EMBO reports

viewpoint

GM food and crops: what went wrong in the UK?

Many of the public's concerns have little to do with science

Derek Burke

Genetically modified (GM) crops are now being grown extensively in North and South America and China, although not in Europe. Food produced from these crops has become a part of the normal diet in North and South America and in China, but not in Europe, where contention continues despite the fact that millions of US citizens eat GM soya without any ill effects in a very litigious society, and many Europeans have eaten GM soya while in the US without any adverse consequences.

> Why has the British public, who normally so pragmatically welcome scientific advances, resisted the introduction of genetically modified crops?

European consumers' continuous and ardent opposition to GM crops and foods has had serious repercussions for plant research, for the commercial development of new crops and, most importantly, for developing countries that could benefit most from GM crops. Several countries in Africa and elsewhere have resisted growing such crops, mainly for fear of being unable to export them to the European market (*The Economist*, 2002). It is therefore worthwhile to investigate what actually went wrong in the debate about GM food and crops in Europe and how these foods have earned such a bad name. Such an analysis could not only help to overcome public fears of this technology, but also help scientists and policy makers to address similar concerns in the future, such as the growing debate over nanotechnology.

The concerns of European consumers about the potential health and environmental threats of GM crops have resulted in an unprecedented effort to investigate those anxieties and communicate with the wider public, particularly in the UK, where the use of public consultation has been extensively developed. The first of these initiatives was the extensive Farm Scale Evaluations of three GM crops (herbicide-resistant beet, oil seed rape and maize), whose results were published last year (Firbank, 2003 and articles cited within; Turner, 2004), followed by the Advisory Committee on Releases to the Environment's report to the UK government (ACRE, 2004). There has also been a major review of the science relevant to GM crops and food, chaired by the Chief Scientific Advisor to the UK Government (GM Science Review, 2004). In addition, the UK Agricultural, Environmental and Biotechnology Commission has produced a series of reports on the scientific, social and ethical implications of sowing GM crops (www.aebc.gov.uk). The Nuffield Council on Bioethics' paper on 'The use of genetically modified crops in developing countries' (2004) reaffirmed its earlier conclusion that "there is an ethical obligation to explore these potential benefits responsibly, in order to contribute to the reduction of poverty and to improve food security and profitable agriculture in developing countries" (Nuffield Council on Bioethics, 1999). Finally, the British Medical Association recently stated in its report 'Genetically modified foods and health' (BMA, 2004) that "The BMA shares the view that there is no robust evidence to prove that GM foods are unsafe" and that "genetically modified food has enormous potential to benefit both the developed and developing world in the long term."

The British government has now made a decision on the basis of this mass of evidence. On March 9 this year, Margaret Beckett MP, UK Secretary of State for Environment, Food and Rural Affairs, made a statement in the House of Commons saying *inter alia* that "There was no scientific case for ruling out all GM crops or products" (Beckett, 2004) and announced agreement in principle to the commercial cultivation of GM herbicide-tolerant maize, subject to some conditions. Beckett further said that "There is no scientific case for a blanket approval of all uses of GM, and equally there is no scientific case for a blanket ban on the use of GM," although she took into account public concerns. "Most people believe that the use of genetic modification should be approached with caution. They want strong regulation and monitoring and in addition, some want a framework of rules for coexistence of GM and non-GM crops, and customers want a clear regime for traceability and labelling so that they can make their own choices."

This was all to no avail. On March 31, Bayer CropScience (Monheim, Germany)

announced that it was giving up attempts to commercialize its GM maize in the UK—the only transgenic plant approved for widespread cultivation (Mason, 2004). The company explained that its herbicide-tolerant maize variety Chardon LL had been left "economically non-viable" because of the conditions imposed by the Government on its growth in the UK. After the Farm Scale Evaluation trials showed that it caused less damage to wildlife than conventional varieties, Beckett had given the crop limited approval, but had not yet decided rules for mixing GM and non-GM crops, and for compensation for "contamination" by GM pollen. Bayer pointed out that Chardon LL had been developed for approval in 1999, but in the interim had lost its competitive edge against rival varieties as the controversy over GM crops continually slowed its introduction. It also warned that the UK's tough regulations on GM plants could put at risk the adoption of this new technology.

Bayer's decision to withdraw Chardon LL from the UK and other European markets means that UK farmers will not grow GM crops until GM oil seed is approved for cultivation; this will not be before 2008. The moral is obvious: States that procrastinate and prevaricate over new technologies lose it. Decisions such as this will only accelerate the flight of both scientists and companies from the EU to countries that are more accepting of new technologies.

So, despite all these scientific activities, there is still considerable antipathy to the introduction of GM crops and food. Why has the British public, who normally so pragmatically welcome scientific advances, resisted the introduction of genetically modified crops? What went wrong in the past few years and what lessons can we learn from this experience that might be helpful elsewhere in Europe and in future debates about new technologies?

In fact, the British public has not been proactive on the GM question. It does not crop up spontaneously either in general polls about voting issues, or in more detailed questionnaires about family and social matters. One recent consumer survey (FSA Public Attitudes to GM, 2002) commented that "In normal circumstances, GM [is] very far down the list of considerations with regard to food; [it] is a tiny feature on the mental map of food issues, [and] does not figure at all for some", while GM safety was not among the top ten sources of information most used when selecting food. During the 'GM Nation? The Public Debate' (2004), the website received interest from only 0.035% of the population and letters and emails from 0.0002% (Myram, 2004). When people were asked whether they are in favour of GM foods or planting GM crops, 36% answered "No"—with 13% supportive and 39% neither for nor against—so it might be better to describe the public as unpersuaded by the benefits (Poortinga & Pidgeon 2004; Cordon, 2004). However, in another survey (Consumer Watch, 2003), only 13% of consumers said they actively avoid foods with GM ingredients, while 13% said they would welcome these products on the supermarket shelves, and 74% were not sufficiently concerned about GM food to actively avoid it. It was not seen as a priority when compared with other aspects of the purchase decision. It seems as if consumers prefer to go along with what appears to be the easiest course, which in this case is a precautionary approach. This attitude, driven in part by the press, campaign groups and government equivocation, is indeed resistance, but it is important to emphasize that it is not public-led.

> It is as if GM is a lightning rod for a whole series of consumer concerns, already present but unexpressed

It is also puzzling that there has never been any public concern about the fact that, for the past 50–60 years, plant breeders have used chemical and radiation mutagenesis to create new varieties, involving major and quite unknown genetic modifications followed by selection of useful outcomes. So why is there so much opposition now? It is as if GM is a lightning rod for a whole series of consumer concerns, already present but unexpressed. Let me suggest some of them.

Consumers assess risk in a different way to scientists. The technical definition of risk is 'the likelihood of adverse consequences from any hazard', but that is not the way the public sees risk. It does not explain why some risks trigger so much more alarm, anxiety or outrage

Consumer information:
You can easily recognise genetically modified foods by their evil smile. Crops without genes just look foolish.

than others, seemingly regardless of scientific estimates of their seriousness. Research over many years has identified several 'fright factors', which affect the way the public sees risk (Bennett, 1999). People are generally more worried if they perceive a risk to be involuntary, for example, exposure to pollution, rather than voluntary, such as smoking. Risks are also seen as more serious if they are inequitably distributed, inescapable by taking personal precautions, if they arise from an unfamiliar or novel source or if they cause hidden and irreversible damage. Danger to small children, pregnant women or future generations also arouses particular dread, as does the possibility of certain forms of death, injury or illness. Risks are perceived to be more threatening if they damage identifiable rather than anonymous victims. Finally, public fears also increase if the issue seems to be poorly understood by science and is subject to contradictory statements from responsible sources. GM soya scored positively on many of these factors.

One explanation for conflicting views about GM is that scientists and the public work under different value systems. Scientists and technologists see novel applications from new discoveries as logical and reasonable, and characterize all opposition as unreasonable: "If only they understood what we are doing, the public would agree with us." This is often untrue. Indeed, the public's reaction to risk is often rather different to that of scientists, and can occur as outrage (the way the public regards Monsanto), dread (as many would regard a nuclear power station explosion) and stigma (the way the public regards food irradiation).

> …experts respond to hazards, but the public responds to outrage

Peter Sandman, an expert on risk communication at Clark University (Worcester, MA, USA) points out that the risks the experts think will cause problems are not usually the risks that upset people (www.psandman.com). He outlines four traditional responses to public fears: the conservative's answer is that the public is stupid and irredeemably irrational on risk issues, so we must protect public health but ignore public opinion; the liberal's answer is that the public is educatable but ignorant, so we must explain the data better; the company's answer is that the public is manipulated by sensational mass media or radical activist groups, so we must fight the propaganda battle better; the activist's answer is that the public is right—the experts have been misled or bought off—so we must base public policy on public opinion.

Sandman thus suggests a new way to look at risk: experts respond to hazards, but the public responds to outrage. Experts often define risk as probability multiplied by consequences. In contrast, Sandman defines risk as hazard plus outrage. Scientists may wonder why the public responds as it does to some risk issues—and it is usually caused by outrage. It is therefore not possible to predict how the public will react to new risks by consulting only scientists and technologists; perception of risk is as important as any technical assessment of a new technology.

Ethical issues also have an important role. For example, UK regulators were asked about sheep that were genetically modified to carry the human gene for factor IX, about normal animals that contained no gene but had been part of an experiment, and about animals that contained an inactive gene or part of a gene. There were no food safety issues involved; but would consumers object to eating an animal that had been part of a scientific experiment, or an animal containing an inactive human gene? Was this gene just a stretch of DNA or was it special because it came from a human being? Was it even cannibalism? Would Muslims or Jews be concerned about pork genes in lamb, and vegetarians about animal genes in plants?

Public consultation revealed a variety of concerns, many of an uneasy nature, sometimes called the "yuk" factor. Some individuals were very much opposed to the idea, and none were moved by the fact that there was effectively no chance of eating the original human gene; they remained concerned even if the gene was completely synthetic. The Jewish reaction in contrast was refreshingly straightforward: "If it looks like a sheep, then it is a sheep." I suggest some of these concerns stem from a deep antipathy to meddling with 'Nature'. Prince Charles objected to "…taking into the realm of man what rightly belongs in the realm of God." For him and some others, genetic modification is 'unnatural', articulating a romantic view of nature that regards everything 'natural' as good and anything tampered with by humans as bad.

> British newspapers run campaigns in the fierce competition for circulation, readers like scare stories although they may not believe them and scientists do not understand the workings of the media; the stage was set for trouble

This argument is based on an interpretation of 'natural' as not merely a description of the world around us, but as a value in itself. In our post-modern Western world, which has largely abandoned conventional religions, 'natural' has often become synonymous with 'good'. The question then is why opponents to GM regard it as 'unnatural'. Possibly, GM came to be seen as an offence to nature by those very people who promote naturalism. However, under other circumstances, it could have become part of the organic movement to reduce the use of chemicals in agriculture, and as such would have been seen as 'natural'. Thus, people with pre-existing agendas projected their value judgements onto the GM debate. In contrast, few scientists see genetic modification as unnatural, but agree that some things are unethical and that not everything that is possible should be done.

The conclusive influences on the GM debate in the UK were those of the media and the non-governmental organizations (NGOs). British newspapers run campaigns in the fierce competition for circulation, readers like scare stories although they may not believe them and scientists do not understand the workings of the media; the stage was set for trouble. In fact, the media had a field day when Árpád Pusztai claimed on television on 10 August 1998, and later in a press conference in the UK House of Commons on 12 February 1999, that feeding rats with genetically modified potatoes caused them damage. Despite its eventual publication in a peer-reviewed journal (Ewen & Pusztai, 1999), the Royal Society (1999)

stated, after a careful investigation by a peer group, that "we found no convincing evidence of adverse effects from GM potatoes." Although Pusztai's claim was not supported by evidence (Chen *et al*, 2003), the headlines of many newspapers from that period stagger the imagination (see sidebar).

This was not the only newspaper campaign run against GM foods and crops. Just before the results of the Farm Scale Evaluation were released on 16 October 2003, a large number of anti-GM headlines appeared in several British newspapers, clearly aiming to influence public opinion. Even after the report was published, many newspapers stated the results as "the end of GM in the UK". In fact, the trials did not assess the effects of genetically modifying crops but rather the effect of different types of weed control. They had almost nothing to do with genetic modification.

In addition to the hostile attitude of many newspapers, the NGOs involved in the GM debate in the UK have proved themselves to be very skilled at presenting their position to the media. They are highly organized, have clear points of view and are well funded. They know how to 'spin', or change the way journalists approach a story. Their mission is not to debate facts and findings but to influence public opinion, and any debate with them is unlike a standard scientific debate. NGOs are not looking to find a mutually agreed solution, but rather to promote a single uncompromising message. As soon as one objection is dealt with, they move on to the next, never admitting that they might be wrong. Scientists, in contrast, know that science at the cutting edge is not always able to provide clear conclusions. But that does not mean "We shall never know", or even "It is impossible to find out." In that sense, scientific findings are always provisional, but faced with the crisp, clear and often outrageous claims of NGOs, they are unimpressive in the public debate.

So, what lessons have we learned from the GM drama in the UK? First, scientists have to organize themselves. In the debate following Pusztai's claim, the scientific community was continually losing out, while the pressure groups released one news story after another, winning new headlines about every three days. Scientists were always on the defensive, and often too busy to respond quickly to news stories.

REACTIONS TO PUSZTAI'S PRESS CONFERENCE

Are we at risk from mutant make-up?
Express on Sunday, 21/02/99
Scientists warn of GM crops link to meningitis.
Daily Mail, 26/04/99
Scientists raise the fear of GM foods triggering new allergies.
The Express, 30/04/99
Lifting the lid on the horror of GM foods.
The Express, 12/05/99
The GM pollen that can mean a cloud of death for butterflies.
Daily Mail, 20/05/99
Mutant porkies on the menu.
News of the World, 23/05/99
GM risk in daily food of millions.
Guardian, 24/05/99
GM food 'threatens the planet'.
Observer, 20/06/99
Meat may be tainted by Frankenstein food.
Daily Mail, 06/07/99
M&S sells genetically modified Frankenpants.
Independent on Sunday, 18/07/99

HEADLINES BEFORE THE FARM-SCALE EVALUATION REPORT

Is GM the new thalidomide?
Daily Mail, 08/10/03
How GM crop trials were rigged.
Independent on Sunday, 12/10/03
Flaw in crop trials destroys the case for GM.
Independent on Sunday, 12/10/03
Stop the rush to GM crops (leader).
Independent on Sunday, 12/10/03
Curb on GM crop trials after insect pollution.
Daily Telegraph, 14/10/03
Polluted for generations.
Daily Mail, 14/10/03

Thus, a rebuttal group is invaluable. For instance, the media reaction to the Farm Scale Evaluations infuriated the scientific community in a way I have never seen before. As an interested but independent scientist I felt we had to respond, so I decided to write to the Prime Minister telling him of widespread demoralization in the scientific community and the danger of losing new technologies, and asking for an assurance that when making his decision about the future of GM, he would take the scientific evidence fully into account. I sent colleagues a draft letter, asking whether they would sign it, and within a few days there were 120 signatures from men and women working right across the biological sciences, including a Nobel Laureate, nearly 40 Fellows of the Royal Society and several academics who had helped to start new companies. The letter was delivered to Prime Minister Tony Blair on 30 October 2003, and he replied on 7 November: "I believe that the technology has great potential in the UK [and the Government] will take decisions on the basis of scientific evidence … and will not react to scare mongering, but will continue to build a firm evidence base." It is important that a rebuttal group must be able to react quickly to any new developments. They need to stay in constant contact and must be prepared to react within 24–48 hours. It is no good waiting until the weekend. Nor is it any good asking a professional society to conduct a "proper review to allay the fears of the public". It will be too slow, too late and will not influence events.

Scientists must accept the media as it is. What can they do about it? One thing is to get some media training; many scientists in the UK have already done this. Another is to get involved, and that means being available at very short notice to respond to requests from radio and TV stations, to have the facts at your fingertips and to be ready to be subjected to hostile, in some cases brutally hostile, questioning. None of us in the UK have enjoyed this, but many have felt that it is absolutely necessary. Scientists also need a series of 'good news stories', not stories about splendid new scientific advances, but realistic, honest stories about how a new technology can benefit the public, and particularly the consumer. I believe that we also have to consider the wider implications of research, recognizing that our work may have ethical implications, and that we should start thinking them through. Most scientists do not have the training, the skills or frankly the right to speak out on these issues. Instead, we need to work with social scientists, philosophers and theologians to adopt a credible stand in the public's view. It will be an education.

Importantly, we must not adopt the strategies of NGOs, which means that we must not hype. But we also have to get the message across that change is necessary if, to take but one example, we want to feed the burgeoning world population without changes in agriculture. Without such initiatives, scientific research is

endangered, for it is very easy now to persuade the public that science for its own sake is risky, even dangerous, and that society does not need it.

None of this is good news. Many a scientist will resent the loss of time and the way in which their honest efforts for society will be twisted, and they may even face personal recrimination. But there is no other way.

REFERENCES

ACRE (2004) Advice on the implications of the farm-scale evaluations of genetically modified herbicide-tolerant crops. www.defra.gov.uk/environment/acre/fse

Beckett M (2004) www.defra.gov.uk/corporate/ministers/statements/mb040309.htm

Bennett P (1999) Understanding response to risk: some basic findings. in *Risk Communication and Public Health* (eds Bennett P, Calman K), pp 3–32. Oxford Univ. Press, Oxford, UK

BMA (2004) Genetically modified foods & health: a second interim statement. www.bma.org.uk/GMFoods

Chen ZL, Gu H, Li Y, Su Y, Wu P, Jiang Z, Ming X, Tian J, Pan N, Qu L (2003) Safety assessment for genetically modified sweet pepper and tomato. *Toxicology* **188:** 297–337

Consumer Watch (2003) *GM Food and Farming: What are Consumers' Latest Views?* IGD, Watford, UK

Cordon G (2004) GM crops opposition may have been 'over-estimated'. *The Scotsman* February 19

Ewen SW, Pusztai A (1999) Effects of diets containing genetically modified potatoes expressing *Galanthus nivalis* lectin on rat small intestine. *Lancet* **354:** 353–354

Firbank LG (2003) The Farm Scale Evaluations of spring-sown genetically modified crops. *Phil Trans R Soc Lond B* **358:** 1777–1778

FSA (2002) *Public Attitudes to GM.* www.food.gov.uk/multimedia/pdfs/gmfocusgroupreport.pdf

GM Nation? The Public Debate (2004). www.gmpublicdebate.org.uk

GM Science Review (2004) An open review of the science relevant to GM crops and food based on interests and concerns of the public. www.gmsciencedebate.org.uk/report

Mason J (2004) Beckett is blamed as Bayer bins GM plan. *The Financial Times*, March 31

Myram C (2004) The future of GM crops: doom and gloom or shine and fine? *Arable Farming* February 16, p 48

Nuffield Council on Bioethics (1999) Genetically modified crops: the ethical and social issues. www.nuffieldbioethics.org

Nuffield Council on Bioethics (2004) The use of genetically modified crops in developing countries. www.nuffieldbioethics.org

Poortinga W, Pidgeon NF (2004) *Public Perceptions of Genetically Modified Food and Crops, and the* GM Nation? The Public Debate *on the Commercialization of Agricultural Biotechnology in the UK* (Understanding Risk working paper 04 – 01). Centre for Environmental Risk, Norwich, Norfolk, UK. www.uea.ac.uk/env/pur/final_report_gm_survey_2003_04-02-06.pdf

Royal Society (1999) Review of data on possible toxicity of GM potatoes. www.royalsoc.ac.uk/gmplants

The Economist (2002) Better dead than GM-fed? March 13, p 31

Turner R (2004) The field-scale evaluation of herbicide-tolerant genetically modified crops conducted in the UK. J *Commercial Biotechnol* **10:** 224–233

Derek Burke was Chairman of the UK Advisory Committee on Novel Foods and Processes from 1989 to 1997.
E-mail: dcb27@cam.ac.uk

doi:10.1038/sj.embor.7400160