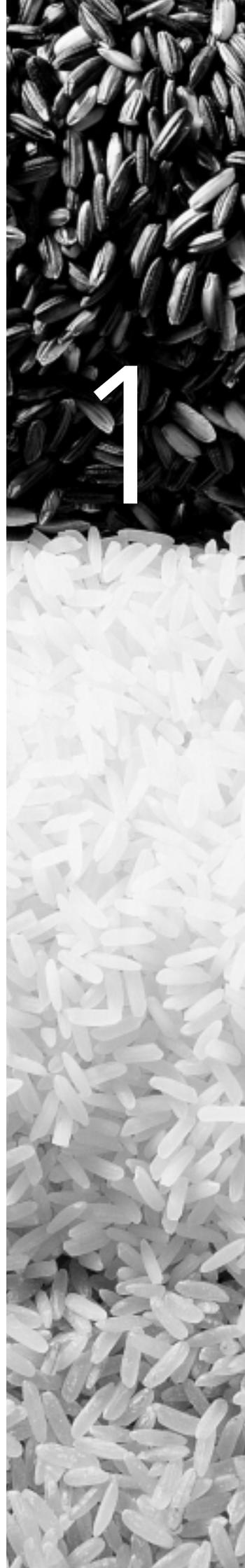


Chapter

Introduction

1



Introduction

Background

1.1 In May 1999, the Nuffield Council on Bioethics published a Report on **Genetically modified crops: the ethical and social issues**.¹ When work began in 1997, issues raised by the use of genetically modified (GM) crops had received relatively little public attention. By the time the Report was published, GM plants and animals had been likened in the media to Frankenstein's monsters. It was claimed that reckless academic and commercial scientists were endangering the natural world. This view gained wide support and GM crops were frequently referred to as 'Frankenfoods'. In his foreword the Chairman of the Working Party, Professor Alan Ryan, wrote:

'As Reports of previous Working Parties have had occasion to observe, heat and light are not the same thing. We have been struck by the extent to which hard-to-allay fears are aroused by almost any discussion of genetic science, not only in this context, but also in the contexts of cloning and the genetic components of physical and mental illness.'

1.2 In June 1999, the Environment Ministers of the European Union (EU) declared a *de facto* moratorium on the use of GM crops which had not yet received regulatory approval. Since then, the controversy about their use has persisted and intensified. In many parts of Europe, experimental field trials on GM crops have been sabotaged. In the UK, some farmers, fearing repercussions, withdrew from these experiments. Supermarkets and restaurants have labelled produce as 'GM-free' to allay the concerns of consumers. Others, however, unconvinced about the alleged risks of GM crops, view these developments with dismay.

1.3 Most people believe that evidence-based, rational assessment of risks and benefits should take the place of scaremongering and highly polarised debates. As one way of contributing to a more balanced and open discussion, the UK Government announced in 2002 a public debate on possible uses of genetic modification. This comprised three strands: a series of public meetings and discussions;² an economic analysis of the costs and benefits of using GM crops;³ and a review of the science underlying the genetic modification of plants.⁴ The Council decided to complement these various initiatives by producing a Discussion Paper to follow up its 1999 Report. This Paper focuses in particular on the role of GM crops in developing countries (see Box 1.1). There were two main reasons for this decision.

1.4 First, the Council was concerned that disproportionate attention was being paid to the implications of the use of GM crops in developed countries, at the expense of consideration of poorer countries. This narrow focus ignores the possibility that decisions made about the use of GM crops in developed countries may also have considerable consequences for those in developing countries. Furthermore, some developing countries have already adopted the technology. Since 1999, the total area planted with GM crops in developing countries has

¹ The Executive Summary of that Report is at Appendix 1.

² GM Nation? The Public Debate. Available: <http://www.gmpublicdebate.org.uk/index.html>. Accessed on: 10 Oct 2003. A report summarising the discussions was published in September 2003, *GM Nation? The findings of the public debate*. Available: http://www.gmpublicdebate.org.uk/ut_09/ut_9_6.htm#summary. Accessed on: 8 Oct 2003.

³ GM Crops - Strategy Unit Study. Available: <http://www.number10.gov.uk/output/Page3673.asp>. Accessed on: 10 Oct 2003. The final report of the Strategy Unit was published in July 2003, *Field Work: weighing up the costs and benefits of GM crops*. Available: <http://www.number-10.gov.uk/su/gm/index.htm>. Accessed on: 10 Oct 2003.

⁴ GM Science Review. Available: <http://www.gmsciencedebate.org.uk>. Accessed on: 8 Oct 2003. *The Science Review's First Report – An open review of the science relevant to GM crops and food based on interests and concerns of the public*. Available: <http://www.gmsciencedebate.org.uk/report/default.htm>. Accessed on: 10 Oct 2003.

more than doubled, from 7.2 to 16.0 million hectares.⁵ The implications of this development deserve further examination.

1.5 Secondly, the 1999 Report concluded that on the basis of the evidence available, there was a moral imperative for making GM crops readily and economically available to those in developing countries who wanted them.⁶ We intended to ask whether the arguments for this conclusion were still valid today. To answer these questions, the Council decided to re-examine the current and possible future role of GM crops in developing countries. This requires a careful analysis of the benefits and risks associated with their use. Below we briefly outline what these are commonly held to be.

Box 1.1: What do we mean by 'developing countries'?

A useful way of distinguishing between countries at different levels of development is to compare their relative income. This is often expressed as the gross national product (GNP) per person. By *developing countries* we mean those countries with a GNP in 2001 of less than US\$9,205 per capita.* However, a country's economic development, the well-being of its population, and its capacity to benefit from decisions and policies made in the developed world depend on much more than average GNP. Other influential factors include:

- the purchasing-power of a country's currency;
- the composition and efficacy of its spending, especially on basic health and education;
- its income distribution; and
- its climatic and other risks.†

* World Bank (2003) *World Development Report 2003* (Washington, DC: Oxford University Press and World Bank), pp. 233–5.

† A succession of annual United Nations Human Development (UNHD) reports has endeavoured to allow for such matters. In practice, indicators of mean GNP which are adjusted to take into account the variable purchasing power of one US\$ in different countries (purchasing-power parity, PPP) provide a rough guide to levels and trends of welfare, and are closely correlated with human development indicators such as life expectancy and access to education, see World Bank (2003) *World Development Report 2003* (Washington, DC: Oxford University Press and World Bank), pp. 2347.

Benefits and risks associated with the use of GM crops in developing countries

1.6 Generalised judgements about possible benefits and risks of 'GM crops' to 'developing countries' as such, are of limited use. When assessing the benefits and risks of introducing a specific GM crop, the socio-economic and agricultural context of individual countries needs to be considered. Relevant factors include:

- the prevalence of specific climatic conditions;
- the presence of wild relatives of the crop;
- the availability of water for irrigation;
- the level of infrastructure in place;
- the extent to which commercial fertilisers or pesticides are used;
- the proportion of farm produce which is sold;

⁵ James C (2002) *Preview, Global Status of Commercialized Transgenic Crops: 2002* ISAAA Brief No. 27 (Ithaca, NY: ISAAA).

⁶ See paragraphs 4.1–4.82 of the 1999 Report.

- the relative proportion of crop production directed to domestic and/or export markets;
- access to export markets;
- the effects of competition from subsidised agricultural products from developed countries; and
- the nature of national regulation for biotechnology.

It is therefore much more helpful to focus on particular countries, or, where possible, on sufficiently similar types of countries, to assess the impact of a specific GM crop on the environment, agriculture and the economy.

Possible benefits

1.7 GM crops (see Box 1.2) might offer advantages where other forms of plant breeding, agricultural practice or farm land management are not suitable to address particular problems prevalent in developing countries. Genetic modification can provide improved resistance to disease and pests. It may enable the production of more nutritious staple crops which provide essential micronutrients, often lacking in the diets of poor people. GM crops that are better suited to cope with stresses such as drought or salty soils, common to many developing countries, are also being developed.⁷

Box 1.2: Genetically modified crops

Genetic modification allows selected individual genes to be transferred from one organism into another, including genes from unrelated species. The technology can be used to promote a desirable crop character or to suppress an undesirable trait (see paragraphs 3.4-3.17).

1.8 Furthermore, proponents note that GM crops might prove to be an important tool in accelerating the increase of crop yields, especially of staple crops.⁸ This might be particularly relevant for small-scale, resource-poor farmers in developing countries. Seventy per cent of the world's poor live in rural areas and about two-thirds of these rely primarily on agriculture for their livelihoods.⁹ Increased yields through improved seeds normally lead to higher demands for labour in agriculture. This usually implies growth in employment income among the malnourished, and would have a positive effect on their ability to afford sufficient food. Such developments would be valuable. It has become clearer that both the reduction of poverty and growth in crop yields have slowed in most of the developing world since the 1980s. Moreover, poverty has persisted and crop yields have remained low in most of Africa, the poorest continent of the world.¹⁰ In this Paper, we examine which kinds of GM crops have been grown in particular developing countries, and assess whether there have been, or are likely to be, significant improvements for farmers who grow them. However, any deliberation about the benefits of a technology also needs to address likely risks.

⁷ Thomson J (2002) *Genes for Africa: Genetically Modified Crops in the Developing World* (Cape Town: University of Cape Town Press); Conway G (2003) *From the Green Revolution to the Biotechnology Revolution: Food for Poor People in the 21st Century*. Speech at the Woodrow Wilson International Center for Scholars Director's Forum. 12 March 2003. Available: <http://www.rockfound.org/documents/566/Conway.pdf>. Accessed on: 10 Oct 2003.

⁸ The term staple crops refers to crops which are mainly used for household consumption. By non-staple crops we mean crops which are grown predominantly for sale.

⁹ World Bank (2003) *World Development Report 2003* (Washington, DC: Oxford University Press and World Bank).

¹⁰ Between 1987 and 1998 the percentage of people living on less than US\$1 a day in sub-Saharan Africa remained unchanged at 46%. See World Bank (2001) *World Development Report 2000/2001: Attacking Poverty* (Washington, DC: World Bank and Oxford University Press); Huang J, Pray C and Rozelle S (2002) Enhancing the crops to feed the poor, *Nature* **418**: 678–84.

Possible risks

- 1.9 Some commentators take the view that possible risks of GM crops for human health have not yet been sufficiently examined. In a common, but controversial, interpretation of what is known as the *precautionary principle*, critics argue that GM crops should not be used anywhere unless there is a guarantee that no risk will arise (for a discussion of this approach see paragraphs 4.35-4.42).¹¹
- 1.10 There is also concern about the impact of GM crops on the environment. Critics point to the risk of potentially irreversible effects on *biodiversity*, which can be understood as the variety of plants, animals and other organisms that exists in nature. Genetic material from GM crops could be transferred to other plants and organisms, which might lead to unpredictable transformations. Critics therefore argue that unless there is certainty about the absence of such risks, neither field trials, nor commercial planting should take place. The centres of diversity of modern crops such as cotton or maize are primarily in developing countries. There are those who fear that cultivated crops and their wild relatives, which still grow in these regions, might be irreversibly altered by the transfer of genetic material from GM crops.¹²
- 1.11 There are also concerns about how and by whom GM crops are developed and marketed. The substantial benefits which accrued in developing countries from the Green Revolution (see Box 1.3) were largely the result of research undertaken in the public sector. But most research on GM crops is being undertaken by a relatively small number of private companies, although there is also significant work in the public sector. Many of those who object to the use of GM crops fear that research will be directed primarily towards the demands of commercial users in developed countries.¹³ It could be that only large-scale industrial farmers and the agro-chemical industry will benefit, while the needs of small-scale, resource-poor farmers in developing countries will be neglected.

Box 1.3: The Green Revolution

The Green Revolution is the popular term for the development and spread of high-yielding staple foods in developing countries. It began with maize hybrids in the 1950s. However, the main component was the introduction of semi-dwarf wheat and rice varieties, mainly to parts of Asia and Central America with well-functioning systems of irrigation, between 1962 and 1985.* The Green Revolution was brought about almost exclusively through research undertaken by institutions in the public sector. Apart from systematically spreading crop varieties that would flourish in a wide range of environments, it also involved increased use of fertilisers, pesticides and mechanised agriculture.

* Lipton M and Longhurst R (1989) *New Seeds and Poor People* (London: Routledge).

¹¹ British Medical Association (1999) *The Impact of Genetic Modification on Agriculture, Food and Health: An Interim Statement* (London: BMA); Oxfam (1999) *Genetically Modified Crops, World Trade and Food Security* (Oxford: Oxfam).

¹² Food and Agriculture Organization (FAO) Electronic Forum on Biotechnology in Food and Agriculture (2002) Background Document to Conference 7, 31 May – 6 July 2002 *Gene flow from GM to non-GM populations in the crop, forestry, animal and fishery sectors* (FAO UN). Available: <http://www.fao.org/biotech/C7doc.htm>. Accessed on: 10 Oct 2003.

¹³ Action Aid (2003) *GM Crops - Going Against the Grain* (London: Action Aid); Five Year Freeze (2002) *Feeding or Fooling the World?* (London: Five Year Freeze).

1.12 Doubts have also been expressed about the technical and financial capacity of some developing countries to develop and apply regulation to ensure the safe use of GM crops.¹⁴ Some take the view that encouraging developing countries to adopt GM crops demonstrates a lack of sensitivity to their vulnerable position. Many of these countries have an urgent need to address issues of food security and may be tempted to adopt in haste a technology that could pose severe risks.¹⁵ Furthermore, there is concern that a focus on GM-related applications may detract from efforts to explore other ways of enhancing agriculture, such as fostering more relevant national and international policies, improving systems of seed production and distribution, and promoting better development of markets and improved agricultural practices.¹⁶ We consider these and other arguments in the chapters that follow.

Structure and methodological approach

1.13 In this Discussion Paper, we review recent scientific, regulatory and policy-related developments in the use of GM crops in developing countries. We assess the potential of the technology to improve the effectiveness of agriculture under the often difficult conditions which prevail in these countries. Chapter 2 begins with an outline of the economic and demographic observations which guided our deliberations in the 1999 Report and contrasts them with recent evidence. In Chapter 3 we explain the basic technical and conceptual principles behind the genetic modification of plants. We also present eight case studies which illustrate some of the evidence that has been gathered over the past three years on the current and potential use of GM crops in developing countries. This is followed by a discussion of socio-economic and ethical arguments about their use (Chapter 4). We then consider issues raised by developments in governance, national and international regulation and trade (Chapter 5). Chapter 6 examines issues relating to the control of and access to GM technologies.

1.14 The Paper does not aim to provide an exhaustive account of how food security could be improved and poverty reduced in developing countries. By focusing on the role of GM crops we consider only a part, albeit an important one, of a large and complex picture. We are aware of the many factors that affect agricultural productivity in developing countries. For example, the Food and Agriculture Organization (FAO) of the United Nations (UN) has listed war and other forms of armed conflict as the exclusive cause of food emergencies in 10-15 developing countries during the last three years.¹⁷ Furthermore, many developing countries have to cope with worsening economic conditions for local agriculture. These result from the failure of national agricultural policies and the absence of private organisations that could fill the void of state services. There are also instances of poor governance and corruption. In addition, land reform is urgently needed in many developing countries.

1.15 At the international level, problems arise from the fact that developing countries are constrained in their participation in global agricultural markets. Subsidies and import restrictions are commonly provided by developed countries to support their own farmers.

¹⁴ See, for example, the discussion in the Archives of Debate of Conference 9 of the FAO Electronic Forum on Biotechnology in Food and Agriculture 28 April – 25 May 2003, *Regulating GMOs in developing and transition countries*. Available: <http://www.fao.org/biotech/logs/c9logs.htm>. Accessed on: 10 Oct 2003.

¹⁵ Independent Science Panel (2003) *The Case for a GM-Free Sustainable World* (London: ISP).

¹⁶ Action Aid (2003) *GM Crops – Going Against the Grain* (London: Action Aid); Food Ethics Council (2003) *Engineering Nutrition: GM crops for global justice?* (Brighton: Food Ethics Council); Oxfam (1999) *Genetically Modified Crops, World Trade and Food Security* (Oxford: Oxfam).

¹⁷ FAO (2003) *Foodcrops and Shortages: Global Information and Early Warning System on Food and Agriculture*. Available: <http://www.fao.org/giews/english/fs/fsstoc.htm>. Accessed on: 10 Oct 2003.

According to the International Food Policy Research Institute (IFPRI), in 2001, member states of the Organisation for Economic Co-operation and Development (OECD) provided US\$311 billion to subsidise their domestic agricultural production.¹⁸ This results in the frequent glutting of markets, leading to lower prices, which in turn reduce incentives for poor farmers from developing countries to produce for the world market. Even incentives to produce for the domestic market are harmed by subsidised imports from developed countries. Examples of such practices are well known in relation to cotton, sugar and rice, with the main distortions due, respectively, to the USA, the EU and Japan.¹⁹ IFPRI estimates that in 2001, the agricultural policies of wealthy countries cost developing countries US\$24 billion in lost agricultural income. The elimination of protectionism and subsidies provided to farmers in developed countries could triple the net agricultural trade of developing countries.²⁰

- 1.16 We emphasise that such problems urgently need to be addressed, taking into account the vulnerable situation of farmers in developing countries and their even poorer employees. But whatever progress is made in resolving these issues, other substantial problems remain, such as difficult climatic conditions and increasingly scarce and unreliable access to water. In this context, GM crops could have a role to play. Restricting our examination to the specific question of what kind of technical contribution GM crops can make to improving agricultural practice does not mean that we are indifferent to, or complacent about, the prevailing geo-political context in the majority of developing countries.²¹
- 1.17 We take a sceptical view about broad, often sweeping, generalisations of either the benefits or the risks associated with the use of GM crops in developing countries. As will be clear throughout this Discussion Paper, there are considerable differences in the ways in which:
 - (a) socio-economic conditions, agricultural practices and national regulations bear upon decisions over GM crops in different developing countries;
 - (b) the impacts of international and regional trade policies affect different developing countries; and
 - (c) traits of particular GM crops pose risks and benefits to human health and to the environment.
- 1.18 The interplay of these factors makes generalisations about the use of GM crops in the developing world almost impossible. For example, small-scale, resource-poor farmers in rural Africa will usually benefit from increased yields resulting from the use of GM sweet potatoes that are resistant to particular pests (see paragraphs 3.51-3.52). However, it may also be the case that using GM crops could be to the detriment of agricultural workers, for example, if the use of herbicide resistant GM crops leads to a considerable reduction in the demand for labour for weeding on farms (see paragraph 3.61).

¹⁸ Diao X, Diaz-Bonilla E and Robinson S (2003) *How Much Does It Hurt? The Impact of Agricultural Trade Policies on Developing Countries* (Washington, DC: IFPRI).

¹⁹ OECD Joint Working Party on Agriculture and Trade (2002) *The Medium-Term Impacts of Trade Liberalisation in OECD Countries on the Food Security of Non-Member Economies*. Available: [http://www.oilis.oecd.org/olis/2001doc.nsf/LinkTo/com-agr-td-wp\(2001\)74-final](http://www.oilis.oecd.org/olis/2001doc.nsf/LinkTo/com-agr-td-wp(2001)74-final). Accessed on: 10 Oct 2003; Diao X, Diaz-Bonilla E and Robinson S (2003) *How Much Does It Hurt? The Impact of Agricultural Trade Policies on Developing Countries* (Washington, DC: IFPRI); Oxfam (2002) *Cultivating Poverty: The Impact of US Cotton Subsidies on Africa* (Oxfam International).

²⁰ Diao X, Diaz-Bonilla E and Robinson S (2003) *How Much Does It Hurt? The Impact of Agricultural Trade Policies on Developing Countries* (Washington, DC: IFPRI).

²¹ For a discussion of issues arising in context of global food and trade policy, see Chapter 5.

- 1.19 We also note that discussions about the benefits and risks of GM crops are as much about politics and economics as they are about technological issues. Thus, whether or not the use of a GM crop will be beneficial will depend on many factors. Even if the technology is effective and there is no scientific evidence of risks for human health or the environment, political constraints such as restrictive trade policies of some markets, may lead to the conclusion that it is better not to use a specific GM crop in a particular context.
- 1.20 We therefore take the view that it is important to focus on the specific situations in particular countries and to ask the question: 'How does the use of a GM crop compare to other alternatives?' All possible paths of action must be compared, including inaction, in respect of improving, in a cost-effective and environmentally sustainable way, human health, nutrition, and the ability to afford an adequate diet. This approach might lead to the conclusion that there may be other safer, more efficient or more economic options. It could also mean that GM crops might have attractive benefits in particular cases.