# GM Crops

Price 70p

## Does the world need GM food?

In the time of Malthus at the end of the 18th century, global population was about 1 billion (bn). By 1960 it had reached 3 bn, in 1987 5 bn. Another billion was added in the next 12 years and the total is nearing 7 billion now. It is something of a miracle that, outside war zones, virtually all the world's people are still being fed.

The 7 fold increase in population since 1800 has of course required a 7 fold increase in food production. It has been achieved by scientific cross breeding of plants and animals to achieve higher yields, increasingly intensive agriculture with more mechanization and high energy use, and heavy use of agro-chemicals, ie fertiliser, fungicide, pesticide and herbicide. The consequences have included pollution of some watercourses and water supply aquifers, loss of wildlife and worries about food safety.

All cultivated crops and domesticated animals have been genetically modified from the original wild varieties and species. What we now call genetic modification (GM) is the technique of adding *individual* genes to seeds to increase yields, add qualities, resist attack (so requiring less chemical protection) and, overall, cause less harm to the environment.

## Why can't we simply change to organic farming?

At the mid 2008 agricultural survey 743,516 hectares (ha) were under organic regimes including 149,103 ha in conversion. This is 4.3% of the UK's agricultural area of 17,449,891 ha (not including common rough grazing) of which about a quarter is for crops. The area has varied, the 2008 figure being as high as the previous peak in 2001, though it fell slightly in 2009. Most (84%) of the organic area is actually pasture. Organic cereals cover only 57,239 ha (1.7% of the UK cereal area) whilst all other organic food crops including orchards cover only 32,801 ha (2.4% of the total). The 624,171 ha of temporary and permanent pasture is about 5.7% of all pasture. Farmers now receive £30/ha/year once their land is certified as organic which can increase to £60/ha/year if other environmentally positive measures are pursued, plus £450/ha/year over 5 years to convert. The figures are higher for orchards.

The downside of organic farming is that crop yields are often less than 2/3rds of conventional crops and, because crops are rotated and have to include break periods of one or more years to replace the nitrogen in the soil, need *twice* as much land to produce the same quantity of crops. Thus the UK would grow *barely half* the present amount of food if it went fully organic. More food would be imported and more fossil fuel used transporting it longer distances. Any extra land exploited for organic farming would be *at the expense* of forest, wildlife habitat or land for bio-fuel crops. Though rates vary, organic food costs around 50% more to produce (about 30% more in shops despite subsidies).

There are other disadvantages. Where irrigation is necessary organic crops require more water per tonne of produce - a particular problem in many countries overseas. The carriage and working of manure into fields and the tilling of fields to reduce weeds, requires more mechanisation risking soil loss. Though organic farming uses less energy/tonne than conventional farming with most crops it depends heavily on the use of animal manures which can release methane, a damaging greenhouse gas.

Pro organic campaigners make much of the pesticide residues found on conventional food even though these are only a few percent of the safety limits. Organic food however is more likely to be contaminated by toxic moulds and, because much of the nitrogen component of organic fertiliser comes from animal manure, there have been outbreaks of food poisoning through the transfer of pathogens such as E.coli 0157 and

citrobacter with one child's death reported in Germany. This is why a 'Spanish cucumber' organic farm source was initially suspected of the 50 deaths and around 4000 illnesses caused from eating bean sprouts in Germany in May 2011. In truth the dangers from contamination are small and the Food Standards Agency (FSA) and their equivalents in Sweden and France have concluded that organic and conventional foods are equally safe. More significantly Sir John Krebs, former head of the FSA, has concluded that organic food is no tastier or nutritious than conventional. He can say this with confidence because both can be measured - by blind tasting trials and laboratory analysis.

All material is made of chemicals. Despite the impression given by some campaigners, organic farming does permit


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The purpose of this briefing note is to present the main facts on GM crops as accurately as possible. It has been prepared for ALDES by Richard Balmer but the opinions expressed are his own. If you see errors or have comments please email him at richardbalmer162@btinternet.com

certain *synthetic* (man made) as well as complex naturally occurring chemicals to be used including undesirable copper sulphate and sulphur. Generally however organic uses less synthetic chemical and, because this means it is less effective in controlling weeds and insects, it consequently supports significantly more bird life and butterflies. On the other hand organic fertilizers are less easily controlled than synthetic ones and leach *more* nitrate into water courses and aquifers per tonne of crop.

The truth is that GM is working towards the same goal as organic farming: the use of less chemicals and less impact on the environment for the same quantity of crop. There is actually no logic in organic farmers using conventional but not GM seed if this would help. In the warm moist 2007 summer organic potatoes were threatened with the same late fungal blight that led to the Irish potato famine of 1846-50. They applied 'Bordeaux mixture' which may sound 'cuddly' but is in fact poisonous copper sulphate. Trials of a GM potato capable of combating this blight are proceeding in Norfolk. It would be folly not to use this for organic grown potatoes if it proves successful.

### But there is plenty of food - what about the food mountains?

For the first time for decades there was real concern over global food supplies in 2008 due to failures in Australia and some other grain supplying countries and the introduction of a new demand for bio-fuels. Grain prices soared and the EU, who required farmers to 'set aside' certain proportions of land since 1992, suspended requirements in 2008 and have now cancelled them. Almost 900,000 ha were set-aside in the UK in 2007. It would be wrong to say there is an absolute food shortage, but the margins seem tighter.

### So what is GM?

DNA, the 'code' which defines living things, is made up of long strings of 'genes' linked to 'gene promoters'. Genes are 'templates' or 'patterns' from which *copies* of different proteins can be made. Gene promoters are enzymes (biochemical catalysts) which 'switch on' the gene when given specific stimuli. One gene in the human body is the template for insulin. The insulin gene promoter detects sugar in the bloodstream and 'switches on' the gene which converts the sugar to energy.

From a food safety viewpoint the genetic make up of a food is less important than knowing which genes will be *active*. For example the potato and Deadly Nightshade are in the same plant family but the gene which makes - or in the scientific jargon 'expresses' - the Nightshade toxin is inactive in the potato.

Many genes are common to plants, animals and humans. Humans share 25% of their genes with the cabbage! Plants contain tens of thousands of genes.

Selection of the best seed varieties and animal species is known to have occurred at least 10,000 years ago in SE Asia. Cross breeding attempts to blend desirable characteristics from two plant strains. For example a high yielding wheat might be crossed with a quick ripening one for use in short growing seasons as in Canada. Cross breeding began seriously in the 19th century though the breeding of mules, a cross bred donkey and horse, has occurred for 3000 years. Cross breeding is clearly a man made intervention leading to artificial or 'unnatural' genetic arrangements, as is mutation of seed via X-rays, which was first used in 1927.

Nonetheless GM, which first developed in the 1970s, was an important breakthrough. GM allows the transfer of *single* genes. This, scientists believe, is more precise and predictable and therefore *safer* than the old fashioned cross breeding which transfered 2000 or more genes at a time with unknown side effects. GM also allows unrelated genes to be introduced which could not be done by cross breeding.

### How does GM work in practice?

The prime object of GM is to produce more and better food using *less chemical*. Several different strategies can be employed. The first is by reducing wastage. Once red, tomatoes continue to ripen rapidly, go soft, and attract moulds. GM replaces the gene responsible for ripening, slowing the process down so fewer tomatoes are wasted between field and shop, in the shop, and after purchase. The quantity eaten can be 20% greater, so less land, water, and chemicals are needed.

Second, fertilized fields are attractive to weeds. These can squeeze out crops, reducing yields. All crops are herbicide tolerant to some extent. Some herbicides (weedkillers) for example may kill broad-leafed weeds but not grasses and so can be used with cereal crops. Monsanto, the US biotechnology company, has modified a number of crops including soya, maize, oil seed rape (OSR) and sugar beet to be resistant to the mild, broad spectrum herbicide, glyphosate (commercial name, Round-Up). Weed control is more effective and though the same quantity may be used the crop yield *per unit of herbicide* can be greater while the environmental impact is typically less than one third of the conventional alternative. Incidentally, now that plant genetic codes are better understood, some herbicide tolerant seeds are being created by *conventional* cross breeding methods which makes the notion that GM is uniquely 'unnatural' difficult to sustain.

Third, some crops are vulnerable to attack by various pests. 60% of all pesticide used in the USA goes on controlling the boll weevil insect in cotton. Using a gene which makes cotton less palatable to the boll weevil increases the yield of cotton/per unit of chemical. Monsanto claim that some other crops will no longer need any pesticide whilst many will need less. The £60bn worth of damage caused by the tiny nematode worm each year gives some idea of the potential value in finding new ways to resist this form of attack.

Fourth, crops are vulnerable to other things like fungi and bacterial and viral disease, and also to basic matters like heat and cold, drought and salinity. GM plants are being developed to promote resistance and greater tolerance, increasing yields on the one hand and crop area on the other.

The fifth strategy is more obtuse. Monsanto tried to develop denim blue and other coloured cottons. This could have reduced the need for chemicals used in the dyeing process.

Last, but perhaps of increasing importance, GM is being used to improve both quality and the nutritional value. Companies are improving the baking quality of wheat and the brewing quality of barley, enhancing the taste of fruits such as apples, introducing new colours to flowers such as carnations and modifying OSR to produce higher yields of bio-fuel and feedstock for plastics. Other companies are trying to use the banana and sweet potato as cheap but efficient way of administering vaccines against infectious diseases such as hepatitis B for the developing world or adding vitamins, as in the so called 'golden' rice (available perhaps from 2012) where there is dietary deficiency. A GM soya is being tried with added omega-3 acid, important to protect against heart disease and diabetes and assist brain growth. A yeast to make artemisinin, the key ingredient of an anti-malarial drug, is another exciting possibility.

### If GM's so good, why is there opposition?

Probably because food and its safety effects every single person and when it first appeared on the European scene it ended up as a 'lightning rod' for a range of suspicions about modern agriculture and intensive farming highlighted by the unhappy failure of BSE. At the same time there is a vocal anti-capitalist lobby concerned by the power of large, often American, multi-national companies which dominate the sale of GM seed, even though a great deal of GM development is being done at British research institutes. Multi-national companies can have more power than governments and act outside the constraints of the democratic process. The GM Nation consultations carried out in Summer 2003 showed mistrust was extremely widespread. Add to all this the strange scientific word 'genetic' and poor public appreciation of science in the UK and it becomes relatively easy for an unaccountable press to run 'Frankenfood' scare stories to help sell its newspapers. GM has, or had, a 'Brave New World' feel to it. There was an understandable reaction of 'hold on a bit - things are going too fast'.

### How do we know GM food is safe to eat?

Many foods carry risks. We used to avoid pork when there was an R in the month for fear of tape worms. Chicken and eggs are associated with salmonella, and milk with listeria. Butter and cheese can put up cholesterol levels. Cakes and the like invite dental decay and obesity. Vegetarians and, even more, vegans, take risks of omission. Whereas meat contains the 8 amino-acids for optimum health including brain development in the young, vegetables and fruit are usually deficient in at least one. Vegans commonly suffer from anaemia which results from insufficient iron, zinc and vitamins B6 and B12. On the other hand taking *too much* B6 is as risky as too little. There are occasional deaths from eating the pips in peach stones which contain cyanide. Even something as innocuous as a peanut can cause a lethal reaction. An Independent article in 1999 claimed that "Food scares *themselves* cause anxiety and can harm health"! Perhaps porridge is the answer.

Many foods including so called 'health foods' have never been subject to the testing demanded of GM so, logically, GM should be safer. GM products have now been on the market for 15 years and have been consumed (in varying quantities and by different routes) by hundreds of millions if not billions of people. There is of course no way to predict problems that might happen 40 years from now, but that is true of all novel foods and we discover new links between health and historic foods frequently. Is red wine good or bad and, if good, how much should one drink? Chocolate, once the ultimate in sin, is now thought (albeit in the plain version) to reduce heart disease and childhood allergies. There is an argument for monitoring the impact of GM and all new foods as far as possible for at least a decade after they go on sale, but harm seems most unlikely.

### What are the environmental dangers?

We do not know for sure but our understanding is improving all the time. As more crops are grown the probability of unforeseen problems arising gets less. Unhappily for every generation of new wonder drugs which prolong and improve life there will be a disaster like thalidomide. Mankind is not all-seeing. It is the question *we don't realise we should ask* that trips us up. It was the Comet crash at Elba which made engineers recognise the threat from metal fatigue. Drugs, aircraft, and so on are more advanced and safer due to the lessons from past failures. Thankfully doom merchants usually turn out to be wrong.

One GM concern is that transferred genes may 'escape' into other plants (what is called 'horizontal gene flow') causing havoc. Plants contain both male (the stamen) and female (the stigma) parts. Pollen contains the male DNA and is transferred by wind or insects such as bees.

There are a number of factors however which mean transfer is a lower risk than some make out. First, plants of one species *only* pollinate *each other* or varieties within the same species. Roses do not cross pollinate daisies. Second related plants need to flower at the same time and use the same carrier, and the pollen needs to be the right size. Third, cross pollination can occur between both cultivated and wild, i.e. weedy, varieties of the same crop, though this is only a problem in the UK with OSR, not the 4 other major GM crops: sugar beet, potato, maize, or wheat.

Much attention is being given to GM herbicide tolerant crops which have dominated the first wave of commercial growing. Some weeds could become herbicide tolerant (HT) so that more powerful herbicides will be needed leading to a kind of 'arms race'. At the beginning of 2002, English Nature reported on a problem that had arisen in Alberta, Canada. Two GM and one *conventionally* bred variety of HT OSR had been grown in adjacent fields. Some 'followers' (plants germinating from seed left behind at harvest the preceding year) were found to have 2, and others 3, of the HT traits. This so called 'gene stacking' is undesirable because the followers were resistant to 2 and 3 types of weed killer. English Nature asked for assurances that farm management guidelines would minimise this risk because, unlike Canada, HT traits here could be passed to weedy relatives as well.

It should be remembered of course that HT in weeds is not new. It already occurs with non-GM varieties. No one tends weeds. They thrive because they are tough and adaptable.

A linked concern, that HT weeds will have a competitive advantage and spread rapidly across the land, misunderstands the natural world. A HT weed only has an advantage where that herbicide is being used, ie on farmland, not in the wider environment. A study by Imperial College on 4 of the 5 major GM crops (they omitted wheat) found none were more invasive than conventional varieties. Indeed GM companies have a huge incentive to *prevent* weeds taking up resistant genes because their product and investment becomes worthless if they do.

Another frequently stated worry concerns the planting of

GM and non-GM, particularly organic, varieties of the same species in nearby fields. Different pollens travel different distances, from a few metres to a few kilometres according to their weight. In certain special weather conditions they can fly right across country. However, at present only *one* GM crop poses a major 'threat' to organic farmers in the UK. That is GM maize which could cross pollinate with organic sweetcorn. The organic movement was holding out for zero cross pollination with GM varieties but though threshold levels, say 1.0 or 0.1%, can be guaranteed, 0% can not and a threshold value of 0.9% has now been agreed.

Some years ago there was concern about the use of antibiotic 'marker' genes. Scientists have no way of knowing whether the key gene has been successfully transferred so they 'tie' a 'marker' gene to it. Initially many marker genes had antibiotic properties. If the new plant resisted an attack one could assume the key gene and its marker had been successfully transferred. The chosen antibiotics were not important in health care but their presence in the natural world was undesirable and alternatives have now been found.

### Are there risks to wildlife?

As noted earlier, GM has helped focus attention on trends in farm management which have been going on for 50 years. Farmland birds declined in number by over 40% between 1970 and 2000 with the corn bunting down 80% and the linnet 49%. The rate of decline slowed from about 1988 and various 'rescue' schemes are now helping to save threatened species. Much research is being done (perhaps a little late in the day) to establish the causes. It is clear that whilst chemical use is a factor (it kills the insects birds feed on and the weed habitat that insects require) this is not the only cause. For example many believe the introduction of autumn sown crops had a major impact. Sophisticated (non-GM) seed varieties and use of fungicides allowed this planting, particularly of wheat, which removed the over-wintering habitat of several birds. Monoculture (the growing of the same crop for several years at a time) has also reduced biodiversity. Now hedgerows, for example, are no longer being removed and the length may even be increasing and stream and river water quality is improving. It has become clear that the way a farm is managed is actually more important than the type of seed used. Indeed one of the *benefits* of GM research has been to make farm management of *all kinds* more environmentally friendly. The movement towards so called 'integrated farming' looks for ways to make simple changes at little cost but substantial environmental benefit. Until recently our understanding of the interaction between agriculture and environment was very sketchy.

### Is it true non-plant genes are being introduced?

Yes. The original scary headline concerned the use of a gene from a flounder to provide frost protection in strawberries conjuring up all kinds of distasteful image. This proved unsuccessful but the headline missed the point that genes are single building blocks like bricks in a house and that many, especially those dealing with survival, are common to plants, humans and animals.

### Aren't we trying to play God?

There is no objective answer to this. Some, including Prince Charles, would argue that DNA is the key to life and we have no right to mess with it. Others, following the Galileo tradition, would say God has given us the intelligence to pursue knowledge and wants us to use it for the benefit of mankind. Claims that genetic engineering is an unholy interference with nature are being undermined by the first success of gene therapies to rectify disabling conditions in humans. One truth is that nature is not sentimental. Mankind has been pitting its wits against it for thousands of years. Global population would not be at present levels without mankind's successful fight *against* nature.

### Shouldn't we be worried by multi-nationals rushing to making huge profits?

Liberal Democrat philosophy is to encourage and reward innovation and expertise. The party is anti-monopoly but not anti-profit. Because GM needs massive research funding it is inevitable large companies will predominate.

There is of course a fear that some GM products will be *so* good that they will displace all existing varieties and give one or two GM companies a dominant market position. This is a monopoly issue which should be addressed by governments. It is not specifically a GM one.

A linked concern is that having displaced a conventional crop, problems or health risks might be found and there will be 'no way back'. This is unlikely. There are already seed banks with thousands of varieties. There is a case however to limit the spread of each GM crop over, say, the next 25 years even if this means providing subsidy for non-GM varieties.

Another fear, which has now begun to die away, relates to 3rd world farmers and the emotively called 'terminator' gene. Some crops such as a non-GM maize already produce sterile seeds. It is done to maintain seed quality. Some GM varieties might have this trait though none do at present. 'Terminator' genes would remove worries that genes will 'escape' but replace them with the fear that poor farmers would no longer be able to collect their own seed and be exploited by the seed companies. The fear rests on the patronising assumption that 3rd world farmers are so ignorant they can not weigh the advantages of higher yields with bought seeds against lower yields with collected ones. Lastly, there is a fear that big multi-nationals will use their political muscle to over-ride scientific caution. The main safeguard is that the GM market is potentially huge. It would be a foolish company that risked its long term investment by an avoidable tragedy.

### If GM is ok, why are some scientists opposed?

As the area under GM crops has grown and initial concerns addressed scientific opposition has dwindled to a small fringe. (Public opposition, led by Greenpeace, FoE, the Soil Association (who have a vested interest) and some others remains). It is a proper function of scientists to look for risks as well as benefits and, especially after the BSE debacle, to warn of *possible* problems so that they can be researched. This is not opposition but vigilance. Some years ago the Royal Society for example supported GM technology but called for more testing for potential allergic reactions and suggested that GM products not be used initially in baby foods.

### Who regulates GM development?

Some early commentators suggested there was little or no regulation but in fact it is extremely onerous. Research within a laboratory is regulated by the Health and Safety Executive.

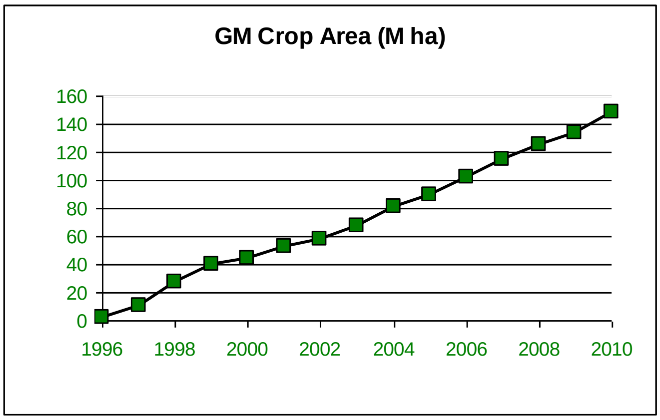
When a company, research establishment, or university wants GM trials in the open air, approval has to be sought from DEFRA (the Department of the Environment, Food and Rural Affairs). DEFRA  is advised by an independent committee called ACRE - the Advisory Committee on Releases to the Environment. ACRE advises on all kinds of release, not just GM. Some years ago it was looking at the release of beavers into Scotland. GM consents give the details of the crop, the purpose of the trial, the location, size of plots, margins, the timescale for planting, the reporting requirements, and details of any restrictions. From 1st Feb 1992, under the EC 90/220 directive, all details have to be placed on public registers held regionally. Sadly, anti-GM activists have used this open-ness to trash trial crops including some GM potato experiments being carried out by Leeds University as recently as June 2008.

Directive 2001/18/EC regulates commercial growing in EU countries. Approval to grow for the market is sought first from the competent national authority in which the crop is to be grown. In the UK this is ACRE. If ACRE is satisfied the application is submitted to the European Food Standards Authority (EFSA) and comments invited from similar competent authorities in the other EU member states. If EFSA are satisfied they make a recommendation to the member states which can be approved by qualifies majority vote. If differences can not be reconciled, the European Commission makes a decision. Approval allows the crop to be grown and marketed in the host country and a country may not refuse a farmer permission unless they can produce convincing scientific evidence. The handling and sales of GM imports to the EU are dealt with in a similar way.

There are two additional steps. First national authorities maintain their own seed registers. For home grown crops registration is required before any seed can be used. Second, the safety of all GM *food* (not all GM crops are food) grown or imported has to be assessed. This is done by DEFRA after consultation with DoH and advice from another advisory committee ACNFP, the Advisory Committee on Novel Foods and Processes. The ACNFP was set up under the EC Novel Food Regulation 258/97 which came into force on 15th May 1997. ACNFP is also independent of government. Its membership includes consumer, medical, theological, scientific and industrial representatives.

## What has happened so far?

No GM crops have been grown commercially in the UK yet although at least 12 including Soya beans, OSR, chicory, carnations and 3 types of maize have marketing approval. GM maize and soya have been imported into the EU for animal feed since 1997 and GM tomato puree was on sale in selected Sainsbury and Safeway stores between 1996 and 2000 at about 15% below the non-GM price before being withdrawn after threats from anti-GM activists. A vegetarian cheese, which uses a GM organism instead of rennet taken from calves' stomachs, has been on sale since 1992 and 90% of hard cheeses now use this organism. In 2004 the EU approved 17 varieties of GM maize so this can now be sown in all 25 countries and in March 2010 approved the Ampora potato, an industrial potato used for its starch. A GM maize variety resistant to the European corn borer active in south and central Europe (and slowly moving north) was grown in Spain and Germany before 2004 but now only continues in Spain. 6 other EU countries, including Sweden and Germany (who are trying the Ampora) have GM crops. Romania, which was growing the non-EU approved soybeans, was incensed that it had to cease doing this when it joined the EU. It highlighted the frustrations between the EU nation states, some of which (including the UK) want to try GM and others that are vehemently opposed. In July 2011 the European Parliament voted to allow individual states to ban *EU approved* varieties on grounds other than health and the environment. Hopefully this 'backstop' may help the more scientifically literate governments to get approvals through.




Elsewhere in the world GM goes from strength to strength. The global area of GM crops is now 148M ha, 5 times the area of the UK and around 10% of global cropland. The number of countries with GM has reached 29, of which 17 are 'developing' and use 48% of the total area. An estimated 15.4M farmers grow GM of which 14.4M are small, resource-poor, farmers. America still has the largest GM area (66.8M ha) but its share is steadily dropping and Brazil (25.4M ha) Argentina (22.9M ha), India (9.4M ha) and Canada (8.8M ha) are catching up. The predominant crops continue to be Soybean, Maize, Cotton and OSR and the predominant trait, herbicide tolerance. Not all varieties have proved successful. There are problems with wheat which has a complex DNA, but, unlike UK organic farming which stumbles along despite large subsidies, the growth of GM has been extraordinary and its market would have fallen away if it was not commercially successful.

## Are GM foods properly labelled?

It was a struggle. The Americans saw little difference between GM and non-GM varieties so did not bother to separate them at harvest. Separation of course would have brought higher costs. GM soya, which is used in many processed foods, was originally exported without labelling. Labelling is an EU responsibility. Despite pressure from the UK it took a long time before the Commission finalized agreement that identification was needed if the GM content was 0.9% or more. Happily the *technology* used to produce food has been excluded as a factor. GM OSR *oil* for example does not contain the GM transferred gene and so is indistinguishable from the non-GM variety once processed. Of course the flip side of detailed labelling is what others decry as 'red tape'.

Since then a different problem has arisen. Because the EU must approve all *imported* GM varieties it sometimes lags behind approvals elsewhere. A great deal of soya is imported for animal feed mostly from Argentina and Brazil. In theory it could contain non GM soya, approved GM soya and traces of *non approved* GM soya and be rejected. South American farmers found the separation into approved and non-approved bothersome and, in 2008, began re-directing their exports to less pernickety markets in China and elsewhere. As GM soya is cheaper than non-GM, EU farmers ended up at a competitive disadvantage.

### Where are we now in the UK?

The GM debate reached boiling point in the UK in 1999 with the imminent commencement of commercial growing. Misinformation was being thrown around as successfully as in the debate about the euro and the government 'kicked for touch'. It got the GM companies to accept a moratorium on commercial growing to enable public opinion to become better informed and to fund 3 years of 'farm scale evaluations (FSE)'. Unhappily debate remains sterile. Opposition reappeared in 2007 when a field trial into the blight resisting GM potato was requested by the German company BASF. A Derbyshire farmer withdrew due to his fear of criminal damage by anti-GM activists and other trials in Yorkshire were trashed. In March 2004 Government had given the go ahead for the commercial growing of the GM maize tested in the FSE but due to consumer suspicion and the inevitable costs of going up the learning curve, the seed company, Bayer, turned the opportunity down.

### The Farm Scale Evaluations

In truth the FSE achieved little. They were supervised by a 7 person scientific steering committee which included members from English Nature, RSPB and the Game Conservancy Trust and concentrated on 4 crops: fodder maize, spring-sown OSR, winter sown OSR and sugar beet, all modified for herbicide tolerance. What they did do was to provide a unique opportunity to study the interaction of fauna and flora in farmland, the food chains and the impact of farming practices. The results of 3 were made public in October '03 and the 4th in March '05.

The simple conclusion was that GM and conventionally grown crops had different impacts on biodiversity. The GM HT maize was apparently better for biodiversity while the other 3 GM crops were worse. The most important conclusion however was that whether seed is created by GM technology or not was irrelevant. It was the herbicide regime which counted. The variety of OSR made HT through *conventional* cross breeding would have performed *exactly* as the GM variety. GM and conventional varieties receiving the *same* herbicide would also have performed identically.

The scientists found that herbicide used on the GM crops for beet and OSR, though less powerful, was, by virtue of the timing, more effective in killing weeds. (It was less so on maize.) They showed that weed cover was the *principle* determinant of the richness of biodiversity because weeds provide habitat for insects including butterfly larvae, nectar for bees, webs for spiders, and so on. *Weeds are the main foundation for the wildlife food chain.*

This of course confronts us with an obvious problem! The last things farmers want are weeds! So the stark question is: how much are we prepared to pay for more bees, butterflies, birds and wild flowers in this country? If we want more, it means more weeds but more weeds mean lower crop yields and higher prices. The issue is not about GM technology at all. It is of finding better ways of growing the *same* amount of food at similar cost but with greater biodiversity.

Essentially this means putting a value on biodiversity per tonne of crop produced and rewarding farmers who adopt practices to achieve target levels. This is now being done with a reward of up to £30/ha/year if appropriate measures are carried out. The incentives seek to balance the simple objective of farmers to produce good food cheaply with a more intelligent approach to flora and fauna. We live in what is, after all, a crowded country.

### Is there any action we should be taking?

In any assessment of a new technology, one needs to ask not only "what are the consequences of using it?" but "what are the consequences of *not*?" Not including GM varieties in the spectrum of alternatives could mean unnecessary agro-chemical use and, in some cases, unnecessary harm to the environment. Given that GM technology is well regulated and relatively well understood the appropriate policy (as with most new technology) is to move forward with caution. That means:

(a) accepting those GM varieties that, on balance, either through increased yields or reduced harm to biodiversity, have some advantage over conventional ones.

(b) continuing health and environmental monitoring of GM crops for at least 10 years *after* commercial release

(c) monitoring any adverse environmental and health effects on a *global* basis in case the envelope of risk assessment needs to be extended further

(d) above all, supporting agricultural strategies which aim to produce the same amount of food at not much greater cost, but with a steady improvement in the richness of the landscape and biodiversity across the country.

It is not for anti-GM campaigners to worry whether GM will prove commercially successful or not. If, in the event, GM does not fulfil its promise its market will simply disappear. Their concern should only be over possible health and environmental consequences. So far every anxiety has proved unfounded. Though caution is still required we can not continue to be cowed by anti-GM campaigners whose objections are ideological, not scientific.