm-saved seed	£15-£25 per ha.

The GM companies are policing the use of farm-saved seed extremely seriously. US farmers are obliged by their contracts to allow biotechnology company inspectors onto their farms to check whether any infringement of their patent can be detected. Like all crops, leftover seed from GM volunteers can germinate in the same field in following years when a different crop is growing there.

⁴⁵ Economic consequences for UK farmers of growing GM herbicide tolerant sugar beet
M J MAY, Broom's Barn Research Station. Association of Applied Biologists 2003

⁴⁶ Economic consequences for UK farmers of growing GM herbicide tolerant sugar beet
M J MAY, Broom's Barn Research Station. Association of Applied Biologists 2003

In the landmark case in 2001 of Saskatchewan farmer, Percy Schmeiser accused by Monsanto of growing their round-up ready oilseed rape without a licence, which he said had come in as volunteers from a neighbour's land, the judge ruled that where the patented crop came from or how it arrived on the farm was of no importance,

'...the source of the Round-up resistant canola (OSR)... is really not significant for the issue of infringement.'

Schmeiser, who is appealing, was left with legal costs of \$600,000.

So if GM crops are found to be growing on your farm unlicensed, whether they've arrived on the wind or in the tread of a visiting grain lorry, you may be liable to a serious fine. Just as were: Kentucky farmer, David Chaney who paid Monsanto \$35,000; a fellow Kentucky farmer who agreed to pay \$25,000; and three Iowa farmers are on record as having paid Monsanto \$40,000.

These and other farmers also had to sign 'gagging clauses' and agreed to give Monsanto complete access to their land for the following years. Crops have also been destroyed and seed confiscated. There are currently 550 farmers in North America facing pending legal action.

Many US farmers have decided to grow GM crops simply to avoid such threats.

GM crops represent yet another step down the road towards greater corporate control of farming and the loss of control of individual farmers over how they run their own business.

So perhaps there's no overriding need or demand for GM crops in the UK, but the developing countries desperately need them?

"If anyone tells you that GM is going to feed the world, tell them that it is not... To feed the world takes political and financial will – it's not about production and distribution."

Steve Smith, former head of Novartis Seeds. 2000

Many farmers in the UK will be aware of the claims that if we do not grow GM crops here we will be preventing poorer nations from getting access to this technology and so obtaining a solution to hunger in these countries. These claims are a cynical marketing ploy used to play on the philanthropic instincts of the public and producers in the developed world.

Given that GM crops require high annual capital investment, are designed for large-scale, highly industrialized farms, and produce foodstuffs that consumer export markets don't want. It is hard to see how they offer a sustainable and affordable solution to the hunger problems of small farmers in developing countries.

But let those from the developing countries make their own case against GM crops:

"We strongly object that the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly, nor economically beneficial to us. We do not believe that such companies or gene technologies will help our farmers to produce the food that is needed in the 21st Century. On the contrary, we think it will destroy the diversity, the local knowledge and the sustainable agricultural systems that our farmers have developed for millennia, and that it will undermine our capacity to feed ourselves."

Response to Monsanto from Delegates from 20 African Countries to the Food and Agriculture Organisation of the UN. 1998

Are there less controversial, more obviously beneficial applications of biotechnology in agriculture?

“Within the wheat plant we have a vast reservoir of genes. We also have the advanced analytical equipment necessary to pinpoint the molecular characteristics we need. And the marker-assisted systems to reliably build these characteristics into high output varieties through conventional plant breeding”.

Jeff Cox, general manager for Monsanto Northern Europe. Farmers Weekly (UK), 30 Aug 2002

The science has now moved on from where it was when the GM transgenic crops proposed for commercialisation were developed. The central dogma that transgenics was founded on has now been shown to be fundamentally incorrect. Transgenics was based on the premise that one gene codes for one protein that in turn controls one characteristic. The subsequent discovery that humans have only c.30,000 genes producing the c. 250,000 proteins in the body has shown that most genes have several effects. It is not yet known how these different functions are controlled. This high level of complexity means that attempts to manipulate genes to perform only a single function carry a high degree of risk.

With the growing concerns over the safety and real benefits of GM crops, and the advancements in the understanding of the complex interactions of genes, there is a need to explore alternative paths. What other options are available that could make use of recent scientific breakthroughs in the field of genetics? Some experts suggest that the future lies in boosting the power of conventional breeding by marrying it to genomic and other molecular-genetic techniques, while making a concerted effort to break with the proprietary approach to intellectual property and corporate commercialism.

The technique of transgenics is only one alternative method of utilising the potential of Genomics to create new crop plants. Genomics – the understanding of genetic traits – is purely a resource that can be applied to a number of different plant-breeding techniques.

Marker Assisted Selection (MAS) uses genomics to profile the genetic code of different varieties of a single species of crop plant. Breeders are able to identify desirable qualities within the genetic codes of these various strains. The genes governing these traits are then marked. Plants containing these desirable traits are bred together using traditional techniques. The offspring produced then have their genetic codes analysed to see whether the marked genes have been successfully transmitted to the next generation.

Traditionally, breeders have relied on visible traits to select improved varieties. For pest resistance, for example, that means examining mature plants in the field over successive generations to see which survive best in the face of attack by pests, before carrying out new crosses. MAS relies on identifying marker DNA sequences that are inherited alongside a desired trait during the first few generations. Thereafter, plants that carry the trait can be picked out quickly by looking for the marker sequences, allowing multiple rounds of breeding to be run in quick succession.

It is clear from previous examples of conventional breeding successes and recent research into the potential for MAS that there is more than ample genetic resources within the genetic codes of all the varieties of a species to make significant developments in the performance of crop plants.

Conclusion

As stated at the beginning, **farm's** main objective in this briefing is to examine whether or not GM crops offer any real, long-term benefits for UK farmers. Our conclusion is that the evidence available fails to demonstrate any scale of benefits to farmers that justify the risks, higher costs and loss of market orientation involved with growing the transgenic crops.

That is not to say that the application of biotechnology in agriculture does not hold the potential for benefits – only that this current generation of crops created through transgenic modification are not in the best interests of farmers:

- There is no market for GM foodstuffs – directly or indirectly derived from transgenic crops
- GM crops will not increase your yields or cut your costs
- Nor will they deliver environmental benefits
- They will bring a vast raft of extra rules, regulations and red tape
- They will prevent you or your neighbour from exercising the right to grow the crops you choose to supply the markets you choose
- They have not fulfilled the promises as claimed in North America and elsewhere
- They will not solve world hunger and the developing countries don't want them
- You can say, 'No' to GM transgenic crops, whilst saying 'Yes' or 'Possibly' to other biotechnology applications in agriculture.

Added to all the above reasons why farmers should hold back from planting GM crops is the risk of damaging the unquantifiable, but priceless asset of their reputation and further undermining the trust in which the public regards agriculture.

farm was formed by a group of working farmers and others dismayed at the running down of UK agriculture by politicians, in the press and consequently amongst the public. In contrast, we believed that there should be much common ground between the farming community and the wider public – if both had a better understanding and acceptance of each other's concerns and needs. This was a view shared by the 600 farmers we surveyed before we launched **farm** – with 80% saying they wanted to see a new organisation focus on promoting good public relations and understanding between producers and consumers.

Over the year **farm's** been in operation, we have detected a definite shift in public opinion. With even some of the more hard-line, traditional 'farmer-bashing' groups, acknowledging that UK farmers are indeed having a hard time and are the victims, rather than the drivers of a global food system that serves the interests of a few very large agribusinesses, commodity traders, processors and retailers.

This positive shift is at risk of being undermined by the GM issue. The vast majority of the public is opposed to the commercialisation of GM food crops in the UK and as this briefing shows won't buy GM food. That market rejection is a good enough reason on its own for farmers to be cautious about taking on the responsibility of planting GM crops in the UK. An even stronger reason is the long-term damage that will be done to the image of UK farming if farmers ignore the wishes of the public, their customers, and plough ahead with planting GM crops in UK soils.

Why should farmers risk their reputation by doing the dirty work of the GM companies? These huge companies are desperate to recoup unwise investments put into the GM food crops, which the market doesn't want. If they can persuade you to plant them, they can by-pass the market and use you to force their failed technology into the fields and onto the shelves – in the hope that consumer rejection will weaken over time. If it doesn't, as the evidence we've presented in this briefing suggests it won't, then it's farmers who will bear the brunt of the financial costs.

Time and time again farmers have borne the risks and shouldered the blame for someone else's mistakes or short-cuts – BSE, Organophosphates, Salmonella etc. It's time farmers got out of the firing line and let those seeking to force this controversial and unnecessary technology into our fields face the flak and take on the responsibility directly.

Appendices:

1. Consumers' Association list of over 30 retailers with a 'no GM policy':

Asda	Associated British Foods plc	Cadbury Trebor Bassett
Co-operative Group (CWS)	Glanbia Food Service	Hazelwood Foods
H J Heinz Co Ltd	Kraft Foods	Masterfoods
McVities/KP	Nestle	Northern Foods
RHM Frozen Foods Ltd	Unilever	Uniq plc

2. Management and cost implications of growing GM crops

Extensive record keeping

Additional activities include:

- Identifying fields in which GM crops have been sown.
- Noting field reference numbers, varieties sown and their specific GM characteristics.
- Keeping a detailed crop operations diary from date of sowing up through to harvest, including details of storage, post-harvest treatment etc..
- Post-harvest monitoring including sketch mapping of volunteer incidence and details of action taken to control volunteers, continued throughout the rotation.

Cost implications:

- Extra training for and time of staff.

Negotiation with neighbouring farmers

Additional activities include:

- If GM crops are to be grown next to a neighbouring farm there must be negotiation in order that required separation distances are maintained.
- The onus lies with the GM grower to notify neighbouring farms in writing of his planting intentions as soon as possible and at the latest by 1st August for autumn-sown crops and by 1st March for spring-sown crops.
- Failure to reach agreement between neighbouring growers must be notified to SCIMAC at the latest within 7 days of the specified notification date for consultation with the appropriate representative body.

Cost implications:

- Failure to resolve matters may lead to legal disputes.

Maintenance of separation distances

Additional activities include:

- Current recommended separation distances between GM crops and non-GM same species crops are 200m for Oil Seed Rape, and 600m for Forage and Sugar beet.
- To comply with these distances close attention will have to be made to cropping schedules.

Cost implications:

- Could impact on option to make the most profitable use of available land.
- Maintaining separation distances may require changes to crop rotations. Greater impact on systems that rely on rotations for weed control or nutrition.

Extra cleaning of machinery

Additional activities include:

- Ensuring seed drills thoroughly cleaned before use to prevent carry over of seed from previous operations.
- And after use to prevent the introduction of herbicide tolerant seed into unplanned areas of the farm.
- Ensure harvesting machinery is thoroughly cleaned in the field – between fields and between varieties

Cost implications:

- Time lost cleaning machinery.

Extra control of sugar beet bolters and volunteers.

Additional activities include:

- The extra work required to control volunteers and bolters.

Cost implications:

- Other herbicides required to deal with resistant weeds and volunteers.

3. Excerpts from a copy of a TUA used in Canada in conjunction with the growing of Monsanto's Round-Up Ready Canola (OSR)

TECHNOLOGY USE AGREEMENT TERMS AND CONDITIONS

The Grower shall use any purchased Roundup Ready® canola seed for planting one and only one crop for resale for consumption. The Grower agrees not to save seed produced from Roundup Ready canola seed for the purpose of replanting nor to sell, give, transfer or otherwise convey any such seed for the purpose of replanting. The Grower also agrees not to harvest any volunteer Roundup Ready canola seed crops.

The Grower shall purchase and use only Roundup® branded herbicide labelled for use on all Roundup Ready canola seed purchased. The Grower shall purchase both the Roundup branded herbicide and the Technology Use Agreement as a package from his retailer of choice.

The Grower grants Monsanto the right to inspect, take samples and test all of the Grower's owned and/or leased fields planted with canola, or any other land farmed by the Grower, and to monitor the Grower's canola fields and storage bins for the following three years for compliance with the terms of this Agreement.

If the Grower violates any of the Terms and Conditions of this Agreement, the Grower shall forfeit any right to obtain any Agreement in the future and this Agreement may, at Monsanto's option, be terminated immediately. In the event of any use of Roundup Ready canola seed which is not specifically authorised in this Agreement, the Grower agrees that Monsanto will incur a substantial risk of losing control of Roundup Ready canola seed and that it may not be possible to accurately determine the amount of Monsanto's damages. The Grower therefore agrees: a) to pay Monsanto \$15.00 per acre for every acre planted with Roundup Ready canola seed not covered by this Agreement; and b) to deliver to Monsanto or its designated agent, at the Grower's expense, all seed containing the Roundup Ready gene that results from the unauthorised use of Roundup Ready canola; or at Monsanto's option, the Grower shall destroy all crop containing the Roundup Ready gene resulting from the unauthorized use of Roundup Ready canola; and c) if the Grower sells, gives, transfers or otherwise conveys any seed containing the Roundup Ready gene contrary to the Terms and Conditions of this Agreement, the Grower shall pay to Monsanto a sum equal to \$15.00 for each acre capable of being planted using the seed that was sold, given, transferred or otherwise conveyed, or a sum equal to the amount received by the Grower for the seed that was sold, given, transferred or otherwise conveyed, whichever is greater; and d) to pay Monsanto all costs incurred by it as a result of the Grower breaking any of the terms and conditions of this Agreement, including all legal fees and disbursements incurred by Monsanto on a solicitor and client basis.

Only Roundup Transorb and Roundup Original are registered for use on Roundup Ready canola.

(Taken from Network Of Concerned Farmers, <http://www.non-gm-farmers.com/>)

4. Text messages received by the Farmer's Guardian in response to a poll on GM – July 2003

There were no positive messages, supporting the introduction of GM crops published by the Farmer's Guardian

"NO to GM. There is no scientific proof they are safe for humans, animals and the environment"

"I am anti-GM. Levels of support for GM in farming reflect a businessman's natural desire for maximum freedom of action."

"GM crops - bad for the environment and unwanted by consumers. GM crops are a non-starter."

"GM crops are an unquantifiable risk to the environment and will benefit no one but Monsanto etc."

"No to GM. There is no scientific proof that they are safe for humans, animals and the environment."

"GM? No way. Who knows what mutation it would produce through the human food chain."

"No to GM. Recent research has found GM DNA in human gut bacteria. It is now only one step away from the human genome."

"An unleashing GM crop is an irreversible move and negative ecological consequences have already been proven. We should use existing technology properly first"

"When the Biotech companies are prepared to accept UNLIMITED liability, on a corporate and personal scale, for the consequences of letting GM loose, their supposed advantages can be considered. Until then, no thanks.

"Ref the GM debate - can we not learn from the Canadians. You had a report of their experience of GM crops a few weeks ago. Surely their situation and UK will be the same. Consumers don't appear to want GM and the supermarkets won't entertain it. Current GM crops appear to be geared to herbicide tolerance, at least that is the message that is coming across. This then appears as a chemical company-led technology. Perhaps research into consumers' thoughts as to what would be acceptable should be undertaken. Is drought resistance acceptable for use in 3rd World? How about modifications to insect pests and implications of this on wildlife, bearing in mind DDT experience of the 50s & 60s and food chain transmission! It's no use growing food that no one wants. We have to learn from food scares like BSE. We must also stand up to US pressure on this." (sent as five linked text messages!)

Throughout this briefing we have made an effort to try and quantify the practical and economic implications of the commercial growing of GM crops in the UK. Obviously, there are limitations to the information we have been able to present in as these crops are not yet grown commercially in the UK – although we have presented facts and figures from North America. The lack of transparency on the part of the companies marketing these products has also been a hindrance. As they have not made public any information regarding the proposed costs of the seeds, whether they will be implementing a technology agreement or imposing technology fees. Nor have they provided information regarding herbicide applications or rates.'