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GM CROPS AND FOOD: A Review of Developments in 1999

GeneWatch

UK

Briefing Number 9
January 2000

1999 has seen a spiralling decline in the fortunes of genetically modified (GM) crops and foods. Public demand for GM-free food has led all the UK's major food retailers and producers to remove GM ingredients from their products and, as the year has progressed, concern about GM foods has spread to other countries, including Japan, Canada, Australia and the USA. This briefing reviews the major developments in the regulation, science and politics of agricultural gene technology in 1999 and considers their implications. Developments in human genetics will be examined in a separate briefing to be published in the near future.

Public Opinion

Public Opinion in the UK

Public opinion in the UK continued to harden against GM food in 1999 and has reached a point where: "*Genetically modified foods have overtaken BSE as the public's biggest food safety concern*".¹ The polls which were conducted during the year also show how little trust there is in information about GM crops and how uneasy the public and farmers are about GM crop trials.

August 1999: Greenpeace/MORI poll²

- 62% tend to be/are strongly opposed to having a GM trial in their local area.
- 59% believe GM crop testing on farmland should be stopped but it is acceptable in laboratories.
- 74% would be concerned if the definition of organic crops was changed to include those that had cross pollinated with GM crops.

August 1999: The National Consumers' Association¹

- 85% of people are worried about being denied access to the full facts on GM foods and other goods.

June 1999: BBC Newsnight/Royal Agricultural Society of England Survey³

(Survey replied to by 200 farmers from 30 counties in Britain)

- 65% would not be happy to have a GM crop trial on their farms.
- 52.5% of farmers would not grow GM crops on their farms.

The depth and scope of concern about GM foods and crops is also reflected in the Five Year Freeze campaign. This was launched on 16th February at the House of Commons with 29 members (including GeneWatch UK) calling for a moratorium on the commercial growing, use, import and patenting of GM crops. The fact that there are now more than 104 national organisations, 45 local authorities and over 300 shops, restaurants and local groups supporting it, is another tangible demonstration of public attitudes. The supporters include aid agencies such as Christian Aid and Action Aid, women's groups such as the National Federation of Women's Institutes, environmental groups like Friends of the Earth and Greenpeace, as well as religious and consumer groups.

Growing Opposition in the Rest of the World

The export market for soybeans from the US to Europe declined sharply in 1999 and this, in part at least, is thought to be attributable to the growing opposition to GM foods⁴. In 1997-8, the EU accounted for 27% of US soybean exports but this dropped to around 7% in 1998-99 (the accounting year is September to September). This was a fall from the equivalent of 81 million bushels (2,946 million litres) of soybeans in 1997-8 to 19 million bushels (691 million litres) in 1998-9.

It has, however, been argued that the UK and the rest of Europe are a special case. Because of the

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GeneWatch

UK

The Courtyard, Whitecross Road, Tideswell, Buxton, Derbyshire, SK17 8NY, UK
Phone: 01298 871898 Fax: 01298 872531 E-mail: gene.watch@dial.pipex.com

Website: <http://www.genewatch.org>

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As US opinion polls are showing, past lack of interest in GM foods may be more a case of ignorance than acceptance

BSE crisis, it is claimed that Europeans are excessively sensitive about food safety and that concerns have been whipped up by pressure groups and the media. In contrast, the USA is said to be more pro-technology and has faith in the Food and Drug Administration (FDA), which oversees safety. However, this argument is beginning to unravel. As US opinion polls are showing, past lack of interest in GM foods may be more a case of ignorance than acceptance:

- 37% aware of GM foods and 40% believe more regulation is needed - Edleman PR survey, September 1999⁵.
- 45% believe GM foods should be labelled (up from 40% in 1997) and 63% believe biotechnology will bring benefits (down from 78% in 1997) – Food Council poll⁶.
- 68% want labelling of GM foods – Gallup poll, October 1999⁷.

These kinds of results have been seen in other parts of the world, including Japan, Canada and Australia and, worryingly for the biotech and food industries, they are reminiscent of trends in public opinion in the UK prior to the furore over GM food. Consequently, both industry and some governments have begun to react and this is posing serious questions about the future viability of the GM food industry:

July 1999: Gerber (owned by the biotech company, Novartis) and Heinz remove GM ingredients from their baby food products in the USA⁸.

August 1999: Australia and New Zealand agree to label GM foods by the end of 2000⁹.

August 1999: Japan announces it will label GM foods from April 2001¹⁰.

September 1999: Japan's largest producer of soybean food products, Fuji Oil, announces it will stop using GM soybeans by April 2000¹¹.

September 1999: Archer Daniels Midland, the largest grain merchant in America, insists that farmers segregate GM soya¹². Earlier in the year, the company had told farmers it could not accept GM crops if they were not approved for export into Europe.

September 1999: All three major beer makers in Japan (Asahi Breweries, Kirin Brewery and Sapporo Breweries) stop using GM maize in brewing¹³, posing further problems for the US export market.

October 1999: US FDA announces a series of public hearings on GM foods across the USA¹⁴. These meetings are packed and have large demonstrations outside.

December 1999: Talks at the World Trade Organisation meeting in Seattle collapse. Efforts to establish a WTO committee to evaluate GM foods fail as countries resist attempts to remove decision making at a national level and override the Biosafety Protocol.

December 1999: Canada's McCain Foods, one of the world's largest producers of frozen chips, decides to stop using GM potatoes¹⁵.

Throughout the 1990s, the USA has been fiercely resistant to labelling GM foods, arguing that this is only justified on nutritional or compositional grounds. As Stuart Eizenstat, the US under secretary of state for economic, business and agricultural affairs, wrote in the Financial Times in April¹⁶: “*What the US does not accept is labelling that is misleading and that implies genetically modified products are somehow dangerous or of lesser quality, when scientific evidence,*

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Research studies have exposed how limited knowledge is about the behaviour of GM Bt crops in the environment

beneficial parasitic wasps were attracted to Bt plants as a result of chemicals released when leaves were eaten by pest larvae. Because Bt sensitive larvae ate only small quantities before they succumbed to the effects of the toxin, a lesser amount of attractant chemicals were released than when they fed on non-Bt leaves. Consequently, the wasps were more attracted to leaves inhabited by Bt resistant larvae which could feed on them for longer periods and release more of the attractant chemicals. It was therefore argued that such complex behavioural responses may mitigate against harmful effects on beneficial species. In December, laboratory studies showed that Bt can leach into soil from the roots of some Bt maize varieties where it remains toxic for at least three weeks – whether this will improve pest control or raise further concerns about non-target beneficial species remains uncertain⁵⁰. What these studies expose is how limited knowledge is about the behaviour of GM Bt crops in the environment, how complex the interactions may be and how risk assessments have to be open to constant updating.

Conclusion

The demise of GM foods in the UK was predictable. Research had shown what a sensitive issue this was for a whole host of reasons – ethical issues, food safety, environmental effects, sustainability and corporate control. These concerns were largely dismissed as being irrational and based on ignorance by companies and governments alike. However, because food retailers and producers had been seriously affected by the BSE crisis and other food safety issues and knew they had to listen to their customers, consumers were able to say ‘no’ and have their wishes translated into action. The same story is now being played out globally and it is difficult to see how the situation could be retrieved.

The UK Government has responded to the situation by recognising that the past approach to GM crops was not sufficiently broad and that many concerns were falling outside the regulatory framework. Their response has been to set up an Agriculture and Environment Biotechnology Commission (AEBC) which will report to the Cabinet Office. Although the recognition that a broader approach to GM crops and food is welcome, the formation of a new committee is a typically British response to serious political controversy. Whether the AEBC will have any real effect and the extent to which it meets the demands of public concern will be a test of the Government’s commitment to address the issues seriously.

The biotechnology industry has responded to the dramatic decline in the fortunes of GM foods by increasingly requesting discussions with public interest groups. Not surprisingly, there is considerable suspicion that this is merely a public relations exercise and that the companies are determined to carry on their ‘business as usual’ regardless of the outcomes of such consultations. However, if GM crops and food products are ever to be accepted in the UK, the biotech industry should recognise that there must be a statutory moratorium and an open-ended debate about whether or not GM crops can be part of sustainable agricultural systems. Without this, the companies involved will never be trusted and never be able to engage in real debate about the future of food and agriculture.

Consumers were able to say ‘no’ to GM foods and have their wishes translated into action

testing and approval show no risk to human health.” It remains to be seen whether the USA can maintain this bullish position in the light of the wide ranging concerns about GM foods, the legitimate right of people to choose what products they buy in a market economy, and mounting public opposition in the USA itself.

1999 – A Bad Year for Monsanto and the Biotech Industry

March 1999: DuPont buys the seed company Pioneer Hi-Bred and establishes ‘Optimum Quality Grains’ to develop the business⁶⁰.

April 1999: Monsanto expands its interests into GM trees and announces a joint venture with New Zealand’s Fletcher Challenge Group (a paper, energy and forestry company) and the USA-based paper companies International Paper and Westvaco⁶¹.

July 1999: Reports from the influential Deutsche Bank called ‘GMOs are dead’ and ‘Ag Biotech: Thanks, but no thanks?’ advise against investment in companies developing GM crops⁶².

August 1999: AstraZeneca is reported to be contemplating selling off its agricultural business because of concerns over GM foods⁶³.

August 1999: The Advertising Standards Authority rules that Monsanto’s advertisements about GM crops in 1998 were misleading. Two GeneWatch UK complaints are among the four upheld.

September 1999: Novartis is reported to be considering selling off its agribusiness sector because of the GM foods furore⁶⁴.

October 1999: Monsanto joins AstraZeneca in committing not to use so-called ‘Terminator Technology’, which makes harvested seed sterile and prevents farmers from keeping seed for re-sowing^{65,66}. Revelations about the technology caused uproar and fears for the food security of the 1.4 billion poorest people in the world who rely on saved seed. However, all the large biotechnology companies are still developing other uses of the chemical switch technology used in Terminator. Disease resistance and time of flowering are just two of the traits they hope to link to the application of a chemical.

October 1999: Monsanto’s share price drops to just over \$39, a 25% decrease since May. Pressure from Wall Street and investors mounts on Monsanto to sell off its agricultural biotechnology interests as GM crops are now seen as a liability⁶⁷.

November 1999: Monsanto develops a sudden and surprising interest in ‘dialogue’ and commissions a UK charity, The Environment Council, to broker a ‘National Stakeholder Dialogue on GMOs’ with the draft aim to “identify and progress sustainable ways forward which address the priority issues and concerns of stakeholders surrounding agricultural biotechnology”⁶⁸.

November 1999: Monsanto successfully opposes a High Court Appeal from GenetiX Snowball activists requesting a public hearing over Monsanto’s injunction against them following a protest at a GM crop trial. They promise to take their call for a trial to the House of Lords and European Court of Justice if necessary.

December 1999: Novartis and AstraZeneca announce plans to merge their agrochemical interests (which include GM crops) into a separate, independent operation. The new company, to be called Syngenta, will be the world’s third largest seed supplier⁶⁹.

December 1999: Monsanto announces that it intends to merge with the pharmaceutical giant Pharmacia-Upjohn and share prices in both companies fall⁷⁰. Since the failure of its merger with American Home Products, Monsanto has been looking for a partner to help bail it out of its financial difficulties. Monsanto also announce that it is dropping its attempt to acquire Delta and Pine Land, the maize seed producer.

December 1999: The final indignity – Friends of the Earth reveal that the canteen at Monsanto’s UK headquarters has banned GM ingredients from its food.

The influential Deutsche Bank advise against investment in companies developing GM crops

Friends of the Earth reveal that the canteen at Monsanto’s UK headquarters has banned GM ingredients from its food

GM Foods

The Pusztai Affair

Growing opposition to GM foods gained particular momentum in 1999 as the result of a preliminary research study on the safety of GM potatoes containing an

The Pusztai affair left the public wondering if this was another case of collusion between Government and industry

insecticidal protein, called a lectin, from the snowdrop. However, it was not so much the research findings themselves but rather the heavy-handed attempts to suppress and discredit them which provoked such an adverse reaction.

In August 1998, in a *World in Action* programme, Dr Arpad Pusztai of the Rowett Research Institute revealed that his results suggested that the GM potatoes could impair the growth and damage the immune system of rats. He was initially hailed as a whistleblower and then rapidly removed from his position, gagged and disgraced, having allegedly misled the public about the implications of his work. He was also prevented from discussing his findings with the audit committee set up to examine the work, which decided it was flawed.

However, in February 1999, a group of international scientists announced their support for Dr Pusztai's work¹⁷. But in an effort to contain the controversy, rather than funding more research (maybe as costly an error for the biotech industry as the failure to implement a slaughter policy in the early days of BSE was for British farmers), the Royal Society was enlisted to investigate. Their report, published in May, criticised the design of the Pusztai study and emphasised that new results should not be released until they had been subject to peer review¹⁸. Even so, when *The Lancet* published the research in October,¹⁹ following review by six scientists, the majority of whom recommended publication, the Royal Society was not pleased. Richard Horton, the editor of *The Lancet*, was threatened by a senior member of the Royal Society that he would try to have him sacked²⁰.

Such an establishment response is disturbingly reminiscent of the BSE affair and the efforts of Government and scientists to discount the dangers. As a result, the public are left wondering what there is to hide and whether this is another case of collusion between Government and industry – not a good recipe for safety. It is hardly surprising, therefore, that the remaining shreds of public confidence in the independence and impartial inquiry of science are in tatters.

The UK Food Industry Rejects GM Ingredients

1999 marked a dramatic u-turn in the attitudes of food retailers and food processing companies in the UK as each followed the other to announce that they would no longer use GM ingredients in their products. The Iceland supermarket chain had thrown down the gauntlet in March 1998 by declaring that its own-brand foods would be GM-free but others resisted the move until consumer pressure became too great. Then, in March 1999, a positive scramble to change positions began in earnest:

March 16th Marks and Spencer announces it is to remove GM ingredients from its own-brand products.

March 17th Sainsbury's announces it will follow suit

March 18th Sainsbury's and Marks and Spencer form a consortium with other European food retailers - such as Carrefour in France and the Irish Superquinn chain - to source non-GM products.

March 21st Iceland announces increased profits. This is widely linked to their

greater hardship for less developed countries by depriving them of essential export income³⁸.

- Integrated Coffee Technologies are to start field trials with a decaffeinated-coffee tree in Hawaii. However, the trees will be three times more expensive than ordinary coffee trees so may not be available to poor farmers³⁹.
- Scientists at the John Innes Centre in Norwich, announce that they have found a gene that controls plant height. They hope to transfer this gene to locally adapted varieties of crops to develop dwarf varieties and improve yields⁴⁰.
- Lettuces genetically modified to have curlier leaves so they look more exotic and are crisper are being tested in greenhouses by G's Fresh Salads in Ely⁴¹.
- In California, maize has been genetically modified to produce human antibodies to sperm. The antibodies will be extracted and included in contraceptive lubricants⁴².
- Monsanto scientists succeed in producing polymers in plants which can be used in the production of biodegradable plastics⁴³. Yields are currently too low to be commercially viable.

Research on the Environmental Effects of GM Organisms

The debate over the effects of GM organisms on the environment continued to be characterised by contradictory research findings during 1999. This was particularly evident with regard to gene flow and insect resistant Bt crops.

Gene flow: An international conference at Keele University in April 1999 discussed the latest information about gene flow between GM crops and related wild species⁴⁴. The overall consensus was that gene flow is inevitable if compatible species exist nearby but that it was impossible to quantify the amount of gene flow that would take place. For example, in Europe, gene flow from sugar beet to wild sea beet has been demonstrated⁴⁵ but the implications are uncertain. Scientists are now trying to address the issue of whether gene flow matters by trying to predict what effect a gene may have – will it, for instance, give the wild species an advantage so it flourishes and disturbs ecosystem function? Such studies, however, are limited by a lack of knowledge about which characteristics determine how a plant population behaves. Nevertheless, it is essential that uncertainties over the consequences of gene flow are resolved as quickly as possible since pollen can travel long distances and any adverse effects may be irreversible. Research commissioned by The Soil Association⁴⁶ showed that maize pollen could be carried many kilometres by the wind and Friends of the Earth detected pollen from GM oilseed rape in bee hives up to 4.5 kilometres from farm scale trials.

Bt crops: Bt crops are those which have a gene transferred from the bacterium *Bacillus thuringiensis* to enable them to produce their own insecticidal toxin as a defence against pests. The potential effects of Bt crops on non-target organisms have been the subject of much research. One study indicated that monarch butterfly larvae could be harmed by pollen from Bt crops falling on the milkweed plants on which they depend⁴⁷. This has been criticised as not being representative of the real world where lower levels of Bt may be encountered than in the laboratory studies⁴⁸. In August, a report in *Nature*⁴⁹ showed that

The debate over the effects of GM organisms on the environment continued to be characterised by contradictory research findings during 1999

One by one, food retailers and processors announced that they would no longer use GM ingredients in their products

Compared with conventional crops, there has been no significant difference in yields from GM crops

were found in other regions. Furthermore, in the case of Bt crops, there were no significant differences in total insecticide usage in any of the areas studied but there was a 53% increase in the Mississippi delta region. This is because not all maize and cotton pests are affected by Bt and other insecticides must therefore be used, often before the emergence of the crop.

The USDA research also revealed that, compared with conventional crops, there had been no significant difference in yields from the GM crops in most of the regions in either 1997 or 1998. Similarly, data on the performance of GM Bt maize in 1999 from the University of Missouri showed very little difference in yields between Bt and non-Bt varieties³⁰. This is because the levels of infestation with European corn borers (the Bt's intended target) were low. As a result, there was no advantage gained from growing the Bt maize and, because a technology fee has to be paid, no economic return.

There have even been problems with Monsanto's flagship GM crop, Roundup Ready soybeans, which have not performed well in hot conditions. Research suggests this may be because the modification which allows them to resist the herbicide glyphosate, may affect lignin production so they become more brittle, split, and allow disease causing organisms to invade³¹.

New Developments in Crop Genetic Engineering

There were numerous new developments of GM crops and plants in 1999. Some of these are summarised below:

- Tobacco plants genetically modified to break down explosives so they could be used to decontaminate land³².
- At the Chelsea Flower Show, Scotts, an American horticultural company announce that they are within three years of marketing a slow growing lawn grass that needs less mowing³³.
- Pioneer Hi-Bred, the seed company owned by DuPont, announce that they have developed a new approach to genetic modification which 'tweaks' existing genes but does not introduce foreign genes.
- Swiss scientists genetically modify rice varieties either to produce beta-carotene (β -carotene), which is converted into Vitamin A in the body, or increase iron levels^{34,35}. This research is intended to help tackle the problems of Vitamin A and iron deficiency in developing countries where diets are largely rice based – a food which is very low in both these micro-nutrients. Issues of food safety remain and whether a problem which is located in poverty and lack of a proper diet can be addressed in this way needs to be questioned.
- Monsanto have genetically modified oilseed rape using a bacterial gene to increase the content of β -carotene in the oil³⁶ and have made PR capital by claiming it could be used to tackle nutritional problems in developing countries. However, since natural oils with high levels of beta carotene already exist in developing countries³⁷ and oilseed rape is not grown in these areas, Monsanto's approach may be of little benefit. Monsanto's subsidiary, Calgene, is conducting parallel work intended to alter the fatty acid composition of oilseed crops, which could lead to the development of substitutes for palm oil and cocoa butter. Ironically, this could result in

Calgene's work with GM oilseed rape could deprive developing countries of essential export income

position on GM foods²¹.

April 14th Tesco, the UK's largest food retailer, insists it has no plans to ban GM food²².

April 28th Tesco bans GM ingredients in its own-brand products²³.

April 28th Unilever, owner of Birds Eye Walls and Van den Burgh Foods, bans GM ingredients²³.

April 29th Nestlé goes GM free.

April 30th Cadbury's join in to make UK chocolate GM free.

May 20th The Federation of Bakers confirms that GM ingredients are not used by British bread makers²⁴.

June 8th Northern Foods, whose chairman Lord Haskins is an advisor to the Prime Minister, grudgingly bans GM ingredients²⁵.

June 12th McDonald's goes GM free, joining Pizza Express and Domino Pizza. Other fast food chains on the way to removing GM ingredients include Wimpy, City Centre Restaurants (who own Café Uno, Garfunkels, Deep Pan Pizza Co and Café Metro), Perfect Pizzas and Prêt à Manger²⁶.

September 19th Blake Bros, the UK's largest frozen food distributor bans GM ingredients.

December 13th Iceland becomes the first retailer to ban GM feed for its poultry²⁷.

December 20th Tesco announces it is to phase out the use of GM ingredients in animal feed.

Whilst the Government has stood aloof from these developments, many local authorities have removed GM ingredients from school dinners. The Local Government Association, which represents 450 local authorities in England and Wales, has joined the Five Year Freeze Campaign calling for a moratorium on GM foods and crops - a move which is thought to have enraged the Prime Minister.

Labelling Regulations

On 1st September 1999 it became mandatory for restaurants, pubs and cafés to inform customers if they are using GM ingredients in their foods. As with all other GM labelling regulations, this only applies if the food contains foreign DNA or protein (see GeneWatch Briefings 1 and 4). Because successive Governments and the biotech industry have consistently resisted the segregation and tracking of GM foods and ingredients, the rules are almost impossible to implement and do not even give the consumer the information they want – an accurate statement about whether GM was used in the production process.

Food labelling regulations are also being reviewed by the European Commission in order to decide the amount of foreign DNA or protein which is permitted before a food product must be labelled as containing GM ingredients. The figure being proposed is 1%. However, a consortium of European supermarkets, including Sainsbury's, are setting up schemes to ensure GM-free ingredients and working towards a contamination limit of 0.1% - some 10 times lower than the standard being proposed by the European Commission.

Labelling regulations do not give the consumer the information they want

The breeding and testing of GM animals in the UK has more than doubled in three years

Animal Genetic Engineering

Animals are at the sharp end of genetic engineering, being used in experiments which are justified by claiming that medical benefits will arise. Below are just a few examples of how animals were genetically engineered in 1999:

- Home Office statistics revealed that the breeding and testing of GM animals in British laboratories has more than doubled in three years. Almost half a million GM animals were involved in experiments in 1998, a 27% increase on 1997⁵¹.
- New Zealand approved the production of a flock of up to 10,000 GM sheep by the UK company, PPL Therapeutics. The sheep will have copies of the human gene for alpha-1-antitrypsin and will produce the protein in their milk, which it is hoped can then be used to treat lung disorders such as emphysema⁵².
- New Zealand also approved two herds of GM cows with either high levels of casein (a milk protein which is used in food and other products) or low levels of lactoglobulin (a protein which causes allergies in some people)⁵³.
- A four legged chicken with no wings was created in an attempt to understand limb development⁵⁴.
- Mice that glow green were created by introducing a gene from the jellyfish. This was to identify when an animal had been successfully genetically modified as techniques are unreliable⁵⁵.
- Scientists hope to genetically modify pigs to be more human so that their cells can be used in tissue and organ repair, although concerns about possible disease transfer remain⁵⁶.
- Mice were genetically engineered to produce human proteins in their semen. Scientists hope to apply the technique to pigs so the proteins could be harvested⁵⁷.
- Chickens were genetically modified to produce drugs in their eggs by AviGenics in Georgia⁵⁸.
- A type of gene therapy was used to increase growth rates in pigs. Growth hormone genes were injected into the muscles of piglets with a promoter which switches the gene on inside muscle cells. Piglets were 22% bigger after 65 days⁵⁹.

GM Crops

‘Virtual’ Moratorium on New Applications to Market GM Crops in Europe

During 1999, no new approvals to market genetically modified organisms (GMOs) have been granted in Europe and, since 1998, the EU’s Deliberate Release Directive (90/220/EEC), which covers the environmental safety aspects of GM crops, has been under review. It is now widely agreed that there are shortcomings in the existing directive and a revised directive is due to be considered by MEPs for a second time early in 2000. Recognising that the present rules are inadequate and do not cover, for example, the effects of the GMO on biodiversity as a result of altered agricultural practices, the Environment Council of Ministers have acted to prevent any new GM crop approvals for commercial use until a new directive is agreed which will take at least two years. This ‘virtual’ moratorium is the result of a declaration signed by the Danish, Greek, French, Italian and Luxembourg Governments, who will form a blocking minority in decisions about new GMO applications. The UK did not support this move believing that any moratorium is illegal.

Farm Scale Trials and the Voluntary Moratorium in the UK

Although the Advisory Committee on Releases to the Environment (ACRE) has yet to report on what research is needed to evaluate the effects of GM crops on biodiversity, the UK’s answer to the inadequacies in the environmental safety regulations has been to introduce a series of large, farm scale trials. These

involve the crops which could be the first to be grown commercially in the UK (see GeneWatch UK Briefing No 8). The industry recently announced that it would have a voluntary moratorium on the commercial growing of these crops until the trials are completed in 2003. Of course, any commercial growing before that time would make a nonsense of any claim that the biotech industry was serious about safety. However, shortcomings in the trials, the lack of any parallel commitments to ensure choice, a failure to resolve the potential conflict of interests with organic farmers through cross-contamination, and the fact that it is the industry itself that is controlling the situation mean that their voluntary moratorium falls far short of what is needed. There must be a Government controlled moratorium and a commitment to addressing all the issues (see GeneWatch UK Briefing No 4).

GM Crops and Performance

The area of GM crops grown worldwide in 1999 increased by 44% on 1998. The vast majority of GM crops are grown in the USA (72%), with Argentina (17%) and Canada (10%) being the only other countries growing GM crops on any significant scale (see Table 1). Herbicide tolerance accounts for 71% of GM crops, Bt insect resistance 22%, combined herbicide tolerance and Bt insect resistance, 7%. Monsanto’s GM ‘Roundup Ready’ soybean accounts for over half of the total GM crops grown. In the USA, this formed 50% of the total soybean crop and in Argentina it was 90%. 33% of US maize, 62% of Canadian oilseed rape and 55% of US cotton were genetically modified²⁸.

The area of GM crops grown worldwide in 1999 increased by 44% on 1998

COUNTRY	1998	1999	% INCREASE
USA	20.5	28.7	40
Argentina	4.3	6.7	56
Canada	2.8	4.0	43
China	<0.1	0.3	200
Australia	0.1	0.1	-
South Africa	<0.1	0.1	-
Mexico	<0.1	<0.1	-
Spain	<0.1	<0.1	-
France	<0.1	<0.1	-
Portugal	0.0	<0.1	-
Rumania	0.0	<0.1	-
Ukraine	0.0	<0.1	-
TOTALS	27.8	39.9	44

Table 1: Commercial cultivation of GM crops worldwide (millions of hectares)

In 1999, the first assessments of the performance of GM crops in commercial conditions became available. The United States Department of Agriculture (USDA) examined data from herbicide tolerant (HT) maize, cotton and soybeans and insect resistant (Bt) maize and cotton from different areas of the USA in 1997 and 1998²⁹. The results have been mixed and cast doubt on the claims that herbicide and insecticide use will decrease as a result of the introduction of herbicide and insect tolerant varieties. For instance, although there was a decrease in herbicide usage on HT crops in some areas, no significant differences

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