PUBLIC CONCERNS OVER THE USE OF TRANSGENIC PLANTS IN THE PROTECTION OF CROPS FROM PESTS AND DISEASES AND GOVERNMENT RESPONSES

J E Hill
The Green Alliance, London, UK

Public concerns over the use of transgenic plants in the protection of crops from pests and diseases and government responses

J E Hill
The Green Alliance, 49 Wellington Street, London WC2E 7BN

ABSTRACT

A large number of organisations and individuals have expressed concerns about the potential environmental impacts of genetically modified (GM) crops. Common themes of these concerns are: the need to consider indirect and cumulative effects of GM crops, in particular their use in conjunction with chemicals; the need to consider in what direction GM technology will take agriculture; the need to distinguish between scientific evaluation of risk, and political judgement about the acceptability of risks; the need to recognise the uncertainties inherent in environmental risk assessment; and the need to come to a broader consensus about what should or should not be considered environmental 'harm'. The Government still lacks a strategic response to these concerns, and this paper makes recommendations for next steps.

INTRODUCTION

This paper describes the escalating public debate about the potential environmental impact of transgenic crops. In 1994 The Green Alliance (GA) consulted a range of interest groups, and sought scientific opinions, to produce a briefing paper (Anon, 1994a). Foremost of the concerns were: the possibility of gene transfer to wild relatives of crops, with unpredictable ecological consequences; genetic 'pollution' of native species; the environmental effects of chemicals used in conjunction with GM crops; and the extent to which GM crops would contribute to, or compromise, more 'sustainable' forms of agriculture.

AN INCREASING NUMBER OF VOICES OF CONCERN

A large number of organisations, from very different perspectives, have added their voices to the views expressed by The Green Alliance in 1994.

In 1996, the Government's Panel on Sustainable Development, a panel of five high level, independent advisers, investigated the regulation of biotechnology (Anon, 1996). They commented: 'Introduced genes may over time spread to other organisms with consequences that cannot necessarily be foreseen. Although similar concerns arise in the release of organisms modified through traditional breeding and selection processes, transgenic techniques may provide the capability to make greater changes more quickly.' They concluded that: 'A weakness of the case-based approach is that wider issues surrounding the use of genetically modified organisms (GMOs) are often not considered. Adequate consideration is not given to possible interactions following the introduction of GMOs in

different fields.' The panel called on the Government to bring together a range of interested parties to 'draw up key principles governing biotechnology and GMOs'.

In July 1997 Greenpeace issued a report entitled 'From BSE to Genetically Modified Organisms - Science, uncertainty and the precautionary principle' (Sheppard, 1997). The report highlighted the scientific uncertainties inherent in assessments of the ecological and other risks of GMOs and warned 'Official risk assessments of GMOs have tended to equate the absence of any evidence of risk with the conclusion of no or minimal risk. We now know from the BSE case that this may prove to be a fallacious and dangerous assumption'.

In October 1997 the report was followed up by 'Genetic Engineering: Too Good to go Wrong?' (Parr, 1997) in which Greenpeace cited a series of genetic experiments which had had unexpected results, and concluded that 'the central assumption of predictability is invalid'. The report asserted that 'the potential hazards are colossal and quite likely irreversible and uncontainable once released into the environment' and re-iterated Greenpeace's opposition to all releases.

Also in July 1997, The Royal Society for the Protection of Birds (RSPB) produced a review of 'possible ecological effects of releasing GMOs into the environment and the implications of such effects for bird populations' (Anon, 1997a). It considered a number of mechanisms by which GMOs might effect the environment, including the establishment of the GMO as a 'pest', such that it causes harm to ecological processes or to non-target species within the ecosystem; the transfer of introduced genes from the GMO to other species, which subsequently become established as pests; changes in the extent to which herbicides, insecticides and other pesticides are used in the environment; changes to the range of geographical locations, altitudes, soil types etc. within which the production of certain crops is economically viable; changes to seasonal cropping patterns; and production of industrial crops. The RSPB concluded that all these scenarios could result in effects on birds, although little attention had been given to the last two. The RSPB called for 'more stringent monitoring of the effects of releasing GMOs', including monitoring 'levels of herbicide, insecticide and pesticide applications ..in situations where herbicide or pesticide resistant crops are introduced'. The RSPB also argued that if the use of GM crops allowed increased intensification, 'they should be grown on the condition that other parts of the farm are managed extensively'.

In September 1997, the Country Landowners Association (CLA) issued a report from the Agriculture and Rural Economy Sub-Committee (Anon, 1997b). The CLA voiced concern that if GM crops became the norm, with the majority being bred for herbicide and pesticide resistance, 'such trends would impinge upon biodiversity, due to the greater emphasis on monoculture crops'. The CLA asserted that 'the possible transfer of characteristics from genetically modified species into the more general environment e.g. (the) pest and disease resistance implications of genetic transfer need further consideration and research.' In a response to the Ministry of Agriculture, Fisheries and Food (MAFF) consultation document on genetically modified herbicide tolerant crops, the CLA called for 'a ban on the cultivation of these crops' until a suite of government research projects on their impact were completed.

In October 1997, The Consumers Association issued a report titled 'Gene cuisine - a consumer agenda for genetically modified foods' (Anon, 1997c). The report concentrated on the use of GM foods, but also drew attention to environmental concerns: 'As well as human safety, the use of genetic modification could have implications for environmental safety which could in turn impact on consumers. The over-riding worry is that there is not enough known about the behaviour of genes once they are released and, since genetically modified organisms can migrate, mutate and multiply, any mistakes made could be irreversible'. The report considered the possible evolution of insect resistance to GM bt-crops; gene transfer from GM crops to wild relatives; 'contamination' through cross-pollination of non-GM crops by GM crops; possible increased reliance on herbicides; and loss of biodiversity. The Consumers Association called for all these risks to be considered by regulators and demanded 'a uniform approach to risk assessment that takes a precautionary approach acknowledging that scientific knowledge may not always be complete.'

In November 1997, Friends of the Earth began a campaign against genetically engineered oilseed rape developed by Plant Genetic Systems (PGS). Concerns cited in a Briefing Sheet (Anon, 1997d) included: the increased use of glufosinate, the possible increased use of other pesticides used on the crop; the possible spread of glufosinate tolerance to other rape crops; the spread of glufosinate tolerance to weeds; the possibility that plants could develop multiple resistance to herbicides; and the possibility that the crop could have adverse impacts on insect and bird populations. Friends of the Earth called for a moratorium on growing of genetically engineered crops 'until the implications have been fully evaluated'.

By the beginning of 1998, such concerns were being expressed a range of people and organisations that would generally be considered 'close to the establishment'.

In 1994/1995 the NFU's Working Party on Biotechnology which expressed a number of concerns about potential environmental and agronomic problems from growing GM crops. In March 1998 the NFU issued a revised report (Anon, 1998a) in which high on the list of concerns was the possibility that '..the use of herbicide tolerant crops, and ones that contain a built-in pesticide, could reduce the number of insects so that predatory species, ranging from other insects to birds and mammals, will become reduced in numbers. Because of these environmental uncertainties the NFU recommend that a ten-year monitoring period be instituted when a specific genetically modified crop is commercially grown in the UK for the first time'.

The fourth Annual Report of the Advisory Committee on Releases to the Environment (ACRE) (Anon, 1998b) contained a whole chapter on the control of genetically modified herbicide tolerant crops. It concluded 'we consider that the current regulatory regimes cover most of the concerns raised regarding the safety of GM herbicide tolerant crops'. However, at the press conference to launch the report, ACRE Chairman John Beringer drew attention to the possible cumulative impacts of HT crops. He was quoted in the Daily Telegraph on 24 March 1998: 'It is hard to make a good cereal crop more free of weeds than it is already...but theoretically if all crops were herbicide tolerant there would be less food available and it would be cranking up the pressure on wild species'. Such impacts were not considered to be within ACRE's remit.

In May 1998 the Parliamentary Office of Science and Technology compiled a comprehensive report on 'Genetically Modified Foods - Benefits and Risks, Regulation and Public Acceptance' (Anon, 1998c). The report considered environmental impacts including the implications of gene transfer; possible changes to the competitiveness of GM crops; whether pests would evolve resistance to GM plants, the impacts of herbicide tolerant plants on herbicide use, and the possible impact on biodiversity. On the last two, the report asserted that assessing impacts, would be 'very difficult' and noted that 'current risk assessment methods cannot allow us to predict all the possible ecological effects of GM plants, and there are also concerns that these wider environmental and ecological issues fall between the various different regulatory bodies.' On the possibility that herbicide-tolerant primary crops could further intensify agriculture the report concluded that 'while herbicide-tolerant crops do not pose new conceptual issues ..they can be portrayed as a further 'tightening of the screw', not only tying farmers in contractual terms to certain herbicides ..but also, through promising to control weeds even further, removing even the small amount of food for native species that remains with current levels of agriculture'. The report made no recommendations.

On June 8th 1998 The Prince of Wales published his concerns in the Daily Telegraph. He questioned the ethics of genetic modification and called for 'a wide public debate of the issues of principle which cannot be addressed effectively through science and regulation alone'. He also gave his view of the environmental hazards, saying 'We are told that GM crops will require less use of agro-chemicals. Even if this is true, it is certainly not the whole story. What it fails to take into account is the *total* ecological and social impact of the farming system'.

Also on 13 June 1998, The Economist published an editorial headed 'in defence of the demon seed'. The piece defended the technology as being 'of great benefit to mankind' but also made the comment 'Scientists and industry must accept that the BSE crisis has put the burden of proof in food safety firmly on to the innovator, where it belonged in the first place. Great public disclosure (in the form of labelling) and tighter regulation (through more systematic testing both before and after release) are desirable in themselves - and have become politically inescapable. This need not stifle innovation, as some companies may fear.'

In July 1998 English Nature, the Government's statutory adviser on nature conservation, issued a position statement (Anon, 1998d). Re-iterating concerns voiced earlier in the year, the statement pointed out that 'modern agricultural practices have already caused significant declines in farmland species, and that introduction of genetically modified (GM) crops could increase this pressure by transfer of modified genes, plants or animals into native ecosystems and by changes in crop management, such as increases in broad-spectrum herbicide use on herbicide tolerant crops... English Nature continues to call for a moratorium on the commercial release of genetically modified herbicide-tolerant and insect-resistant crops until current research on their potential effects has been completed and analysed'. The RSPB immediately backed the call for a three-year moratorium.

Also in July 1998, Friends of the Earth expressed a complete loss of confidence in the current regulatory system. The group moved for a judicial review of the Department of

Environment's decision not to stop a GM maize trial which was considered by Friends of the Earth to be in danger of contaminating an adjacent plot of organic sweetcorn and thereby causing a 'harm' under the terms of the 1990 Environmental Protection Act. Friends of the Earth also called for the Advisory Committee on Releases to the Environment to be sacked on the grounds that too many members had 'links to industry' and that this meant that the Committee had too positive a view of the technology to make impartial decisions.

These expressions of concern have been accompanied by an increasing number of 'direct actions' where GM trials have been destroyed. Although such actions have involved members of radical environmental groups, they have also involved local people not previously affiliated to any group, demonstrating a strong current of feeling in the public arena.

There have been a number of attempts to access the views of a wider public about the risks of GMOs, but few have concentrated on environmental hazards. The 1994 Consensus Conference organised by The Science Museum and funded by the BBSRC, had one section on environmental issues. The consensus conference panel comprised sixteen members of the public who were given access to expert views over two weekends and a day-long conference before making their report. The panel concluded that 'the impact of plant biotechnology on the environment is extremely difficult to predict' and attempted to take a 'balanced view' of the expert testimony presented to them. They said that 'Society must increase its knowledge and appreciation of environmentally sustainable agricultural practices. Gene technology can assist in this process, or further the trend towards monoculture that delivers short-term benefits at long-term risk' (Anon, 1994b),

A more recent exercise used a series of focus groups conducted by the University of Lancaster, and the results were reported in 'Uncertain World - Genetically Modified Organisms, Food and Public Attitudes in Britain' March 1997 (Grove-White, *et al.*, 1997). Participants in the focus groups expressed the common sentiment that 'perhaps progress was going too far and that technical innovation should develop more cautiously. Nature should be more respected; otherwise we interfere at our peril'.

In June 1998, the organisation GeneWatch commission a Mori poll of 950 adults. One of the questions was: 'If genetically-modified plants (such as oilseed rape and sugar beet) come into contact with natural, but related plants in the wild, it is possible for them to breed, transferring the genetically-modified material into the wild. How concerned are you, if at all, that genetically-modified plants may come to breed with wild, natural plants in this way?'. 38% were very concerned; 35% fairly concerned; 14% not very concerned, 6% not at all concerned, and 7% didn't know. When asked if there should be a ban on the growing of genetically-engineered foods in Britain until their impact has been more fully assessed, 51% strongly agreed, 26% tended to agree, 9% were neutral, 11% disagreed, and 3% couldn't say.

AN INCREASING FOCUS ON DECISION-MAKING PROCESSES

Common themes of the above statements are:

- The need for the regulatory system to cater for a broader range of environmental risks, notably 'indirect' and 'cumulative' effects, particularly the effects of using chemicals in conjunction with a GM crop or of using inbuilt pest resistance strategies.

- The need to consider the direction in which GM technology will take agricultural practice, and how changed practice might affect the environment.

- The need to clearly distinguish between scientific evaluation of risk, and political judgement about the acceptability of risks.

- The need to acknowledge the uncertainties inherent in environmental risk assessment

- The need to come to a broad consensus about what should or should not be considered environmental 'harm'.

RESPONSES FROM GOVERNMENT

Despite the growing expressions of concern from almost all quarters, the Government still lacks a strategic approach to the variety of issues and potential risks raised by the development of GMOs, including the environmental risks. A series of consultation exercises are in train which may lead to revised Government policy.

The first of these is the National Biotechnology Conference, convened by the Conservative administration as a response to the concerns expressed by the Government Panel on Sustainable Development (see above). Held at Lancaster House in March 1997 and chaired by the Earl of Selborne, the chair of the Joint Nature Conservation Committee, it involved some 150 participants from environmental and consumer groups, industry, scientific institutions, and officials from interested Departments including Environment, Agriculture, Industry and Health. The report of the Conference was prepared by an independent rapporteur, Professor Richard MacRory of Imperial College, and submitted in May 1997. The report was published later in 1997 with a covering letter from the new Environment Secretary of State, Michael Meacher saying 'I am determined to ensure that this event become the start of an evolving process that will help shape and inform the future framework for biotechnology in the UK and will help to ensure that society benefits from the technology' and promising a full government response. As of September 1998, no response had been issued.

Issues highlighted in the report were: the possibility of including a broader range of interests beyond scientific expertise in the advisory committees; the importance of transparency in decision-making; the need for a co-ordinating committee across the different parts of the regulatory system so that issues did not 'slip through'; the possibility of widening the remits of the safety committees to include consideration of the justification for biotechnology

products; analysis of the technology's impact on bio-diversity; and a framework for handling broader issues of principle. The report highlighted 'the search for mechanisms which could develop a more clearly articulated set of discriminatory principles over the use of GMOs in food and other products which was more in tune with public anxieties and expectations'. This mechanism might take the form of a rolling series of public consultations, and/or a Standing Advisory Committee to advise Ministers.

In the meantime, the Department of the Environment Transport and the Regions has responded to concern about 'indirect' effects of GMOs on biodiversity by asking the Biotechnology Unit within the Department to research possible impacts. The Minister for Environment, Michael Meacher MP, convened a meeting of conservation organisations and other interested parties for a preliminary discussion of the issues in June 1998.

Another Government consultation was undertaken by MAFF on genetically modified herbicide tolerant crops (Anon, 1997e). Issued in July 1997, the paper set out the potential agricultural advantages and disadvantages of GMHT crops, the latter including negative impact on biodiversity. The options for action presented were: encouraging the industry to manage developments; a Government-led code of practice; regulatory controls on agricultural implications; a ban on the cultivation of GMHT crops; and pressing for further EU regulatory controls. At the time of writing in September 1998, no Government response to the results of the consultation had been announced.

A further Government consultation was announced by John Battle, the Minister for Science, Energy and Industry, in November 1997. In a press notice Battle said: 'These developments offer hope. But they also raise difficult ethical questions and there is a real fear that technological advances are outstripping our capacity to handle them. A EuroBarometer survey last year found that above all, people want their views on biotechnology to be taken into account. I am determined to address those concerns and ensure the people's voice will be heard'. As of September 1998, the exact focus of the initiative is unclear.

CONCLUSIONS AND RECOMMENDATIONS

It can be concluded from this series of lengthy Government deliberations that there are no easy answers to the public's and pressure groups' disquiet over GMOs. The BSE situation has damaged public confidence in the Government's ability to understand and manage risks, leading to calls for a broader range of people than those in the usual circles of scientific and official advisers to be involved in decision-making. New approaches to regulation and policy-making are urgently needed.

It is in the interests of the biotechnology industry to support the development of new institutional arrangements, just as it was in the acknowledged interests of the industry to support the development of regulation in the late 1980's. In the view of The Green Alliance, the industry should support the following steps:

- An expanded remit for ACRE, to include the indirect and cumulative effects of GM crops, including the impacts of using chemicals in conjunction with GM crops. This would entail bringing on to ACRE people with expertise in the environmental impacts of conventional pesticide regimes.

- No new applications for marketing consents for herbicide tolerant or insect resistant crops should to be made or granted until agreement has been reached on how to assess the effects of these crops on biological diversity.

- The development of protocols for the monitoring of environmental impacts after commercial consent has been granted. Ideally, a requirement to submit a plan for post-commercialisation monitoring should be incorporated into Directive 90/220. An opportunity to do so has been presented by the process of revision of the Directive, due to be finalised in 1999. It should be borne in mind that a monitoring 'plan' could be anything from a justification of why monitoring is unnecessary (for instance for a crop with introduced genes that are effectively 'biologically contained') to a plan for comprehensive and long-term monitoring. If agreement cannot be reached in Europe, monitoring provisions should be put in place within the UK.

- The Government should propose a number of options for a strategic body, with representatives from a wide range of interest groups, to consider all the implications of biotechnology, including the environmental implications. These options should then be put out to wide consultation.

REFERENCES

Anon. (1994a). Why are environmental organisations concerned about release of genetically modified organisms into the environment? *Briefing paper produced by The Green Alliance.*

Anon (1994b). *Final Report of UK National Consensus Conference on Plant Biotechnology.*

Anon. (1996). *Second Report by British Government Panel on Sustainable Development.*

Anon (1997a). Potential effects of releasing genetically modified organisms into the environment. *Report for Royal Society for the Protection of Birds.*

Anon (1997b). Biotechnology and genetically modified organisms (GMOs). *Report for Country Landowners Association Agriculture and Rural Economy Sub-Committee.*

Anon (1997c). Gene cuisine – a consumer agenda for genetically modified foods. *Report for the Consumers' Association.*

Anon (1997d). Genetically engineered oilseed rape. *Briefing paper for Friends of the Earth.*

Anon (1997e). Weed control on the farm: Management of genetically modified herbicide tolerant crops. *Ministry of Agriculture, Fisheries and Food.*

Anon (1998a). *Report of the Biotechnology Working Party for the National Farmers Union.*

Anon (1998b). *The fourth Annual Report of the Advisory Committee on Releases to the Environment (ACRE).*

Anon (1998c). Genetically modified foods – benefits and risks, regulation and public acceptance. *Report by Parliamentary Office of Science and Technology.*

Anon (1998d). Position statement on genetically modified organisms. *English Nature (July 1998).*

Grove-White R; Macnaghten P; Mayer S; Wynne B (1997). Uncertain World: Genetically modified organisms, food and public attitudes in Britain. *University of Lancaster.*

Parr D (1997). Genetic Engineering: Too good to go wrong?. *Report for Greenpeace.*

Sheppard J (1997). From BSE to genetically modified organisms: Science, uncertainty and the precautionary principle. *Report for Greenpeace.*