



# gm

Corn growing in the Garcia Rovira province, Colombia.

issue 105

## genetically modified crops

a decade of failure [1994 - 2004]



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the Earth  
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**friends of the earth**  
*international secretariat*

P.O. Box 19199  
 1000 GD Amsterdam  
 The Netherlands  
 Tel: 31 20 622 1369  
 Fax: 31 20 639 2181  
 E-mail: [info@foei.org](mailto:info@foei.org)  
 Website: [www.foei.org](http://www.foei.org)

**editorial team** Juan Lopez (FoE Europe), Ann Doherty (FoE International), Niccoló Sarno (FoE International), Larry Bohlen (FoE International).

**with contributions** from Olexy Angurents (FoE Ukraine), George Magdraze (FoE Georgia), Maria Luisa Ramos (Fobomade), Adrian Bebb (FoE Europe), Liz Wright (FoE England, Wales and Northern Ireland), Farah Sofa (FoE Indonesia), Bill Freese (FoE US), Liliane Spendeler (FoE Spain), Irene Velez (FoE Colombia), Jagoda Munic (FoE Croatia).

**with thanks** to Karin Nansen (FoE Uruguay), Simone Lovera (FoEI), Agbenyo Dzogedo (FoE Togo), Nnimmo Bassey (FoE Nigeria), Silvia Ribeiro (ETC Group), Cedric Cabanne (FoE France), Lilian Joensen (Grupo de Reflexion Rural Argentina), Percy Schmeiser, Ida (Konphalindo), Ana Lucia and Elizabeth Bravo (Acción Ecológica Ecuador), Greenpeace, Geert Ritsema (FoE Europe).

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Farmers and members of the public from around the United Kingdom at the October 2003 'Tractors and Trolleys' GM protest.

## executive summary

The first decade of the commercialization of genetically modified (GM) crops was a resounding failure for biotech companies. The first GM crop was commercialized in 1994, and now, ten years later, the promises made by the biotech industry and its powerful lobby groups have still not materialized. Meanwhile, the global opposition to GM crops continues to swell.

### brave new agriculture

The genetic engineering of seeds is without doubt the most radical transformation in food production since the first days of agriculture, more than 10,000 years ago. The first GM crop was commercialized in the United States in 1994. This 'Flavr Savr' tomato was a flop, and was eventually removed from the market. But other GM crops were better received, and between 1996 and 1999 a significant number of GM crops were sown, primarily in the United States, Argentina and Canada.

### the seeding of global opposition

The enthusiasm of the biotech industry about the introduction of GM crops around the world was not universally shared. Concerns quickly arose about the potential health, environmental and socioeconomic impacts of these new crops.

By the end of the 1990s, opposition to GM crops had arisen on every continent. The European Union adopted a moratorium on the commercial growing of genetically modified organisms (GMOs), bans were established in Asian and Latin American countries, and many southern countries refused GM food aid. In general, consumers worldwide were reluctant to embrace GM food.

Although the biotech industry had expected people and governments everywhere to embrace GM crops without question, public scepticism has forced companies to limit their current activities to a few main countries. Biotech corporations failed to market products with clear benefits for consumers or farmers. Instead, GM crops created novel and alarming problems, including genetic contamination.

Biotech giants and their powerful lobby groups relied heavily on public relations strategies to sell their products. For example, they heralded the genetically modified 'Golden Rice' as a solution for Vitamin A deficiency in the Third World, but to date this appears to be a 'golden hoax' to

### ten years later: broken promises and unsustainable agriculture

Biotech companies promised that GM crops were safe, that they would provide better quality and cheaper food, that they were environmentally sustainable, that they would improve agricultural production, and that they would feed the developing world.

After ten years, none of these promises have materialized. The regulatory regimes in GM producing countries cannot ensure the safety of GM crops, and the StarLink and biopharmaceuticals incidents are early warnings of the potential health implications of introducing food products not authorized for human consumption into the food chain. Furthermore, not a single GM food on the market is cheaper or better quality than its 'natural' counterpart. GM crops may threaten biodiversity: for example, the 2003 UK Farm Scale Evaluations concluded that GM oilseed rape damaged farmland wildlife.

Developing countries are already experiencing serious problems with GM crops. In several parts of India and Indonesia for example, farmers have complained that Monsanto's GM cotton has not delivered on the company's claims of higher yields and improvements in the livelihoods of farmers. Furthermore, the case of Argentina proves that GM crops are not the solution for feeding the world, as the biotech companies promised. Argentina is the second largest world producer of GM crops, but millions of people in this country go to bed hungry each night.

Large biotech companies like Monsanto are driven to control agriculture markets. In 2003, Monsanto was the world leader in GM crops. Seeds with Monsanto traits accounted for more than 90 percent of the global area planted with herbicide tolerant or insect resistant crops. According to the company's 2003 annual report, their Roundup herbicide is the world's bestselling herbicide. At the same time, the company is suing hundreds of farmers in the US and Canada in an attempt to prevent them from saving their seeds, a tradition and right since the beginning of agriculture.



promote GM crops. Behind the scenes, biotech companies play dirty to secure their interests; for instance the biotech industry has been behind various threats of trade sanctions, including the attempts by the US administration to impose GM food on reluctant countries like Bolivia, Croatia and Sri Lanka as well as on the European Union.

However, citizen opposition to GMOs is snowballing. In Europe, distrust is so high that GMOs have in effect been removed from the majority of supermarket shelves. In the South, several countries in Latin America, Africa, and Asia have rejected GM food aid outright. Consumer and retailer suspicion has forced Monsanto to delay the commercialization of its GM wheat, initially planned for 2004.

The biotech industry's dream of the large-scale introduction of GM crops around the globe would further exacerbate the ecological vulnerability already associated with monoculture agriculture. Ten years later, it can be concluded that GM crops are leading us down a dangerous path to unsustainable agriculture.

Fortunately, however, there are viable and practical alternatives to GM crops that are almost invariably cheaper, more accessible, more productive in marginal environments and more culturally and socially acceptable. The failure of biotech companies in the last decade and the growing global opposition should catalyze a shift of focus towards alternative, reliable agricultural techniques that are less costly than the multi-billion dollar modern biotechnology industry



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## our dream a world without genetically modified crops

foreword by ricardo navarro, chair, friends of the earth international



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2004 marks the tenth anniversary of the commercialization of the first genetically modified (GM) crop in the United States. Ten years of experience has shown that the fears and concerns raised by environmentalists throughout the 1980s and 90s have come true. Contrary to the promises made by biotech companies, the reality of the last ten years of commercialization shows that the safety of GM crops cannot be ensured, that they are neither cheaper nor higher quality, and that they are not a panacea for global hunger. Moreover, the creeping spread of GM crops around the planet is a serious threat to biodiversity, and the global ambitions of companies like Monsanto to control agriculture are a menace to the livelihoods of farmers everywhere.

Friends of the Earth International, in collaboration with other organizations and local communities, has been a leading force against the release of GM crops. Friends of the Earth groups in countries as far flung as Nigeria, the United States, Nicaragua, Sri Lanka and the United Kingdom have been campaigning on this front for many years. For example, Friends of the Earth Europe was a lead advocate of the European moratorium obtained in 1999. In 2000, Friends of the Earth United States discovered a GM maize variety not approved for human consumption in the food supply. This was a huge blow to the biotech industry, costing companies over US\$1 billion, and a major contribution to the improvement of regulatory systems in many countries. Friends of the Earth, together with local NGOs and local communities, continued to discover more illegal GMOs through monitoring US food aid sent to Latin America and food products in European supermarkets.

Ten years of GM crops has been enough to substantiate our claim that genetically modified crops play no role in a sustainable future. Now more than ever, we are convinced of the need to prevent the release of GMOs into the environment, and we hope that the grim reality revealed in this report will strengthen the movement against GM crops. In the meantime, we will continue to campaign for agricultural policies based on the needs of local communities, and promote the available alternatives for achieving food security, food sovereignty and environmental sustainability.

The genetic engineering of seeds is without doubt the most radical transformation in food production since the first days of agriculture, more than 10,000 years ago.

The first genetically modified (GM) crop was commercialized in the United States in 1994. This 'Flavr Savr' tomato, engineered by the Calgene company, eventually failed and was removed from the market. But other GM crops received a warmer welcome, and the first significant planting of GM crops, mainly in the US, took place in 1996. The global area planted with GM crops grew at a rapid rate, particularly between 1996 and 1999, but remained primarily concentrated in just three countries: the US, Argentina and Canada.

## chapter one | brave new agriculture



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*Women carrying baskets of seeds and emptying them out to dry them in the sun, Nayakrishni Center.*



## genetic engineering

a radical new technology



Genetic engineering, also known as genetic modification, is a relatively new technology that allows scientists to create plants, animals and micro-organisms by manipulating genes in a way that is not possible via traditional or natural processes. GM technology is not simply an extension of conventional agriculture; it is radically different from traditional plant and animal breeding.

Genetic engineering involves the artificial manipulation of seeds at the cellular level, and allows DNA from one type of organism (such as an animal) to be introduced into another unrelated organism (such as a plant). This means that human genes can be introduced into plants or fish. Scientists have already introduced a gene from an arctic fish into a tomato, for example, enabling the tomato to be grown at lower temperatures.

The biotech industry is very enthusiastic about the potential of genetic engineering in the field of agriculture, claiming that it will mean higher

crop yields and fewer pesticides for farmers, and better quality and cheaper food for consumers.

The biotech industry has heavily lobbied governments in the US and Canada to adopt GM crops without requiring specific regulations to deal with them. For example, the relevant US authorities consider genetically modified crops to be substantially equivalent to their conventional counterparts, and do not require mandatory safety testing or labeling. Consequently, GM food products are exported to other countries in the world without labeling or other identifying information.

*more information:*

*"GMO Contamination Around the World," Friends of the Earth International: [www.foei.org/publications/pdfs/contamination2eng.pdf](http://www.foei.org/publications/pdfs/contamination2eng.pdf)*  
*GE Food Alert: [www.gefoodalert.org](http://www.gefoodalert.org)*  
*GM Watch: [www.gmwatch.org](http://www.gmwatch.org)*  
*Third World Network: [www.twinside.org.sg/bio.htm](http://www.twinside.org.sg/bio.htm)*  
*Greenpeace: [www.greenpeace.org](http://www.greenpeace.org)*



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brave new agriculture two

## flavr savr tomato goes rotten

In early 1994, the US Food and Drug Administration (FDA) announced that the 'Flavr Savr', a new genetically modified tomato produced by Calgene, was as safe as tomatoes bred by conventional means. Thus the Flavr Savr became the first fresh genetically modified crop sold in the world.

Calgene, a small start-up biotech company based in California, genetically modified tomatoes so that they could be picked when ripe and transported without bruising. They

believed that the Flavr Savr would have a longer shelf life than conventional tomatoes, and would provide processors and consumers with tastier tomatoes.

The FDA approved the product. More generally, it decided to regulate GM foods in the same way as non-GM foods so they do not require pre-market approval, arguing that the two are the same or substantially equivalent. Nevertheless, there was no scientific evidence that the tomatoes were safe for human consumption. In fact, the FDA ignored the advice of its own scientists who were concerned about studies showing that the GM tomatoes could potentially cause stomach lesions. In one study, gross lesions were observed in 4 out of 20 female rats fed one of the two lines of transgenic tomato. In another study, the rats had both gross and microscopic lesions. The FDA, however, downplayed these findings and did not communicate them to the public.

In 1994, Flavr Savr tomatoes were labeled as GM and sold under the MacGregor's brand name. Initially they sold relatively well, and were available in 2500 stores nationwide by 1995. Ultimately, however, a combination of safety concerns by consumers, the cost of the GM tomatoes (about double the price of ordinary tomatoes), the flavor (not better than non-GM) and the tendency of the tomatoes to bruise led to their withdrawal from the market in 1997.

Ultimately, the world's first commercialized GM crop was a flop. This also led to the demise of Calgene, which had accumulated heavy debts in the development of the tomato. In the end, biotech giant Monsanto bought Calgene, but has never tried to introduce a tomato similar to the doomed Flavr Savr.

source:

Soil Association: [www.soilassociation.org](http://www.soilassociation.org)

More than 40 genetically modified crop varieties are currently authorized for commercialization in the US. The four most popular are corn, soybeans, cotton and canola. Two traits (or qualities) – herbicide tolerance (HT) and insect resistance (Bt) – have been engineered into these commodity crops, which have proven very popular with US farmers and have been widely adopted. Biotech giant Monsanto is the lead producer of GM crops, followed by DuPont/Pioneer, Syngenta, and Dow/Mycogen.



#### tolerating herbicides

Almost two-thirds of the GM crops grown on a commercial basis in the United States have been modified to tolerate certain herbicides or weed killers. Crops such as corn, soy and canola have been genetically engineered to withstand otherwise lethal doses of chemical pesticides. Farmers can therefore douse their fields with herbicides without having to worry about killing their crops.

become resistant, farmers will have to use more glyphosate, leading to unsustainable intensive chemical use.

#### resisting pests

Second in acreage to herbicide-resistant crops, insect-resistant ‘pesticide plants’ are engineered to produce a toxin in their tissues, the edible grain included. ‘Pesticide plants’ are produced by ‘shooting’ a ‘gene gun’ loaded with a toxin-producing gene taken from a soil bacterium – *Bacillus thuringiensis* (Bt) – directly into the tissues of corn, canola, potato and cotton plants to render them poisonous to insects. About 25 percent of the US corn crop is now planted with Bt varieties. Proponents of genetic engineering argue that Bt crops will reduce the need for pesticides and therefore alleviate stress on the environment. Opponents, including some scientists, argue that the Bt toxin may be a human allergen and that more testing is warranted.

## gm crops spread like wildfire

Despite the fact that the first GM crop was commercialized in the US in 1994, it was not until 1996 that significant numbers of GM crops were planted. Over the next few years, GM crops multiplied at a rapid rate, and by 2003 there were over 60 million hectares under GM cultivation around the world. Nevertheless, in 2002 only three countries accounted for 95 percent of this total area: the US (66 percent), Argentina (23 percent) and Canada (6 percent).

Soybean growers appear to have been won over by the convenience of using glyphosate instead of older herbicides. Glyphosate, better known by its trade name Roundup, is a herbicide first introduced in 1974 by Monsanto. Roundup was advertised as safe, effective and relatively benign, environmentally speaking. It became a popular tool in no-till farming, a practice in which farmers spray weeds rather than plowing the ground. In 2001, Roundup Ready soybeans accounted for 75 percent of all soybeans planted in the US. That same year, some 33 million pounds of glyphosate were sprayed on soybean crops alone throughout the country, a fivefold increase from 1995 according to the US Department of Agriculture.

Monsanto generates around 50 percent of its annual sales from Roundup herbicide. Critics point out that the use of glyphosate on millions of acres of crops will intensify resistance in weeds unrelated to soybeans. As weeds

Companies claim that insect-resistant cotton in the US has led to substantial reductions in pesticide use for certain insects. Bt corn has also become quite popular, as it seems to boost yields in fields plagued by the damaging European corn borer. However, letting the GM genie out of the bottle has also allowed other less benign impacts of tinkering with food to manifest themselves (see page 12).

US-based Monsanto is the world's largest producer of GM crops. 90 percent of the area under biotech cultivation worldwide has been sowed with the company's GM herbicide-tolerant and pest-resistant varieties.

The enthusiasm of a few biotech corporations in the US, Argentina and Canada to adopt GM crops was not shared by others around the world. Concerns quickly surfaced about the potential health, environmental and socioeconomic impacts of GM crops.

Opposition to GM crops appeared on every continent: the European Union adopted a moratorium on their commercial growing, bans were established in Asian and Latin American countries, and many countries in the South refused GM food aid. In general, consumers worldwide were reluctant to embrace GM food.

Pro-biotech countries fought the opposition by threatening countries that decided to adopt bans, moratoria or comprehensive regulations on GM crops with trade sanctions. Meanwhile, in order to gain public acceptance of their product, biotech corporations developed strong public relations strategies with increasing propaganda about the benefits of GM crops.

## chapter two | the seeding of global opposition



Friends of the Earth activists from 14 European countries call for their food to be protected from genetic contamination in October 2002 in Brussels.



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the seeding of global opposition **one**

## environmental, health and socioeconomic concerns

Since 1996, as more and more genetically modified crops took root, a growing number of stakeholders around the world began to voice their concerns about the possible negative impacts of GMOs and their contribution to an unsustainable model of agriculture. Opposition is particularly heated on three grounds: environmental, health and socioeconomic.

### environmental pitfalls

Scientific research is raising increasing concerns about the potential environmental risks associated with GM crops, including:

**gene transfer:** Genes from GM crops can be (and have been) transferred to wild relatives of these crops. In its report “Genetically Modified Organisms (GMOs): The significance of gene flow through pollen transfer”, the European Environmental Agency states that oilseed rape is “high risk” and sugar beet “medium to high risk” for pollen mediated gene flow from crop to crop and from crop to wild relative.



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**pest resistance:** Insect pests may develop resistance to GM crops engineered to contain Bt toxins, shortening the useful life of such crops and compromising the effectiveness of existing Bt insecticides. This has serious implications for the organic community and other farmers using integrated pest management (IPM) and other sustainable agriculture approaches. The naturally occurring Bt pesticide that these non-GM farmers benefit from becomes useless as insects become resistant.

**adverse impacts for non-target organisms:** Pest-resistant crops may have adverse impacts for beneficial insects and other invertebrate populations. In 1999, scientists at Cornell University revealed that pollen from genetically engineered Bt corn could kill Monarch butterflies. The findings of this lab study have since been confirmed in an ongoing field study at Iowa State University. In addition to the monarch butterflies, there is evidence showing that Bt crops may also affect beneficial predator insects such as lacewings and ladybirds when they eat insects that have been feeding on genetically engineered plants. A 2001 US National Academy of Sciences study affirmed that the

Europe. In Canada, canola resistant to three different herbicides resulted from uncontrollable crossbreeding between plants that were each resistant to one herbicide. These 'superweeds' can be difficult and expensive for farmers to eradicate. They could potentially displace existing species of plants, destroying local ecosystems and threatening biodiversity.

#### health concerns

Some of the main concerns about the consumption of GM crops are:

**new allergies:** GM crops could introduce new allergens into foods that sensitive individuals would not know to avoid. The problem is unique to genetic engineering because it alone can transfer proteins across species boundaries into completely unrelated organisms. Genetic engineering routinely moves proteins into the food supply from organisms (such as viruses) that have never been consumed as foods. Thus importing proteins, particularly from nonfood sources, is a gamble with respect to their allergenicity.

British doctors have urged a halt to genetically modified crop trials. In November 2002, the British Medical Association, which has a membership of over 120,000 and represents more than 80 percent of British doctors, said that there "has not yet been a robust and thorough search into the potentially harmful effects of GM foodstuffs on human health."

#### socioeconomic issues

**corporate control:** The corporations that market GMOs and the associated chemicals seek to control agriculture and food production by buying up seed companies, patenting seeds and locking farmers into exclusive agreements. If this strategy succeeds, it will dramatically reduce agricultural biodiversity and lead to more industrialized and unsustainable farming.

**no benefit to consumers:** The majority of GMOs that have been authorized or are pending approval are either herbicide-tolerant or insect-resistant. They pose real problems for the environment and offer absolutely no benefit to the consumer, as they are neither cheaper nor better quality than conventional foods.

Bt 176 variety of GM corn was likely harmful to Monarch butterflies.

**intensification of chemical dependence:** Herbicide-tolerant crops have contradicted the claim that genetic engineering helps the environment. Instead of moving farmers away from their dependence on chemical pesticides, these crops actually encourage pesticide use – a threat to our food and drinking water and to wildlife. Indeed, a 1999 US report, which reviewed more than 8,200 university-run field tests on herbicide resistant crops, found that farmers planting Roundup Ready soybeans used two to five times more herbicide than did conventional soybean farmers.

**creation of 'superweeds':** It has been shown that herbicide resistance genes can spread to related plants via pollen carried by bees or by the wind. Researchers have found evidence for this in the case of canola and sugar beet in

**antibiotic-resistance:** The presence of antibiotic resistance genes engineered into foods (these genes are used by biotech companies as 'markers' to identify new traits in the engineered product) could reduce the effectiveness of disease-fighting antibiotics when they are taken with meals. This concern grew in 2002 when British scientific researchers demonstrated for the first time that genetically modified DNA material from crops is finding its way into human gut bacteria, raising potentially serious health questions. If genetic material from these marker genes can find its way into the human stomach, then people's resistance to widely used antibiotics could be compromised.

**increased toxins in plants:** The addition of new genetic material through genetic engineering could also increase levels of toxic substances within plants.

*sources: The Union of Concerned Scientists:*  
[www.ucsusa.org/food\\_and\\_environment/biotechnology/index.cfm](http://www.ucsusa.org/food_and_environment/biotechnology/index.cfm)

*British Medical Association:* [www.bma.org.uk](http://www.bma.org.uk)

*more information:*

*FoE US website:*

[www.foe.org/camps/comm/safefood/gefood/index.html](http://www.foe.org/camps/comm/safefood/gefood/index.html)

*European Environmental Agency:*

"Genetically Modified Organisms (GMOs): The significance of gene flow through pollen transfer", March 2002:

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*The Guardian*, 17 July 2002:

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[www.nature.com](http://www.nature.com)