This brochure is published by Hivos and FoEI.

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THE WORLD AS A TESTING GROUND

Risks of genetic engineering in agriculture

CONTENTS

foto cover Paul Maassen

foto: Suzan Dijkhuizen

Introduction[1]

The Green Revolution
During the sixties, international agricultural research institutes produced an increasing number of high yielding hybrid varieties of the world's major food crops. Consequently production increased considerably in many regions. High yield varieties required additional fertiliser, which became available in chemical form in the same period. Hybrid varieties were mainly selected for high yields and in the process of being improved they lost other characteristics like resistance to pests, disease and drought. Initially, because of the availability of early chemical pesticides, this did not seem to pose a problem. World leaders were very optimistic that hunger and starvation would soon be a thing of the past. The seed industry, together with the chemical industry, would solve the problem. Extension services would only have to instruct farmers on seed and pesticides use.

The downside of the Green Revolution for small farmers
Within two decades the negative sides of the Green Revolution became apparent throughout the world. Small farmers often had to borrow to buy new seeds or inputs and the varieties often did poorly under local conditions. When crop prices fell, even medium-size farmers fell into debt and in many countries large numbers of farmers were pushed out of agriculture altogether. Even big farmers started to feel the pinch. They were forced to follow strict guidelines, were at the mercy of the banks and increasingly had to face pesticide resistance problems and falling prices for their produce. Crop diversity rapidly diminished and pests resistant to chemicals destroyed entire harvests. Farmers therefore were sucked into a vicious circle of using ever more chemicals and higher costs. The chemical companies prescribed new recipes and the banks only provided loans for purchasing those packages. The extension services which instructed farmers were trained by the chemical companies. Before they recognised they had lost their independence, farmers became trapped in this spiral and rarely could escape from it. The chemical corporations, supported by the banks and governments, increasingly controlled agriculture.

As already mentioned, many small farmers in many countries were pushed out of agriculture. Although production rose dramatically and average basic food prices fell, hunger and starvation were never eradicated. The new crops caused new and deeper social contradictions. Landlords became richer and more powerful, the moneylender business boomed, and the poor ended up ever deeper in debt. Even though enough food is produced to feed the world today, at least 20% of the world's inhabitants go hungry.

The ecological downside of the Green Revolution
The environmental costs of this form of agricultural development became apparent during the seventies. The disastrous effects of pesticides on many non-targeted species as well as the persistence of pesticides in the environment started to show. Research into the development of resistance by targeted species showed they could develop resistance to virtually any pesticide. These insights led to more attention being paid to other ways of improving crop production and avoiding production loss. Organic agriculture[2] started to spread, and agro-ecological production[3] began to grow in all continents. Integrated pest management[4] was rapidly becoming more efficient and the importance of organic fertilisers and other solutions to soil fertility were demonstrated. Whole new approaches to rural development saw the light during the eighties. The concept of sustainability increasingly began to appear in discussions. The new approaches hardly included

1 Written by Harrie Oppenoorth, Hivos, The Netherlands. The Humanist Institute for Development Co-operation is an organisation working to further emancipation and democracy and to combat poverty in developing countries. www.hivos.nl
2 There are many definitions of Organic Agriculture. A short one might be: Organic agriculture is an ecological production management system that promotes and enhances biodiversity cycles and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain and enhance ecological harmony.
3 Agriculture that respects the natural lifecycles and balances of ecosystems and maintains their diversity and production capacity.
4 Integrated Pest Management is the judicious use and integration of various pest control tactics in the context of the associated environment of the pest in ways that complement and facilitate the biological and other natural controls of pests, in order to meet economic, public health, and environmental goals. (Cate, J. R. and M. K. Hinkle. 1994. The National Audubon Society Special Report)

any chemical inputs. In the meantime, some chemicals were banned and all had to comply with stricter norms and regulations in more and more countries. Although pesticide sales soared and every year many new pesticides entered the market, in principle these tendencies posed a threat to the chemical corporations.

The development of genetically modified organisms (GMOs)
Genetic engineering (GE) appeared on the scene in the eighties and developed fully during the nineties. The chemical corporations took the lead and started producing genetically engineered varieties of different crops by artificially introducing strains of genetic material from different species or from different varieties into the plant. Even today the technique is still rather haphazard, so many failures occur and unwanted varieties are created. Only sometimes are the desired characteristics present in the new variety. These genetically engineered varieties are patented and, if field introduction is approved, the company starts selling. So far the characteristics introduced in 75% of the patented varieties are to combat pests or promote herbicide tolerance. These varieties account for 99% of sales.

GMOs and pesticides
The relationship between genetic engineering and pesticides is hardly perceived by the public. “Life science” and chemical companies suggest that genetically modified crops will solve all problems. Hunger will be banished from the earth, nutritional deficiencies will be tackled, dietary prescriptions will be incorporated, crops will resist pests, diseases and droughts, pesticide use will diminish, production costs will fall, post harvest losses will be reduced, etc. The commercials are reminiscent of DDT ads in the sixties, where happy families were shown spraying their rooms with DDT. We are made to believe that the world is crying out for these new seeds, in particular the third world.

Disadvantages of GMOs
Most of the purported advantages are still fiction. The reality is entirely different. On the health side, beneficial crops still don’t exist, while there is increasing evidence of harmful effects (e.g. allergies, effects on hormonal systems, etc.). Sources in Western Canada say the use of herbicides has actually increased (see chapter 3). Furthermore, cross-pollination means that some crops become resistant to various herbicides and turn into “superweeds”. This is already the case with rapeseed (canola). Insecticide use also tends to go up after two or three years. For several crops, studies also show that incorporating an insecticide makes a plant more vulnerable to other insects (see chapter 5), which in turn requires the use of other insecticides. So within a few years production costs start to rise.

When improving crops it is hard to select or build in several characteristics simultaneously. Improving one characteristic will generally weaken others. Most genetically engineered crops were not designed to produce greater yields. Information from Canada and Brazil show that GE rapeseed and soya provided lower yields and couldn’t compete with conventional or organically produced locally adapted varieties (see chapter 6).

Small farmers and GMOs
That small farmers would benefit from GE crops because varieties can be adapted exactly to their conditions (like drought and salty soils) is an unlikely scenario. Most of the green revolution’s high yielding varieties were never designed with small farmers in mind because as a market this sector is too small. The corporations are mainly interested in producing a few varieties that will perform well in the bigger markets, and this means concentrating on relatively fertile medium or large scale farms. Small farmers generally face the worst conditions; poor soils on hill slopes, little water, lack of money to purchase inputs, fierce climates, etc. Over centuries they developed and selected their own strains of seeds, the ones best adapted to their area. Not just one, but a wide variety, to spread risks and for different uses. They can’t afford big losses. In practice, the crops that have been developed were designed mainly for conditions in the US, Canada and Argentina. Small farmers’ crops and seeds shall become contaminated with GMOs. If a natural disaster like a drought occurs, these farmers are forced to eat the seeds ment for sowing next year. The following season there won’t be much choise in the seeds provived to them, these might very well be only GMOs. Their farming systems are based on variety, rotation and particular input-output systems and they might be seriously weakened in the medium term by the gene revolution.

Monocultures and vulnerability
The introduction of GE crops will promote an unprecedented growth in monoculture. The same varieties will be marketed from Ukraine to Japan, and from Canada to Tierra del Fuego. They will then start to contaminate existing plant populations and probably wild relatives. Monocultures on such a huge scale will not survive. Bt-resistant pests will wipe out a lot of Bt varieties. The unfortunate thing is that this is foreseeable, will probably happen and will result in many casualties: many farmers will go bankrupt and many will go hungry.

GMOs and the environment
Very little research is done on the effects of GMOs on other organisms, wild relatives and ecosystems. Non- target species and beneficial insects are affected. Wild relatives may acquire unforeseen GMO characteristics. Soil scientists are finding alarming results. It appears that soil micro-life is seriously threatened by toxins released when Bt plant remains are left to rot. It also looks very likely that lateral gene flow may have allowed bacteria in river sediments to acquire the capacity to produce Bt toxin from B. Thuringiensis. Many important questions need to be answered before these varieties can be safely released into the environment.

GMO contamination
What biologists feared some years ago is already happening. They warned that cross-pollination and hybridisation would be inevitable. Some characteristics of GE varieties turn up in other relatively pure varieties and are incorporated into the traditional variety mix. And they are hard to get rid of. This is now happening, for instance, in maize’s centre of origin in the South of Mexico. The natural gene-bank of traditional varieties is already contaminated with GE characteristics (see chapter 2). And this only took three or four years. Something similar is about to happen with potatoes in the centre of origin of potatoes in Bolivia (see chapter 7) Nobody can imagine what effects this will have on agro-biodiversity or natural relatives and other species. It will also mean that it will be very hard to find traditional uncontaminated material that could be used for further improving the crop and maintaining genetic diversity. There is no way back.

Patents
The life science companies patent the varieties, or the GE characteristics. They don’t want them to be used or reproduced by others. It is the source of their profit. To further protect their invention, they even designed sterile seeds, the so called Terminator Technology. They claim they will not use this

technology but a lot of new patents have been issued in precisely this area. If the seeds are not sterile, they can be used to reproduce. Anyone saving or reproducing the patented characteristic has to pay a licence fee to the patent holder. In North America this is already being enforced. People are actually brought to court for this, even if the use was unknown or involuntary (see chapter 3). In some countries, to promote government approval, companies are claiming that farmers will be able to save seeds. This is doubtful, given the number of patents.

Mergers and lobbying

In the eighties the chemical corporations merged with the life science industry and, more recently, absorbed many seed production and seed trade companies. The third world and animal feed sector of Cargill, the biggest grain trader in the world, merged with Monsanto in 1998. Monsanto expands its seed activity by take-overs of many southern seed companies. These Monsanto subsidiaries are lobbying heavily in their countries to get GE crops approved for commercial use. Over the last few years, this hasn't been easy. The EU de facto moratorium on field introduction of GMOs scared many countries. But pressure to allow GMOs comes from different sides now. Croatia and Sri Lanka, under pressure from the US embassy and threatened with World Trade Organisation (WTO), sanctions were forced to open up their borders to GMO imports. Sri Lanka actually repealed a law that banned GMOs from entering the country and Croatia dropped a proposed law that would have set a moratorium on GMOs. Under pressure from the USA and NAFTA, Mexico had to allow GMO imports, with contamination as a consequence.

In several countries, Food Aid from the USA turned out to be contaminated with GMOs, resulting in a 'fait accompli'. Cases of contaminated food aid have been documented in Bolivia, Colombia and Ecuador. Bolivia wanted to refuse the donation but eventually accepted after pressure from the US embassy. In Nicaragua, GMOs were recently found in food aid from the World Food Programme (WFP). GE maize not cleared for human consumption was found in food aid to Bolivia. When it was found in the US, Aventis bought back the contaminated product. Why is this not also happening in the case of Bolivia? Nevertheless, the US keeps exercising pressure to force countries to accept imports of GMO crops because huge interests are at stake. If the Bio-safety Protocol could be ratified quickly (it would come into force if 50 countries ratify it) any country, signatory to the protocol, could refuse GMO imports for bio-safety reasons. That's why we think everything should be done to promote ratification of the Biosafety Protocol.

Freedom of choice

Farmers and consumers should have the right to choose GMO free products. The merger of agro-chemical, life science and seed companies is proving very successful in spreading GMOs even before adequate scientific research is done or good legislation is in place. If no action is taken, within a couple of years, there will be no choice left. What happens when Brazil decides to allow production of GE soya, corn and sorghum? Where will Europe get feed for its cattle? Europe still has the choice. But it has to move fast to maintain uncontaminated supply chains.

Freedom for farmers to choose their seeds or to improve their own seeds will be seriously hampered and consumers will loose freedom of choice. The EU presently insists on maintaining three separate production chains: the conventional chain, the organic chain and the GE chain. But already it is clear that the crops will mix, if not during production, then in handling, transport or storage. The discussion about distances to maintain between crops in order to avoid cross-pollination also illustrates the problem. Leaving aside the question as to whether there is a safe distance at all, the proposed distances have already proven to be far from safe. In the US, an organic seed producer is suing Monsanto for contaminating his product. The maximum tolerated contamination percentages proposed in the EU are completely unrealistic (0.1 to 1%). Several studies have shown that, in practice, it will be impossible to keep contamination under 5% for several crops. Harbour facilities would have to be changed completely to avoid mixing. Once approved, within a few years, everything will be contaminated. Soon there will be no choice left to the consumer.

Who will be responsible?

And what if a worst case scenario comes true? Who will be liable? It will be very costly, if not impossible, to repair the damage once a crops turns out to be really dangerous. So far, liability for biodiversity loss is only regulated internationally if the crops contribute to the extinction of rare species or contaminate protected areas. Only then is the "polluter pays principle" applied. It is hard to imagine this liability will ever really be enforced under current international law. Criminal liability will be hard to enforce once a crop is officially approved, probably only where it can be proved that a company withheld information on possible hazards. Civil liability is the preserve of national legislation. There too, it will be hard to win a case once a crop is approved. The ICCP[5] should urgently address this issue. Civil damage is already occurring. Organic crops have been contaminated, undermining the whole philosophy of the organic movement. Organic farmers suffer the damage. Who is liable?

The way forward

We're at a crossroads in history. The stories from different countries in this publications detail the facts, the problems, dilemmas and fears provoked by GMOs. All over the world, people are concerned. Farmers' unions, consumers organisations, the environmental movement and many others are in favour of a moratorium until we know more. Waste can be removed, poisons can be destroyed, but GMOs reproduce and probably it won't show on the outside. They will proliferate and we'll find out too late. The presence of GMOs in processed products can also go unchecked, unless consumers force the corporations to label GMO containing produce. In the USA, corporations have successfully managed to avoid obligatory labelling. Will they succeed in Europe too, and in other countries where there is no legislation yet?

The Corner House[6] asked: If GMO's are the answer, what was the question? There are already solutions available to all the problems identified by the life science industry. Jules Pretty[7] from Essex University made an impressive list of more than 250 successful organic or sustainable solutions to increase poor yields and deal with other agricultural production problems. All of these have had a considerable impact and are easily replicable elsewhere under similar circumstances. Thousand of farmers' organisations and NGOs have enjoyed success with alternative solutions. Why should we blindly believe in 'high tech' where existing practice does better? It is time to bring these alternatives more to the fore. It is time to invest massively in them. There is still time to resist GMOs, at least until we are convinced of its safety and benefits.

In this publication you can find references to publications and web sites which have further information on all these issues. We hope this publication leads to better understanding of and a critical attitude towards GMOs in agricultural production. We hope it brings together the elements necessary to reopen discussion and reinforce the pleas for moratoria.

5 ICCP: Intergovermental Committee for the Cartagena Protocol on Biosafety
6 British Scientific Institute; Institute Briefing 16 'If Cloning is the Answer, What was the Question? Power and Decision-Making in the Geneticisation of Health' by Sarah Sexton; 1999
7 Jules Pretty and Rachel Hine 'Reducing Food Poverty with Sustainable Agriculture: A Summary of New Evidence' University of Essex; 2001

foto: Stockfotografie

Mexico[8]

The maize scandal

In November 2001, Nature, one of the worlds leading scientific magazines, published an article by two Berkeley scientists, Ignacio Chapela and David Quist. The article reported the results of a comparison between traditional maize varieties from the Sierra Norte de Oaxaca mountains in Mexico, a bulk grain sample from a local subsidised food distribution point of the Mexican government, genetically engineered maize varieties from the Monsanto company in the US and samples known to be uncontaminated. Four out of six samples from the Oaxaca region tested positive on one GE indicator, two for another and one for a third. The bulk grain sample tested strongly positive.

Their findings caused an uproar in the scientific world. Pro-genetic engineering scientists scrambled to challenge the methodology used, the conclusions, the adequacy of scientific peer review, etc. The uproar persuaded Nature to do something it had never done before, to retract the paper it had published. Later it was found that most scientific criticism had been triggered by an e-mail attacking the article. The email made false claims, probably used false names, was from an institute that did not exist and was probably organised by a company specialised in internet lobbying, hired by Monsanto[9].

Source of contamination

Whether there were scientific flaws or not in the research done by Chapela and Quist is no longer relevant, because research from other sources clearly proves they were right. After alerting the Mexican government, Mexico's Ministry of the Environment and Natural Resources found GE DNA in 3 to 10% of the Sierra Norte de Oaxaca maize. In April this year, the Mexican Government produced new results. The Institute of Ecology of the Environmental Ministry found evidence of contamination at 95% of the sites, with an average of 8% contamination. This is the worst case of contamination recorded anywhere. The highest contamination was found near main roads. In remote areas, contamination was much lower, between 1 and 2 %.

The initial uproar might suggest the widespread contamination came as a surprise. But biologists and ecologists have been warning about contamination for decades. The US Environmental Protection Agency said it was inevitable long ago. The contamination could have been caused in several ways:

- Cross-pollination: pollen is carried to the next field by the wind or animals and the GM genes start to proliferate in the GM-free crop. This would not explain how so huge an area became contaminated in such a short time, since maize pollen is relatively heavy and the wind will not carry it very far.
- A second possibility is that insects were responsible for inserting parts of GE DNA into non-GE maize and this recombined with the plant's original DNA. This is a real possibility since it is very likely that the GE maize was not stable and had "loose" DNA. The stability of the GE strains should be tested before a new variety is released into the environment. However, this has only been done in the case of Monsanto's Roundup Ready Soya and not for a single other GM variety. In this case it was found to be highly unstable, quite different from the original data provided by Monsanto.[10]
- A third possibility is that farmers used maize imported or donated by the US as seed, without knowing they were sowing a contaminated crop. This is probably the main factor responsible for the contamination in this case. It would explain why the contamination near main roads, where such maize is sold, was so much higher than further away.

Dumping of subsidized GE maize

The GE maize DNA found in Mexico came from varieties which were approved in 1996 in the US. In 1998, Mexico imposed a

8 Written by Harrie Oppenoorth, Hivos, The Netherlands
9 The Guardian; 14th May 2002
10 ISIS Report; February 2001

moratorium on new plantings of GE maize. This was partly a response to pressure from international organisations, to protect its crop genetic diversity. At the same time, the North American Free Trade Agreement (NAFTA) forced Mexico to allow imports of US maize, unseparated and unlabelled. Some 30% of this maize is GE maize. Because of the vast extensions of GE maize in the USA, the European Union (EU) refuses to import maize from the US, while in the EU a moratorium on field release of these varieties is still in place[11]. Europe is not alone: Japan and Korea also refuse to accept GE maize[12]. Brazil, which is the main producer of GE free maize, was able to supply the market and US maize farmers were confronted with falling prices. As a consequence, production of GE maize stagnated in the US and remains at some 20% of total production. Maize farmers in the US are now compensated for the low prices and receive subsidies to at least cover the cost of production. These subsidies can reach 40% more than the price paid by the big grain traders like Cargill and ADM. Then the maize is dumped abroad or bought back by the US government and "donated by the people of the United States" as food aid. Of course, local producers can't compete with these prices. Mexico, which in 1994 hardly imported any maize, is importing vast quantities. It is very likely the small farmers used this cheap maize as seed.

Biodiversity

Whatever the reason for the contamination, the fact is that it occurred and on a large scale. The Oaxaca region, one of the principal centres of diversity of maize in the world, is now highly contaminated. This is a major disaster. In 1970, a pest destroyed 15% of US maize production, causing billions of dollars in losses and a sharp rise in prices world-wide. Only after resorting to traditional varieties of maize from Mexico, were scientists able to produce a new variety resistant to this pest. Already since the seventies, diversity is rapidly declining. This loss in varieties will be reinforced by massive imports of just a few varieties of GE maize. It is not known how many varieties, together with all their potentially beneficial genetic traits, have already been lost. It will become increasingly difficult to find traditional varieties to improve existing crops when new pests and diseases appear.

The gene bank

When the traditional varieties are contaminated, what happens to the CIMMYT gene bank? CIMMYT is the international maize and wheat improvement centre in Mexico and one of the world's 16 International Agricultural Research Centres. It has the world's most important maize gene bank. So far, it looks like the maize populations maintained at the gene bank have not been contaminated. Still, what's worrying is that although the Centre is officially in charge of genetic diversity conservation, it has not acted in this case. Instead of clarifying this confusing situation and calling for application of the precautionary principle at an early stage, it limited its action to testing the purity of the gene bank. It should be warning Central American governments that GE contamination has occurred and that GE maize imports and food aid may be vehicles for contamination in their countries too (tests of food aid in Nicaragua recently demonstrated contamination). Even the EPA in the US took such measures for certain regions where wild relatives of cotton exist, prohibiting planting of GE cotton in these areas.

GE maize does not only spread to other races and varieties. It can also spread to wild relatives. In Mexico wild relatives of the "evolutionary parents" of maize exist. Some appear to have genes that protect them from some of the major viruses causing destruction in maize at the moment. Such characteristics might be useful to create virus resistant maize varieties.

11 With the exception of Spain and Portugal

12 Just one week before finalising this publication (July 2002), Japan accepted a GE maize variety

Nobody knows what the GE DNA material might do to these wild relatives nor how long their genes will remain present in the environment.

Who is responsible?

It is difficult to establish the damage done, this will only become clear in the long run. It is equally difficult to establish who was responsible. Was it the US Department of Agriculture or the EPA who approved the crop for commercial production? Was it Cargill (which happens to have merged with Monsanto for third world and animal feed activities) or their Mexican associates who imported it? Was it NAFTA forcing Mexico to import unlabelled crops? Is it CIMMYT still not warning other countries? Was it one of the life science companies that developed the crop? Up till now, it is not even clear from which varieties or from which companies the contamination is coming. Monsanto, Syngenta and Aventis all use the same technology. The Mexican government could not find out which of the three varieties was responsible for the contamination, because the companies refused to disclose which protein they used[13]. In any case, there is no liability regime that could force the polluter to pay or clean up the mess. Besides, it is almost impossible to clean up the mess when contamination happens on such a scale. The centre of diversity of maize varieties is contaminated and may remain so forever. It is very detrimental to seed diversity and therefore in the long run to agriculture and to humanity.

It is clear that the precautionary principle should be applied here. The most immediate thing to do would be to stop maize imports. And that's exactly what the Mexican farmers' unions, ANEC, UNORCA and CNI have been demanding. For them, not only maize is contaminated, but also their culture, which is based on maize. Moreover, their lives are in danger, not because of the GE material, but because of the economic hardship they have suffered since the cheap, subsidised maize imports started.

13 Aventis provided the US government with the necessary genetic material when it contaminated the US food supply. Obviously, in the case of a developing country, they don't feel obliged to do the same.

foto: Stockfotografie

Canada[14]

Monsanto versus Schmeiser
Canola is an edible oilseed that has been grown in the prairie provinces of Canada for the past 50 years. It has become one of the major cash crops of the prairie region of Canada with exports going to all areas of the world. Percy Schmeiser is a Canadian farmer who is involved in a legal battle against the world's largest agrochemical company, Monsanto. Monsanto sued him for infringing its patent, because genetically modified (GM) rapeseed (canola) was growing on his land without a license. This was discovered by a private police force that Monsanto employs, which trespasses on farmers' land and intimidates farmers. Initially Monsanto had also sued him for stealing the seeds, but this claim was later withdrawn. Monsanto outlined their request for patent infringement seeking damages totalling US $ 400,000. Schmeiser feels that Monsanto has asked for this exorbitant amount to serve as a warning to other producers. He says that if he would have "bowed on my hands and knees" in the beginning, Monsanto might have settled for what it calculated were unpaid technical fees of about $15,000.

Property
Unlike scores of similarly accused North American farmers who have reached out-of-court settlements with Monsanto, Schmeiser fought back. "I never put those plants on my land," says Schmeiser. "The question is, where do Monsanto's rights end and mine begin?" Schmeiser, who developed and saved seeds for over fifty years, never wanted GM plants in the first place: the GM plants had seeded themselves and then pollinated the conventional rapeseed. 'I didn't want the weed and got sued on top of it!' Despite this, the judge ruled that:
- It does not matter how a seed comes on a field.
- If a field becomes contaminated, the crop becomes Monsanto's property.
- All Schmeiser's profits go to Monsanto.

Schmeiser filed an appeal against Monsanto, which will be heard before the federal Court of Appeal on May 15th and 16th 2002. The landmark case has attracted international attention because it could help determine how much control a handful of powerful biotech companies can exert over farmers. "Whether Mr. Schmeiser knew of the matter or not matters not at all," said Roger Hughes, a Monsanto attorney quoted by the Western Producer, a Canadian agriculture magazine. Schmeiser commented "It was a very frightening thing, because they said it does not matter how it gets into a farmer's field; it is their property. If it gets in by wind or cross-pollination, that doesn't matter."

Tension between farmers and biotech companies
The legal appeal by Canadian farmer Percy Schmeiser for the right to be able to save his seed underlines the increasing tension between farmers and large biotech companies, which threaten to forever alter traditional agricultural practices with the introduction of patented genes. The right of farmers to save, use and exchange their seeds and other planting materials is a cornerstone of agricultural practice. Traditionally farmers saved their best seeds from year to year. Now, however, contracts between seed companies and farmers for GM seeds stipulate that the seeds be used for only one season. Farmers are thus forced to buy the company's seed every year. "I've been using my own seed for years, and now farmers like me are being told we can't do that anymore if our neighbours are growing (genetically modified) crops that blow in. Basically, the right to use our own seed has been taken away." says Percy Schmeiser. If farmers lose the right to save seeds, they will also lose their autonomy and become increasingly dependent economically on big agribusiness.

14 Edited by Inez Staarink, Hivos, The Netherlands, based on articles and speeches by Percy Schmeiser. See www.percyschmeiser.com

Contamination
In Canada, pure canola and soybean seeds are no longer available: Schmeiser concludes from this: 'There's no such thing as containment. Pollen doesn't only blow in the wind, it moves in many ways: how do you stop a bee? There is no such thing as co-existence either: If one farmer grows it, in four years everything will be contaminated.' The whole western Canada region is contaminated already.

"All claims made by the GM seed producers only five years ago proved false. Yields didn't grow, but shrank. The use of chemicals didn't diminish, but grew six to ten fold. GM Canola has become a super-weed, that is totally resistant to Round Up and which is growing everywhere, even on golf courses." Says Percy "In Canada in 1996 no one could tell what would happen.' 'There's no going back for us now. Europe still has a choice. Canadian farmers have seen overseas markets disappear because of genetic contamination. Organic farmers have been destroyed in the space of only two crops. After fifty years of farming we don't have any pure seeds left. All our seeds are contaminated. Let this not happen to you."

Organic farmers counter attack
Farmers' communities in Canada are fighting genetic contamination of their organic crops. On 20 January 2002, two organic farmers from Saskatchewan filed a class action lawsuit against Monsanto and Aventis on behalf of all certified organic farmers in Saskatchewan. The aim of the suit was to obtain compensation for damages caused by the introduction of GM canola from Monsanto and Aventis, as well as an injunction that prevents the introduction of Monsanto GM wheat in Saskatchewan.

"Since wheat is the cornerstone of prairie agriculture, and essential for organic crop rotations, losing wheat to genetic contamination would devastate organic farming in Saskatchewan.(...) We feel we have no choice left but to pursue legal action. This is a matter of survival for organic agriculture in Saskatchewan" sais Arnold Taylor, President of the Saskatchewan Organic Directorate (SOD). The suit also aims to make Monsanto and Aventis liable for genetic contamination and many other grounds like trespass, negligence and environmental pollution.

Schmeiser tells his story
My name is Percy Schmeiser. I am a Canadian farmer. For the last 50 years my wife Louisa and I have farmed 1,441 acres in Bruno, Saskatchewan. We have built up a farm that works well. Rapeseed is an important crop for us and we used to sell it all over the world for cooking oil and cattle feed. Like most farmers in Western Canada, I collected and stored my own seed. After years of selection I had a variety that gave a good yield, was quite resistant to local diseases and was relatively weed free.

In 1997, I sprayed Roundup as usual on the weeds and stray rapeseed plants growing around my fields. I was surprised that so much rapeseed survived the application. Had I got the herbicide concentration wrong? I now realise this was the first sign that my fields had been contaminated by genetically modified (GM) rapeseed.

My neighbours and 40 percent of farmers in Western Canada plant GM rapeseed. Since 1993, Monsanto Canada has been licensed to use technology that will make plants resistant to its glyphosate herbicide, Roundup. Farmers can then use Roundup as a broad-spectrum herbicide without damaging their GM crop. In 1995, Canada approved the uncontained release of GM rapeseed and in 1996 local companies started selling GM varieties. Although Monsanto owns the gene and the technical know-how, they have done little to contain their invention once it entered the environment.

In 1998, Monsanto inspectors entered my land without permission and took rapeseed. They accused me of planting GM rapeseed without a license and prosecuted me. If Monsanto suspects farmers are growing GM rapeseed without a license, they take away rapeseed plants for inspection. If test results are positive and the license fee of Canadian $15 per acre and contract have not been met, legal proceeding for infringing Monsanto's patent follow.

In my case, GM plants had seeded themselves on my land and they pollinated my conventional rapeseed. The following planting season I tried to contain GM contamination by buying new seed but still 20 per cent of my harvest was contaminated. In Canada, there is no law against carrying rapeseed in open trucks or leaving cut rapeseed in the field. This makes it easy for the small seeds to spread. It is also impossible to contain pollen flows. The gene responsible for glyphosate resistance is a dominant gene and rapeseed an open-pollinated plant. When a GM plant crosses with conventional rapeseed, resistance will be carried into the following generation. In my fields, the GM variety was thickest along the roadway. There was little in the field itself. When I received the court summons I wondered why anyone would think I had deliberately mixed GM rapeseed with my own seed. The only advantage of growing GM rapeseed is its resistance to Roundup. If farmers spray Roundup on a mixed GM and non-GM crop they can expect big losses.

When this gene incorporates itself into a seed or plant, what are Monsanto's rights? The seed and plants are the farmer's property. GM rapeseed has the ability to intrude where it was not planted. I believe Monsanto lost its right to exclusivity when it lost control of its invention. How can farmers avoid GM rapeseed getting into their crops and becoming a contaminating weed? These questions are now being discussed by Canada's Federal Court.

Schmeiser is standing up to Monsanto in court. I'm going to fight, and fight and fight. Because I believe what is happening to farmers is wrong. And I'm fighting this not just for myself, but for my children and my grandchildren, and for my farmer's friends. Today, we cannot sell our rapeseed abroad and other products are being affected too. Just recently the Netherlands rejected a consignment of Canadian honey because it was contaminated with GM material. Organic farmers in our district have a particular problem because they cannot meet the GM-free standard for organic certification.

Farmers dread the financial consequences of litigation. Today I face legal bills of Canadian $160,000 plus Canadian $40,000. Monsanto's legal bill is Canadian $400,000. If I lose I will have to pay Monsanto's costs as well. But I have to fight. I know from the support I have received from all over the world that farmers need to protect their rights to choose the technology they use, the crops they grow, and the seeds they save. I have filed a counter suit against Monsanto. I know many farmers are watching how my struggle proceeds. The federal Court of Appeal will be hearing my case May 15th and 16th 2002. You can follow my case on www.percyschmeiser.com.

Private investigators and "snitch" lines
"The worst thing about the whole matter is the intimidation and the way farmers are set up against each other. It is undermining the countryside community" says Percy. Since Monsanto launched their lawsuit against Percy Schmeiser, information has surfaced in the trial documents about the

disregard the Monsanto company representatives had for the Canadian farmer. Monsanto hired retired Royal Canadian Mounted Police (RCMP) officers working for a firm called Robertson Investigations to conduct "investigations" on farmers that were selected as a result of rumours, random tests and reports to a "snitch" line.

Monsanto encouraged farmers to report any suspicious activity so an investigation could be conducted. The infamous "snitch line" that the company proudly advertised on radio stations in western Canada encouraged farmers to report any suspicions that one may have had, pitted farmer against farmer. Due to the public outcry of this approach, Monsanto has since discontinued the telephone line. Monsanto publicly boasted about conducting random tests as they drove by canola fields in the countryside. Monsanto representatives had no respect for property rights as they then stole canola plants that were growing in the farmer's fields or the "right of way" along the road (which are the property of the farmer). Personnel from Robertson Investigations would introduce themselves as "former RCMP," trying to lend clout to their position.

Monsanto would send letters demanding immediate payments. Farmers perceived this to be very threatening and intimidating. Probably, in fear of an expensive lawsuit, many paid. To quote from one letter sent by Monsanto to a Canadian farmer in November 1998 "...We have completed our investigation and have very good evidence to believe that Roundup Ready canola was planted in approximately 250 acres of land .... The planting of Roundup Ready canola without a license is a very serious violation of Monsanto's property rights. Prior to making any final decision as to what steps we will be taking, and in an attempt resolve this issue in a timely and economical manner, we are prepared to refrain from any legal proceedings against you subject to the following:

- You forthwith pay Monsanto the following sum: 250A x $115/A = $28.750,00
- You acknowledge Monsanto has the right to take samples from all of your owned, leased land and storage bins for three years from the date of this letter
- You agree not to disclose the specific terms and conditions of this Settlement Agreement to any third party..."[15]

15 For complete letter see www.percyschmeiser.com

South Africa[16]

The Green Revolution did not bypass Africa. Africa was introduced to the hybrid varieties, fertilisers and pesticides of the Green Revolution but according to the FAO, even though fertiliser use grew, per capita production fell, since the early 70s. In spite of the widespread replacement of traditional varieties of maize with hybrids, yields remained stagnant. So, we have to ask ourselves the question - why did this not work in Africa? Africa has a complex ecology and much of Africa's soils are not suitable for intensive monoculture production. African farmers lack access to infrastructure, markets and support in general. The World Bank has estimated that half of their agriculture projects in Africa failed because of a lack of infrastructure[17].

Introduce GMOs into this scenario. GE crops are basically an extension of the Green Revolution model, but coming also with a bewildering range of biosafety concerns, requiring significant resources to manage and presenting enormous risks of contamination to agricultural diversity, the mainstay of food security. GE crops are being introduced into Africa at a time when there is a world-wide move towards more sustainable agriculture in an attempt to address environmental and health concerns.

The belief that trade and technology is a quick fix to poverty and hunger is based on a simplistic quantitative perspective on food availability, disregarding many factors, above all the distribution of wealth and power.[18] Global food production per person has outstripped population growth by 16% over the past 35 years and the UN Food and Agriculture Organisation (FAO) predicts it will continue to do so for at least the next 30 years, even without factoring in GE crops.[19]

In South Africa, the Green Revolution was more successful, mainly because there was a good infrastructure and farming was heavily subsidised, as in Europe. South Africa also has a very strong commercial seed market that made it easy to introduce new seed varieties.
South Africa has a history of land dispossession and inequalities which led to a situation where there are now about 50,000 commercial farmers, farming on 80% of the agricultural land and about 1 million subsistence farmers farming on the rest. Because over the years, small-scale farmers and rural communities have lost their land and had very little support from the government, traditional farming practices and varieties have all but disappeared. Today the focus is on supporting black commercial farmers and very little attention is paid to preserving agro-biodiversity.

This context, in conjunction with a government that focus its policies on international competitiveness, and a highly vocal and active scientific lobby, has led to the early and rapid introduction of GE. Industry strategy has been to: lobby and develop close relations with government and research institutions; philanthropic deeds, such as supporting an agricultural college for emerging farmers; co-opting scientists to influence opinion-makers. When civil society started questioning the lack of transparency by which GE was introduced, industry's rapid response was to form a front organisation, Africabio, to promote GE in Africa and ensure that unnecessary trade barriers were not formed.

GE in South Africa

The area planted with GE crops world-wide grew 20-fold in the past 4 years with the 6th fastest expansion taking place in South Africa. According to the Department of Agriculture, to date there has been 175 field trials of GE crops and about 350,000 ha of commercially planted GE crops. In 2000 alone, over 120 permits for field trials, import-export, commercial and other use, were granted. The first commercial release took place in 1997 and permits have also been granted for the import and export of Bt maize for animal feed.

16 Written by Elfrieda Pschorn-Strauss, Biowatch South Africa. Biowatch South Africa is a national non-governmental organisation dedicated to publicising, monitoring and researching issues of biological diversity, genetic engineering and sustainable livelihoods. www.biowatch.org.za
17 Kuyek, Devlin. 2002. 'Genetically modified crops in Africa: The implications for small farmers.' Research paper for GRAIN and the African Network.
18 Einarsson, P. November 2000. 'Agricultural trade policy as if food security and ecological sustainability mattered.' Globala Studier No 5. Forum Syd.
19 FAO. July 2000. 'Agriculture: Towards 2015/1030.' www.fao.org/es/ESC/at2015/toc-3.htm

In South Africa, several GE crops are planted on a commercial basis, including Bt cotton, Bt maize and Roundup-Ready cotton and soya bean. During the 2001/2002 season, South Africa planted its first GE white maize, for human consumption. White maize is the staple food in South Africa, in particular for the poor. Africabio has predicted that wheat will be on the market within two years. The South African policies are particularly lenient, in that they allow Monsanto to do field trials for India and China which are illegal in those countries. They also allow for field trials on wheat, which is highly controversial all over the world.

The Legalities of GE in South Africa

The GMO Act, which regulates the release of GE crops and other organisms, was finalised in December 1999, two years after the first crops were commercially released. Biowatch South Africa has commissioned a series of papers to review the GMO Act and its regulations. These results were presented to a meeting of experienced environmental and human rights lawyers. The group was asked to independently assess the conclusions of the study, and to suggest a future path of action. All were unanimous in their criticism of the Act and its Regulations, commenting that the legislation showed a "cynical disregard for contemporary international and national environmental principles, as well as for the development imperatives of South Africa".

Some of the disturbing conclusions of the report were:

- the absence of public participation in procedures for the approval of field trials and commercial releases of GMOs;
- inadequate assessment and monitoring of environmental and social impacts of GE crops;
- lack of transparency in the decision-making process; and
- the imposition of liability on farmers and other users for any environmental damage incurred through the use of GE crops.[20]

South Africa is not only the only African country that has so far grown genetically modified crops on a commercial scale. It also has not signed the Biosafety Protocol.

A case study: Bt cotton and small-scale farmers

South Africa is the first country in the world where small-scale farmers are planting GE crops. Bt cotton has been introduced to small-scale farmers in the Makhatini Floodplains in Northern Kwa-Zulu Natal and is reported to be very popular with a high rate of adoption. This is now Monsanto's flagship project and is being used to convince the rest of the world why Africa should adopt GE crops and so solve hunger.

But this project might also be Monsanto's "Trojan horse", in the words of one researcher.[21] "There are many reasons why it would be a fundamental mistake for the rest of Africa to accept the apparent success of this project as a reason for adopting other GE crops. The circumstances under which Bt cotton was introduced cannot easily be replicated." The South African Dept of Agriculture, Monsanto, Vunisa (a seed company) and the Landbank formed a partnership to make this project work. The Landbank agreed to give credit to the cotton farmers to buy seed and other inputs. Seed was made available to farmers in the same year as field trials started in the area, and according to the Provincial Department of Agriculture, this was highly unusual and surprising.

It is not the most marginalised and poor farmers in Makhatini that benefit from Bt cotton, but those with access to land and therefore credit. Those that do manage to get credit are locked in a debt-cycle. The Landbank will provide loans to cotton

20 Mayet. M, 2001. 'Critical analysis of pertinent legislation regulating genetic modification in food and agriculture in South Africa.' Biowatch South Africa.
21 Kuyek, Devlin. 2002. 'Genetically modified crops in Africa: The implications for small farmers.' Research paper for GRAIN and the African Network.

farmers because they get cash in hand as soon as they deliver to the ginneries. In other words there is a ready market for their cotton and their debt can be immediately repaid. This puts the farmers in a very precarious position, a failed crop will mean that they will not be able to buy seed the next season. They also become increasingly dependent on external inputs.

From a socio-economic point of view, the planting of Bt cotton by small-scale farmers in South Africa, raises many concerns. For small-scale farmers, Bt cotton seems a very attractive option, as the spraying of insecticides is a huge problem for these farmers. It is expensive, backbreaking work and there is the risk of poisoning and polluting water sources.

During face-to-face interviews with farmers on the Makhatini floodplains planting Bt cotton, it has become evident that farmers are signing licensing contracts they cannot read or understand. Many of the farmers interviewed understood these contracts to mean that in the case of a crop failure, the seed will be replaced. They were not aware that they should plant a refuge, that the insects might develop resistance over time, or that during some seasons they will have to spray for unexpected insect outbreaks.

Farmers in South Africa, as in other parts of the world, buying genetically engineered seeds have to sign growers' contracts stating that:

- To use the seed for planting a commercial crop for only one season (i.e they may not save seed).
- To plant a refuge as part of the insect resistance management strategy.
- To not supply any seed containing Bollgard (Bt) cotton to any third party, i.e. no exchange of seed.
- To not use or provide seed containing Bollgard to anyone for crop breeding, research or seed production.
- To not ratoon any Bollgard cotton. If they do, they must pay a technology fee for every year they ratoon.
- To allow Monsanto agents to inspect the grower's fields.
- To only use the companies' chemicals, i.e. Roundup in the case of Roundup Ready crops.

Many farmers in the US have been forced by Monsanto to destroy their crops for not complying with this agreement and several court cases are pending.

Patents and corporate control

The ability of farmers in developing countries to control how they use their seed is a question of survival and the basis of their food security. Farm-saved seeds represent about 90% of total planted seeds on the African continent.[22]

The advent of GE has allowed for genetic material, including seed, plants, animal and human genes to be patented and GMOs are, without exception, patented. Life forms can now become the intellectual property of a multinational corporation. The patent system has largely been driven by the biotech industry and this has implications in that farmers are prevented from replanting "proprietary" seed. The patenting of seed restricts farmers' traditional right to save seeds from year to year. It also negates the role played by farmers in breeding and selecting their seed.

Genewatch UK recently published information on the "gene patent rush" obtained from a commercial database. As of November 2000, patents are pending or have been granted on more than 500,000 genes and partial gene sequences in living organisms.[23] Apart from an increased interest in the commercial use of genetic resources, this surge in patenting is largely due to the rapid development of genetic engineering that allows for

22 Preparatory Meeting for the Establishment of an African Seed Trade Association, Lilongwe, Malawi 1999 in Wynberg R.2000. 'Privatising the Means for Survival, The commercialization of Africa's biodiversity.' www.grain.org
23 The Guardian, 15 November 2000. 'The Ethics of Genetics' Special Report on Patenting of Life. London. www.guardianunlimited.co.uk/genes/

'novel' plants to be developed. It begs a key question: should private individuals and multinational corporations own the fundamental biological components of life?[24]

Control over food and medicine is becoming concentrated with a handful of corporations. The past 10 years has seen the concentration in corporate power become the defining feature of today's global economy. The 'life sciences' industry is converging into new corporate structures that have profound implications for every aspect of commercial food, agriculture, and health.

It is estimated that OECD countries hold 97% of all patents, and global corporations 90% of all technology and product patents.[25] The issue of monopoly patents and the huge profits companies derive from it, was highlighted when the pharmaceutical industry charged that South Africa was infringing monopoly patents by attempting to import cheaper anti-AIDS drugs for the poor.

In a context where multinationals are buying up seed companies, dominating seed markets in the South and restricting the choice of varieties available, poor farmers may find they have no choice but to use genetically engineered seeds. In Brazil, for example, Monsanto controls 60% of the maize market, in Argentina 90% of all soya planted is GE with Monsanto having monopoly rights to the seed. In South Africa, Monsanto bought Sensako, a local seed producer. Another big South African seed company, Carnia, has sold a majority stake to Monsanto.

Independent information and research

In line with a world-wide trend, research institutions in South Africa have been privatised and science is done mostly in commercial interests. The Agricultural Research Centre (ARC), a parastatal research centre that in the past did independent research in the interest of farmers, has now been semi-privatised. So have research at many other previously public research institutions, including universities. The ARC does research on the impact of Bt cotton at Makhatini. They however do this research for Monsanto, and the information is therefore not available to the public.

The ARC is intimately linked to Africabio, a consortium formed by Monsanto, Delta and Pine, Agr Evo, Novartis, Pioneer Hi Breed and several research institutions. Africabio was formed to promote GE and "provide one strong voice for lobbying the government on biotechnology and ensuring that unjustified trade barriers are not established which restrict its members."[26] If the 'public' research institutes and scientists are the promoters of industry, it begs the question, where does this leave the farmer, or policy makers, for that matter, to go for independent research and advice?

24 Grain, 2000. 'Of patents and pirates.' Grain briefing paper, July 2000.
25 ETC/RAFI ibid
26 The Farmer/Die Boer, April 2000

foto: Paul Maassen

India[27]

Farmers suicides

Over 10,000 Indian cotton growers have committed suicide in the past 20 years. In the mid-1980s, synthetic pyrethroids, fourth generation pesticides, were introduced into India in response to bollworm pest problem in cotton. Scientists as well as the farmers were very happy with the results for the first two to three years. But then the insect started developing resistance. The suicides began when farmers were unable to control the American bollworm pests which devoured their crop. These farmers were often heavily in debt and the only option for nearly 10,000 of them was to take the fatal route to escape the humiliation that accompanies indebtedness.

In an open letter to the Indian prime minister dated December 12, 2001, Devinder Sharma, an independent scientist, said: "Perhaps the large-scale suicides by cotton growers would rank amongst the biggest man-made tragedies in independent India. ... Some 15 years back, cotton growers and agricultural scientists had rejoiced for the first two or three years as the potent chemical killed the insects. We had even then warned that spraying more deadly chemicals is not the answer to the menace of American bollworm. And no sooner the insect began developing resistance, farmers once again became a victim of the circle of poison or what is called the 'pesticide treadmill'. Genetically engineered Bt cotton is no different from other chemical pesticides. It too will cause a temporary reduction of pesticides in the first few years and then the insect will develop resistance to the toxin gene. If the past experience is any lesson, the resulting 'biological treadmill' will force farmers again to commit suicides. Dear Prime minister, who will be responsible for those families whose only bread-earner will prefer to end his life? ... How long should cotton farmer continue to give their lives for the 'experiments' that agricultural scientists and now the department of biotechnology continues to conduct in their name?" The insect has already begun to develop resistance to Bt toxin in cotton in Australia and China."

Monsanto has conducted open field trials of its genetically engineered Bt cotton "Bollgard" at 40 locations spread across 9 states of India from 1998. A 3 year test period was to establish sufficient data for a decision on introduction. On March 26, 2002 India's right-wing government, led by the Bharatiya Janata Party (BJP) government, granted approval for the commercial farming of BT cotton. The clearance comes just a few months after the government ordered the uprooting and burning of 11,000 hectares of illegal Bt cotton in Gujarat in November 2001.

Criticism on field trials

There has been a lot of criticism about the way the field trials were conducted and the lack of public participation in the decision making process. In the above mentioned letter, Devinder Sharma says: "In fact, what is more baffling is despite your Government's commitment to bring in the right to information, the department of biotechnology has maintained complete secrecy over the research trials results and the lack of transparency in itself is an indication that the trials were not conducted in a scientific manner. ...This may go down in contemporary history as the biggest scientific scam to have hit the country. In none of three years of the crop being sown for research, was the Bt cotton sown even once in time. Last year, in 2000, the crop was sown as late as two months late ... when the crop is sown late by two to three months, the crop escapes the peak insect attack. And when the insect attack is not there, Bt cotton would obviously look to be very effective. ... In June 2001, the Indian Council of Agricultural Research (ICAR) had asked GEAC for two more years of research trials. Mahyco-Monsanto, the promoter of the genetically modified seed, had objected to this saying that the data so compiled by them was correct. Interestingly, a compromise was then reached and the company was asked to go in for one more year of trials. This may perhaps be the first case when a compromise has been reached in scientific research!!" Dr. Vandana Shiva criticises the experiments as incomplete, misleading and false on three basic lines.[28]

In the first place, the experiments on cross pollination. In these experiments the "safe distance" between fields to assure that cross-pollination cannot take place should be established. The experiments carried out by Monsanto/Mahyco conclude that the safe distance beyond which pollen flow would not happen could be anything between 2 and 15 metres, depending upon the design of the plantation as well as environmental conditions. What is a "safe" distance under different and diverse cultivation patterns and environmental conditions has not been determined by the Bt cotton trials so far. The trials are therefore inadequate and incomplete and do not provide reliable, systematic data for biosafety decisions. The scientific uncertainty of pollination distances calls for renewed trials, carried out in diverse ecosystems with diverse cropping patterns in a transparent and open manner.

In the second place, the impact on non-target beneficial species has to be examined. The trials have reported that control of boll worm infestation through the use of Bt cotton hybrids does not influence the density or characteristics of non-target insects like sucking pests or beneficial insects in any significant way. Observations for sucking pests (jassids and whitefly), recorded through out the crop growth, indicated non-significant differences between Bt and non-Bt hybrids. The data of the trials, however show that jassid presence is nearly 200% higher in Bt compared to LNH 144 and whitefly presence is 250% higher. Thus Bt cotton is more vulnerable to sucking pests. Bt cotton could be more prone to pest infestations of other species in comparison with non-Bt cotton.

"Beneficial insects (chrypsopa, lady beetle and spiders) presence was observed as uniform between Bt hybrids and non-Bt hybrid cotton in checks throughout the crop season". "Beneficial insects activity did not show any significant difference, confirming that the Bt cotton cultivation would not be deleterious to beneficial insects." These statements are misleading. The study reported shows that the studies have been carried out with zero populations of beneficial species in both Bt and non-Bt varieties. Impact on non-existent populations of beneficial insects is not proof on "no significant difference" in impact but evidence of "no significant study" on impact. It is a non-experiment generating non-data. These experiments need to be repeated with real populations of beneficial insects.

Finally, she states that the socio-economic studies are also unreliable. In the study it is claimed that the trials indicated that both yields increase and costs are down and that these are the major benefits of Bt cotton to the farmers. This is misleading for 2 reasons:

- The data reported that the yield of the non-Bt LNH 144 is higher than the Mech 184 Bt variety.
- Cost savings were compared to chemical agriculture not to organic agriculture. In the case of organic agriculture savings are as high as Rs. 4350/acre and costs can be reduced up to 80%, compared to conventional chemical cotton production. Cost reduction was only 50% in the case of Bt and this is likely to become less because of the increased presence of non-targeted pests and possibly also because of resistance

27 Written by Inez Staarink, Hivos, The Netherlands, based mainly on articles, letters and reports from Vandana Shiva (Research Foundation for Science, Technology and Natural Resource Policy), Devinder Sharma (independent scientist and publicist www.dsharma.org) and Suman Sahai (Gene Campaign). See www.vshiva.net

28 "Government of India clearance of BT Cotton will increase Farmers Woes" Dr. Vandana Shiva, April 2002

development in the boll worm against Bt toxins. Costs of Bt cotton seeds, such as technology feeds and royalty payments were not taken into account. Furthermore, prices of conventional cotton containing pesticides or Bt toxin are expected to decline as much as 17%, because subsidies in the US to cotton production were doubled lately and dumping on the Indian market can be expected. The price of organic cotton is 25% higher than the price of conventional cotton because of its quality.

Confusion surrounding introduction

A lot of confusion and misinformation surrounds the introduction of Bt cotton. Suman Sahai[29] from Gene Campaign reports the following during her visit to Gujarat and Maharashtra. "Rumours are rife in the villages of this cotton belt. The propaganda and rumours through the local grapevine have many interesting, if tragic aspects. The farmers are being told that yields will go up phenomenally and the higher seed costs will be more than off-set by higher volumes of cotton produced per acre. ... Others had heard that the government had made it compulsory to buy the Monsanto cotton and seed of other varieties would only be supplied if the Monsanto variety were also bought. In some villages we heard the farmers describing that credit would be available only for the Mahyco-Monsanto seeds." "Reports are coming in of hole-in-the-wall companies, often one-man operations that are selling magical Bt cotton seeds through advertisements. Many of these phoney operators are not even aware of what Bt means or what its supposed actions are. As this mayhem plays out, there is not one single action taken by the government. No rebuttals of the crazy claims are being made, no damage control exercise, no information campaign to warn the farmer against fake seed operators out to fleece him."

Spread of illegal GMOs

Another problem in India's cotton belt is the spread of illegal GM seed. In 2001, 11,000 acres were planted with an illegal Bt cotton variety from Navbharat. "Eleven thousand acres of the illegal crop have yielded a lot of seeds. Since the Genetic Engineering Approval Committee (GEAC), in a spectacular display of incompetence, had failed over a period of several months, to take any action when Navbharat's transgressions came to light, the market is awash with the illegal, unregulated cotton variety, making a public mockery of India's ability to regulate and direct the use of this new and controversial technology." Says Sahai.

Reactions on introducing GMOs

There have been a lot of different reactions on the introduction of GMOs in India. Some scientists and farmers have been very optimistic, others were more sceptical. The fact that emotions concerning the introduction of Bt flamed up is illustrated by the burning down of an experimental field of Monsanto's Bt cotton in Urugonda, a village in Andhra Pradesh in December 1998, with about 200 farmers involved. The major Indian farmers' unions and organisations have officially rejected the release and commercialisation of the genetically engineered and patented Bt cotton.[30] The Farmer Unions and others demanded that permission for Mahyco to commercialise Bt cotton should be immediately withdrawn.

A campaign called "Monsanto Quit India" was launched by the Research Foundation for Science, Technology and Natural Resource Policy on Quit India Day 9th August 1998, the anniversary of the day when Gandhi told the British to Quit India. The campaign was launched in reaction to the Bt field trials and the purchasing of Mahyco, the biggest national seed company, by Monsanto. 10,000 citizens from across India sent the Quit India message to Monsanto Headquarters in India. The national movement against Monsanto and genetic engineering held public hearings in all 9 states where trials had been carried out.

29 'The economics of BT Cotton: a travel diary by Suman Sahai' Gene Campaign June 2002

30 These farmers unions include All India Agragami Kisan Sabha, All India Agriculture Workers Union, All India Kisan Sabha (Ajay Bhavan), All India Kisan Sabha (Ashoka Road), ARISE, Bharat Krishak Samaj, Bharatiya Khet Mazdoor Union, Bharatiya Kisan Sangh, Bharatiya Kisan Union (Ambavat), Karnataka Rajya Ryota Sangh, Navdanya and Samyukta Kisan Sabha.)

31 'Monsanto's Genetic Engineering Trials in India are Dangerous and Anti-democratic' Dr. Vandana Shiva, see www.vshiva.net

Vandana Shiva

Dr. Vandana Shiva is a physicist, ecologist and director of the Research Foundation for Science, Technology and Natural Resource Policy. On their position on Bt cotton she says[31] "Genetic engineering has serious ecological risks... Bt-cotton is not 'pest-resistant' but a pesticide producing plant. The severe ecological risks of crops genetically engineered to produce toxics include the threat posed to beneficial species such as birds, bees, butterflies... Nothing is yet known of the impact on human health when toxic producing Bt crops such as potato and corn are eaten or on animal health ... Further, while pesticide producing plants are being offered as an alternative to spraying pesticides, they will in fact create the need for more pesticides since pests are rapidly evolving resistance to genetically engineered Bt-crops."

In her opinion, GMOs don't fit into Third World farming systems. "This will lead to increased use of agri-chemicals thus increasing environmental problems. It will also destroy the biodiversity that is the sustenance and livelihood base of rural women. What are weeds for Monsanto are food, fodder and medicine for Third World Women.... In West Bengal, 124 "weed" species collected from rice fields have economic importance for farmers. Woman farmers in the Third World are predominantly small farmers. They provide ... food security in partnership with other species. The partnership between woman and biodiversity has kept the world fed through history... Agriculture based on diversity, decentralisation and improving small farm productivity through ecological methods is a woman-centred, nature-friendly agriculture. In this woman-centred agriculture, knowledge is shared, other species and plants are kin, not 'property', and sustainability is based on renewal of the earth's fertility and renewal and regeneration of biodiversity and species richness on farms to provide internal inputs. In our paradigms there is no place for monocultures of genetically engineered crops and intellectual property right monopolies on seeds." [32]

32 'Monocultures, Monopolies, Myths And The Masculinisation Of Agriculture' speech by Vandana Shiva during the international conference on Woman in Agriculture June 28- July 2, 1998,

foto: Paul Maassen

Brazil[33]

Brazil is a very large country, with a total territory of 8,547 thousand km², occupying 66% of South America. The richness of its natural resources contrasts deeply with its social and economic inequalities. The concentration of wealth is amongst the highest in the world: the 10% poorest share only 0.8% of incomes; the 10% richest own 47.9% of the country's wealth (World Bank, 1998)[34].

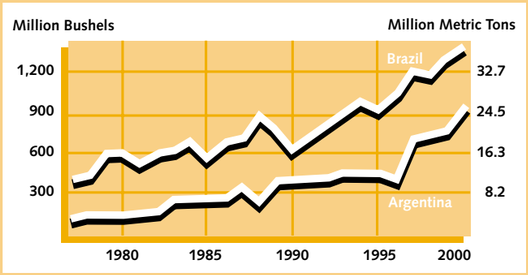
A significant part of the Brazilian poor live in the rural areas. Data from 1999 has shown that 15 million people (3 million families) in rural areas had an income of a dollar or less a day (PNAD, 1999)[35].

Since the 1960s, Brazilian agriculture has gone through significant technological changes. High yielding varieties, fertilisers and pesticides were introduced, like in many other Third World countries, with the aid of different agricultural policies, including credit, tax incentives and the building of large public research and extension systems. Governmental efforts to "modernise" Brazilian agriculture were concentrated in a few export crops like soya, sugarcane, coffee, orange and tobacco. Subsistence crops were not the subject of any specific agricultural policy.

Technological development based on the Green Revolution package has not been able to generate a better distribution of income in the rural areas. The concentration of land has remained unchanged in recent decades. Furthermore, the number of people working in agriculture decreased by 23% between 1985 and 1995 (IBGE, 1996) and one million farms disappeared. A significant part of this population went to the cities.

Nevertheless, family farms remain an important force in Brazilian agriculture, accounting for 85,2% of the total number of farm units and 37,9% of the gross value of agricultural production, in spite of receiving only 25% of the total annual investment in the agricultural sector[36]. Structured, in most cases, as mixed crop systems, these farms are capable of generating high crop values per hectare: US$ 47.27 per hectare (on average) against US$ 20.00 per hectare yielded in the operations based on wage labour[37]. Responsible for the production of a significant part of Brazilian's diet, family farms perform a crucial role in the country's food security.

GRAPH 1: Brazil & Argentina Soya Production 1975-2000[38]



Source: USDA

In the year 2000/2001 Brazil was the second largest producer of soya in the world - after the USA .

GMOs in Brazil

In Brazil, commercial release of GMOs is illegal, unless approved by three ministries based on the technical advice of a special committee (CTNBIO). Several crops have been approved so far, some without the officially established

33 Written by Claudia Schmitt, Centro Ecológico Ipê, Brazil. The goal of cooperation is the protection of agricultural biodiversity, food security, safety and independent control of seeds by farmers.
34 See: CORDEIRO, A. Sustainable agriculture in the global age: lessons from Brazilian agriculture. Svenska Naturskyddsföreningen Rapport, 2000. P.7
35 See: SILVA, J. G. Velhos e novos mitos do rural brasileiro. Projeto Caracterização do Novo Rural Brasileiro, 1981/95. Mimeo. P. 1-2.
36 GUANZIROLI, C. E. et al. Novo retrato da agricultura familiar: o Brasil redescoberto. Projeto de Cooperação Técnica INCRA/FAO. Brasília, fevereiro de 2000. p. 31.
37 GUANZIROLI, C. E. et al. Novo retrato da agricultura familiar: o Brasil redescoberto. Projeto de Cooperação Técnica INCRA/FAO. Brasília, fevereiro de 2000.
38 See: www.unitedsoybean.org/soystats2001/page_35.htm. Consulted on July, 2th, 2002

necessary experiments or without complying with procedures. Many field trials, some of considerable size, take place. There is also a lot of illegal cultivation. Big farmers and international companies have strongly opposed the strict regulations, and some have tried to get round them by smuggling and illegal production. As a result of these illegal activities, the soya crop in Rio Grande do Sul now suffers from a high level of contamination.

In June 1998, when a multinational asked the government for an official statement concerning the commercial release of Round-up Ready soya, Brazilian civil society made its feelings very strongly felt. In September of that year, the Federal Courts, applying the precautionary principal, issued an injunction prohibiting the commercial cultivation of GE soya on the grounds that:

- the marketing of GE-products in the country was not legally regulated;
- an environmental impact study evaluating the possible consequences of the release of this product into the environment was not presented;

This position was ratified by the Federal Courts in August of 1999. The case is now being re-examined by the Brazilian Justice as a result of an appeal made by Monsanto. The National Council of the Environment (Conselho Nacional do Meio Ambiente - CONAMA) has recently approved a resolution[39] stating that anyone who wants to use GMOs or GMO by-products - either in research activities or for commercial purposes - must obtain a license issued by the Brazilian Institute of the Environment (Instituto Brasileiro do Meio Ambiente - IBAMA). Since the commercial release of GMOs is still illegal in the country, the practical implications of the Resolution will have an immediate impact on the research activities that are being conducted in different parts of the country.

Society in action

In 1999, civil society organizations, including ASPTA, Action Aid Brasil, ESPLAR, IDEC, INESC, Greenpeace, CECIP, Centro Ecológico and FASE, started a national campaign called "For a Brazil Free from GMOs". Since than, these different campaigners have been engaged in a wide range of activities against the introduction of GMOs in Brazilian agriculture, including legal action, political lobbying and continuous work to inform and mobilise both producers and consumers about the risks of this technology in its current state of development.

In 1999, in Rio Grande do Sul, one of the main producers of soya in the country, the state government[40], together with several civil society organizations, started to encourage farmers to support the creation of a GMO free state. From 1999 to 2000, more than 12,000 people were engaged in the public debate on the issue, participating in different regional meetings and, finally, in a state-wide conference with more than 1.000 participants. A significant part of the population was made aware of the different positions on GMOs through the media coverage of these events.

The unwelcome harvest

The illegal introduction of GE-soya seeds, smuggled across the Brazil-Argentina border, has been going on since at least 1998/1999. Farmers plant these illegal soya beans for different reasons. One of them is the intense propaganda put out by multinationals on the advantages of the herbicide resistant soya. Soya producers are led to believe that their fields will be free from weeds if they use GE-varieties and that they will only need to apply one single brand of herbicide at any time of the season. An informal network of agents, involved in the illegal trade of GE seeds, helps to convince farmers that it is worth planting GE-seeds.

39 Resolution no 305 of the National Council of the Environment (Conselho Nacional do Meio Ambiente - CONAMA), June, 12, 2002.

40 The State government of Rio Grande do Sul has been in the hands of the Worker's Party (Partido dos Trabalhadores - PT), a party with historical roots in different popular movements, since State government1999.

41 We are not speaking, here, of genetic contamination, but of the mixture between GE and non-GE grains. Estimates of contamination mentioned here refer specifically to that. There is a high possibility, though, that genetic contamination is already occuring in soybean fields. As soya is a self-pollinated plant, unlike maize, there is a low probability of cross-pollination (around 3%). But, as we know, a low probability is different to a zero probability. There have already been cases where farmers planted conventional varieties for export but strip-tests showed the presence of GM soya.

It is impossible to know, for sure, what percentage of Brazilian soya production is contaminated with GMOs[41]. The press has mentioned the figure of 15% contamination (mixture between GE and non-GE grains) for Brazil as a whole. In the State of Rio Grande do Sul, estimates of "contamination" range from 30 to 80%, the differences being explained by the different political and economic interests making the estimates. There is a high level of consensus, though, that the presence of GE soya is greater in the state of Rio Grande do Sul than elsewhere in Brazil. The plan to turn Rio Grande do Sul into a GMO Free Zone has been severely affected by the movement of GE seeds across the border. It is important to understand, though, how this happened.

During 1999, the state government played a leading role in the fight against GMOs, prosecuting loosely controlled experimental areas and inspecting farms, co-operatives and agribusiness stores suspected of illegal cultivation or illegal trade of GE seeds. These initiatives were publicly supported by the those sectors of civil society engaged in the campaign against the commercial release of GMOs. Large producers, willing to keep up with "modern technologies", and many scientists involved in genetic engineering research and development reacted strongly to these measures.

In December 1999, the opposition was strong enough to have the Legislative Assembly approve a law banning the state government from inspecting GE products or otherwise controlling the planting of modified seeds for eleven months. Some confiscations of GE seeds continued to occur, but it was very clear that the state government's role in the fight against GMOs had become less important than that of the Federal Government.

Cultivation problems

In Southern Brazil, multinationals' promises about the technical performance of GE-soya have not been fulfilled. Preliminary field studies conducted by Nodari and Destro[42] recently drew attention to several problems associated with the cultivation of GE-soya. Data was collected in nine different farm fields cultivated with herbicide resistant GE soya in the municipality of Palmeira das Missões, Rio Grande do Sul, during March 2002 - approximately a month before harvest time.

Four different GE-varieties of soya were identified. Three of them seemed to have come from Argentina, the fourth one was of unknown origin. The findings of this study can be summarised as follows:

- GE plants originating from Argentina were smaller in height than conventional soya plants. This bad performance can be partly explained by the fact they are adapted to higher latitudes. When cultivated in lower latitudes these plants tend to flower prematurely, giving poor yields.
- Failures in germination were identified in at least two of the fields.
- In the fields cultivated with GE seeds, a significant amount of plants presented cracks in the stem. Farmers mentioned that many of the plants bent by the tractor during cultivation ended up breaking apart. Similar problems have already been reported by a research team from the University of Georgia in 1999.[43]
- Farmers also reported high rates of herbicide use in GE-fields: an average of 5 litres per hectare in two separate applications. At least three different populations of weeds (Ipomea purpurea, Euphorbia heterophylla and Cynodon plectostachys) could no longer be eliminated by commercial doses of glyphosate.
- Colonies of predatory fungus (probably Fusarium) were also found in the roots of GE plants. Scientists at the University of Missouri, USA[44] have already reported high rates of infestation

42 See: NODARI, R. e DESTRO, D. Relatório sobre a situação de lavouras de soja da Região de Palmeira das Missões, RS, safra 2001/2002, cultivadas com cultivares convencionais e com cultivares transgênicas. Rubens Nodari is a specialist in Genetics and Plant Breeding at the Federal University of Santa Catarina (Universidade Federal de Santa Catarina - UFSC); Deonísio Destro is also specialized in Genetics and Plant Breeding, working at the State University of Londrina (Universidade Estadual de Londrina - UEL).

43 See: STEINBRECHER, Ricarda. Reprint of the paper: Redesigning life? The Worldwide Challenge to Genetic Engineering. London: Ed. Brian Tokar, Zed Books, 2001. p. 75-102. p. 12.

44 See: Por um Brasil Livre de Transgênicos. Boletim no 109, April of 2002.

by Fusarium in Roundup Ready soya plants treated with glyphosate.

- Yields per hectare were lower in GE fields than in conventional fields. The productivity of GE soya ranged from 1,020 kg to 1,600 kg per hectare, while in conventional fields it reached between 1,680 kg and 1,800 kg.
- Finally, it is important to notice that GE and non-GE fields were planted very close (only a few metres) to each other. Cross-pollination between GE and non GE varieties has already been reported by researchers from the Brazilian Agricultural Research Corporation (Empresa Brasileira de Pesquisa Agropecuária - EMBRAPA) and could easily be happening in the farms visited by the two researchers.

Low productivity, high costs, soil degradation by herbicide use, the development of super-weeds and the contamination of fields with GMOs are some of the results of this unwelcome harvest. If one million hectares of GE seeds were planted, farmers would lose around US$ 80,000,000.00 in a single year[45]. Who is going to pay the bill for that?

A threat to farmers' rights

The illegal introduction of GE soybeans into Brazil is a threat to national sovereignty and to farmers' rights. The dissemination of these seeds helps to enforce the idea that GE crops are inevitable and that people cannot choose between different paths of technological development. Farmers who are planting GE seeds are not paying, yet, for the use of genetically engineered genes, but are already being forced to buy chemicals developed by the multinationals. The commercial release of GE crops could end this relatively comfortable situation: GE seeds would naturally become more expensive and the right of farmers to save their own seeds would be limited by contract, as in other countries.

As was mentioned before, a significant part of Brazilian agriculture is made up of small agricultural units, based on family labour and structured as mixed crop systems. Segregation between GE and non-GE crops is not possible in these communities. The introduction of GMOs would take away the right of these farmers to access genetic resources that they have been developing, collectively, year after year, and to choose to preserve and further develop ecologically and culturally based farm systems.

45 See: Por um Brasil Livre de Transgênicos. Boletim no 109, April of 2002.

foto: Suzan Dijkhuizen

Bolivia[46]

"It is outrageous that a small country like ours is forced to accept genetically modified foods, despite public opposition".

The crucial role of the potato in Bolivia
In Bolivia, which is the potato's centre of origin, genetic diversity of the crop is so high that up to 70 varieties can be found within one ayllu (a locally family farming unit), from sour to semi-sour to sweet. Recent studies have demonstrated that 235 species of wild or cultivated potatoes exist.

Farmers in the High Andean Region guarantee their food requirements through diversified agriculture with the aid of high biodiversity. The potato is one of the most important staples of the country and assures food sovereignty for Bolivian farming families and for the nation.

Because the preservation of native potato varieties is crucial for farmers in that region, several local community initiatives have been launched to revitalise and improve local potato seeds. One such initiative taken by Agruco (Agroecology of the University of Cochabamba) consists of maintaining more than 45 native potato varieties in one ayllu seedbank. The seedbank functions as a source for varieties not actively cultivated, or for seeds, if planting stock quality diminishes. In this way, potato biodiversity is preserved and revitalised.

The introduction of GM potatoes: the risks for Bolivia
In April 2000, the Bolivian Biosafety Committee approved a request for field trials of a GM potato resistant to nematodes, a pest. The field trial was to be conducted by the Proinpa Foundation, with plant material originating from Leeds University, England. In Bolivia, genetic contamination through lateral transfer of GM potato genes poses a high risk to traditional varieties and wild relatives. Serious impacts on biodiversity and cultural diversity are possible, for instance genetic erosion, disappearance of some varieties by genetic derivation, and the disappearance of traditional cultural practices connected to the potato. The introduced GM characteristic could affect other ground dwelling micro-invertebrates not targeted for elimination. There is also the risk of nematodes developing resistance to the toxin and thus orming a "super pest" impossible to control.

People's resistance to the GM potato
When the request to conduct GM potato field trials became known, farmers from different Andean areas rejected the field trials in a letter addressed to the Bolivian Vice-minister of Natural Resources and Environment.

Bolivia's foremost development NGO (non-governmental organisation) network, the Association of Agroecology Producers and the environmental NGO, FOBOMADE, wrote to the Committee to protest. Unfortunately, the committee ignored civil society organizations' wishes on this critical biosafety issue. The plan to introduce the GM potato to its Bolivian centre of origin caused a strong national reaction not foreseen by the project promoters. Andean farmers strongly opposed the project and threatened to destroy the field trials. Meanwhile, statements against the GM potato's introduction came from around the world. Immediately after the Biosafety Committee approved the field trials, the Proinpa Foundation came under heavy criticism at public meetings in La Paz, Cochabamba and Sucre.

The international opposition surprised Proinpa. When the GM potato project was presented at a May 2000 conference on the impact of biotechnology, organised by Friends of the Earth and OXFAM in Brussels, it was severely criticised by many participants, mainly from developing nations.

On 3 June 2000, the Association of Agroecology Producers of Bolivia (AOPEB) organised a seminar with the participation of Pat Mooney of the Rural Advancement Foundation International (RAFI). Here again representatives of Proinpa met with overwhelming rejection of GMOs.

Precautionary principle and alternatives to the GM potato
The United Nations Convention on Biological Diversity (CBD) has recognised that the precautionary principle should be used in connection with biotechnology. In the Biosafety Protocol (adopted January 2000) the precautionary principle is recognised as a key element for achieving biosafety. For Bolivia, this means that the critical resource of potato biodiversity should not be risked for a technology that has not proved its worth.

In connection with the Bolivian potato case, FOBOMADE delivered a statement both nationally and internationally calling for a moratorium on GM crop releases into the environment, especially in countries that have traditional varieties or close relatives of the GM crop. The statement also said that Bolivia's problems should be tackled through methods based on the nation's genetic richness, not through methods such as genetic engineering that threaten biodiversity. The use of genetic engineering cannot be justified in Bolivia when study of the full potential of traditional potato varieties remains incomplete. Furthermore, the study of Bolivian native varieties through traditional hybridisation methods is an endeavour that can easily be carried out by the nation's own farmers.

Project withdrawn
On 5 June 2000, the Proinpa Foundation withdrew its project to perform GM potato field trials due to the "debate generated by GM potatoes in the country" and stated that it would "wait for a more appropriate moment."

Resistance continues
In September 2000, the Bolivian Confederation of Farmworkers put the subject of GM food on its agenda, and persuaded the government to sign a decree which stated that, "All production of GM food is stopped during the review period established, and until the final report is issued, with recommendations on amendments to the regulations on access to genetic resources and biosafety" (Decree 25929).

Then, in January 2001, the agriculture minister adopted Ministerial Resolution 2001, which decided "To ban, for a period of one year, the import of products, subproducts and foodstuffs of agricultural origin derived from genetically modified crops." The resolution was a provisional and preventive measure to protect the population's health.

In new negotiations on 23 August 2001, the Bolivian Confederation of Farmworkers persuaded the national government to extend the above resolution until beyond December 2001 and upgrade it to the status of a Supreme Decree.

Corporate influence reverses democratic decree
However, pressures for field trials of GM potatoes and other crops persisted. Permanent lobbying by transnational corporations put pressure on the Bolivian government and its institutions to open the gate to modern biotechnologies. Led

46 Written by Maria Luisa Ramos, Fobomade. The Foro Boliviano sobre Medio Ambiente y Desarrollo is an organisation wich brings together the Bolivian social and environmental movement, academic institutes and individuals who work from their communities to promote the defense of the environment and natural resources. www.megalink.com/fobomade

by the Argentinean soya sector, the lobby strongly attacked the Bolivian decree that banned GMOs.

A leaked Bolivian memo asserted that "the [Argentinean] soya corporate sector is behind the attack, because it exports almost five billion dollars of genetically modified soya." In the same memo, Bolivian authorities said that "the present situation is very sensitive, because the Bolivian Mission at the WTO considers that the reasons given by the Argentinean Mission are valid, according to WTO rules, and our country does not have any solid justification to back the measure adopted."

Thus, despite widespread opposition from farmers, environmental and sustainable development leaders, the corporate lobby succeeded in October 2001 in getting the ban on GM product imports lifted until new regulations are made.

The repeal of the above resolution reveals the Bolivian government's weakness in the face of Argentinean and agribiotech company pressure. It is an outrage that a small nation like Bolivia should be forced to accept GM foods against public sentiment.

Farmer and environmental NGOs in Bolivia have vowed to continue urging their country to regulate GMOs in the face of pressure from abroad. Since products in food aid to Bolivia were found by FOBOMADE to contain GM ingredients, concern is even greater. The Association of Agroecology Producers of Bolivia urges that controls be placed on food and seeds imports from countries like Argentina, Canada and the U.S., and that strong sanctions be imposed on any corporation or organisation that markets GM products in Bolivia.

Genetically engineered crops and pesticide use[47]

Pesticide use not reduced

Almost all genetically engineered crops available for commercial production are developed to be used together with herbicides or produce insecticides. Generally these crops also need additional pesticides. So far only a few independent studies have been carried out on the actual pesticide use in GE crops. In the case of herbicide tolerant soya, accounting for about 59% of GE crops world-wide, results vary. In the US it was found that in five states the use of pesticides was reduced moderately or 10%, while in three states the use was 10% up or more and in 6 states the use was 30% or more greater. In 2000, it was found that there has not been a reduction in the total amount of herbicides used in cotton production, but there has been a shift towards increased use of glyphosate. Whether the environmental effects of glyphosate prove to be less damaging than the chemicals it is replacing has not been investigated. In the case of insect resistant Bt corn, which accounts for about 18% of GE crops world-wide, independent research indicates a wide range of results, varying from modest reductions to levels comparable to those in conventional corn production.

Over the years, insecticide use increases slowly. There is considerable evidence for short term reduction of insecticides in the case of Bt cotton production (accounting for 7% of GE crops world-wide), because the insects that actually eat the plant are effectively eliminated. On the other hand there is evidence that sucking insects tend to increase. So it is likely that also in Bt cotton production insecticide use will eventually increase. Data from Australia already support this assumption. Where pesticide use reduction was 52% in 1997, in 2000 the reduction was only 28%. Data from the USA are complex to interpret. Some states report reductions, but others an increase. It is not clear yet why such huge differences exist. Some pests that are not attacked by Bt toxins are on the increase here too. In one state in 2001, it was found that the additional costs of Bt cotton are no longer compensated by reduced pesticide costs.

Resistance

Insect resistance has been a recurring problem for cotton farmers around the world. Historically, nearly all new insecticides and other pest management technologies appear to work well in the early years following introduction, but as time goes on, farmers encounter increasing insect resistance. There is no reason why this would not be the case with Bt crops. The short term reductions in pesticide use brought about by Bt cotton for instance, will not be sustainable. Since the Bt crops produce the toxin during most of their lifecycle and ever larger areas are covered with Bt crops, it is highly likely that resistance will occur for most pests targeted, within a few years. Not all individual plants produce a high dose of toxin, so part of the pest will not be killed and progressively develop resistance. Farmers will return to synthetic pesticide use once the insects become resistant and insecticide use will go up again.

Resistance management

To avoid the development of resistance, the US Environmental Protection Agency required corporations to develop what are known as "resistance management plans". The idea is that farmers plant a small plot of a non Bt crop nearby, where the pest will not develop resistance. If mixed with the resistant pest, resistance will be "diluted". Studies show however, that at least one third of the farmers in the US don't follow the resistance management guidelines. In developing countries this percentage will be far higher, because of poor instructions, absence of extension services and illiteracy. Observations from Gujarat and Maharashtra (India) confirm this. "Faced with defiant farmers who do not see the logic of 'wasting' 20% of

47 Written by Harrie Oppenoorth Hivos, The Netherlands. This article is a summary of materials produced by Genetically Engineered Food Alert and the Pesticide Action Network. For further information see www.gefoodalert.org and www.panna.org. Furthermore, use was made of 'The current status of genetically modified cotton and its potential implications for organic and smallholder farmers' by Sue Mayer from Genewatch UK(2001)

48 'The economics of BT Cotton: a travel diary by Suman Sahai', Gene Campaign June 2002

their land, the government is now finding it very difficult to convince farmers that this fantastic technology they were promoting all along, does indeed have a downside. Scientist and agriculture departments are already admitting that they have a problem on their hands since farmers do not intend to follow any instructions about demarcating insect refuges."[48]

Non-target species

Research is beginning to reveal the impacts Bt crops can have on other, non-target insects. Some of these, like ladybirds, lacewings and parasite wasps are known as beneficial insects, because of the important role they play in keeping pest populations in check. Others, like bees and bumblebees are beneficial because of the role they play in pollination. These insects eat either the pest or the pollen and since these contain the Bt toxin they may be affected. If the pest eating insect population diminishes, there will be more pests and generally the farmers will use more insecticides to control them.

Organic farming

Bt, Bacillus thuringiensis, has been used as a spray for decades by organic farmers and by conventional farmers also who use a system of integrated pest management. However, in these systems, applications are made only when a pest becomes uncontrollable. With such a relatively low level of use and the fact that Bt sprays do not persist in the environment, resistance is not likely to develop. But now that Bt through the genetically engineered crops becomes widely present, the resistance is developing rapidly. Although organic Bt sprays generally contain several different toxins and the GMO Bt variety only one, the biotech companies are actually putting at risk an important pest control instrument of organic agriculture.

Health and environmental risks

Large scale introduction of herbicide tolerant crops and of insecticide producing crops is a risk to human health and the environment. Both of these risks have been widely documented over the past three decades for many toxins. With the new crops however, new risks appear. One of the risks is related to the limited knowledge available of the effects of the genetic modifications, because they are produced in a rather haphazard way. The crops produce proteins the effects of which on human being are not known. They include substances which may be toxic, others that may cause allergies. In many cases, hardly any experiments were carried out before the variety was approved. So far, the long term effects can only be guessed at.

The same applies to the environment. The effects of massive Bt introduction into the environment are unforeseeable. Already however, studies show that Bt crop residues cause disruption of micro-organisms in the soil. Other research shows that non-target species and even beneficial species are affected by the genetically engineered crops. There are indications that other bacteria can assimilate the capacity to produce Bt toxins, thus increasing the presence of Bt toxins in the environment. Once again: so far long term effects can only be guessed at.

Since so little is known, the precautionary principle should be applied and the crops should not be released into the environment for the time being.

Conclusions and recommendations

The articles in this booklet present a lot of information about the introduction of GMOs, how they perform in the real world and what the consequences of their introduction are or might be.

Experience in several countries has shown it is impossible to avoid unwanted spreading of GMOs once they enter the country, even when this is explicitly prohibited. GMOs are introduced in various ways. In Mexico, probably through food aid or import, vast areas in the centre of origin of maize are contaminated with GE maize. In Western Canada, because of cross-pollination there is hardly a place left were canola/rapeseed crops are not contaminated with GE material. In Brazil, illegally imported GE soya is rapidly spreading to many soya producing areas.

Approval for the import or introduction of GE crops and products containing GMOs are influenced by all kinds of illegal or highly questionable pressures. These pressures probably come from the companies that produce the GMOs. For example, in India, it is hard to imagine that tens of thousands of hectares were planted without the support of the companies; and in Brazil, where illegal imports from Argentina take place. In several countries, the procedures established for approval are skipped, or required tests are not carried out or poorly implemented, or results of experiments are interpreted misleadingly, like in the case of the US, India and Colombia. The life-science companies are very active in lobbying to promote their seeds. They invite government officials to free seminars abroad or cover the costs of meetings where bio-safety legislation is designed (this has happened in some Eastern European countries[49]). Companies managed to gain representation on the committee that approved Bt Cotton in Colombia[50].

Some countries have no legislation at all and others have only guidelines. In some countries, like South Africa, legislation has been drafted to protect the biotech industry. Other countries had legislation, but were forced to amend or repeal it. This was the case in Sri Lanka where the USA put pressure on the government, threatening it with WTO sanctions. In Bolivia, the USA and Argentina forced the government to lift the one year moratorium on imports. Food aid is increasingly becoming a vehicle for GMO introduction. This was demonstrated in Nicaragua and Bolivia. Obviously the countries receiving food aid are in a weak position to say no to this food, even if their laws ban the import of such products.

Separation of GMO produce and non-GMO produce is not really possible. Contamination is happening in Brazil, the USA, in India, Bolivia and in Mexico. It is impossible to tell with a visual inspection. Even where procedures and facilities are in place, mixing will no longer be an exception. In the USA and Bolivia a GE maize, explicitly not approved for human consumption, turned up in food and food aid.

GMO crop yields in Canada, India and Brazil are no higher than conventional or organic crop yields (See chapters 3, 5 and 6). In many cases, the varieties are not adapted to local circumstances and perform poorly. The GMO crops are advertised as the best and many farmers are poorly informed, for example, in India or South Africa. Often they borrow to buy the seeds. When it turns out they are not adapted to local circumstances and yields are poor, they rapidly fall into the debt trap, like the South African case shows.

The costs of planting many GM crops are lower only in the short term because pesticide use can be reduced, as demonstrated by studies in the USA, Canada and Australia.[51]

49 Project 'Implementation of National Biosafety Frameworks in Pre-Accesion Countries of Central and Eastern Europe'; July 2000

50 The 15th of March 2002, the Consejo Técnico Nacional de Bioseguridad, CTN, from the Instituto Colombiano Agropecuario ICA elected the Monsanto representative as vice president to the CTN and in the same meeting the Monsanto Bt cotton variety release was approved. Monsanto only did one, questionable, risk assessment.

51 See Pesticide article, basically a summary of materials produced by Genetically Engineered Food Alert and the Pesticide Action Network. For further information see www.gefoodalert.org and www.panna.org. Furthermore use was made of 'The current status of genetically modified cotton and its potential implications for organic and smallholder farmers' by Sue Mayer from Genewatch UK (2001)

Furthermore, the cases of Brazil and India show that the GMO crops are more prone to non-target pests and diseases, or develop other weaknesses that make them more vulnerable. The Brazil case study shows that, when mixed with other varieties, GMO crops further the proliferation of diseases to other varieties. The cases of Canada and Bolivia show the development of super-weeds and super-pests that will be very hard to get rid of.

Farmers who produce GMOs are not allowed to save seeds. In Canada, they are prosecuted. In India and South Africa and probably many other countries the labels tell the farmers they are not allowed to save the seeds. Sooner or later, they too will be prosecuted if they replant. And when their conventional crops becomes contaminated with GMOs, they will probably suffer the same destiny as Percy Schmeisser and be sued by Monsanto or one of the other companies for infringing on their patent.

Finally, there is the issue of liability. The GMO crops are spreading. The GMO varieties are mixing with others. The GMO crops are present in centres of origin. So, original relatively pure seed strains become contaminated as do wild relatives. It is not clear who will be liable for the loss of genetic characteristics and the reduction in biodiversity this will cause. Neither is it clear who will compensate the organic or conventional farmers whose produce is contaminated or who lose the seeds they have developed to suit local conditions.

Recommendations

The risks of GMOs to both farmers and to biodiversity are great, and the advantages questionable. That is why Friends of the Earth International and Hivos feel measures need to be taken to ensure biosafety and put a halt to biodiversity loss:

- Governments should sign and ratify the Biosafety Protocol as soon as possible, in order to implement a minimal regulatory framework to protect global biodiversity. Countries should also create national regulatory frameworks on GMOs and GMO products.
- Governments should have the right to use the precautionary principle and establish bans or moratoria on GMO crops. Effective monitoring and enforcement capabilities should be in place.
- The release or introduction of GM seeds, food or feed should be banned in countries that are centres of origin and diversity
- Biodiversity and biosafety priorities to protect the environment and human health should not be subordinated to trade conditions imposed through WTO legislation.
- No patents or other types of intellectual property rights should be granted on seeds or any other living material.
- The farmers' right to save the seed should be sacrosanct. Governments should support the initiatives of local and indigenous communities to save their traditional seeds, exchange them for others, cultivate them and improve them.
- Governments should promote ecologically friendly alternatives to GMOs, such as agroecology and organic production. Governmental policies should give adequate support for organic/ecological agricultural practices and production, as the basis for national rural development and agricultural policies, and as a fully viable alternative to GM mono-cropping.
- National governments should work to establish a globally binding regulatory framework to control corporate activities so that they do not impact negatively on biodiversity, the environment and the rights of the majority of the global population, including women, indigenous peoples and local farming communities who have been the stewards and curators of biodiversity conservation throughout history.
- A liability system should be established, in case contamination is not prevented. Companies responsible for introducing GMOs should be made liable, and not farmers.

foto: Stockfotografie

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