# Genetic engineering: not the only option

*"Genetic engineering is often justified as a humane technology, one that feeds more people with better food. Nothing could be further from the truth. With very few exceptions, the whole point of genetic engineering is to increase the sales of chemicals and bio-engineered products to dependent farmers."*
David Ehrenfield, Professor of Biology, Rutgers University, USA

## The Gene Revolution

A new agricultural revolution is taking place: the "genetic engineering revolution". For the first time it is possible to break through natural species' barriers, systematically moving genes from one species to another that do not combine in nature. This is done by transferring genetic material, for instance, from bacteria to plants. Proponents of genetic engineering (GE) claim it will provide new plants and animals that would lead to a more environmentally-sound agricultural production with crops that produce their own pesticide thus reducing the use of chemical pesticides. They also promise crops that produce medicine, plants tolerant to salt and drought and enriched food to restore micro-nutrient deficiencies. Many see GE as "the" solution to hunger, poverty and many health problems. Some advocates go a step further by accusing opponents of genetic engineering as 'colonialists who withhold technologies from poor farmers' (p.36).

It sounds too good to be true. But when we begin to look behind the façade of this promise-filled development, many important questions emerge:

- Who benefits from genetic engineering and who loses?
- What are the risks and who will bear them?
- What are the alternatives to genetic engineering?

This issue of LEISA Magazine and the accompanying journal "Biotechnology and Development Monitor" attempt to explore these questions.

## Genetic Engineering is different

GE, also known as genetic modification or manipulation (GM), is part of what is termed "biotechnology" or "biotech" in short. Biotechnology is a very inclusive term, ranging from natural fermentation, to safe and relatively cheap practises like in-vitro propagation to genetic engineering. A good starting point to understand the different types of biotechnology is the article by Visser on p.9. It gives an overview of the potential, costs and expertise required by each of them.

In this issue, the focus is on genetically modified crops as they have far-reaching implications on sustainable agriculture in general, and farmers' livelihoods in the South in particular. Genetic engineering is sometimes presented as just another step in a continuous process of agricultural development. In other words, there is no reason to worry. However, this argument cannot be justified. Genetic engineering is radically different from previous technologies because it allows for the moving of genes between different species across natural boundaries, which makes the risks unpredictable.

## Ecological concerns

Despite many reassuring words by companies, researchers and some governments, many concerns about the implications of GM crops remain. Major concerns relate to the consequences for the ecological systems into which they are being introduced. These concerns are often neglected by the GM seed industry, the authorities approving their access to the market and the farming communities making use of the proposed technologies. For instance, the insertion of Bt (*Bacillus Thuringiensis*) genes was thought to be a silver bullet, a permanent solution to insect problems. But the model of "one pest – one solution" does not work forever, as is the case with pesticides; sooner or later resistance builds up. Similarly, building of herbicide resistance in plants is headed for trouble as it unleashes basic ecological reactions. Excessive use of herbicides as a major or only tool of weed management, will eventually reduce the sensitivity of weeds to herbicides and create an even worse weed problem. It is "to a large extent a victim of its own success". Recently, more and more evidence is being brought to support the fact that these concerns are not negligible. Yield decline in GM soybean, for instance, is being traced to reduced root development, nodulation and nitrogen fixation.

Another effect is related to the unexpected impact of gene transfer and its consequences. One example from USA tells how genes from one bacterium *Xanthomonas* were transferred to another soil bacterium, *Kebsiella planticola*. The new organism was meant to ferment stubble into alcohol, thus providing farmers with an extra source of income instead of burning the stubble. However, a test by the authorities found that wheat planted in the soil containing the new organism was killed by it.

In Europe, scepticism is widespread due to the many ecological concerns that surround the introduction of GM crops. A de facto moratorium on releasing genetically modified organisms has been in place since 1998 (p.13) One can draw no other conclusion than that, in many countries, GM crops have been brought too early into the market and that precaution should prevail.

## Private companies appropriate farmers' livelihoods

One thing that makes the development of GE unique in the history of agriculture is that it is almost fully controlled by private companies. Transnational corporations (TNCs), often with their roots in the production of agro-chemicals, carry out the laboratory research, field trials, production and sale of GM crops. They spend enormous amounts of money on developing herbicide-resistant crops that are being sold to farmers as a package inclusive of both the herbicide and the seeds. Through patents these TNCs keep competitors at bay. It appears that GE technologies are not being developed because of their problem-solving capacity, but because of the patent - and thus profit - it can bring to the companies. For instance, in the 1980s, Monsanto was not interested in genetically engineering virus resistance into plants, as it would bring minimal profits. In the "old days" public-funded international or national agricultural research centres could have stepped in and carried out that research. However, the public research centres seem to be loosing ground in access to the knowledge and genetic material, thus widening the gap between public and private research. Recently, private companies have been pushing further, trying to get exclusive rights over nature's genetic resources as in the case with Monsanto's application seeking patent protection related to (wild and domesticated) soy beans.

Terminator technology takes the issue further. This technology, in which genes are manipulated to be able to switch seeds on and off by treatment with chemicals provided by one and the same GM seed company, effectively prevents farmers from keeping their seeds for replanting. Strong public opposition has forced the companies to give up this line of research, but they still hold the patents to the technology.

These examples illustrate very well what kind of agricultural development these companies promote, namely high-input, highly industrialised monoculture systems, which force farmers to buy packages of inputs from just one company. In this context it is rather shocking that, in 2001, the US government generously funded biotechnology research and development in agriculture with a budget allocation of US$ 310 million, whereas support for organic farming was less than US$5 million. Farmers have expressed their concern about these developments, as can be concluded from the citizen's juries conducted in many parts of the world (p.27). Rossett also clearly illustrates that GM crops have very little to offer to farmers in risk-prone, diverse and complex agriculture (p.6). It is expected that GM crop research will be very slow in responding to the needs of low-input agriculture.

### Contamination: No guarantee that crops are GE-free
The contribution from the Louis Bolk Institute (p.12) shows that the organic movement does not consider GM crops as organic. It accepts conventional breeding and the new technologies available to assist it, but finds manipulation at the cell level and below as unacceptable. The article describes how the debate on GE has led organic farmers to reconsider their dependency on seed companies that focus on high-input agriculture.

But how can farmers be sure that they grow GM crops, considering that seeds and pollen spread by wind, water, birds and insects. Large areas can be contaminated by the introduction of GM crops by a single farmer. In the US, contamination by GM crops is now such a big problem that organic farmers find it almost impossible to get GM-free seeds. Tests have shown that "organic crops" from the US are often contaminated with engineered genes despite farmers' efforts to stay GM-free. Consequently, the international organic movement (IFOAM) is considering refusing certification of organic crops from the US. But who will pay for the damage inflicted on the organic farmers in the US?

### Who bears the risk?
With the introduction of agricultural genetic engineering, the costs of contamination and other costs of reduced market shares are being imposed on farmers, consumers and the environment as a whole - not only in Europe or North America, but also in the South! Will GM seed companies bear the risk of releasing these crops in the South? What will happen if things go seriously wrong, e.g. a GE crop turns out to have negative health effects or becomes a serious ecological threat?

The GM crop in question may be banned but that does not mean it will stop existing. This situation is not comparable to that of an agricultural chemical which turns out to have unanticipated side effects after a number of years. The effect of such chemicals will eventually disappear from the environment. Not so with GM crops that are likely to survive in the wild and spread their genes through crossing with other plants. This is already taking place in Mexico where wild relatives of maize have been contaminated with genes from GM crops (p.25). Since Mexico is the centre of maize diversity, such contamination constitutes an irreplaceable loss. The wide variety of genes in wild plants and in traditional agriculture is the main insurance we have to cope with new demands on crops – whether caused by new pests and diseases, increased salt levels or changing climates. In Southern Brazil, estimates are that despite the ban on GM crops, 30% of the soybean acreage is already contaminated, thus threatening Brazil's GM-free status (p.19).

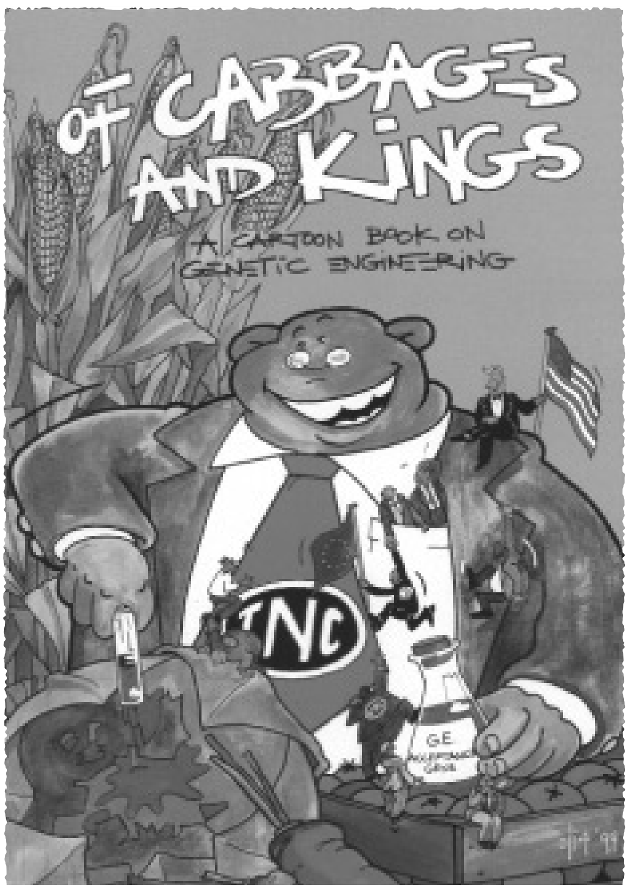
The risk of an unintended introduction of GM crops is more threatening in countries where no legal framework exists, as is the case in many African countries. For instance, one expert from Zambia expressed his concern that illegal trade in GM varieties is most likely once neighbouring countries have it. Again, who will bear the risk?

### Alternatives
But do we really need GM technology to combat malnutrition, to improve local production and to make agriculture more productive. Has the introduction of GM crops contributed to the reduction of poverty? The FAO (United Nations Food and Agricultural Organisation), in a recent report, indicated that "for the world as a whole there is enough, or more than enough, food production potential to meet the growth of effective demand, i.e. the demand for food of those who can afford to pay farmers to produce it." This implies that "any residual hunger problems will be largely poverty, rather than production-related", which means that reaching the goal of food security for all should be based on a premise other than genetic engineering. Alternative approaches to agricultural production are, therefore, essential.

Over the years, LEISA Magazine has documented a wealth of agro-ecological, low-external-input alternatives to agricultural production. The articles in this issue confirm, once again, that the potential of LEISA is far from exhausted. The case of natural crop protection from the Andes (p.23) indicates that there are many plants in nature, which provide us with clues for better pest management. During a forum in the Netherlands, an Indian journalist informed the audience that agricultural research in India is only making use of 3% of the total of 3000 rice varieties that are known. Research done in Thailand indicates the potential that exists in nature for selecting and breeding varieties with desired characteristics such as salt tolerance (p.16). Many ecological principles that are still being overlooked, underestimated or sidelined, deserve more attention as they provide relatively cheap, controllable and low external input solutions to many problems that farmers face. The System of Rice Intensification (SRI) is an example of the many roads to sustainable agriculture that are hardly explored (p.15). Moreover, these approaches are not accompanied by the many risks - both economic and ecological – that GM crops are posing.

The push-pull system in Kenya (p.17), organic cotton production in Senegal (p.21) and zero-tillage no-herbicide soybean cultivation in Brazil (p.19), are examples of ecologically-sound alternatives that already exist. They are not a danger to the environment, nor do they make the farmers dependent on agricultural supply companies. Third world farmers will certainly be much better off if research efforts and resources are dedicated to agro-ecological approaches that have wide-ranging possibilities.

■




**Cartoon book on genetic Engineering,
A Seed Europe, P.O.Box 92066, 1090 AB, Amsterdam, The Netherlands
www.groundup.org/cartoon/toon.htm**