The GM Debate – Who Decides?

An analysis of decision-making about genetically modified crops in developing countries

Above:
Test tubes containing 'golden rice' seedlings at International Rice Research Institute in the Philippines. Proponents of GM agriculture have heralded 'golden rice' as the launch of a 'new green revolution'.
CHRIS STOWERS/PANOS PICTURES

Cover:
Harvested rice in Roulim de Moura, Rondonia, Brazil. Brazil is the fourth largest grower of GM crops in the world. Soya is the country's main GM crop. Other GM crops are being field-tested.
SEAN SPRAGUE/PANOS PICTURES

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Contents

Vegetables for sale at a floating market in Damnoen Saduak, Thailand. In Thailand organic produce is a major export to countries in the European Union. Farmers are concerned that access to this market will be put at risk if the Thai government allows commercial planting of GM crops.
JEREMY HORNER/PANOS PICTURES

Introduction

Genetically modified (GM) crop plants are being developed and adopted around the world at a rapid pace. In 2004, 81 million hectares of land were under the legal cultivation of GM crops (around 1.6 per cent of the total agricultural land in the world) and the area is growing at a rate of 20 per cent every year.

But GM crops are still highly controversial. Proponents claim that genetic modification (GM) will enable farmers to produce more food, for lower cost, without using more land or natural resources, and using lower levels of chemical inputs. On the other hand, there are concerns about the long-term impacts of GM technology on the environment and fears about the safety of GM crops for human health. Information and discussion about GM technology is often polarised and polemical, with supporters of GM dismissing opponents as 'anti-progress', while opponents of GM often conjure up exaggerated and inaccurate fears. Reasoned argument, assessing benefits and risks, and seeking consensus are rare.

Why does GM technology arouse such strong passions? One reason is that opponents of GM see the introduction of GM crops into an environment as an irreversible decision, whose long-term results are unknown. For instance, modified genes may escape from a crop into neighbouring crops or wild plants and start being reproduced naturally. Another reason for controversy is that until now private biotechnology companies have been the leading actors in developing and promoting GM crops, and opponents or sceptics of GM suspect that their motives are to increase their profits rather than the public good.

Decision-making on GM crops

In this atmosphere of heightened expectations and fears, governments have to work within international law to make policy and draw up legislation on a range of issues: whether to allow the import of GM foods; whether to allow planting of GM crops; how to regulate them to minimise risks; and whether to support research to develop GM crops for their own country. Governments have to make their decisions based on a number of considerations: the science of genetic technology, the potential benefits and risks, as well as other questions of economic and social development.

Like any other new technology, GM technology will bring benefits to some and disadvantages to others. If increased food production and greater agricultural sustainability result, these benefits will be shared by the whole society. But so will the risks – to the environment, and perhaps to human health.

Scientific evidence about the impacts and the potential benefits of GM crops is inconclusive. This is largely because GM is such a new technology, with a short history of use, in a limited number of different environments. Its impacts may only become apparent in the longer term. As a result, decisions about what risks are worth taking, what can be done to minimise them, and how much risk the public can be asked to live with have to be taken in the absence of full scientific knowledge of the benefits and risks.

Government decisions about GM, which affect the lives of everyone in the country, are of course based on discussion with experts and interested stakeholders, but should be made in a consultative and consensual way, with the involvement of people and their elected representatives. In most countries, society is increasingly scrutinising science-based policy decisions, and demanding that decisions to accept risk should be transparent.

Encouraging consultative and participatory decision-making

Consultative and participatory decision-making requires accessible information and a high quality of public debate. To participate effectively, people – including MPs and governments – should have accurate information, understanding of the science, understanding of the issues, and awareness of the views and concerns of different stakeholders. Such public information and debate could be supported and stimulated by good media coverage.

This report is not about the science of genetic modification, but about the politics of decision-making on GM in developing countries. Three of the world's top five nations growing GM crops are developing countries – Argentina, Brazil and China. (The top two GM-growers are Canada and the US.) In addition, India and South Africa have large GM research programmes and are preparing to commercialise GM crops on a greater scale. In all, more than two dozen developing countries are now active in pursuing research into and commercial growing of GM crops.

How do governments in developing countries decide whether GM crops are to be grown? What considerations influence them? To what extent is the public able to influence decision-making, directly, through NGOs or through parliaments? This report summarises key policy-making issues on GM crops, such as the interpretation of scientific research, the roles of the biotechnology industry and the public sector in funding research, the role of international NGOs, and crucial trade policy disputes between the US and the EU.

The report also draws on case studies from five developing countries – Brazil, India, Kenya, Thailand and Zambia. As well as exploring decision-making processes and who is involved in them, the case studies examine the media coverage of GM and the extent to which the media facilitates vigorous and well-informed debate representing the multiplicity of views and interests that exist in any country. They included more than 100 interviews, some of which are quoted in this report.

In order to make appropriate decisions about GM, it is vital that the views of all interested parties are heard – policy-makers, farmers, industry, NGOs, international donors and scientists. As well as being of interest to these key stakeholders, this report is also intended for journalists and others working in the media, who have a key role to play in creating spaces where the different views in the GM debate can be expressed and explored.

The place of GM crops in agriculture today 1

The spread of GM crops

Genetic modification technology in agriculture first appeared in the mid 1990s in the US, which is still today the world's largest grower of GM crops. A decade later, while member states of the European Union (EU) proceed cautiously on allowing commercial plantings of GM crops, increasing numbers of developing countries are joining the US in allowing the commercial planting of GM crops.

In 2004, 81 million hectares of land were under the legal cultivation of GM crops in 17 countries. This is around 1.6 per cent of the total agricultural land in the world and the area is growing at a rate of 20 per cent every year. In 2004, 8 million farmers were legally growing GM crops, up from 7 million in 2003. The actual number of farms growing GM crops and the amount of land given over to GM crops are both likely to be much higher than the official figure, as illegal planting is widespread, particularly in Argentina, Brazil, India and Mexico.[1]

The majority of crops that are grown on a commercial scale have been developed by private companies (mostly by Monsanto) and are either crops that will be used in animal feed or GM cotton. So far, private companies have shown little interest in developing GM crops unless they have the potential to be bought and sold on a mass scale. Because of this, just four varieties of GM crops – soybean, maize, cotton and canola (rapeseed) – occupy 99 per cent of commercial plantings, and are worth more than $40 billion each year.[2] The majority of these crops have either been modified to resist viruses and insects, or modified to tolerate chemical weed-killers (herbicides).

By contrast, scientists and governments in developing countries are more interested in research and commercialisation of GM food crops for human consumption and to help ensure food security. GM varieties of wheat, rice, chickpeas, sweet potatoes, millet, sorghum, cassava, potatoes and many other fruit and vegetables are being developed in laboratories and test plots across the developing world. The traits being tried out are largely insect and virus resistance, qualities that would be equally useful to small-scale farmers as to large-scale ones. In developing countries, much of this research is funded by (or organised by) public sector institutions.[3]

Decision-making on GM crops in developing countries

GM crop plants are being developed and adopted around the world at a rapid pace. In most countries, decisions are now being made about GM crops that will affect generations to come. These decisions will affect nutrition, livelihoods, the agricultural economy, food safety, and the long-term sustainability of agricultural productivity.

The types of decisions that governments in all countries have to make include:

- Whether to import GM ingredients, or manufacture foods and products containing GM ingredients
- Whether to allow GM seeds to be planted commercially
- Setting a balance between public and private investment in research on agricultural biotechnology
- Appropriate laws and regulatory mechanisms to ensure GM food products cannot harm the health of people and animals
- Appropriate laws and regulatory mechanisms to ensure GM crops do not harm the natural environment or pollinate non-GM crops
- Whether food containing GM produce should be labelled.

1
James, Clive, *Global Status of Commercialised Biotech/GM Crops: 2004*, International Service for the Acquisition of Agri-Biotech Applications, 2004. ISAAA is a biotechnology industry-funded research and lobbying organisation, but a reliable source for data on GM crops.

2
FAO, *Agricultural Biotechnology: Meeting the needs of the poor – The state of food and agriculture 2003/2004*, FAO, Rome 2004.

3
Cohen, Joel, 'Poorer nations turn to publicly-developed GM crops', *Nature Biotechnology*, 2005, vol 23, no. 1.

"Everyone has heard about the GM debate, but only a minority really understands the technology, the controversy and the forces behind it. If a reader doesn't understand the biology, the argument reduces to the fact that: GM is a plant, which receives a piece of DNA from bacteria; some people want you to eat it; and they say it does no harm. From such a simplified explanation, you can already see that the message sounds a negative one. I mean, who wants to eat a plant with bacteria?"

Herton Escobar
Science and environment correspondent
O Estado de S. Paulo
Brazil

"I absolutely agree with the principle of participatory decision-making. Thailand needs it. Otherwise, we could easily risk making mistakes over a complicated issue such as GM."

Wichai Chokewiwat
Director General, Department of Thai Traditional Medicine and former Director General, Food and Drug Administration

What is genetic modification?

Living organisms are made up of millions of individual cells. Each cell contains a set of biological instructions, known as genes. Each gene spells out one of the many thousands of instructions needed to build and maintain an organism. In a plant, for example, its genes determine everything from the colour of its leaves to its capacity to resist diseases.

Genes are made up of a molecule known as DNA (deoxyribonucleic acid). The chemical structure of DNA is like a string of letters spelling out the genetic message. The letters (of which there are just four) are known as bases. Each gene consists of a stretch of DNA many thousands of bases long; the difference between one gene and another is the order in which the bases are arranged.

Since the early 1980s, scientists (known as geneticists) have been able to extract individual genes from the cells of one species of plant (or animal) and insert them into the cells of another. This process was often known as genetic engineering in the 1980s and 90s, but is now more commonly described as genetic modification or genetic manipulation.

Improvement of plants by human ingenuity is not new. The traditional – and still very important – way of developing desirable traits in plants and animals is through selective breeding and cross-fertilisation. This method can be somewhat arbitrary and it can take several years to develop a new variety. Genetic modification, by contrast, can be quicker and more predictable. And whereas traditional techniques can only cross-breed among different varieties of the same species, genetic modification can transfer a gene from one species, such as an animal, to another, such as a plant. For this reason, some GM organisms are described as 'transgenic'.

GM basics
Total worldwide value of GM crops: $44 billion
Total worldwide area of GM crops: 81 million hectares
Most common crops: Canola, cotton, maize, soy
Dominant traits: Tolerance to herbicide and resistance to pests
Countries with commercial GM crops include (in order of GM area): US, Argentina, Canada, Brazil, China, Paraguay, India, South Africa, Uruguay, Australia, Romania, Mexico, Spain, Philippines
Number of farmers of GM crops worldwide: 8.25 million

Source: *International Service for the Acquisition of Agri-Biotech Applications (ISAAA)*

Kenyan farmer using liquid organic fertiliser on crops. The Kenyan government is supporting the development of GM crop technology.
BETTY PRESS/PANOS PICTURES

Planting rice in Orissa, India. A number of GM crops, including rice, are being researched in India, which has the largest biotechnology research programme in the developing world.
MARK HENLEY/PANOS PICTURES

GM controversies 2

GM crops have generated public controversy to a degree that is unusual for an agricultural technology. Over the past decade and across the world, there have been hard-fought campaigns and (in India) even suicides as an expression of opposition to the commercial introduction of GM technology in agriculture.

Many small-scale farmers, consumer groups and other NGOs are strongly opposed to the commercialisation of GM crops. Despite this degree of opposition, however, most governments remain committed to research and testing of GM crop plants and have developed or are developing appropriate laws and regulations for eventual commercialisation of GM crops. In part this is because, in the words of Thailand's Prime Minister Thaksin Shinawatra, they do not want to "miss the biotechnology train". In addition, large-scale farmers in many countries are saying that some GM crops are better for the environment, require fewer chemical inputs and in some cases result in greater yields.

Why is the debate over GM technology in agriculture so polarised?

Helping to feed the world?

The Food and Agriculture Organisation (FAO) of the UN estimates that in order to feed the 842 million people who are currently chronically undernourished, as well as a projected population increase of 2 billion within 30 years, food production must at least double, without much additional use of land and water resources.[4, 5] Proponents of GM argue that new technology has the potential to meet this need.

The original Green Revolution helped feed the growing populations of Asia and Latin America, although it was not without its critics. Today, supporters of GM technology in agriculture regard GM technology as a 'doubly green revolution'[6], which will help farmers produce more food, but without using more land or natural resources, and with fewer chemical inputs.

The potential for GM crops to bring significant changes to world agriculture does exist. Crops can be modified, for example, to secrete small amounts of toxins when attacked by insects and to withstand chemical weed-killing sprays (herbicides).

By modifying crops genetically in these ways, scientists have developed or are working on crop plants that will:

- Require fewer chemical inputs
- Resist pests and diseases
- Thrive in harsh conditions, such as poor (or arid) soils, and possibly survive drought
- Last longer in storage and during transport
- Provide greater yields
- Contain additional nutrients.

"Past experiences have shown that science and technology have provided the world with improved food production methods, lessened labour burdens and improved the socio-economic condition of populations. Genetic modification is one of these advancements."

Margaret Karembu
International Service for the Acquisition of Agri-Biotech Applications
Kenya

4
Nearly one-third of the earth's land surface is now cultivated, with more land being converted into cropland since 1945 than in the whole of the 18th and 19th centuries combined (*The Millennium Ecosystem Synthesis Report*, produced by 1,400 of the world's leading conservation scientists and endorsed by the UN, March 2005).

5
FAO, *Agricultural Biotechnology: Meeting the needs of the poor – The state of food and agriculture 2003/2004*, FAO, Rome 2004.

6
Conway, Gordon, *The Doubly Green Revolution: Food for all in the 21st century*, (Cornell University Press 1999). Gordon Conway, former President of The Rockefeller Foundation in New York, is now Chief Scientific Advisor to the UK Department for International Development.

Consumer groups, other NGOs, some scientists, some members of the general public and many small-scale farmers, however, are more sceptical. Some do not believe GM technology will deliver on its claims to feed the poorest and help nourish the undernourished. As previously mentioned, despite nearly a decade of commercial activity, just four crops dominate GM plantings around the world, none of which are intended as food for human consumption. GM sceptics also doubt whether private companies are interested in commercialising crops aimed at small-scale, subsistence farmers and poor consumers who are unlikely to buy enough quantities of GM seeds to match the profits that biotechnology companies can generate from their existing GM crop portfolio.[7]

Critics of GM argue that the required increase in food production can be more effectively achieved by conventional means, such as selective breeding, more careful management of water and inputs, conserving soils and rotating crops. They also believe that governments, large-scale farmers and the biotech industry see GM technology as a way for more small-scale farmers to convert to a more industrial-scale style of agriculture, characterised by more intensive farming and farmers buying seeds every year. This is certainly what the US government, for example, sees as the best future for agriculture, as demonstrated in its new agriculture assistance strategy for the developing world, announced in July 2004.[8]

"Genetic engineering is a powerful tool and provides unlimited opportunities for designer crops. There is greater responsibility on the part of scientists for its judicious utilisation so that its products do not harm health and environment."

R P Sharma
Indian Agriculture Research Institute
New Delhi

"GM crops do not address the needs of the Zambian farmer in terms of crop production. They will not address problems such as a poor road network, droughts, problems with inputs, subsidies – the list is endless."

Lovemore Simwanda
Zambia National Farmers' Union

"GM will benefit international trade more than food security."

Phansiri Winichagoon
Environment manager, UNDP
Thailand

The impact of GM crops on human health and the environment

One major point of debate in the GM crops controversy is the question of potential health and environmental risks associated with GM crops. All sides in the debate acknowledge that GM technology is not risk-free. However, there is disagreement over the extent to which 'potential' risks are likely to become 'actual' risks. There is also much debate on the definition of what constitutes a potential risk to human health or the environment from GM crops (see box on 'Attitudes to risk', page 9).

So far, the evidence from available research suggests that GM crops pose no harm to human health, but that they do pose some risks for biological diversity – though these risks appear small. However, research into health and environmental impacts from GM technology is still in its infancy and scientists are only now beginning to address these issues in their work. The coming years and decades may see the situation change.

7 Wijeratna, Alex; Orton, Liz; and Sexton, Sarah, *GM Crops: Going against the grain*, Action Aid, 2003

8 *USAID Agriculture Strategy: Linking producers to markets*, US Agency for International Development, 2004

It is well known that pollen from GM seeds can sometimes pollinate neighbouring crops or wild relatives of a crop. However, the long-term environmental effects of this are not known.[9] The most comprehensive GM impact assessment for any country is widely acknowledged to be that undertaken by the UK government.[10] Over a period of three years, it tested the impact on biodiversity of three crops – oilseed rape, sugar beet and maize – that had been genetically modified to tolerate herbicides. The results were mixed: the presence of GM rape and beet looked likely to lead to a reduction in on-farm wildlife if grown as suggested by the manufacturers. The results from GM maize, on the other hand, suggested that it would be of benefit to biological diversity.

Attitudes to risk

What degree of risk should societies be willing to accept? This is an important question that goes to the heart of the GM debate. Supporters of GM technology in agriculture argue that the potential benefits of GM are large, while the risks are small: for example, no one has died from eating GM foods and evidence of negative environmental impact is slight and inconclusive.

Opponents of GM on the other hand cite what is called the 'precautionary principle', which underpins one of the main international laws governing GM technology – the Cartagena Protocol (see page 16). The precautionary principle is similar to the idea of 'safety first'. When applied to new technologies it means holding back from using a new technology until there is conclusive evidence that it will do no harm. Critics of GM technology say it is too early to say this conclusive evidence exists.

Had GM technology been developed 50 years ago, it is likely that it would have been cleared by politicians and with less public engagement compared to today. This is partly because the wider public was previously less engaged in decisions on new technologies than it is today – in the past scientists and politicians tended to make such decisions largely on their own.

"Development should not be about whether we go faster or slower. A better question to ask is, 'What kind of development do we want?' For something like GM it may be better to wait and exercise the greatest care before making any decisons."

Wichai Chokewiwat
Director General, Department of Thai Traditional Medicine and former Director General, Food and Drug Administration

"The risk of any technology is always weighed against its benefits – and the benefits of biotechnology are indisputable."

Ranjana Smetacek
Monsanto India

9 *Maize and Biodiversity: The effects of transgenic maize in Mexico*, Commission for Environmental Cooperation of North America, 2004.

10 *GM Science Review: Second report*, UK Office of Science and Technology, 2004.

The National Centre for Genetic Engineering and Biotechnology, Thailand. Although research into GM crops is going on in Thailand, senior scientists are urging caution.
MARCUS ROSE/PANOS PICTURES

Scientific research and the GM debate

While the science of assessing the environmental and health risks of GM crops may still be relatively young, scientists have been involved in many other aspects of GM research and policy for a long time. Governments, industry and NGOs throughout the world regularly commission research from universities and other research institutions to provide scientific evidence on which to base their decisions. However, in the GM debate (as in almost every other branch of scientific research), scientists are often divided among themselves and there is often no clear consensus about how the results of research should be interpreted or implemented[11], as the following examples show:

GM technology and the FAO: In May 2004, the FAO published its annual *State of the World's Food and Agriculture* report, which focused on the potential for biotechnology to meet the needs of the poor. The report reviewed a number of recent research studies on different aspects of GM technology and concluded that the evidence suggested that GM technology, on balance, has a future in developing countries. The FAO's principal arguments were that: no one has yet died or suffered ill-health from eating GM food; the balance of evidence suggests that GM seeds do not harm the environment; GM crops have resulted in greater yields, with fewer applications of weed-killers and pesticides; and public opinion in developing countries is broadly in favour of the technology.

Days after the report appeared, a letter signed by 650 groups and 800 individuals from all over the world, including many scientists attached to NGOs, was delivered to the FAO headquarters in Rome. The signatories complained that the report included very little scientific research from Southern countries, and had cited very little existing research that did not agree with the report's conclusions. Later, NGOs commissioned their own academic research to scrutinise the FAO report, including the scientific sources that were used in its conclusions.[12]

Importing GM maize in Mexico: In November 2004, an international group of environmental scientists advised members of the North American Free Trade Agreement (NAFTA) to maintain a moratorium on importing GM maize in Mexico. The scientists, all members of NAFTA's environmental advisory committee, had reviewed existing research on whether pollen from GM maize might contaminate non-GM fields and Mexico's native diversity of maize. They concluded that there was not enough knowledge on the issue and further research was advised before the moratorium should be lifted.

11
Lewontin, Richard, C. *The Doctrine of DNA: Biology as ideology*, Penguin, 1993. In this book, Richard Lewontin, professor of zoology at Harvard University, provides an overview of the successes and limitations of modern biology.

12
Tapper, Richard, *Review and Commentary on the FAO Report on the State of Food and Agriculture 2003/4*, UK Food Group, 2005.

Another group of scientists, representing NAFTA's three governments (Canada, Mexico and the US) rebutted this advice, despite the fact that it came from some of the world's top experts. NAFTA's representatives supported the report's "scientific findings", but disagreed with the way these findings had been interpreted to recommend that the moratorium stay in place. Judith Ayres of the US Environmental Protection Agency said: "Some of the recommendations… reflect cultural and social perspectives of the advisory group and other entities." The term "other entities" here refers to Mexico's indigenous communities and small-scale farmers, who are mostly opposed to GM technology in agriculture and had asked NAFTA's environmental advisory group to look into the matter in the first place.[13]

GM technology in the Millennium Development Goals: In January 2005, more than 100 of the world's leading scientists produced a report for UN Secretary General Kofi Annan that recommended ways of achieving the UN Millennium Development Goals (a series of international targets to halve world poverty by 2015). There was plenty of debate between the scientists on how the goals should be reached. The scientists who wrote the report's chapter on science and technology were more enthusiastic about a role for biotechnology in poverty reduction, compared with those who wrote the chapter on hunger. The latter argued that other priorities should take precedence over GM technology in the battle against hunger.[14]

The role of public and private sectors

When comparisons are made between GM crops and Green Revolution agriculture, one important difference is emphasised by both supporters and critics of GM. While Green Revolution agriculture was developed mostly in the public sector, and seeds and the results of research were free to anyone who wanted to use them, the vast majority of GM crops to have been commercialised so far are those with substantial private sector involvement.[15] For both supporters and critics of GM technology in agriculture, this is undoubtedly a weakness.

The extent of the private sector role in GM technology in agriculture is illustrated by the fact that the ten largest biotechnology multinationals collectively spend around $3 billion annually on research and development in the developed world. The amount spent by public sector sources in developed countries is one third of this ($1 billion). In developing countries, public sector sources (including international aid) spend $250 million on research and development in agricultural biotechnology.[16]

There are two concerns regarding the dominance of the private sector in the commercialisation of GM agricultural technology. First, as previously mentioned, private companies are less likely to be interested in commercialising crops of most relevance for the poorest people, because poor people will not be able to afford to buy them in quantities sufficient to maintain their profits.

A second concern is the development of what are popularly known as 'terminator technologies', in which seeds are genetically modified not to reproduce. For a seed company, the development of this type of technology, more properly called 'genetic use-restriction technologies', helps to increase their profits because it means that a farmer will need to buy new seeds every year. For small-scale farmers, who are used to holding seeds back from one year's planting for use in subsequent years, using 'terminator seeds' would be a significant additional cost.

13 *Maize and Biodiversity: The effects of transgenic maize in Mexico*, Commission for Environmental Cooperation of North America 2004.

14 Sachs, Jeffrey D., *Investing in Development: A practical plan to achieve the Millennium Development Goals*, UN Millennium Project, 2005.

15, 16 FAO, *Agricultural Biotechnology: Meeting the needs of the poor – The state of food and agriculture 2003/2004*, FAO, Rome 2004.

Developing GM crops step-by-step

The process of developing a new GM crop to the point where it can be sold or grown commercially can take many years and involves a number of steps:

Laboratory research: to isolate useful genes and find a replicable and reliable process for inserting them into seeds of the target crops.

Testing: the outcome of the gene transfer by growing GM plants in a laboratory.

Contained trials: growing plants in small test plots under strict conditions to ensure the GM organism does not escape into the outside environment.

Field trials: growing the GM plant on larger outdoor plots or in large greenhouses and testing for environmental impacts.

Authorisation: an application to a national biosafety authority for commercial release of the GM crop. The authority may ask for evidence of no adverse environmental impact.

"80 per cent of Zambians are small-scale farmers who replant seeds they save from the last crop. This will not be possible with GM seeds without paying extra to the seed companies."

Lovemore Simwanda
Head of the GMO Committee
Zambia National Farmers' Union

Patents and the privatisation of life

The ability to patent stretches of DNA holds the key to the involvement of private companies in GM research. If they were unable to apply for a patent on living organisms, companies would be reluctant to invest in research and development as doing so would allow their competitors to use their knowledge without paying for it.

1980 was the year in which the US Supreme Court granted the first ever patent on a living organism. Until then patents on life-forms were not allowed, partly because it seemed to go against the philosophy behind patenting, which is to reward human inventions, and not living things or works of nature.

The first holder of a patent on a life-form was Ananda Chakrabarty, a microbiologist working for the General Electric Company in the US. His invention was a bacterium that had been modified to degrade oil – potentially useful in cleaning up oil slicks.

Chakrabarty first applied for a patent in 1972, only to have it rejected by the US Patents and Trademarks Office. Chakrabarty's subsequent appeal was also rejected, but he took the case to the Court of Customs and Patent Appeals where he won by a margin of three to two. The patents office responded by appealing to the Supreme Court, but in July 1980, the Supreme Court ruled in favour of Chakrabarty by a margin of five to four.

The Chief Justice said that the issue was not one of patenting matter – whether alive or not. Rather it was an issue of whether the bacterium could be classed as naturally-occurring or as a human invention. The judges decided that, as the GM organism did not exist in the past, it had to be seen as "a product of human ingenuity".

The Supreme Court's decision was a controversial one, and is debated to this day. But it had the effect of encouraging private companies to explore investing in biotechnology research in the knowledge that their discoveries and inventions would not be copied without their authorisation.

The EU/US dispute

The international controversy over GM crops would perhaps be less fraught if it were not for the war of words on the issue between the US government and member states of the EU. The US is the world's largest grower of GM crops.[17] By contrast, GM crop activity in EU member states is minimal, partly because the EU only ended a six-year moratorium on growing GM crops in 2003. The situation is unlikely to change quickly as individual applications to import GM seeds into the EU need the approval of all 25 member states. Some EU member states such as Austria, Germany and Italy, remain strongly opposed to growing GM crops.

Why do Europe and the US take such sharply differing approaches to the regulation of GM technology in agriculture?

Europe's approach is based on the precautionary principle (see Attitudes to risks, page 9). According to this, GM maize, for example, cannot automatically be considered the same as conventional maize and will need to be tested independently for any effects on human health and the environment before it can be commercialised.

Though commercial GM crops are banned, processed food in the EU is allowed to contain GM ingredients, but any food product whose GM content exceeds 0.9 per cent needs to be labelled. This is because of another principle underlying EU policy – that the general public should be able to choose whether to consume GM food or not. In fact, many large European supermarkets have chosen to remove GM ingredients from their products. Campaigners in Europe want even stronger legislation to ensure that GM produce is kept separate from non-GM produce at every stage of production – growing, handling and transport, marketing and processing. They can accept the 'co-existence' of GM with non-GM products as long as they are clearly separated.

The US government is opposed to the precautionary principle in GM technology because it does not think that the technology needs special regulations. US policy-makers believe that the precautionary principle is a hindrance to technology development and, ultimately, to trade. They claim: that the EU ban is a barrier to trade costing US farmers several hundred million dollars a year in potential exports to Europe; that it has no scientific basis; and that it is preventing the development of an industry that could benefit the world's poorest people.

17
James, Clive, *Global Status of Commercialised Biotech/GM Crops: 2004*, International Service for the Acquisition of Agri-Biotech Applications (ISAAA), 2004.

The EU view is influenced strongly by a public that largely believes the potential risks of GM crops outweigh their benefits.[18] Not all government officials in EU member states, however, take the same view (the opinion of the UK science minister David Sainsbury on agricultural biotechnology, for example, is closer to that of the US government than to the government of Germany).

In the same way, not all states in the US agree with their federal government. Farmers in some states, for example, are concerned that the trade war with the EU may eventually hurt their profits if they are unable to export food products to European countries (and to those developing countries that want to remain GM-free). Four US states have either made labelling compulsory or banned GM technology in food altogether. Two states have introduced laws that go beyond federal regulations.[19]

The EU and the politics of GM crops

All political decisions at the level of the EU need the endorsement of its three component organs:

- The European Commission, the executive arm of the EU, based in Brussels
- The European Parliament made up of elected representatives
- The Council of Ministers, which represents the governments of the EU's 25 member states.

There is much disagreement within different EU institutions as to the best way forward on GM in the wake of US policy and the ending of the EU moratorium. The European Commission, for example, is the most enthusiastic of the three institutions for technology-based development. The Commission is clear in saying it always intended to lift the moratorium on GM, and persuaded member states to agree to this in exchange for new labelling and traceability rules.

Many members of the European Parliament and the Council of Ministers are more sceptical about GM – helped no doubt by the fact that Green and left-of-centre political parties have a strong showing in both the European Parliament and in many of Europe's governments (such as in Germany).

"If consumers in rich countries are eating fewer GM products in their food, how long can US – and other – farmers continue to grow GM crops if they cannot sell to multinational food companies? Or indeed, if European countries continue to keep the door shut to imports of GM produce? The answer is, probably not for very long, unless Europe (and the multinationals) have a change of heart. Large-scale farmers in developing countries such as Argentina and Brazil, which are aggressively in favour of GM technology, face the same dilemma."

Robert Walgate
Science journalist
UK

18 Gaskell, George; Allum, Richard; Stares, Sally, *Europeans and Biotechnology in 2002*, Eurobarometer 2003. This is a periodic public opinion survey organised by the European Commission in Brussels.

19 Walgate, Robert, *Genetically Modified Food: The American experience*, Danish Centre for Bioethics and Risk Assessment 2003 (report from an international conference held in Copenhagen in June 2003).

Law and regulation on GM issues 3

What policy decisions do governments have to make?

Governments (in both developed and developing countries) base their regulatory decisions on agricultural biotechnology on many of the following factors:

Food security and economic growth

- What is a country's overall strategy for food security? What part are GM crops expected to play in this?
- What is a country's overall strategy for science, technology, innovation and economic competitiveness? What part does promoting GM technology play in this?
- What will be the impact of a decision to grow GM crops on a country's agricultural export markets? How will countries in the EU, for example, react to exports from countries where GM seeds are widespread?

Stakeholder opinions

- What are a country's farmers' attitudes to GM? And how do different types of farmers (subsistence growers, industrial farmers and organic producers) differ in their approach to the technology?
- What are the opinions of scientists, NGOs, indigenous peoples and other groups with an interest or concern about GM technology?
- What are broader public attitudes to GM technology in agriculture?

Legal issues

- If farmers are already planting GM crops illegally (as in Brazil and India, for example), how much should legislation seek to legalise this? On the other hand, should laws penalise what is essentially criminal activity?

Liability and compensation

- What if GM crops exist in neighbouring countries? Should legislation seek to make these countries liable if non-GM fields are pollinated across borders?
- Who should be liable if a non-GM field becomes pollinated from GM seeds that are growing inside a country? Should it be the GM farmer? Or should it be the seed supplier?

Environmental and health risks

- What are the risks to the environment of growing GM crops? How should these be defined? How should they be measured?
- What are the risks to human health from eating GM food? How should they be defined and measured?
- Should GM food be labelled? What should be the minimum proportion of GM content, above which a product should be labelled?
- Should all GM-derived produce be kept apart from non-GM equivalents?

International agreements on GM

National policies on GM are being driven by international considerations as much as national ones. Governments have to consider three separate international agreements covering GM crops, trade in GM material, and research involving GM. They are:

- The food safety guidelines of the Codex Alimentarius Commission, the UN body that is responsible for setting voluntary food safety guidelines
- The rules of the World Trade Organization (WTO)
- The Cartagena Protocol on Biosafety, which is part of the UN Convention on Biological Diversity.

Each agreement has separate rules and provisions and was negotiated independently of the other.

The Codex commission recommends that countries call for safety assessments of all food containing GM content before they are introduced for sale in a country. The Codex guidelines are not strictly legal measures, though they have been agreed by the WTO as a reference point during trade disputes between countries. The guidelines allow countries to reject food for cultural or religious reasons. For example, a Muslim country can reject food that has not been slaughtered using the *halal* method; Israel, similarly, can reject GM food if it is found not to be *kosher* .

The Cartagena Protocol on Biosafety is the principal international legal instrument regulating international trade in GM organisms – known in the protocol's text as 'Living Modified Organisms'. The Cartagena Protocol gives countries the right to refuse imports of genetically modified organisms. Under the protocol, a country that wants to export GM material needs to notify the importing country in advance. The importing country has the right to authorise or refuse the shipment based on its own assessment of the risks to human health and the environment. Refusal is also allowed on the basis of *potential* harmful effects, even if scientific proof of the harm is lacking. This is where the protocol applies what is known as the 'precautionary principle' (see Attitudes to risk, page 9).

The protocol became international law in September 2003 and has since been ratified by more than 100 countries, including 27 in Africa, 28 in Asia and the Pacific, and 22 in Latin America and the Caribbean. The protocol has had a major impact on national laws and most signatory countries are in the process of changing their biosafety systems in line with the protocol.

The United States, however, has not signed the protocol, even though it was the first to suggest the idea of an international conservation convention, which later gave birth to the protocol. Successive US administrations (both Republican and Democrat) have stated that the protocol encourages 'unscientific' responses to GM. By contrast, the US is a strong supporter of WTO rules, under which the precautionary principle is not a valid basis for rejecting imports of food. Many developing countries are not yet WTO members – although the governments of almost all are keen to join.

Decisions, public debate and media coverage in five countries 4

While a minority of developing country governments have authorised commercial releases of GM crops, many more are contemplating a commercial future for GM technology in the not-too-distant future if they can establish that a large enough market for such crops exists. In order to understand the process of decision-making on GM technology in agriculture in five developing countries, Panos commissioned case studies in Brazil, India, Kenya, Thailand and Zambia.

The countries were chosen first and foremost because each is a developing country that has witnessed recent public controversy on GM technology in agriculture. A second reason was that each country has had extensive national and international media coverage of public controversies involving agricultural biotechnology.

In each country, the case studies looked at:

- How does a government decide whether to commercialise GM crops?
- Which government departments or agencies are involved in making decisions?
- To what degree do groups outside of government have access to decision-makers?
- How is the GM crops debate being covered by the media?

To help understand the first three questions above, more than 100 policy-makers, scientists, farmers, industry representatives, members of NGOs and journalists were interviewed. To help better understand the media dimension, we studied newspaper and magazine coverage of GM issues in each country during 2004.

Note on media survey methodology: The study included counting the number of articles on a GM topic that had been published in selected newspapers and magazines and analysing their content. Comparing the frequency with which different expert communities are quoted in media articles is one way of assessing who journalists are talking to. The study analysed the frequency with which scientists, government officials, farmers and others were quoted. A record was also kept of the number of editorial and opinion articles published on a GM topic, including how many were in favour of GM technology, and how many were opposed.

Farmer in Brazil. GM soya is widely grown in Brazil, but GM crops remain highly controversial.
PIETRO CENINI/PANOS PICTURES

Brazil: controversy in the world's fourth largest grower of GM crops

When it comes to growing GM crops, few seem as enthusiastic as Brazil's big farmers. The country has become the world's fourth-largest grower of GM crops and is poised to move up to third place, ahead of Canada. So far, however, farmers have focused on one crop, GM soya, which was planted on five million hectares of land in Brazil in 2004 – up from three million hectares in 2003.[20]

This rapid expansion took place at a time when growing GM crops was illegal in Brazil. It was only in late March 2005 that parliament passed a new biosafety law that clears the way for commercial planting of GM crops. Brazil's National Technical Commission for Biosafety (CTNBio) is now poised to give the green light for commercial planting of GM cotton, maize and rice. These may soon be joined by GM beans, papaya and potato, which are currently being tested.

The new law ends several years of uncertainty over whether GM crops will become legal. However, it is unlikely to end the growing controversy in Brazil, which began a decade ago.

CTNBio was set up as part of Brazil's Ministry of Science and Technology in 1995, comprising mostly scientists and civil servants. In 1998, CTNBio authorised Monsanto to make its herbicide-tolerant GM soya, Round-up Ready, available for sale to farmers in Brazil. Farmers say that it requires fewer applications of chemical herbicides, which in turn leads to cost savings.

However, no sooner did CTNBio announce its decision on GM soya, than Brazil's largest consumer group, the Instituto Brasileiro de Defesa do Consumidor (IDEC), asked the courts to freeze the decision on the grounds that CTNBio had not asked Monsanto for an assessment of the crop's environmental and health impacts. IDEC then joined forces with the environmental group Greenpeace, as well as the government's own environmental protection agency (Ibama). The three groups filed a joint application with the courts asking that all future GM crops be subject to an environmental impact assessment. The ministry of justice accepted the request, which resulted in a regulatory impasse lasting several years involving CTNBio, Ibama, different ministries, other government agencies and the courts.

In 2002, President Ignacio Lula da Silva's Workers' Party government was elected to power, partly on the back of some strong anti-GM rhetoric. The following year, President Lula tried to end the impasse by tabling a new biosafety bill, which reflected the terms of the Cartagena Biosafety Protocol (see page 16). This included mandatory environmental assessments for GM crops; mandatory approval for commercial GM products by the ministries of agriculture, environment and health; greater public representation in CTNBio; and applications for commercial release of GM crops to be heard in public. In addition, the bill proposed setting up a new body, the National Council for Biosafety, which would draw up a new national biosafety policy and help to resolve disagreements between CTNBio and different government ministries.

At the same time, the ministry of justice agreed to demands from consumer groups that food products containing GM will need to carry a compulsory label. (The new label consists of a yellow triangle containing the letter 'T', for 'transgenicos', in black.) Industry continues to oppose this.

Panos is grateful to the following individuals and organisations who gave up time to be interviewed for the Brazilian case study:

Sue Branford, journalist; Campanha Brasil Livre de Transgenicos; Denise Capalbo, Embrapa; Conselho de Informacoes sobre Biotecnologia; João Paulo Capobianco, Ministry of Environment; Herton Escobar, *O Estado de São Paulo*; Eliana Fontes, Embrapa; José Neumar Francelino, Ministry of Agriculture; Darci Frigo, Terra de Direitos; Marcelo Furtado, Greenpeace; Eduardo Geraque, Fapesp news agency; David Hathaway, NGO consultant; Liana John, *Terra da Gente* magazine; Goran Kuhar, DuPont/Pioneer; Marcelo Leite, *Folha de São Paulo*; Flávia Londres, Action Aid; Joaquim Machado, Syngenta; Lúcio Mocsányi, Monsanto; Jairon Alcir Santos do Nascimento, National Technical Commission on Biosafety; Rubens Nodari, Ministry of Environment; Sezifredo Paz, IDEC; Elíbio Rech, Embrapa; Carlos Sperotto, Farsul; Carlos Tautz, journalist; Silvio Valle, Fiocruz.

20
James, Clive, *Global Status of Commercialised Biotech/GM Crops: 2004*, International Service for the Acquisition of Agri-Biotech Applications, 2004.

Brazil's industrial farmers are supported in parliament by an informal lobby group called Bancada Ruralista which comprises members from different political parties who have farming interests. The Bancada Ruralista opposed the proposed new biosafety law and at the same time persuaded the government to regularise increased illegal planting of GM soya by extending temporary permission for farmers to grow GM soya until 2006.

The biosafety bill was passed in March 2005, but it is substantially weaker than that originally presented to parliament. Environmental impact assessments will not now be mandatory for new commercial GM releases. CTNBio will be the only government agency with the power to authorise commercial releases. However, it will not be obliged to hold its hearings in public.

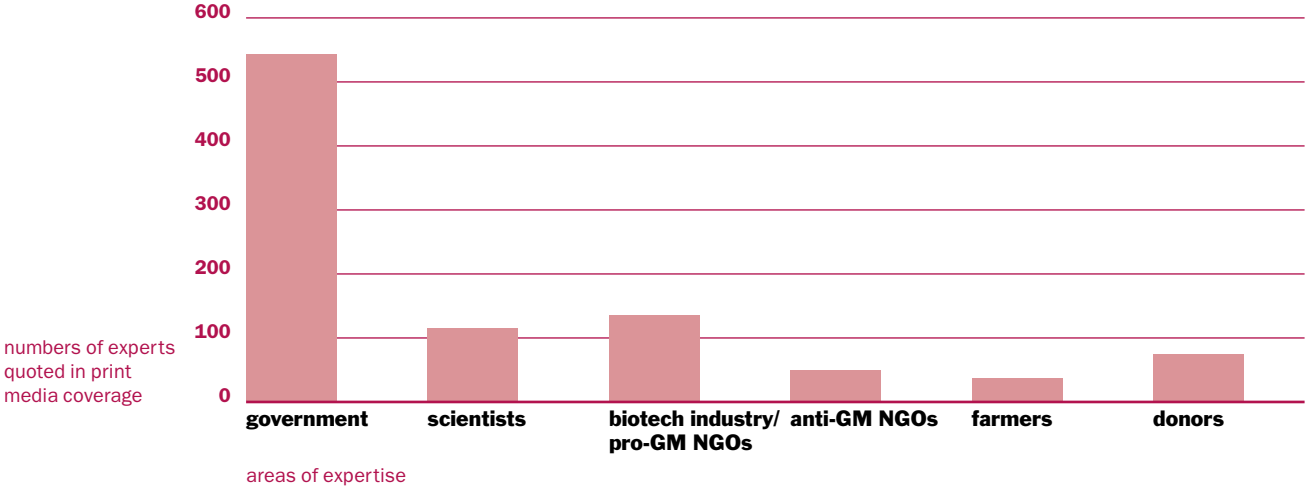
Environmental groups and organisations that represent the poor and landless, including groups that broadly support the government, are angry with the law as it stands. Even within the government, environment minister Marina Silva and officials in the ministries of health and justice have made no secret of their displeasure.

Media coverage of GM issues

Brazil's strong agriculture lobby, coupled with strong social movements, mean that the public GM debate includes a diversity of opinions. This was not the case up until 2002 when, according to many observers, opinions in the media were more often opposed to the technology than in favour of it. This, however, changed when the biotechnology industry set up what is called the Council on Information on Biotechnology (CIB) to promote its views on GM in Brazilian media, and when companies such as Monsanto decided to adopt a more pro-active policy when dealing with the media. In the past, the company mostly chose to remain silent when criticised by environmental groups. But now, Monsanto offers interviews to journalists, pays for media trips to visit its headquarters in the US and engages in advertising and sponsorship.

According to journalists, farmers' groups and industry voices interviewed for this report, since the CIB was created there has been a 'sea change' in media coverage of GM in Brazil. This is supported by the findings of our media survey, which was undertaken when the biosafety bill was going through parliament. The two daily newspapers that we assessed (*Folha de São Paulo* and the financial daily *Valor Economico*) quoted more industry sources than they did NGOs opposed to GM technology. In editorial and opinion articles in these two newspapers, eight were pro-GM and five were against GM.

Figure 1
Numbers of experts quoted in media coverage of GM issues, Brazil, January–June, 2004



"Media coverage has been more neutral and less ideological since 2002. We believe this is a result of more consistent information, based on data in science and not in ideology that the journalists have been receiving."

Lúcio Mocsányi
Director of Public Affairs
Monsanto, Brazil

"The industry has been effective in portraying public figures such as Marina Silva as being opposed to scientific progress. The reality is somewhat different – she is trying to enforce the rule of law."

Marcelo Leite
former Science Editor and now columnist
Folha de São Paulo, Brazil

"Environmentalists are starting to believe that the Lula government may not be that interested in defending the environment. It is still hard to believe that the Workers' Party was able to give birth to a government that is against environment policy."

David Hathaway
Economist and consultant on GMOs to NGOs in Brazil

Table 1
Number of experts quoted in media coverage of GM issues in Brazil, by publication, January–June, 2004

	total articles	government	science	biotechnology industry/ pro-GM NGOs	anti-GM NGOs	farmers	donors
Folha de São Paulo	130	234	59	37	30	12	32
Valor Econômico	111	273	30	86	15	27	46
***Veja* magazine**	5	6	1	1	1	0	0
Pesquisa Fapesp	27	19	27	5	0	0	0
Totals	273	532	117	129	46	39	78

Table 2
Editorial and opinion articles in Brazil, January–June, 2004

	pro-GM	anti-GM	no opinion
Folha de São Paulo	3	4	11
Valor Econômico	5	1	6
***Veja* magazine**	0	0	0
Pesquisa Fapesp	0	0	0

Notes: *Folha de São Paulo* is the main newspaper for São Paulo and sells 300,000 daily; *Valor Econômico* is one of Brazil's main financial newspapers and sells 55,000 daily; *Veja* is a current affairs magazine and sells 1.2 million copies weekly. All are privately owned. *Pesquisa Fapesp* is a monthly science and technology magazine published by the state government. Most of its articles are much longer than standard newspaper articles. It sells 44,000 copies. All are in Portuguese.

Panos is grateful to the following individuals and organisations who gave up time to be interviewed for the Indian case study:

M K Bhan, Department of Biotechnology; A K Bhatnagar, Genetic Engineering Approvals Committee; Sachin Chaturvedi, RIS; Bhagirath Choudhary, ISAAA; Chandrika Mago, *Times of India*; G Padmanaban, Indian Institute of Science; Divya Raghunandan, Greenpeace; M Prabhakar Rao, Indian Seed Industry Association; Shanthu Shantharam, Biologistics consulting; Devinder Sharma, Forum for Biotechnology and Food Security; Manju Sharma, Department of Biotechnology (retired); R P Sharma, Indian Agriculture Research Institute; Ranjana Smetacek, Monsanto; P Sunderarajan, *The Hindu*; Vinod Varshney, *Hindustan Times*; K Vijayaraghavan, consultant to USAID.

India: largest GM research programme in the developing world

India has the largest biotechnology research programme in the developing world, with 14 public-sector laboratories carrying out research on GM cabbage, cauliflower, chickpeas, citrus, eggplants, mung beans, melon, mustard, potatoes, rice, tomatoes and cotton, among many other crops.[21]

India also has one of the earliest and more sophisticated GM regulatory systems of any country. It set up a National Biotechnology Board in 1982 and a government Department for Biotechnology in 1986. However, it was the government's decision in 2002 to approve the country's first GM crop – several varieties of Monsanto's insect-resistant cotton – which prompted the country's largest public debate on the issue. Environmental and conservation groups came out firmly against the reforms, arguing, among other things, that more research was needed on the environmental and health impacts of the proposed crops.

However, insect-resistant GM cotton has proved popular among farmers, as insects are a recurrent threat to India's cotton crop. Illegal planting of GM cotton was already widespread before it was legalised, which is one reason why policy-makers, as in Brazil, felt they needed to act quickly to legalise the situation. In 2004, half a million hectares of GM cotton were under legal cultivation. It is estimated that illegal planting of GM cotton may cover a further 2.5 million hectares.[22]

Given the high estimate for illegal planting, many scientists and campaigners called for the country's existing GM regulations to be reformed, with a strong emphasis on ensuring that laws are enforced. In 2004, two of India's most eminent scientists were commissioned by the government to conduct separate reviews of GM policy. M S Swaminathan, one of the architects of the original Green Revolution, chaired a review of GM regulations in agriculture; while R A Mashelkar, Director General of the Council of Scientific and Industrial Research, chaired a review of GM in healthcare. Both (independently) concluded that a new national biosafety authority is needed – comprising scientists, government officials, non-government groups and industry – to authorise commercial releases of GM products.

Cotton growers in India. The introduction of insect-resistant GM cotton in India in 2002 provoked a major public debate.
PIERS BENATAR/PANOS PICTURES

21 Cohen, Joel, 'Poorer nations turn to publicly-developed GM crops', *Nature Biotechnology*, 2005, vol 23, no 1.

22 Jayaraman, KSJ, 'Illegal seeds overtake India's cotton fields', *Nature Biotechnology*, 2004, vol 22, no 11.

On 31 March 2004, the government announced a longer term biotechnology strategy. Its aim seems to be to repeat in biotechnology India's success as a global software giant. Under the strategy the government wants to generate $5 billion in revenue and to create one million jobs. The strategy includes a proposal to set up a new and autonomous national biotechnology regulatory authority along the lines of that suggested by Swaminathan and Mashelkar.

Twelve biotech multinationals operate in India, alongside national companies.[23] Monsanto has the biggest operation in India of all the multinationals. Its activities include running its own research centre in Bangalore. Interviews conducted for this report and previous research[24] indicate that both national and multinational private companies have considerable access to politicians and regulators.

India is also rare among the countries surveyed for this report in that anti-GM campaigners also have good access to policy-makers, including at the highest levels, as well as access to the media. However, the anti-GM campaigners we interviewed did say that their opinions are rarely taken on board by policy-makers. Devinder Sharma, one of the country's better-known campaigners, told us that he did not have to "work too hard" to get his views across to the media – though he did complain that journalists insisted on balancing his views with those of an industry source.

Interestingly, international NGOs, such as Greenpeace, and international donors, such as the US Agency for International Development (USAID), are not regarded as major players in the country's GM debate. Greenpeace is relatively new to India and USAID (unlike, for example, in some African countries) does not have a large public profile.

Media coverage

Our survey of India's print media found that overall the media in India is supportive of GM technology in agriculture. However, journalists do not report the claims of industry uncritically and mostly seek to balance their articles with different views. In India (as in Kenya and Zambia), there is little coverage of GM issues in languages other than English.

Our survey of news columns in India's general-interest newspapers and magazines, for example, shows that two of the largest-selling daily newspapers, *The Hindu* and *The Times of India*, were mostly balanced in their representation of pro- and anti-GM voices in news articles. *The Hindu* quoted equal numbers of private sector, pro-GM and anti-GM NGO sources and its editorial columns were evenly split between pro- and anti-GM positions. Private sector voices were mainly absent from *The Times of India*. But despite this, seven out of its eight editorials were in favour of GM technology.

Our survey of editorial and opinion columns in newspapers and magazines showed more articles in favour of GM technology than against. In *The Times of India*, seven editorial or opinion articles were for GM and none were against; in *The Hindu* four were pro and three against; in *Frontline* three were pro and one was against; there were no editorial or opinion articles in the Hindi-language edition of *India Today*; and in *Current Science* ten were in favour of GM and one was against.

Some journalists interviewed said that they do accept invitations to attend workshops and study-trips that are funded by industry or international donors. But not all of them do. Chandrika Mago, assistant editor at *The Times of India*, said she feels that multinationals exert a disproportionate influence on "some sections of the media." Journalists in India (as elsewhere) tend not to interview farmers' groups in their reporting.

23, 24
Newell, Peter, *Biotech Firms, Biotech Politics: Negotiating GMOs in India*, Institute of Development Studies, University of Sussex, 2003. This is an authoritative, thorough assessment of GM politics in India.

Figure 2
Numbers of experts quoted in media coverage of GM issues, India, January–June 2004

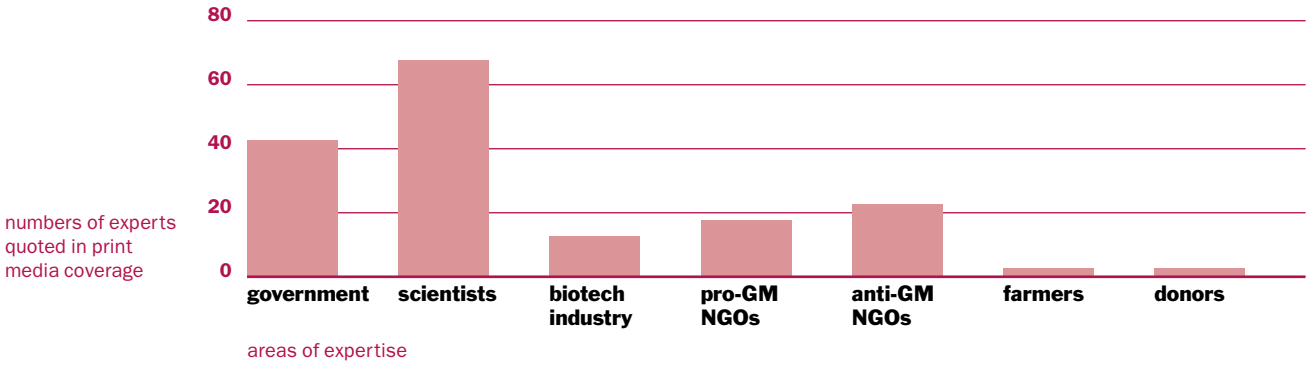


Table 3
Number of experts quoted in media coverage of GM issues in India, by publication, January–June 2004

	total articles	government	science	biotechnology industry	pro-GM NGOs	anti-GM NGOs	farmers	donors
Times of India	26	13	9	0	5	8	0	1
The Hindu	56	21	20	10	7	8	1	2
Frontline **magazine**	9	6	12	2	4	6	1	0
India Today **magazine (Hindi)**	4	1	2	0	0	0	1	0
Current Science **magazine**	15	1	23	1	1	0	0	0
Totals	110	42	66	13	17	22	3	3

Table 4
Editorial and opinion articles in India, January–June 2004

	pro-GM	anti-GM	no opinion
Times of India	7	0	1
The Hindu	4	3	6
Frontline **magazine**	3	1	1
India Today **magazine (Hindi)**	0	0	0
Current Science **magazine**	10	1	3

Notes: *The Hindu* is a national daily newspaper in English with circulation of one million; *The Times of India* is a national daily in English and sells 2.1 million; *Frontline* is a fortnightly current affairs magazine with a circulation of 75,000; the Hindi edition of *India Today* is a glossy weekly current affairs magazine that sells 333,000. *Current Science* is India's leading science journal and sells 4,000 every two weeks. All are privately owned.

Kenya: corporate and government support for fledgling GM sector

Kenya's government (along with Egypt and South Africa) is among Africa's more vocal supporters of GM technology. Kenya's President Mwai Kibaki asserts that GM technology has a role in the country's food security and that it will help the country's scientists and farmers be internationally competitive. While Kenya has no GM crops ready for commercialisation, three potential GM crops are being researched. These are: a strain of maize that is resistant to the stem borer insect; Monsanto's herbicide-tolerant cotton; and a virus-resistant sweet potato, which is also being tested with the help of Monsanto.

In June 2004, President Kibaki inaugurated Kenya's first research institution in biotechnology, which will allow Kenya's scientists to test the environmental impacts of GM crops under controlled conditions. Costing $12 million, it was funded jointly by the government and the Switzerland-based Syngenta Foundation and will be operated by the government's Kenya Agricultural Research Institute (KARI) in association with the International Centre for the Improvement of Wheat and Maize, which is based in Mexico.[25]

Biosafety regulation, however, has yet to catch up with research. In August 2004 Kenya's National Council of Science and Technology drafted a biosafety bill, which was then forwarded to the cabinet for discussion before it is presented to parliament. By February 2005, however, the bill had not been published and groups that oppose GM technology have complained that very few people outside of government and possibly industry have been consulted in drawing up the bill. In December 2004, two members of parliament tabled a motion calling for a ban on the commercial release of GM in agriculture.

President Mwai Kibaki of Kenya is an enthusiastic supporter of GM crop technology
SVEN TORFINN/PANOS PICTURES

As a country that is relatively new to multi-party governance, Kenya has only recently begun to open up to non-governmental organisations that oppose the government line on public policy issues. For example, the Kenya Small Scale Farmers' Forum, which is the main voice of small-scale farmers opposed to GM technology in agriculture, was established only recently in August 2004.

At the same time, the President's position has made it relatively straightforward for biotechnology multinationals such as Monsanto to support organisations that promote biotechnology among the media and politicians in Kenya, and also organise research and data-collection. These industry-funded organisations include the African Biotechnology Stakeholders' Forum, a lobbying group comprising scientists drawn from universities, and the Kenya office of the International Service for the Acquisition of Agri-Biotech Applications (ISAAA), which was set up by Florence Wambugu, one of Africa's most distinguished GM scientists. The ISAAA has quickly established itself as an important and often-cited source for economic and financial information on GM crops around the world – and was also used as a source for this report.[26]

Panos is grateful to the following individuals and organisations who gave up time to be interviewed for the Kenyan case study:

Aghan Daniel, science writer; Kenneth Kambona, Syngenta; Margaret Karembu, ISAAA; Eucharia Kenya, Kenyatta University; Kenya National Federation of Agricultural Producers; Phoebe N Kinyua, Kenya Institute of Mass Communication; Pamela Makotsi, *East African Standard*; Duncan Mboya, *Biosafety News*; Kinywa M'Mbijjewe, Monsanto; Joseph Mureithi, Kenya Agricultural Research Institute; Dorcas Wangechi Mwangi, Consumer Information Network; C K Nzau, National Council of Science and Technology; D O Ogoyi, University of Nairobi; Norah K Olembo, University of Nairobi; Lucas O Sese, African Biotechnology Stakeholders Forum; Florence Wambugu, A Harvest Biotechnology Foundation; Joseph Muyalah Wekundah, Biotechnology Trust Africa; Ngulo K Wellington, Ministry of Agriculture.

25
Kimani,Chege, '$12 million greenhouse signals Kenyan GM commitment', *www.SciDev.Net*, 25 June 2004

26
James, Clive, *Global Status of Commercialised Biotech/GM Crops: 2004*, International Service for the Acquisition of Agri-Biotech Applications, 2004. ISAAA is a biotechnology industry-funded research and lobbying organisation, but a reliable source for data on GM crops.

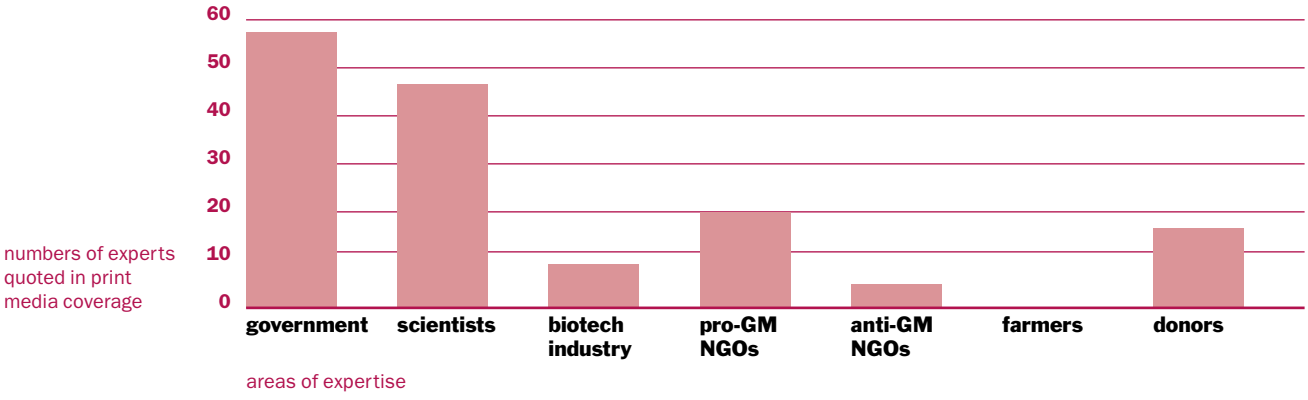
Media coverage

The predominance of voices from the biotechnology industry in Kenya undoubtedly affects the way in which GM issues are covered in the country's media. The survey of newspapers and magazines in Kenya found journalists quoted many more voices supporting GM technology in agriculture and very few that were opposed to it. Moreover, the voice of farmers' groups is completely absent from newspaper and magazine coverage.

Of the journalists that we interviewed, only one voiced a sceptical, critical view on GM technology in agriculture – most were uncritically supportive. Some told us that many of Kenya's journalists are paid by the biotechnology industry and by lobby groups to write articles in support of GM technology. A number of journalists said that it is difficult to write or publish stories that are critical of GM technology in certain newspapers. One told us that GM-sceptic NGOs need to have the courage to speak up more often.

Duncan Mboya, a journalist with a pro-industry newsletter called *Biosafety News*, told us that private companies and their allies occupy a disproportionate amount of space in newspapers. "They only talk of the positive side of their products and hardly talk of the negatives," he said. Science journalism is relatively underdeveloped in the newspapers that we surveyed. The survey also found that there is little coverage of GM issues in newspapers and magazines that are written in languages other than English.

Figure 3
Numbers of experts quoted in media coverage of GM issues, Kenya, January–June 2004



	total articles	government	science	biotechnology industry	pro-GM NGOs	anti-GM NGOs	farmers	donors
Daily Nation	5	8	14	2	9	0	0	1
East African Standard	14	31	24	2	10	2	0	5
***Taifa* (Swahili)**	4	4	3	1	0	0	0	1
Science in Africa	4	14	5	2	1	2	0	9
Totals	27	57	46	7	20	4	0	16

Table 5
Number of experts quoted in media coverage of GM issues in Kenya, by publication, January–June 2004

Editorial and opinion articles in Kenya, January–June 2004
Only one editorial was published in all the four Kenyan periodicals between January and June. It ran in the *Nation* on 25 June following a statement from President Mwai Kibaki supporting GM technology. The editorial urged caution before adopting GM.

Notes: *Taifa* is Kenya's main Swahili daily and sells 42,000; *The Daily Nation* (which also owns *Taifa*) is the largest-selling English newspaper and sells 100,000 daily; *East African Standard* is an English daily that sells 80,000; *Science in Africa* is an English language online science magazine.

Thailand: public opposition reins back government support for GM

Thailand, along with Japan and South Korea, has adopted a cautious approach to GM technology, similar to that of the EU. In Thailand, commercial-scale planting of GM crops has been banned since 2001, and only a handful of varieties (including cotton, rice and papaya) are being tested in laboratories or in small-scale test plots. Thailand's organic farmers, who export to the EU, are sceptical about GM and concerned that GM crops could pollinate their organic fields. From the public controversy during late 2004, it seems that the public, too, has yet to be convinced about the usefulness and safety of GM technologies.

Public opinion in Thailand is sensitive about the role of multinational corporations, such as Monsanto, and foreign government agencies, such as the US Agency for International Development, which help fund research on biotechnology and provide other kinds of support. Wichai Chokewiwat, former Director General of Thailand's Food and Drug Administration and current head of Thailand's Department of Traditional Medicine, told us that the US government had sent high-level officials to Thailand "expressing concerns about our policies".

Some senior politicians in Thailand, however, take a different view and are concerned that if the ban stays in place the country risks missing what Prime Minister Thaksin Shinawatra has called the "biotechnology train". Partly because of this, in January 2004, agriculture minister Somsak Thepsuthin published a strategy to promote Thailand as a regional centre for biotechnology companies. And in August of the same year, Prime Minister Shinawatra said he was considering overturning the ban on commercialising GM crops.

Following the Prime Minister's comments, non-government groups and organic farmers mounted a campaign for the ban on commercialisation to stay in place. It led to a decision by the cabinet to retain the ban. The cabinet also set up a panel of experts to suggest the terms of reference for new biosafety laws (the existing law that applies to GM technology is the 1975 Plant Quarantine Act). The expert group has been asked to address three questions: should GM food be sold in Thailand? should it be banned? or can GM crops co-exist alongside conventional ones?

Thailand's controversy was fuelled by the discovery in the summer of 2004 that GM papaya trees were found growing on several farms close to a government GM papaya field-testing station in Khon Kaen province. It is not known whether this is because pollen from the GM plots leaked out into the surrounding environment, or whether GM seeds were illegally sold to nearby farmers. Whatever the reason, the discovery of GM trees next to an organic farm confirmed the worst fears of organic farmers. Germany has already banned imports of tinned fruits that contain papaya from Thailand.

Unlike in other developing countries, many senior officials in Thailand's scientific and regulatory community are also urging caution towards GM technology. Somvong Tragoonrung, Director of the DNA Technology Laboratory at the National Science and Technology Development Agency (NSTDA), said: "Thailand is a land of biodiversity and we can produce many new breeds of plant naturally. So we may not necessarily need GM for this purpose… We also need proper laws and regulations – as they have in the US."

Panos is grateful to the following individuals and organisations who gave up time to be interviewed for the Thai case study:

Suwan Anantachaiyong, GM farmer; Thaddao Anantachaiyong, Monsanto; Jiraphan Atthajinda, National Research Council; Sakarindra Bhumiratana, National Science and Technology Development Agency; Boonchuay Boonyen, Northern Alternative Agriculture Farmers' Network; Vichai Chokewiwat, Department of Traditional and Alternative Medicine; Tawan Khieowijit, Channel 7 (TV); Witoon Lianchamroon, Biodiversity and Community Rights Action Thailand (BioThai); Chutima Noonman; Saree Ongsomwang, Consumers' Foundation; *Matichon* newspaper; Janjira Phongrai; *Thai Rath* newspaper; Kultida Samabhudi, *Bangkok Post*; Anan Somjak, Chiang Mai Organic Farmers Cooperative; Patwajee Srisuwan, Greenpeace; Somkhuan Sriwongchotikul, GM farmer; Morakot Tanticharoen, National Centre for Genetic Engineering and Biotechnology; Vanchai Tantivittayaphitak, *Sarakadee* magazine; Saksit Tridej, Ministry of Science and Technology; Phansiri Winichagoon, UNDP.

Media coverage in Thailand

Our survey of Thailand's print media, which took place during the public campaign against lifting the ban on commercialisation of GM crops, shows that the media in Thailand generally takes a sceptical approach to GM issues. Even Thailand's main business newspaper, the *Daily Manager*, gave more space to quotations from NGOs critical of the technology than it did to voices from industry. Editorial and opinion pieces were resoundingly against GM, with 12 against as opposed to four in favour in the English-language *Bangkok Post*; six against and none in favour in the *Daily Manager*; and one in favour and none against in *Thai Rath*, a mass circulation daily newspaper published in Thai.

Even GM sceptics feel that the public and media discussion of GM is one-sided and unsatisfactory. Phansiri Winichagoon, Environment Manager of the UNDP in Thailand, said: "The current discussion is not enough. While I agree with the reasoning of anti-GM groups, the other side must be given an opportunity to explain its case, which I do not see happening. There needs to be more balance." Wichai Chokewiwat said that "most people who comment on this issue lack basic knowledge".

Vanchai Tantivitayapitak, President of Thailand's Environmental Reporters Club, said that the public relations skills of Thailand's biotechnology companies do not match those of environmental groups. Thailand does not yet have organisations funded by industry to promote GM technology in the country – a situation that is likely to change, as has occurred in Brazil and Kenya.

Family working in a rice field in northern Thailand.
MIKKEL OSTERGAARD/PANOS PICTURES

Figure 4
Numbers of experts quoted in media coverage of GM issues in Thailand, January–November 2004

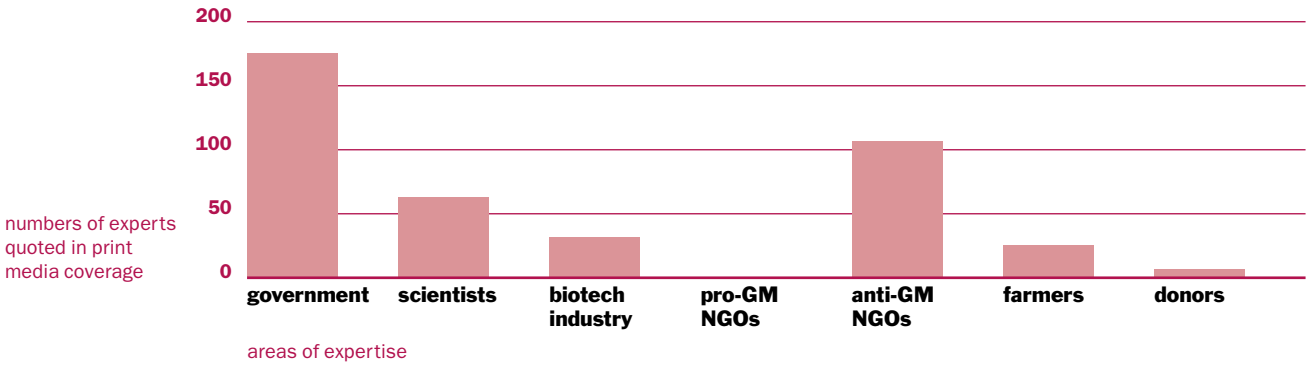


Table 6
Number of experts quoted in media coverage of GM issues in Thailand, by publication, January–November 2004

	total articles	government	science	biotechnology industry	pro-GM NGOs	anti-GM NGOs	farmers	donors
Thai Rath	39	48	9	2	0	10	3	0
Daily Manager	54	79	39	16	0	57	12	0
Bangkok Post (English)	66	46	14	13	0	37	12	9
Update magazine	5	1	3	0	0	2	0	0
Totals	164	174	65	31	0	106	27	9

Table 7
Editorial and opinion articles in Thailand, January–November 2004

	pro-GM	anti-GM	no opinion
Thai Rath	0	1	2
Daily Manager	0	6	0
Bangkok Post (English)	4	12	5
Update magazine	0	0	0

Notes: *Thai Rath* is a daily published in Thai and has a circulation of 1 million; *Daily Manager* is the main Thai language business newspaper; *Bangkok Post*, with a circulation of 70,000, is one of two English daily newspapers; *Update* is a monthly science magazine published in Thai with a circulation of 50,000.

Panos is grateful to the following individuals and organisations who gave up time to be interviewed for the Zambian case study:

Amos Chanda, *Zambia Daily Mail*; British American Tobacco; Edem Djokotoe, *The Post* newspaper; Jesuits Centre for Theological Reflection; Ben K Kangwa, Zambia National Broadcasting Corporation; Luke Mbewe, Zambia Export Growers' Association; Mwananyanda Mbikusita Lewanika, National Institute of Scientific and Industrial Research; Dorothy K Mulenga, Ministry of Science and Technology; Mpundu Mwape, National Agriculture Information Services; C A Njobvu, University of Zambia; Lovemore Simwanda, Zambia National Farmers' Union; P G Sinyangwe, Ministry of Agriculture, Food and Fisheries.

Zambia: government says no to GM food

Until 2002, the words 'GM agriculture' and Zambia were unlikely to be part of the same sentence. Zambia had no plans to introduce GM crops and it was in no rush to ratify the Cartagena Biosafety Protocol, though it was involved in discussions around the Protocol at the international level. But the situation changed in August 2002, when Zambia was offered food aid containing GM seeds in response to the famine that was then affecting southern Africa. President Levy Mwanawasa confounded GM sceptics and enthusiasts alike by saying "no thanks" to food aid containing GM. Overnight, Zambia had joined the global controversy over GM food.

The World Food Programme (WFP) and the US government (the WFP's largest donor) made no secret of the fact that by refusing to accept food aid containing GM they thought the Zambian government was acting irresponsibly. Andrew Natsios, the head of the US Agency for International Development, said that if GM food was good enough for President George W. Bush and then US Secretary of State Colin Powell, it should be appropriate for the 5.5 million Zambians (half of the population) who were undernourished.

International NGOs opposed to GM took the side of the government and said that sufficient non-GM food could be found to meet the needs of the hungry. They also claimed that the US government was using the WFP to get GM crops into developing countries – thus bypassing agreements such as the Cartagena Protocol (see page 16). NGOs agreed with President Mwanawasa and his chief economic adviser, Moses Banda, that Zambia should not be rushed into accepting GM grain before it had reflected on the possible impacts of GM, and built up its capacity to regulate and monitor GM products.

Agriculture has a dominant position in Zambia's economy. Two-thirds of the working population is employed in farming, mostly on small farms. The EU is an important export market for Zambia's farmers, and this was a key reason for Zambia's decision to reject GM food aid. The government feared that EU governments would ban imports from Zambia if GM seeds found their way into the country's food chain.

In 2004, Zambia registered its acceptance of the Cartagena Protocol, which came into force in July of that year. The government started to set up a regulatory system in accordance with the Cartagena Biosafety Protocol. In August 2004, Zambia's Ministry of Science, Technology and Vocational Training published a draft biosafety bill. The bill seeks to set up a national biosafety authority responsible for protecting human, animal and environmental health from potential adverse impacts of scientific research and commercial applications of GM technology, including food, animal feed and medicines. The authority will comprise civil servants and will be advised by a committee of scientists.

All applications to grow GM crops or conduct GM research will need to be cleared by the authority. The authority will also have the power to conduct assessments of potential environmental and health risks. Zambia is also backing a model biosafety law that has been developed jointly by the African Union and the government of Ethiopia. This model law is tougher than the Cartagena Protocol in that, for example, it requires companies who export GMOs to pay compensation for accidents involving the technology.

Media coverage

Of the five case study countries, Zambia's print media seemed the least engaged in reporting on developments in GM technologies or policy processes during the period that was surveyed (January to June 2004). However, coverage was more frequent in 2002 during the controversy over GM ingredients in food aid to Zambia.

During the period of our media survey, the government-owned *Daily Mail* carried just one news piece on GM. Editorial and opinion articles, however, appeared more often, and were mostly opposed to GM technology in agriculture. The *Daily Mail* carried 16 editorial or opinion articles against GM, and seven in favour; *The Post* carried one for each side; the environment magazine *Green Times* had three in favour and four against. Zambia's non-English media (as with that in India and Kenya) carries very little coverage of GM issues.

Edem Djokotoe, Training Editor with the privately-owned *The Post* newspaper, told us that Zambia's print media needed to be more critical in its coverage of announcements on GM-related issues. As with the media in other countries, few of Zambia's journalists are quoting farmers' groups in their articles. Zambia is unusual in that there are no quotations from NGOs that are in favour of GM technology.

> *"The media should be critical of everything, including science. If it was accepted that the world was flat, and you would not sail beyond a certain point, many would not have discovered that the world is spherical, and a lot of what we know now would not have been known."*
>
> **Edem Djokotoe**
> Training Editor, *The Post* newspaper
> Zambia

Zambia refused GM food aid in 2002 during the drought that affected much of southern Africa
GIACOMO PIROZZI/PANOS PICTURES

Figure 5
Numbers of experts quoted in media coverage of GM issues, Zambia, January–June 2004

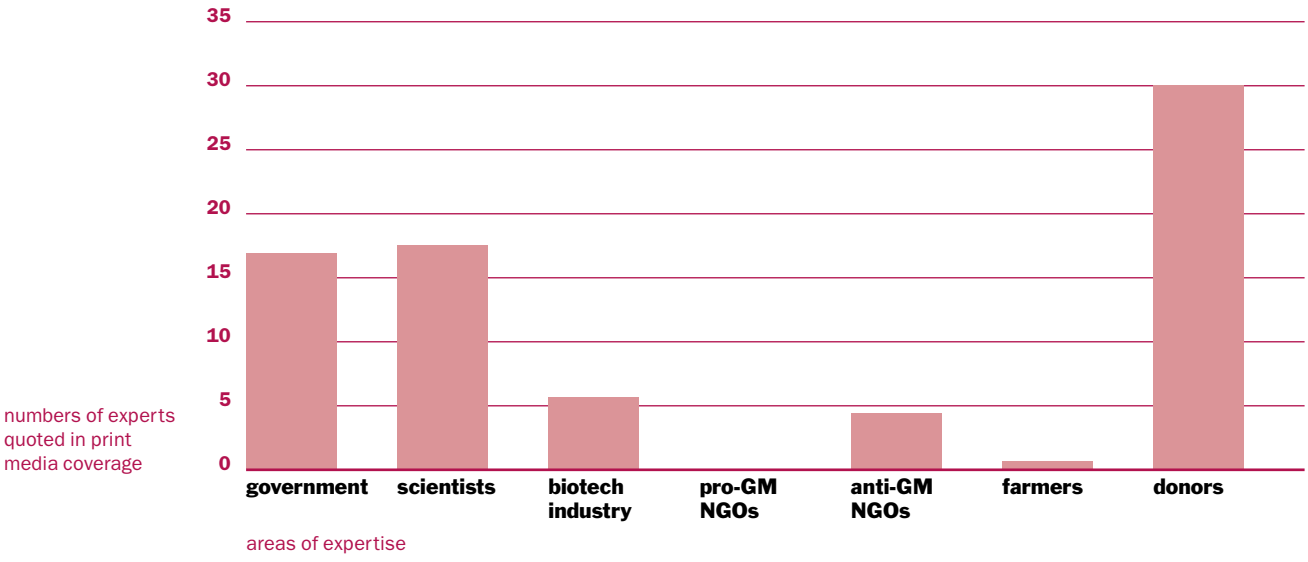


Table 8
Numbers of experts quoted in media coverage of GM issues in Zambia, by publication, January–June 2004

	total articles	government	science	biotechnology industry	pro-GM NGOs	anti-GM NGOs	farmers	donors
Daily Mail	34	9	15	5	0	3	1	14
The Post	5	3	0	1	0	1	0	0
***Icengelo* magazine (Bemba)**	0	0	0	0	0	0	0	0
Green Times	26	5	3	0	0	0	0	16
Totals	65	17	18	6	0	4	1	30

Table 9
Editorial and opinion articles in Zambia, January–June 2004

	pro-GM	anti-GM	no opinion
Daily Mail	7	16	0
The Post	1	1	0
***Icengelo* magazine (Bemba)**	0	0	0
Green Times	3	4	0

Notes: *Daily Mail* is a government-owned daily selling 20,000 copies. Half of its articles on GM were written by a journalist from *Green Times*. *The Post* is a privately-owned English daily selling 25,000 copies; *Icengelo* is a magazine in Bemba (one of Zambia's seven national languages) selling 10,000 copies every month; *Green Times* is an environment monthly in English and sells 5,000.

How governments make decisions and who has access to decision-makers 5

The role of governments

In both developed and developing countries, GM technology in agriculture is regulated by agencies within one or more of the following ministries: agriculture, commerce, science, environment and public health. These ministries are also often charged with the role of proposing new biosafety legislation, which is then placed before parliaments for debate, discussion and amendment.

In developing countries, ministries of agriculture, commerce and science tend to have a greater say in helping to develop new regulations in GM agriculture. These ministries are powerful because agriculture and trade are both important to the economies of developing countries. Science ministries, meanwhile, carry influence because they are regarded as a natural home for GM issues. In developing countries all three ministries often regard GM technology as important to economic growth, food security, economic and scientific competitiveness.

Environment ministries in developing countries, by contrast, have existed for a comparatively short period of time – many were set up only after the 1992 Earth Summit in Rio de Janeiro – and are considered to be weaker politically than the former three. In practice this means that often the role of the environment (or health) ministry will be to comment on a proposed policy that has been developed in the ministry of agriculture or science, rather than develop the policy itself. Following the Cartagena Protocol (see page 16), many more countries are setting up autonomous biotechnology regulatory authorities.

Who has access to decision-makers?

Wise, effective, practical and long-lasting legislation needs governments to be listening to the widest possible constituency of people. For this to happen, citizens' groups need to have access to those who make decisions on their behalf. Part of the aim of the case studies in this report was to understand better the degree of access that different groups have to different government departments. This involved interviewing policy-makers, NGOs, industry representatives, farmers' groups, scientists, international aid donors and journalists in each of the countries under review. We define 'access' as the ability to be able to meet officials who have a decision-making role, without undue hindrance or obstruction.

Farmers' groups, international donors and the biotechnology industry

In all five countries, the case studies found that groups representing large-scale farmers, scientists and international donors have good access to ministries of agriculture, commerce and science. Representatives of each of these groups told us they were able, without too much difficulty, to meet with officials in ministries who have decision-making responsibilities.

International donors reported that they find it comparatively easy to get access to decision-makers on GM issues, particularly in Africa. Representatives of the biotechnology industry told us they have good access to ministries of agriculture, commerce and science in Brazil, India and Kenya, possibly because of each government's positive stance towards GM technology in agriculture.

NGOs and consumer groups

Consumer groups and other NGOs in all five countries told us that they are less successful at attracting the attention of ministries of agriculture, commerce and science. On the other hand, they are more successful at being able to speak to officials in ministries of environment and public health, as well as to sympathetic members of parliaments. The large multinational NGOs such as the World Wildlife Fund and the World Conservation Union have good access to policy-makers in environment ministries and these groups are likely to employ former government officials to help them gain access to decision-makers.

The case studies did find, however, that NGOs who are opposed to their government's approach to GM technology tend to have better access to policy-makers in countries with well-established multi-party systems of government, and where the media is relatively free to report the inner workings of government – as in Brazil, India and Thailand. By comparison, the governments in Zambia and Kenya, which differ sharply in their approach to GM, have yet to see the full-scale emergence of NGOs and journalists critical of government policy.

Scientists

Scientists were the only group to have good access to decision-makers across all policy areas of GM technology in all five countries. This may be because scientists are called on to play a variety of roles by all stakeholders in the GM debate. Scientists are employed by all relevant ministries, in addition to their role in research and testing new GM seed varieties. Meanwhile, all stakeholder groups employ scientists in an advisory role, for example, to advise on the risks to human health and the environment from GM technology. In all countries, many former government scientists are later employed by groups such as professional academies of science, which helps these bodies have good access to science ministries.

"The goal of the [science] ministry is to promote policies that encourage scientific and technological progress. But it is important that governments carry out biosafety research, not only biotechnology companies."

Eliana Fontes
EMBRAPA
Brazil

"There is no question that private industry has most at stake, having invested millions on product development. They will incessantly lobby the government to develop a policy that is favourable to them. Those opposed to GM technology will do the exact opposite."

Shanthu Shantharam
Biotechnology consultant, Biologistics
USA

"The government has to take a balanced view. It takes into account the views expressed by various stakeholders. Transparency, objectivity, free access to information are key to meaningful dialogue."

M K Bhan
Secretary, Department of Biotechnology
India

"Consumers' associations try to talk to senators, but no one replies to our emails and members of government and parliament are not interested in talking to us."

Sezifredo Paz
Brazilian Institute for Consumer Defence (IDEC)

"We print lot of literature on GM, which is translated into different languages. We brought out a pamphlet on Bt cotton called 'A deadly trap', and we distributed 200,000 copies in nine languages to farmers. We also spend a lot of time in discussions and debates with scientists at various levels. The government's Department of Biotechnology does not invite us."

Devinder Sharma
Forum for Biotechnology and Food Security (GM-sceptic NGO)
India

Media coverage of GM issues

The following findings are drawn from our media survey of the five countries:

- The views of farmers' organisations (both large- and small-scale farming) are under-represented in the media, particularly in India, Zambia and Kenya.
- In all the countries studied, many more government representatives and scientists are being quoted compared to other sources. In each country, the combined number of government and science sources quoted was higher than or equal to the total number of other sources (industry, NGOs, farmers' organisations and development agencies). This suggests that there is comparatively little broad analysis of GM issues, with many stories based on announcements from government ministries and research laboratories.
- The highest proportion of non-government sources quoted in the stories surveyed were in India and Zambia.
- With the exception of India, journalists in all of the countries studied quote international donors in their articles. This suggests that journalists have a good understanding of how much access international donors have to policy-makers in their countries. In Zambia, donors comprised two-fifths of the total sources quoted in articles – the highest proportion among the five countries.
- In Brazil, India, Kenya and Zambia the broad direction of media coverage of GM issues is aligned with government policy. In Thailand, where there has been a popular campaign against proposed government policy on GM, the media reflects public opinion.
- Specialist science periodicals in India and Brazil give little space to voices other than those of scientists and are almost wholly in favour of GM technology. Eleven out of 12 editorials in India's *Current Science* magazine were in favour of GM technology. By contrast, editorials in Zambia's environmentalist *Green Times* were surprisingly split evenly between 'pro' and 'anti' positions.
- There is limited coverage of GM issues in languages other than English in India, Kenya and in Zambia. In these countries, English is the language of official business but is not the first language of the majority of the population.

New Delhi, India. Research is going on in India into a number of different GM crops, vegetables and types of fruit, although the issue is highly controversial.
AMI VITALE/PANOS PICTURES

Conclusion

GM crops are a complex and contentious issue. GM controversies include: the extent to which GM is a solution to world hunger; the potential impact of GM crops on the environment and human health; the role of private biotechnology companies in research, production and trade; disagreements over the interpretation of research; the role of international environmental NGOs; and disputes over international trade. This has led in many cases to a polarised debate, with proponents and opponents of GM taking increasingly entrenched positions, making it difficult to find common ground for constructive dialogue and debate.

Scientific research about the impacts and the potential benefits of GM crops is in its early stages. As a result, science by itself cannot be the sole guide to what are effectively political decisions on the level of risk a society is willing to take and the level of evidence sufficient to accept that risk.

Decision-making

As the case studies in this report demonstrate, the framework for decision-making on GM crops varies considerably between countries, according to specific political, economic, agricultural and environmental contexts. Opinions (even among common interest groups) are not homogenous across the developing world. For example, Zambia's farmers have rejected GM crops; Brazil's agri-business groups are enthusiastic about them; and Thailand's organic farmers are concerned that commercialisation of GM agriculture may affect their exports to the EU.

Despite these differences, it is possible to draw some broad conclusions about how governments in developing countries make decisions and who has access to decision-makers:

- GM technology is regulated by agencies within ministries of agriculture, commerce, science and environment. Parliaments mostly – though not always – have a large role in deciding the content of new laws.
- Different groups of citizens vary in their access to different parts of the policy-making process. Scientists, international donors, the biotechnology industry and groups representing commercial farmers tend to have good access to ministries of agriculture, commerce and science.
- Scientists are involved in most stages of the decision-making process and tend to have good access to decision-makers across all policy areas. They advise on state regulation of GM technology. In addition, different stakeholders in the GM debate call upon scientists to play a variety of roles. For example, governments and biotechnology companies employ scientists to develop new seed varieties; NGOs employ scientists to advise them on the potential risks to human health and the environment; and professional scientific bodies employ ex-government scientists to help lobby for their profession in government. However, scientific opinion on GM crops is not uniform – scientists' views have been used to support decisions both to accept and to reject GM technology.
- Consumer groups and other NGOs are more successful at accessing ministries of environment and public health, and sympathetic MPs, than the often more powerful ministries of agriculture, commerce and science.

Media coverage

Accurate and balanced media coverage is crucial to the GM debate. The case studies found that the quality of media coverage and debate was higher in countries with a longer tradition of multiparty systems of government, an active civil society and a tradition of independent media.

However, much of the coverage analysed revealed a lack of analytical (or investigative) reporting. Most of the news articles, for example, were based on announcements from government sources – a reflection of the relative weakness of investigative journalism in science-related issues in most developing countries.

External groups clearly influence media coverage in many countries. Biotechnology companies carry out public relations work, including in some countries establishing NGOs to promote GM technology. Anti-GM NGOs also make themselves heard in the media – some critics claiming that they are driven by international, campaigning NGOs.

Farmers are among those most immediately affected by GM. However, their views, particularly those of small-scale farmers, are rarely reflected in the media.

Who decides?

GM crops have huge implications for developing countries – in terms of nutrition, livelihoods, agricultural economy, food security and agricultural productivity and sustainability. All stakeholders need to be involved in making decisions on GM crops – parliament, farmers, industry, NGOs, the general public, international donors and scientists. Journalists and the media have a key role to play in ensuring all views are heard.

GM crops have become a key issue for all countries. Decisions made now will profoundly affect societies for generations to come. It is crucial that these decisions are informed by a full public debate.

Annex: GM crops around the world

Table 10
GM crops grown on a commercial scale around the world

Country	GM crop area (hectares)	GM crops
United States	42.8 million	Maize, cotton, soy, canola
Argentina	13.9 million	Soy, maize, cotton
Canada	4.4 million	Canola, maize, soy
Brazil	3.0 million	Soy
China	2.8 million	Maize, soy, cotton
India	500,000	Cotton
South Africa	400,000	Cotton

Table 11
Planning for GM field crops

G grown for commercial use
A approved by regulators
F in field tests
L in laboratory tests

	soy	cotton	maize	canola	sugar-beet	rice	flax	wheat	sugar cane	barley	alfalfa	sunflower
Canada	G	A	G	G	A	A	A	F		F	F	F
US	G	G	G	G	A	A	A	F	F	F	F	
EU (15)	A	F	G	A	F	F		F		F	F	F
Brazil	G	F	F			F			F			
China	F	G	F	L	L	F		L		L		
Egypt		A	F	A				F	F	L		
India		G		F		L						
Kenya			L									
South Africa	G	G	G	F					F			
Thailand		F				F						

Table 12
Planning for GM vegetables

G grown for commercial use
A approved by regulators
F in field tests
L in laboratory tests

	potato	tomato	squash	pepper	pea/ bean	lettuce	cucumber	carrot
Canada	A	A	A					
US	A	A	G		F	F	F	
EU (13/15)	F	F	F		F	F		F
Brazil	F	F			F	L		F
China	F	G		G				L
Egypt	F	F	F		L		F	
India	L	L						
Kenya	F							
South Africa	F							
Thailand		F		F	L			

Table 13
Planning for GM fruit

G grown for commercial use
A approved by regulators
F in field tests
L in laboratory tests

	papaya	melon	banana	pineapple	apple	grape	plum	strawberry	watermelon	citrus
Canada	A					F				
US	G	A	F		F		F		F	
EU (8/15)		F			F	F	F	F	F	F
Brazil	F									
China	F	F								
Egypt		F	L							
India										
Kenya										
South Africa								F		
Thailand	L									

Source: *Global Diffusion of Plant Biotechnology: International adoption and research in 2004*, C F Runge and B Ryan, University of Minnesota/Council on Biotechnology Information, Washington DC.

Glossary

Biological diversity
The variety and variability of life on Earth – including all plant and animal species. More commonly known as biodiversity.

Biosafety
Precautions taken to reduce the risks from GM organisms – these include possible harm to the environment and health.

Cartagena Protocol
International agreement that lays down rules under which GM organisms can be transferred from one country to another. The Protocol is a part of the UN Convention on Biological Diversity, an international agreement that entered into force in September 2003.

DNA
Deoxyribonucleic acid. The chemical building block of the genetic information in the cell from which genes are composed

Genetic modification
The manipulation of a living organism's genetic make-up by eliminating, modifying or adding copies of specific genes (often from other organisms) using tools and techniques from biotechnology. Sometimes called genetic engineering or genetic manipulation.

Green Revolution
An organised effort – sponsored by international donor agencies – to increase world food production by introducing high-yielding varieties of cereals and rice, first developed in Mexico and the Philippines. The Green Revolution, which began in the 1960s, led to impressive yields; but at a cost of large quantities of fertiliser, pesticides and water.

Herbicide
A chemical substance that poisons plants; usually applied in the form of a spray and used to kill specific unwanted plants, especially weeds.

Millennium Development Goals (MDGs)
A set of eight goals (divided into 18 targets) to halve world poverty before 2015. The goals were agreed by world leaders at the UN Millennium Summit held in New York in 2000. Much development aid is now contingent on countries signing up to achieve the goals.

Pollen/pollination
Pollen grains are a fine, powdery substance produced by seed-bearing plants. Pollination refers to the transfer of pollen from the male part of the flower to the female part. It is a process necessary for a seed to fertilise. Pollen can be transferred in many ways, such as by wind, insects and rain.

Precautionary principle
The precautionary principle is the theory that if the consequences of an action – especially concerning the use of technology – are unknown but are judged by some scientists to have a high risk of being negative, then it is better not to carry out the action, instead of risking uncertain, but possibly negative, consequences.

Transgenic plant
Genetically modified plant, which contains genetic material that has been rearranged, or which includes a foreign gene (a transgene) from an unrelated organism such as a virus, animal or other plant.

Contacts and news sources

News Sources

Food Safety Network
www.foodsafetynetwork.ca

This is a daily email list-serve providing a summary of the main policy and science news relating to agricultural biotechnology around the world. A comprehensive, must-have source for any journalist who needs to closely follow a GM story. It is compiled by the mostly pro-GM University of Guelph in Canada.

Gaianet
Contact: gaia@gaianet.org

Periodic email list-serve that is a good source of news and comment on a breaking GM story anywhere in the developing world – particularly Africa and Latin America. Compiled by the London-based Gaia Foundation, a small NGO, which is mostly opposed to GM in agriculture.

Science and Development Network
www.scidev.net

Authoritative source of daily news on science from developing countries written by a growing network of correspondents in major capital cities including Nairobi, New Delhi and São Paulo. Services include free weekly email news alert; comprehensive dossier on GM crops; and free access to research papers from the site's sponsors *Nature* and *Science*.

World Bank research newsletter
http://econ.worldbank.org

Monthly email newsletter from the World Bank including abstracts and full-text papers on the latest research from inside the Bank, which is one of the world's largest publishers of development research. Agricultural biotechnology is frequently featured in the newsletter.

Linkages Update
Contact: enb@iisd.org
www.iisd.ca

Fortnightly electronic newsletter including news, publications, international media reports, announcements and meetings relating to the environment and sustainable development. Published by the *Earth Negotiations Bulletin*, a project of the Canada-based International Institute for Sustainable Development.

Information sources

African Centre for Technology Studies
www.acts.or.ke

Nairobi-based policy research institute that regularly publishes research and analysis on the relationship between people, science, technology and the environment.

GM Watch
www.gmwatch.org

Frequently-updated website with news, opinion, comment and contact details on the global anti-GM campaign.

Consultative Group on International Agricultural Research (CGIAR)
www.cgiar.org

The CGIAR is a network of international agricultural research centres in developing countries, funded by rich countries and organised through the World Bank. CGIAR scientists develop new seeds and farming management methods to poor farmers. They fear that the rapid expansion of patented GM technology could mean they will no longer be able to provide this free of cost.

id21
www.id21.org

Free development research reporting service, offering the latest UK-resourced research on developing countries.

International donor agencies

International donors frequently sponsor GM-related research and other projects in developing countries. Organisations worth keeping abreast of include: The Rockefeller Foundation (www.rockfound.org) and the US Agency for International Development (www.usaid.gov).

International NGO Directory
http://www.climnet.org/members/criter.htm

Published by the Climate Action Network, this is a free-to-access online directory containing names and contact information for nearly 400 of the world's leading NGOs working in environment and sustainable development.

Institute of Development Studies, Environment Group
www.ids.ac.uk

Publishes research into agricultural biotechnology and policy processes in developing countries.

International Service for the Acquisition of Agri-Biotech Applications (ISAAA)
www.isaaa.org

Biotechnology industry-funded research and lobbying organisation, the ISAAA is expected to further expand its presence in developing countries, partly to maintain public support for GM technology. The ISAAA is also the best source for data, names and contact details on the biotechnology industry in individual countries.

NEPAD African Forum on Science and Technology for Development (AFSTD)
www.nepadst.org

This website, set up by NEPAD (New Partnership for Africa's Development), contains news and analysis of its periodic policy dialogues which aim to bring together different sides of the debate. NEPAD is based in Pretoria, South Africa.

Panos
www.panos.org.uk

Development and media NGO that produces radio programmes, features, media support material and publications on GM (and other) issues.

Third World Academy of Sciences (TWAS)
www.twas.org

TWAS is the main professional body representing scientists in the developing world. The TWAS yearbook is a 'Who's Who' of the best scientists in the South and an invaluable source on expertise in GM (as well as other) technologies, includes names, email addresses and telephone contacts.

UN Food and Agriculture Organisation (FAO)
www.fao.org

Heavily criticised by NGOs who claim that its 2004 annual report is too uncritical of GM technology, the FAO is keen to repair its relationship with civil society and will be an important source on GM news during 2005 and 2006.

UN Convention on Biological Diversity/Cartagena Protocol
www.biodiv.org

The UN Biodiversity Convention hosts the Cartagena Protocol that governs international transport of GM organisms. This website provides information and documents on news, publications and meetings of the protocol's 100+ member countries. The Convention's secretariat is based in Montreal, Canada.

Desk references and further reading

Kyoto, POPs and Straddling Stocks: Understanding environmental treaties. Linda Nowlan and Chris Rolfe (West Coast Environmental Law 2003). Comprehensive, accessible, 240-page guide to environmental agreements such as the Cartegena Protocol. Free to download from the Web on www.wcel.org/wcelpub/2003/13929.pdf

Global Environmental Negotiations (Centre for Science and Environment, New Delhi). Two-volume illustrated encyclopaedia on the history and politics of the global environment, written from a Southern perspective. Purchase from www.cseindia.org

UN Millennium Project Task Force Report on Hunger (UN Millennium Project 2005). Twenty of the world's leading researchers and policy-makers recommend ways of defeating hunger in a report commissioned by UN Secretary General Kofi Annan. They are not overly enthusiastic about a role for GM technology in the near future. Free to download from www.unmillenniumproject.org

Controversy: The politics of technical decisions. Dorothy Nelkin (Sage publications 1992). Series of case studies on public controversies involving science and technology in the US, edited and compiled by one the world's main authorities on the subject.

Biologists and the Promise of American Life. Philip J. Pauly (Princeton University Press 2002). History of how biology in America helped define the culture and values of the US. Pauly argues that the earliest biologists linked their study of nature with a desire to improve plants, animals, and humans and build a nation whose people would be prosperous, humane, secular and liberal.

Our Final Century: Will civilisation survive the 21st Century? Martin Rees (Random House 2003). Provocative polemic from the newly-elected President of the Royal Society (Britain's official science academy) on whether the rapid advance of science and technology is also advancing the demise of the human race.

Genetically modified crop plants are being developed and adopted around the world at a rapid pace. In most countries, decisions are now being made about GM crops that will affect generations to come. These decisions will affect food safety, nutrition, livelihoods, the agricultural economy, and the long-term sustainability of agricultural productivity. Yet the use of GM technology in agriculture is highly controversial and the debate tends to be polarised.

Given the controversy and complexity of GM issues, how do governments in developing countries decide whether GM crops are to be grown? To what extent are citizens able to influence decision-making? And how is the issue being covered in the media?

In addressing these questions, this report presents:

- A review of the literature and research on GM and summaries of key policy debates on GM crops
- Case studies of the GM debate in five developing countries – Brazil, India, Kenya, Thailand and Zambia – based on more than 100 interviews with politicians, civil servants, scientists and journalists, and representatives from NGOs, the biotechnology industry and farmers' organisations
- An analysis of coverage of GM issues in the print media in these five countries.

In order to make appropriate decisions about GM, it is vital that the views of all interested parties are heard – policy-makers, farmers, industry, NGOs, international donors and scientists. As well as being of interest to these key stakeholders, this report is also intended for journalists and others working in the media, who have a key role to play in creating spaces where the different views in the GM debate can be expressed and explored.

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