Seedling

Biodiversity, Rights and Livelihood

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GRAIN

Girona 25, pral., Barcelona E-08010, Spain
Tel: +34 933 011 381
Fax: +34 933 011 627
Email: seedling@grain.org
Web: www.grain.org

GRAIN is an international non-profit organisation which promotes the sustainable management and use of agricultural biodiversity based on people's control over genetic resources and local knowledge. To find out more about GRAIN, visit www.grain.org.

Seedling

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Back cover: *Chico Caititu, from Mangabal, an authority on the forest, its produce and its dangers, quenches his thirst (Photo: Maurício Torres)*

In this issue...

Once again genetic modification features strongly in this edition of *Seedling*. Such is the pace of change in global farming today that it seems that every quarter we have something urgent and new to say about genetic modification, often bringing to the discussion information that is not readily available elsewhere. Our first article deals with contamination. We have known for some time that, despite the reassurances of the biotechnology companies, genetically modified crops invariably contaminate other, non-GMO crops planted nearby. Indeed, it seems clear that this has been part of the companies' strategy for spreading their crops in a region. But it is becoming equally clear – and this certainly was not part of the companies' agenda – that many peasant communities are developing strategies for dealing with the contamination. In particular, indigenous communities in Mexico, after lengthy discussions, are taking action. At times, their moves are surprising: for instance, they have decided that contaminated maize should not be destroyed but treated as if it is sick, and gradually cured, even if it takes a hundred years to get it healthy again.

Not everywhere have communities been able to organise effective opposition to GMOs. As we show in our article on the 12 years of GMOs in Argentina, one of the tragedies of the soya boom in that country is the destruction of age-old peasant communities, as soya plantations have taken over the land. Nowhere else in the world has such a large area of land been devoted to a single GM crop. Although financial investors and big farmers are still making large profits, the land is dying. New superweeds, resistant to the glyphosate herbicide, are emerging. And, predictably enough, the companies have come up with a new technical fix: a new form of GM soya that is resistant to another herbicide – dicamba. How long will it be before weeds develop resistance to this too?

Meanwhile, fresh threats from genetic engineering emerge. One new technology is based on minichromosomes. Our article explains, in terms accessible to the non-expert, the science behind this new technology. It is interesting to note that, although the biotech companies present this new technology as safe and effective for – yet again – saving the world from hunger and environmental degradation, their patent applications tell a different story: their main goal is pharming (the production of drugs and chemicals through engineered crops). Although the risk of contamination from pollen may decrease with this technology, a new threat will emerge: contamination through bacteria. This raises the spectrum of new forms of contamination, not only between species, but also – and very alarmingly – between kingdoms.

Thankfully, thousands of communities are carrying on with their old way of life, based on very different principles. One such community, called Mangabal, lies deep in the Amazon forest, beside the Tapajós river. Like many others in the Brazilian Amazon, it was formed more than a hundred years ago when north-eastern migrants of European origin were lured to the Amazon basin to tap rubber. The men "solved" the gender imbalance by kidnapping young women from neighbouring indigenous groups. The women brought indigenous knowledge into the rubber-tapping communities, teaching the men how to create living seed banks of cassava. Similar communities are to be found in the Caribbean island of Guadeloupe, where slaves were allowed by their owners to establish "Creole gardens" in the forest so that they could cultivate their own food. These gardens, which were integrated into the forest around them, also became living seed banks, with the breeding of new species and the conservation of medicinal plants. Some of these gardens still exist today and are being rediscovered by the authorities. The farming principles that lie behind this cultivation in both the Amazonian and Caribbean communities are diversity and sustainability – the qualities that modern farming, particularly with GMOs, is destroying.

One of our most popular publications last year was a Briefing on land grabbing – the way governments and corporations, alerted by last year's food crisis, are scouring the world in search of arable land where they can grow food to ship back to their own countries. For those of you who missed the report, we include a summary and details about how you can find the report on our website. We also have a summary of our latest Briefing on a new form of rice – Nerica – that is being strongly promoted in Africa.

The editor

Ever since GMOs were first introduced in the mid-1990s, farmers' groups and NGOs have warned that they would contaminate other crops. This has happened, just as predicted. In this article we look at how communities in different parts of the world that have experienced contamination are developing strategies to fight against it.

Fighting GMO contamination around the world

GRAIN

When GM crops are planted they contaminate other crops with transgenic material. In places where GM crops are grown on a large scale, it has already become almost impossible to find crops of the same species that are free of GM material. And the contamination spreads even to areas where GM crops are not officially permitted.[1] The GM Contamination Register, managed by GeneWatch UK and Greenpeace International, has documented more than 216 cases of GM contamination in 57 countries over the past 10 years, including 39 cases in 2007.[2]

Monsanto and the other biotech corporations have always known that their GM crops would contaminate other crops. Indeed, it was part of their strategy to force the world into accepting GMOs. But around the world people are refusing to lie down and accept genetic modification as a fact of life; instead they are struggling against it, even in places subject to contamination. In fact, some communities experiencing contamination are developing sophisticated forms of resistance to GM crops. These usually begin with short-term strategies to decontaminate their local seeds, but often seek over the long term to strengthen their traditional food and agricultural systems.

We look at the experiences of communities in different parts of the world in dealing with GM contamination to see what insights they can offer others faced with similar situations. Each situation is unique, and gives rise to different processes. Common to all of them is the primary importance of collective action – of communities working at the grassroots to identify their own solutions and

1 See video interview conducted by GRAIN with Meriem Louanchi in November 2008 about the situation regarding GM contamination in Algeria. grain.org/videos/?id=195

2 GM Contamination Register Annual Report, 2008. http://tinyurl.com/79osjp

not depending on courts or governments, which, without strong social pressure, tend to side with industry.

The experience of communities in Mexico

For the indigenous peoples of Mexico and Guatemala, maize is the basis of life. In the creation story of the Maya, maize was the only material into which the gods were able to breathe life, and they used it to make the flesh of the first four people on Earth. For other peoples of Mexico, maize is itself a goddess. The plant has been the fundamental food of Mexicans for centuries, and thousands of varieties provide an amazing range of nutrients, flavours, consistencies, recipes, and medicinal uses.

In January 2002, researchers at the University of California in Berkeley announced their discovery that local varieties of maize in the highlands of Oaxaca state had been contaminated. Other communities of small farmers carried out tests on their own crops and were shocked to find that they too had been contaminated. For these people, it was a deep blow to their culture. They could not sit back: something had to be done.

At first, though, they did not know what to do. GMOs were new to them. They started by bringing together the nearby communities that might also have suffered contamination, as well as NGOs that they were close to. Workshops were held and people were mandated by their local assemblies to discuss on behalf of their communities. The strategy was thus collective from the beginning. This is the first point to be noted about the Mexican experience.

One fundamental point of agreement reached early on was that this GM contamination needed to be viewed as part of a war. It was not an accident or an isolated issue, but part of a war against farmers and indigenous peoples – in their words, a war against the people of maize. They needed to respond accordingly – defending not just their seeds but their livelihoods, their cultures, their whole way of life.

Initially, though, there were few practical ideas about how to decontaminate their maize and prevent further contamination. Concern was expressed that the communities might not have the technical capacity to deal with such a complex problem. But these communities and the NGOs working with them had a great deal of experience in finding grassroots solutions to the problems affecting them, and so, rather than look to outside experts, they turned the question upside down, focusing not on GM maize, which they did not know, but on their own varieties of maize, which they knew intimately.

They began by sharing their own knowledge of maize and what maize needs to be healthy. The most basic point was that to keep their maize alive and well they had to sow it and eat it. In many communities, traditional maize was disappearing because people were sowing it less. The first step in defending their maize was thus to plant more of it. It was also felt, in response to GMOs, that seeds were dangerous when their history was not known. So it was agreed that seeds should be planted only when their history was known, or when they came from a source that was well known to them.

As the communities put these principles into practice, they began to pay closer attention to the crops in their fields, and became aware of all kinds of serious malformations. They tested the deformed plants and found a high rate of contamination, so they began watching for these plants and weeding them out.

Another thing they knew about maize is that it out-crosses, so, to prevent GM contamination, they would have to keep GM maize from crossing with their maize. They began by implementing simple techniques such as planting trees around their fields. Some of the techniques they developed could be applied everywhere, whereas others were specific to certain communities. But the important thing was that they were setting up a system to avoid contamination.

There was much discussion about what to do with contaminated plants. It was strongly felt

that if a very old variety has been in your family for generations and all of a sudden becomes contaminated, this maize should not simply be destroyed. Contaminated maize is sick and needs to be cured, not killed. It may take a year or 100 years to cure it, but it has to be done, because the maize has been with their communities for generations.

The peasant communities of Mexico have probably developed the deepest strategies of any communities facing GM contamination around the world. There are many lessons that can be drawn from their struggle, with perhaps the main ones being:

1) The need to look at GM contamination as part of a wider attack on farmers and local communities. Defending your crops means also defending your land and your water, and this requires strong communities, strong collective decision-making processes, and strong networks with other groups at the national and even international level. Such a wide approach allows more people to participate in the struggle. Even if not everyone can take care of the seeds, there are other things that they can do.

2) The importance of not being beholden to time frames. For the Mexcian communities, GM contamination is part of a war waged against them that is permanent, and so their approach has to be long-term and capable of being permanent. Their decision is to defend their maize, no matter how long it takes. As they see it, when deadlines are brought in, people are faced with what they cannot do, and usually little can be done in the short term, so they compromise. This the Mexican communities refuse to do.

3) The importance of looking at the issue from your own perspective. The communities in Mexico spent a lot of time in the early workshops discussing spirituality and their views on deities and creation. They talked about the rituals that could protect maize. Those invited from outside to participate had a hard time explaining the technicalities of genetic engineering, because the concept appeared so absurd. But, in the end, the communities arrived at their own core understanding of genetic engineering as a method of taking control over agricultural livelihoods, and this core understanding was far more important than the technical information.

4) The need for the communities to control the process. In Mexico, communities were able to maintain control over the processes because they were their own processes from the very beginning. When they had control over the initial tests, they kept the results to themselves for a long time because they wanted to discuss first among themselves what steps to take. And the fact that decisions were taken collectively, by many people, has helped to prevent big mistakes from being made. Mistakes are always going to happen but when a lot of people are involved chances are much lower that there will be fundamental mistakes. When the contamination was uncovered by university scientists, the processes followed were totally different.

5) The need to emphasise social struggles over legal struggles. Among the Mexican communities, there was a lot of discussion about biosafety laws, seed laws and other relevant laws. At a recent workshop dedicated to laws, a time line was presented of all the various laws that the Mexican government has passed in the last 15–20 years. From this picture, the communities came to a clear conclusion that the legal route was not an important route for their struggle. You may lose the lawsuit but if there is enough social pressure you may win in other ways. For them legal options are only effective when there is enough social pressure on authorities. So the tactic is not discarded, but it is not central.

An invasion of illegal GMOs into Thai farms

GM contamination was first reported in Thailand in 1999 after cotton samples from field research conducted by BIOTHAI and the Alternative Agriculture Network (AAN) were found to be contaminated with *Bt* cotton – a genetically engineered cotton variety produced by Monsanto. In 2004, tests made by Greenpeace revealed that a local farmer's plantation in Khon Kaen province was

contaminated by GM papaya. That farmer was one of 2,600 who had bought papaya seedlings from the Department of Agriculture's research station where field trials of GM papaya were being conducted. At first, the government denied that GM crops were being grown in Thailand, but the contamination was so widespread that it reached another province, Ubol Ratchatani, where at least 90 farms had also received papaya seedlings. Most recently, in 2007, Chulalongkorn University's Faculty of Science and BIOTHAI found GM contamination in maize, soya and cotton samples that they tested from provinces all over the country.

The Thais believe that a two-pronged approach is necessary to address this situation. On the one hand, pressure should be put on the government to implement policies that protect the country from GM contamination. The Thai Working Group Against GMOs, which BIOTHAI coordinates, has organised numerous activities to keep the national moratorium on GMOs in place. They have sent petition letters, organised demonstrations in front of government offices, and pushed for a dialogue with top officials, including the deputy Prime Minister and Secretaries of Health and Agriculture. These efforts had an impact : on 25 December 2007, the Thai government announced its rules on GMOs which include, among other things, a mandatory public hearing prior to field testing, and a recommendation that approval from the local people in the field test area, as well as from independent NGOs and the academic community, should be obtained. From the perspective of BIOTHAI – which is currently running a campaign to develop a People's Biosafety Law – this was an important victory.

On the other hand, the Thais are working to increase local capacity to develop systems to detect contamination and deal with its impacts. The Khao Kwan Foundation (KKF), one of the founding organisations of AAN, has been mobilising farmers' knowledge to identify contaminated seeds and to control or eliminate them. The KKF runs trainings and workshops on seed breeding and selection, which indirectly deal with contamination.

KKF believes that farmers are able to notice anything abnormal in their crops, because of their in-depth knowledge of seeds and their skill in selection. Whether it is the colour, the hardness or the smell, every variety has peculiarities that farmers who have been working on seeds know in detail. So any alterations will be easily detected, even before the plant starts to flower.

Daycha Siripatra, founder of KKF, says: "This is the principle of local adaptability. We've made our seeds recognise their environment and use that environment to express their potential. An alien seed, like a GMO, will not automatically thrive in our area and, even if it grows, farmers will be able to notice it right away, just from its appearance."

Filipino farmers deal with contamination

In 2002, the Philippines had the (dis)honour of being the first country in Asia to authorise the commercialisation of GMOs, when it approved the release of Monsanto's *Bt* maize amid nationwide protests. Since then, genetic contamination has been reported in maize-growing areas throughout the country.

In the north-western province of Isabela, a local variety of white glutinous maize grown by farmers for food has reportedly been contaminated by GM maize. No gene testing has been done but farmers identify the contamination by the yellow kernels that appear in the otherwise white maize. In Bayambang, Pangasinan, farmers typically plant maize after rice. But now they are complaining that they have lost practically all the traditional maize varieties in the province due to contamination by hybrid and GM maize. They also fear for their health, as there have been incidents of children being taken to hospital for incessant vomiting after accidentally eating GM maize. There was also a report of a farmer's cow that became sick and eventually died after being fed with *Bt* maize.

In Bukidnon, in the southern Philippines, some communities are responding to contamination by separating the lower-priced yellow kernels from the higher-priced white ones before selling to the market. In Capiz, another major maize-producing province in Central Philippines, farmers are saying that almost all the province's maize-growing area is contaminated with GM maize and that they can no longer find traditional varieties to grow.

MASIPAG is a national farmers' network with a maize programme that collects and improves traditional varieties throughout the country. Recently, the group's back-up farm in San Dionisio, Iloilo (not far from Capiz) was contaminated. The area is a major producer of hybrid maize, and about three years ago mass cultivation of GM maize began by way of a contract growing scheme managed by local elites.

At least three native varieties used for farmer breeding in the back-up farm were immediately

contaminated by the GM maize. At harvest, it was observed that there were yellow grains mixed with maize ears of *pilit-puti* and *mimis* – these are traditional varieties used by farmers for food. The area planted with maize on the back-up farm was only 50–100 metres from the nearest maize farms. Bamboo trees along the creek serve as natural barriers, but since the neighbouring fields are sloping, MASIPAG believes that pollen from the GM maize could nevertheless have been carried to these fields by the wind.

Researchers at the farm say that in the first year of planting after GM maize was introduced, they found 7–12 yellow grains in every maize ear. The following year, no maize was planted. This year, a small portion of the farm was again planted with white maize, adjacent to another farm planted with GM maize. Of the 50 grains counted in the average ear, only 18 were white and the remaining 32 were yellow. MASIPAG tried to explain the situation to the neighbouring farmers, but they are facing debt problems because of the contract growing scheme and are unable to stop growing GM maize.

In 2008, MASIPAG organised a national maize assessment meeting that brought together farmers from across the country. They agreed that it seems impossible to stop contamination, and that, while much is still unknown, it is crucial that they deal with the post-contamination situation. They believe that a range of approaches is needed to ensure that seeds will remain in their hands. One proposal is to develop visual indicators for detecting contamination. Some of the indicators initially identified include: abnormalities in the colour, size and appearance of maize kernels, and deformities in leaf formation.

Another idea is to collectivise monitoring at the community level. Each farmer could help to map out who plants GM maize and where. The map would be shared with the community and would allow farmers to time their planting so as to avoid contamination. Farmers believe that time isolation can potentially minimise, if not totally prevent, contamination by cross pollination. They also see that stronger links among maize farmers – and sharing sources of uncontaminated seeds – in different provinces will greatly help to minimise the impacts of contamination.

At government level, meanwhile, the push to promote GMOs continues. At a "2008 National Biotechnology Week", held very recently, two Cabinet officials stressed the need to harness biotechnology "to boost the country's food production, develop cheaper but effective medicines, and upgrade the production of commodities using higher-yielding crops with higher nutritional content". The Environment Secretary, Lito Atienza, went as far so to express his confidence in the "immeasurable benefits" of using biotechnology to protect the environment and to address the problems of food insufficiency.

Yet just a week before this, RESIST – a national network of farmers, NGOs and academics – held a forum to present and discuss the first results of their case studies of farmers' experience with *Bt* and Round-up Ready maize from three provinces in the country's main arable regions. Initial findings point to a worrying trend: yield and income from these two GM maize varieties did not improve significantly (in most cases they were the same with ordinary hybrids), but at the same time a recurring increase in pest incidence, chemical use, and debt was observed. Loss of genetic diversity due to contamination was also reported due to indiscriminate planting of these GM maizes, occasionally with subsidies from the government's maize programme.

Contamination on the Canadian prairies[3]

The province of Saskatchewan, in western Canada, is one of the country's main producers of wheat and canola, Canada's most important export crops. Compared with other provinces, it is also home to a large number of organic farmers, many of whom produce grains and canola for export markets. But the large-scale introduction of GM crops is threatening their ability to produce certified organic crops.

Soon after Monsanto introduced GM canola into the province in 1996, organic farmers began having

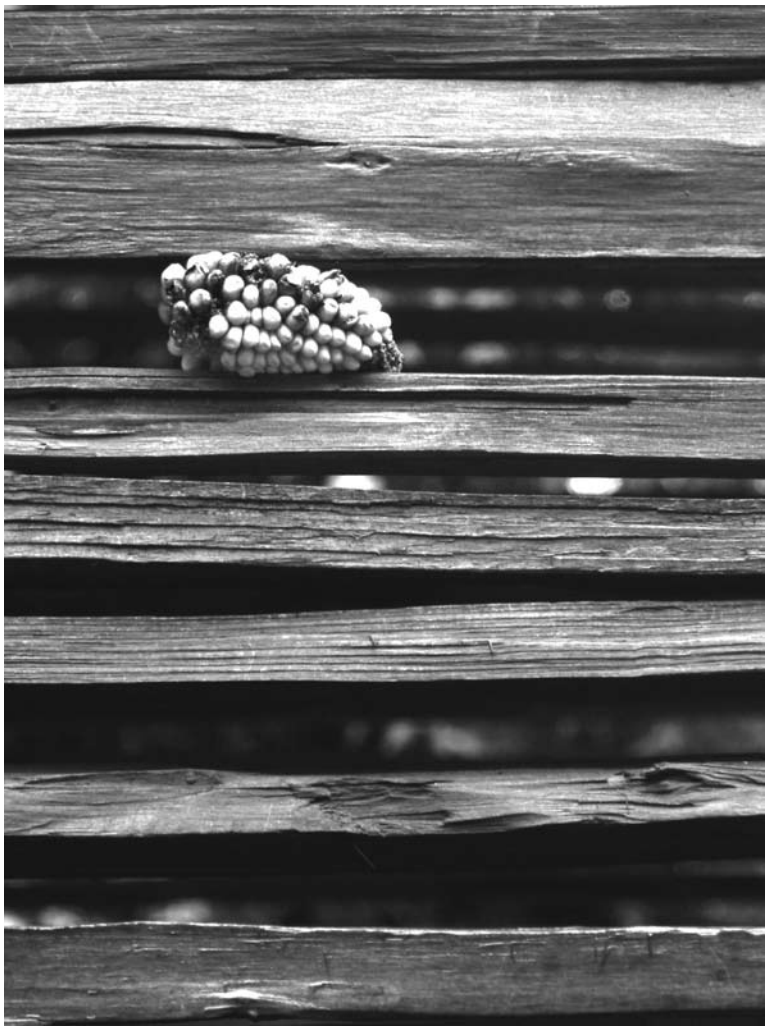
3 The section on Canada is based on an interview conducted by GRAIN with Cathy Holtslander in November 2008. This video interview can be viewed on GRAIN's website, grain.org/videos/?id=195

their crops rejected by organic buyers because tests were showing GM contamination. Today, with even the conventional seed supply completely contaminated by GMOs, it is virtually impossible to grow certified organic canola in the province. This has been a big loss to organic farmers, for whom canola is an important crop in their rotations. But the importance of canola is nothing compared to that of wheat, which is grown by nearly every organic farmer in the province. So in 2001, when Monsanto came forward with an application to introduce GM wheat, Saskatchewan's organic farmers decide to take a stand. They warned that the contamination that would surely ensue from the release of GM wheat would wipe out organic agriculture in the province.

In Canada, there are no regulations to make the corporations that profit from GM seeds liable for the damage that their introduction causes to others. The only possible avenue is to seek damages in the courts. In 2001, the Saskatchewan Organic Directorate (SOD), the umbrella group for Saskatchewan's organic farmers, decided to take collective legal action for an injunction against the introduction of GM wheat and for compensation for losses stemming from the introduction of GM canola. In early 2002, SOD formally launched a class action suit against Monsanto and Bayer. A class action is a lawsuit filed by a group of people, in this case all certified organic grain farmers in Saskatchewan, against an entity such as a corporation. It is supposed to facilitate access to justice for common people, to provide a way for people to be heard in court even if they don't have the resources of a big corporation. It allows people not only to pool their resources but also to reduce risks, because, if you lose a class action, costs are not awarded against you, which means that you don't have to pay the legal bills of the other side, which can add up to millions of dollars.

While their case was before the courts, SOD was also active with a broad coalition of groups at the local and national level fighting the introduction of GM wheat. Together they were able to generate a lot of public pressure, to the point where, in May 2004, Monsanto withdrew its application. At this point SOD dropped the injunction against GM wheat from its class action but continued with its claims for compensation for the contamination caused by GM canola.

In Saskatchewan, a class action suit has first to pass through a hearing to determine whether it is legitimate before it can go before the courts. For the SOD case, the judge at the hearing ruled that the class action was not valid. SOD then appealed



against the judgement, both at the provincial level and at the Supreme Court of Canada, only to have both appeals denied. The only legal option left was to pursue the claims through an individual action, but it was felt that the risks were too high and the chances of victory too narrow, given their experiences with the class action.

"We don't feel it was a complete loss", says SOD director, Cathy Holtslander. "We did a lot of really good work during the time that the legal action was active. The uncertainty that our case created in the corporate sector may have caused GM corporations to hold back from further introductions. People learned a lot about the issue of contamination and the issue of liability. They way things are now, because nobody is liable, the weakest players in the chain – the farmers – bear the costs."

Now the corporations are pushing ahead with the introduction of GM alfalfa, another essential crop to organic farming in Saskatchewan, and GM wheat is back on the table with the rise of biofuels. The SOD and its allies are preparing for a new round of struggle.

Over the last few years biotech laboratories and industry have developed two new techniques – artificial minichromosomes and transformed organelles – which, the industry claims, will allow it to overcome the problems it has faced until now with GMOs, especially their low efficiency and genetic contamination. But basic biology and maths indicate that, contrary to what the industry claims, the new technology will not prevent genetic contamination in plants. In fact, as the two technologies converge, the frightening possibility arises that contamination will reach a new level of toxicity, and occur not only within organisms of the same species but also between species as different from each other as plants and bacteria, or plants and fungi.

The new weapons of genetic engineering

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From its very beginning, genetic engineering has faced two tremendous barriers. First, there is the undeniable fact that the theory that each gene is responsible for a single characteristic (one gene–one trait), if it is true at all, holds true for only some genes. The more that is learnt about the functioning of cells and organisms, the more flexible and multiple the links between gene and function are found to be.[1] Second, there is the complex and powerful self-regulating capacity of chromosomes and genomes, which leads them to expel, delete or "silence" genetic material which is not part of their normal make-up. Mutations occur very often in nature, and most of the time the genetic material itself triggers mechanisms that "correct" or delete these mutations. The result is an amazing and stubborn stability of form and function.[2]

Three major practical effects derive from this: multiple and unexpected side-effects from genetic engineering; a very low rate of successful, stable expression of the engineered traits; and an overwhelming difficulty in genetically engineering traits that involve several genes. The biotech industry has addressed the first problem by not releasing engineered organisms with obviously harmful side-effects and by denying side-effects when they have occurred in the field or lab, or in animals and human beings. Industry has also been very careful to avoid acknowledging that fewer than one per cent of their attempts at genetic engineering are successful in any way. They are also reluctant to admit that none of the attractive initial promises of biotechnology – that it would make all plants capable of fixing nitrogen and acquiring phosphorus, that it would produce plants tolerant of drought, salt and heavy metals, and that it would manufacture new vaccines – has been delivered. A key factor in explaining this is that all these characteristics or products involve gene complexes; by contrast, almost all current biotech products are based upon single genes (plants that are tolerant of herbicide and plants that contain Bt toxin are two good examples).

1 See, for example: "Now: The Rest of the Genome", *New York Times*, 11 November, 2008.

2 Rachel Shulman, "New gene-silencing pathway found in plants", American Association for the Advancement of Science: Eurekalert, 17 November 2008. http://tinyurl.com/6q3fqv

As well as harming their public image, these failures have serious practical consequences for the companies, as they reduce their efficiency and limit their potential profits. Not surprisingly, the industry has long sought new approaches to overcome these limitations. Biotechnologists and the biotech industry are now saying that a major breakthrough has taken place: they are now able to build small artificial chromosomes that carry multiple genes and become fully functional once inserted into a cell. Due to their small size, these artificial chromosomes are called "minichromosomes". It is claimed that they will make the engineering of complex traits possible and that they will dramatically reduce side-effects, as they will not disrupt the native genetic material of the engineered organisms.[3]

A second important development has also taken place, with much less media coverage: the genetic engineering of cell organelles, such as chloroplasts and mitochondria. Because there may be multiple organelles (up to hundreds) per cell, this technique would allow a much stronger expression of the engineered traits. As GE organelles are not transferred through pollen, the industry also claims that genetic contamination of plants would be prevented.

There is still much that is unknown. New research is uncovering a remarkable level of complexity in the web of interactions between genetic material, whole organisms and the environment, which raises questions about how efficient the new technologies will be. Looked at from a commercial point of view, however, it is certainly true that, even if it works only partially, the technology will open up for the industry a whole new world of biotech products and patents. This is because it extends the range of patentable "inventions" beyond genes and traits to chromosomes and complete physiological processes.[4]

What are artificial minichromosomes?

Artificial minichromosomes are small chromosomes built by incorporating genes into a DNA molecule that initially contains only the units that regulate the replication of chromosomes (called telomeres); those that initiate the replication, and those that ensure the right distribution of chromosomes in new cells (called crentromeres).[5] Multiple genes can be added to these two basic units and, to render them functional, there is no need to include the regulating DNA that makes up more than 90 per cent of most natural chromosomes. The biggest artificial minichromosomes built so far carry between a dozen and 20 genes but, in theory, there is no limit to the number of genes that can be included in one single artificial chromosome. Artificial minichromosomes can be built and inserted into all kind of species, from yeast and bacteria, to higher plants, insects, mammals and humans. In fact, in the early years bigger advances were made in developing artificial chromosome technology for animals and humans than for other species, but more recently the technology for plants, yeasts and bacteria has been catching up.[6]

There are natural minichromosomes too, and they are encountered widely among different species and kingdoms. They may be present in the nucleus, as well as in the cell "organelles" that are responsible for photosynthesis, energy processing and other fundamental processes of life. They characteristically lack regulating DNA and may exist in highly variable numbers of copies in the same cell. The role and functioning of natural minichromosomes is little understood, but they may be important in the process of adjusting to very different or changing habitats and conditions.

One characteristic of natural and artificial minichromosomes that has attracted the attention of biotechnologists is that they seem to be more "independent" from the rest of the genetic material than larger nucleus chromosomes. That is, their expression seems not to be determined by – and seems to have little influence on – the behaviour of other chromosomes. When foreign genes are inserted, the genetic material of the artificial minichromosomes is not "silenced" or "deleted", as often happens with genes inserted into existing chromosomes. Once inserted into the cell, artificial minichromosomes also remain physically independent from other chromosomes and genetic material; they are not incorporated into the native DNA and therefore do not cause mutations in the native DNA. Industry and labs developing and using the technology thus claim that minichromosomes will avoid the side-effects of genetic engineering because there will be no disruption of genetic material.[7]

What are transformed organelles?

Organelles – also called plastids – are tiny structures that exist within animal and plant cells. They are the sites where fundamental processes take place, such as photosynthesis and cell respiration. They include chloroplasts, ribosomes and mitochondria. There are multiple copies per cell, each with their own DNA. If a foreign gene or an artificial chromosome is inserted into an organelle, the cell will multiply it, producing new cells with multiple copies of the inserted gene. Under certain conditions that can

3 University of Missouri College of Arts and Sciences press release, 17 December 2007: http://tinyurl.com/a32fpp; entry in Yenra online encyclopaedia, 24 September 2003: http://tinyurl.com/ay2r9v

4 Weichang Yu and James A. Birchler, "Minichromosomes: the next generation technology for plant genetic engineering", University of Missouri, Division of Biological Sciences, August 2007. http://tinyurl.com/7k26mn

5 See, for example patent WO 2007137114 20071129 at http://tinyurl.com/8bxone

6 Arnaud Ronceret, Christopher G. Bozza and Wojciech P. Pawlowski, "Naughty Behavior of Maize Minichromosomes in Meiosis", *The Plant Cell*, American Society of Plant Biologists, 2007. http://tinyurl.com/9vhxup

7 "Transplastomics: a convergence of biotechnology and evolution", WordPress.com blog, posted 16 November 2008. http://tinyurl.com/82rs2d

The main corporate players

The development of artificial minichromosomes and transformed organelles has followed the same pattern as earlier biotech developments: from publicly funded basic research to fully private application and use, with growing concentration in the hands of a few corporations. Two labs have led the way in research into artificial minichromosomes: one headed by Dr Daphne Preuss at the University of Chicago, the other headed by Dr James Birchler at the University of Missouri.

Dr Preuss, who joined the University of Chicago in 1995, worked with her team in the development of methods to build artificial chromosomes. In 2000 she founded Chromatin Inc. as a way of marketing minichromosomes. In 2004 Unilever became the first major corporation to invest in the new firm. In 2007 Chromatin granted Monsanto a non-exclusive licence for the use of minichromosomes and, just four months later, did the same with Syngenta. Both agreements include funds for research, but the amounts involved and the terms of the agreements have been kept secret. All along, Chromatin has continued to receive public funding. Chromatin lists on its web page twelve patents as its own. Six of those patents, however, were actually granted to the University of Chicago[1] and four others are shared with the University. Neither party has disclosed whether the University of Chicago has transferred its rights to Chromatin Inc.

Dr Birchler has long been a professor and researcher at the University of Missouri. His work on artificial chromosomes has been funded by the National Science Foundation, the US Department of Agriculture, and Monsanto.[2] He recently strengthened his links with Monsanto by becoming scientific adviser to Evogene, a biotech company based in Israel that specialises in computer-assisted identification of commercially promising genes. Monsanto currently owns 13.6 per cent of Evogene and will have a 20 per cent stake within 3 years.[3] Evogene will grant Monsanto exclusive licences over identified genes. Monsanto will, in turn, use the technology developed by Birchler or Preuss to engineer those genes into plant varieties.

Transformed organelles have been developed by several University labs, and the privatisation processes have been similar. One of the leading labs, headed by Dr Pal Maliga of Rutgers University, is currently funded by public sources as well as by Monsanto. Another prominent laboratory is headed by Dr Henry Daniell at the University of Central Florida. Dr Daniell has raised record amounts of public money, and the work of his lab is "protected" by over 90 patents. In 2002 Dr Daniell set up a private firm, Chlorogen, to commercialise transformed chloroplasts.[4] In 2005 Chlorogen signed a major agreement with Dow AgroSciences to produce veterinary drugs in plant cells.[5] The company closed in September 2007, selling its technology to undisclosed parties.[6]

Monsanto and Bayer seem to be the corporations to have done most to develop fully commercial applications for both technologies. Monsanto has been very active: it has co-funded, invested, reached research agreements and licensed applications from a variety of university research groups and has also carried out in-house research. It has

be induced, plant cells also increase the number of copies of their organelles. This way GE organelles have the potential to secure multiple copies of the inserted DNA and hence a very high level of expression of the engineered genes, in theory much higher than the improved level that can be reached through minichromosomes.[8]

Although efforts to transform organelles – especially chloroplasts – have been going on for the last decade, they have succeeded in only a few plant species. It is still done "the old way", inserting foreign genes in the organelle DNA, and hence it still faces many of the serious limitations of that approach.[9]

What can be done with these technologies?

The biotech industry expects to solve some of its major hurdles by using minichromosomes. First, they will be able to insert several genes in a cell and thereby expect to make complex traits a feasible target for genetic engineering (although the actual feasibility is still to be seen: complex traits are exactly that and the presence of multiple genes does not guarantee the expression of a complex trait). Minichromosomes will also make "gene stacking" possible: several of the current single genes present in GM crops could be accumulated in one variety, providing a new opportunity to reap profits out of them. "Gene stacking" is currently possible, and is being done by companies such as Monsanto and Syngenta, but the time and work it requires make it far less profitable. Second, artificial minichromosomes should make genetic engineering more efficient by decreasing the type of side-effects that make so many engineered organisms unviable. Third, they will be by-passing many genetic control mechanisms so that the engineered genes will obtain higher and more stable levels of expression.

8 Melinda Mulesky, Karen K. Oishi, David Williams, "Chloroplasts: transforming biopharmaceutical manufacturing", *Biopharm international*, 1 September 2004. http://tinyurl.com/8em3je

9 See Patent Storm, US patent 7235711, 26 June 2007. http://tinyurl.com/9de8y3

been busy signing agreements and obtaining licences from biotech firms, including Chromatin, Evogen, Asgrow and BASF. It is already testing gene stacking through minichromosomes, and it expects to release commercially what it calls its SmartStax "platform" in 2010. On its web page for investors, Monsanto has highlighted the potential use of the technology to lower environmental requirements.[7]

Bayer is focusing its action in the field through Icon Genetics Inc. Founded by two University professors in 1999, Icon Genetics focuses on producing pharmaceuticals through plants. Throughout its life, it has managed to obtain important public grants and has displayed a highly diversified portfolio of agreements with pharmaceutical companies. It was bought by Bayer in 2006. Its products are mostly based on chloroplast engineering, but the company is also working on the engineering of other organelles. It holds at least one patent over a method to produce minichromosomes. It recently opened a new factory in Germany to produce biotech drugs in tobacco plants.[8]

Syngenta has licensed minichromosome technology from Chromatin Inc., and it has already stacked tolerance to glyphosate, rootworm resistance and European corn borer resistance in maize.[9] It holds at least one patent over a method to engineer organelles. Biofuels is one of its main areas of interest. Novartis, Calgene (owned by Monsanto), Pioneer Hi-Bred, and Assgrow are also using the new technologies.

1 They are US Patents 6156953, 6900012, 6972197, 7015372, 7119250, 7132240.

2 University of Missouri College of Arts and Sciences press release, 29 September 2005. http://rcp.missouri.edu/articles/birchler_chromosome.html

3 Evogene–Investor Conference, September 2008. http://www.evogene.com/investors_presentations.asp

4 "About Dr. Henry Daniell", Daniell Lab for Molecular Biotechnology Research, University of Central Florida College of Medicine, 2008. http://daniell.ucf.edu/people/daniell

5 "Dow AgroSciences, Chlorogen to co-develop chloroplast transformation technology for plant cell culture and crop improvements", Dow AgroSciences press release, 16 September 2005. http://www.dowagro.com/newsroom/corporatenews/2005/20050916a.htm

6 "Biotech Startup Chlorogen Shuts Down, Starts Selling Off Its Technology", BioSpace, 12 September 2007. http://www.biospace.com/news_story.aspx?NewsEntityId=69496

7 See http://www.monsanto.com/pdf/investors/2008/12-09-08.pdf

8 "Pilot plant for future-oriented technology opens in Halle", Icon Genetics press release, 16 June 2008. http://www.icongenetics.com/html/5948.htm

9 See Syngenta's Research & Development front page on its website. http://www.syngenta.com/en/about_syngenta/researchanddevelopment.html

If the industry is to be believed, artificial minichromosomes will make the engineering of complex traits possible, which means that it will possible to produce almost any substance through genetic modification. What does this mean for the future of genetic engineering? The industry puts forward two versions. When it is being careful about its public image, it presents this new technique as an effective and safe technology for – yet again – saving the world from hunger and environmental problems. Daphne Preuss, a leading scientist from the University of Chicago, who is now the president of Chromatin Inc., has made presentations for the Gates Foundation and the United Nations on how this technology could herald a breakthrough for African agriculture.[10] However, when discussing the possible applications of the new technology in patent applications, the biotech industry deals with the genetic engineering of crops for food production as only a secondary target, the main goal being pharming (the production of drugs and chemicals through engineered crops). Companies want to create GE plants that will produce drugs, human and animal proteins, and biofuels, as well as specific industrial raw materials, including toxins. Other possible uses include "the production of nutraceuticals, food additives, carbohydrates, RNAs, lipids, fuels, dyes, pigments, vitamins, scents, flavours, vaccines, antibodies, hormones, and the like."[11]

The idea of using crops to produce drugs is an interesting one for industry for two reasons: crops can be employed more efficiently in this process than animals or bacteria, with a larger output achieved with fewer resources; and it is easier for the drugs produced to be delivered orally to people and animals.[12] Other types of organisms have not been discarded, however. Bacteria remain an important target, because they are easier to engineer and they can be more easily used to produce high-value molecules in small quantities; they may, however,

10 See http://tinyurl.com/7hafo7

11 WIPO Patent N°.2007/030510. http://tinyurl.com/a9crbb

12 Melinda Mulesky, Karen K. Oishi, David Williams, "Chloroplasts: transforming biopharmaceutical manufacturing", *Biopharm international*, 1 September 2004. http://tinyurl.com/8em3je

face important regulatory problems. Other species being transformed and tested as possible drug factories are insect larvae and moss.

The application of minichromosomes does not end there. As well as promising higher yields, nitrogen fixation and resistance to salt, drought, heavy metals, viruses, insects, diseases and changes in climate – or any combination thereof – companies are consistently claiming in their patent applications to have the ability to alter plant architecture and physiology, including the process of photosynthesis. In the words of WIPO patent 2007/030510, it may be possible to obtain "resistance or tolerance to drought, heat, chilling, freezing, excessive moisture, salt stress, mechanical stress, extreme acidity, alkalinity, toxins, UV light, ionising radiation or oxidative stress; increased yields, whether in quantity or quality; enhanced or altered nutrient acquisition and enhanced or altered metabolic efficiency; enhanced or altered nutritional content and makeup of plant tissues used for food, feed, fiber or processing; physical appearance; male sterility; drydown; standability; prolificacy; starch quantity and quality; oil quantity and quality; protein quality and quantity; amino acid composition; modified chemical production; altered pharmaceutical or nutraceutical properties; altered bioremediation properties; increased biomass; altered growth rate; altered fitness; altered biodegradability; altered CO_2 fixation; presence of bioindicator activity; altered digestibility by humans or animals; altered allergenicity; altered mating characteristics; altered pollen dispersal; improved environmental impact; altered nitrogen fixation capability".[13] There is, it would seem, a huge range of biologically possible alterations, and industry will establish its targets by seeing which GE modifications are most profitable.

The genetic engineering of organelles offers another set of rewards for the biotech industry, especially through the engineering of plant chloroplasts. The most important of these is much higher levels of productivity of whatever substance the engineered plant will make. If, for example, each cell holds tens of chloroplasts and each chloroplast holds over 200 copies of the foreign DNA, the potential production of the engineered substance will, in theory at least, be many times more than it is with the use of current techniques. And tests have, indeed, shown "hyperexpression" of the transgenes.

A second important promise for industry is the stable passing on to the next generation of the foreign DNA. Organelles are transferred through the so-called "maternal inheritance" as identical copies. A female animal will transfer identical copies to all its offspring and a plant to all the seeds it produces, without changes from one generation to the next. Industry claims that this will ensure the stability of the GE traits from generation to generation. They also claim that, as pollen grains and semen cells do not carry GM organelles, there is no possibility of them being accidentally transferred to other organisms. In other words, GM organelles will be a powerful biosafety tool for preventing genetic contamination, they say.[14]

An obvious powerful development would be to put these two techniques together. The different research groups that have been developing the new techniques do not seem to be talking much to each other, but some of the big biotech companies are working hard to combine the techniques and to use them together, mostly in plants. Bayer has been very active through Icon Genetics Inc. They already claim widespread success in engineering plastids, and have at least one patent related to minichromosomes. Monsanto, which was the first company to engineer chloroplasts, has funded research on minichromosomes at the University of Missouri and has signed a licence agreement with Chromatin Inc., one of the leading players in the new field, for the use of its minichromosome technology. Syngenta is also working with both technologies, although it seems less actively involved than Bayer and Monsanto.

What can be expected from all this?

Artificial minichromosomes and GE plastids are advancing fast, especially for plant species, and some of their field applications are already available. Their impact – independently or working together – may well be huge. The production of all types of molecules and chemicals is now within reach and economically promising, and for various biotech companies the opportunity is too attractive to let pass. It seems inevitable that in the not too distant future we will have multiple GE crops producing toxic substances. Due to their possible application in biofuels and industrial inputs, such toxic crops will eventually cover large areas. Because biotech companies claim that engineered organelles will contain genetic contamination, they will probably manage to introduce the new crops into the field without proper tests or regulation.

The new technologies are, however, far from safe. It may well be true that engineered plastids will not be transferred through pollen in 99 per cent of cases but, given the huge number of pollen grains

13 WIPO Patent N°.2007/030510. http://tinyurl.com/a9crbb

14 Bao-Rong Lu "Transgene escape from GM crops and potential biosafety consequences: an environmental perspective", International Centre for Genetic Engineering and Biotechnology, Collection of Biosafety Reviews, Vol. 4, 2008: 66–141. http://tinyurl.com/7nn3h7

that any plant can produce, one per cent transfer is enough to produce widespread contamination. Toxic genes will be disseminated at a lower speed than is the case with current transgenes, but they will still be disseminated.[15]

There is another route for genetic contamination by artificial chromosomes: widespread transfer through bacteria. Bacteria are readily able to acquire DNA from other bacteria[16] and to transfer it to other bacteria and micro-organisms, and to plants. The pathogen *Agrobacterium tumefaciens* is used in the genetic engineering of plants because it is particularly effective at doing this, but all bacteria have the potential to do the same. Artificial minichromosomes share important characteristics with bacterial DNA, and it is to be expected that bacteria will be able to incorporate some of their genes and transfer them to other bacteria, micro-organisms and plants. So artificial minichromosomes will create new forms of contamination, between species and, more alarmingly still, between kingdoms.

Industry acknowledges other dangers too. Icon Genetics, which is owned by Bayer, indicates in one of its patent applications that not only will the transgenes in chloroplasts lead to the production of different drugs and chemicals, but the hyperproduction of those substances can be highly toxic for the plants, to the point of endangering their development and survival. Instead of seeing this as a good reason for stopping the development of the technology, Icon Genetics is using this as a justification for developing different forms of Terminator-type technology. They are developing plants with genes that will control the expression of other genes at almost any point of development. The control can be switched on and off by externally applying substances as diverse as DNA, RNA, lactose, tetracycline, arabinose, ethanol, steroids, copper ions and so on.[17] Once this technology is accepted, nothing will stop industry from using it to produce Terminator seeds.

It must not be forgotten also that both new technologies will significantly broaden the scope of patentable "inventions". Gene patenting will be expanded to the patenting of chromosomes, organelles and entire physiological processes. Given the wide and diverse potential applications of minichromosomes and transformed plastids, patents and patent claims will multiply quickly and aggressively. The web pages for the laboratory of Dr H. Daniell at the University of Central Florida states that "Dr Daniell's chloroplast genetic engineering technology is protected by more than 90 US and international patents".[18] Industry is not lagging behind. In a list of patents published at MolecularFarming.com, two thirds of those related to pharming to have been filed or granted since 2001 are in the hands of major biotech companies.[19]

We urgently need to monitor these new developments closely and to strengthen social opposition to these and other forms of genetic engineering. Far from solving the many problems caused so far by genetic engineering, artificial chromosomes and transformed organelles create new dangers, exacerbate industrial concentration and corporate control, and open the way for serious and perhaps irreparable damage to all forms of life on our planet.

15 "Transplastomics: a convergence of biotechnology and evolution", WordPress.com blog, posted 16 November 2008. http://tinyurl.com/82rs2d; "Researchers attach genes to minichromosomes in maize", Biology News Net, 14 May 2007. http://tinyurl.com/92xlsk

16 Entry giving definition of "plasmid" at Answers.com. http://tinyurl.com/7yn9tb

17 Icon Genetics and Stefan Mühlbauer, WIPO patent application (WO/2005/054481) "Controlling gene expression in plastids", 16 June 2005. http://tinyurl.com/a5nzcc

18 "About Dr. Henry Daniell", Daniell Lab for Molecular Biotechnology Research, University of Central Florida College of Medicine, 2008. http://tinyurl.com/7mn99a

19 "Molecular farming and plant pharming/biopharming – Chloroplast transformation method and Chloroplast engineering patents", MolecularFarming.com. http://tinyurl.com/7fbobc

In 2008 many developing countries were severely affected by the food crisis, which led to sharp increases in the price of many staple foods. People and organisations examined the situation in their own countries and questioned the policies adopted by their governments. In this article an activist from the small island of Guadeloupe, situated in the Caribbean but integrated into France, explains how the crisis has affected her country.

The food crisis in Guadeloupe

PAMELA OBERTAN*

* **Pamela Obertan**, from Guadeloupe, is studying for a doctorate in law in Canada. She is carrying out research into social movements that are resisting GMOs and the patenting of life.

When in the middle of last year scenes of food rioting appeared on millions of television sets around the world, many people in Guadeloupe felt a shiver run down their spine. Some of our Caribbean neighbours, such as Haiti, were badly affected by the crisis. We saw thousands of Haitians marching down the streets yelling "we are hungry". Could that happen here? we wondered. These events caused people to stop and think, and so we organised debates on the food crisis.

Guadeloupe has every reason to be concerned about the food crisis. After centuries as a French colony, this French Caribbean *département* still imports around 80 per cent of its food. It is therefore very dependent on the world market and vulnerable to price fluctuations. Local peasant organisations, however, such as the Union des Paysans Guadeloupéens (UPG), and some of the island's leading individuals, such as the pharmacologist Henry Joseph, believe this situation to be absurd. Guadeloupe has a number of assets. It has, for example, good quality soils (which have unfortunately been too often polluted), a tropical climate that allows the land to be farmed all year round, and a wide variety of plant and animal species (220 edible species, including 130 fruits and 60 vegetables). In addition, local products are rich in antioxidants and contain vitamins A, C and E.[1] These products are very good for people's health and help the body to fight the main causes of premature death in Guadeloupe – diabetes and cardiovascular diseases. There are therefore very good reasons for Guadeloupians to eat local products rather than imported ones, which are generally processed and have little nutritional value.

It is, however, very difficult for farmers to grow crops for the local market and to diversify their produce. The authorities have neglected subsistence agriculture and have favoured export crops, such as sugar cane and bananas, which alone cover half of the island's cultivated land. This paradoxical situation largely stems from certain unjust structures imposed on the the island in its history. Guadeloupe was a French colony and was forced to send much of its agricultural production to France and other markets. Little land was left for production for the local market, and the island was therefore obliged to import most of its food from France. This set-up, which is very disadvantageous for Guadeloupe, persists today. It perpetuates a

1 Carib Créole, "Nutrition: un régime diétique caribéen", 27 August 2008, at: http://tinyurl.com/9zgq29.

400-year-old history of exporting primary produce with very little added value and importing much more expensive refined and processed products. The result is a large trade deficit.

Moreover, the population's tastes are clearly westernised. Local people often prefer to consume imported products, which are often cheaper than local products. An alarming fact is that many young Guadeloupians no longer know the names of local fruit and vegetables, and have developed a phobia about foods they do not know.[2] So Guadeloupians eat very little of their local produce and, if the food crisis were to hit Guadeloupe, we could end up dying of hunger at the foot of a mango tree laden with fruit. In order to prevent such a situation ever arising, local groups are calling on the people of Guadeloupe to consume local produce. This summer, several individuals and organisations, including the UPG, joined together to raise the population's awareness of this issue. In the context of the food crisis, to eat locally has become a real act of citizenship.

Nevertheless, encouraging citizens to eat local food is not enough: we also need to change the government's policies to support farmers. What is needed is a complete restructuring of the sector.[3] Farming on the island is too concentrated on a limited number of crops, and the trade in Guadeloupian produce is dominated by a few companies that extract high profits. Government policies have to address these issues and ensure that farmers receive a decent income that reflects the important role they play in preserving the countryside and managing water resources. The UPG believes that a new policy is required, based on the idea of sustainable development,[4] that promotes a system of agriculture that respects the environment and benefits all.[5] Agriculture should preserve and enrich local biodiversity, taking advantage of both traditional and scientific knowledge. It should also respect both the people and the land by avoiding the use of pesticides.

Many ideas, such as food sovereignty, are being discussed in Guadeloupe, and efforts are being made to increase the awareness of the population and the authorities about the importance of small farming. This work is beginning to bear fruit and Guadeloupians are becoming better informed and more aware of the situation. There are many cultural manifestations of this growing interest in local produce, including an increasing number of farmers' markets, such as the "ti bourg" market organised by the Petit Bourg commune.

Age-old customs, such as Creole gardens, are making a comeback. The Creole garden dates from the time of slavery when slave-owners allowed slave families to cultivate plots of land so that the slave-owners did not have to provide them with food, which was mostly imported and often very expensive. The Creole garden was closely integrated with the tropical environment around it. Because the sea voyage from Europe was long, very few living plants were imported from France. As a result, the people used the plants in the forests around them and from neighbouring tropical regions. The proliferation of these gardens throughout the island made it possible to preserve, improve and diversify many vegetable species.

The gardens became true temples of biodiversity. They were used to grow vegetables (such as sweet potato and breadfruit), fruit (such as banana, soursop and mango) and the spices used in local cooking (such as peppers, thyme and onion). They also became a pharmacy for poor people, who would grow all kinds of medicinal plants in them. Cultivation methods were respectful of nature, and no fertilisers or pesticides were used. All farming was done by hand. The people listened to the land and understood the cycle of life. Once a garden had been created, it was never abandoned.

When slavery came to an end, the practice of cultivating Creole gardens continued for many years and was passed from generation to generation, especially in the countryside. Although people usually had large families, they preferred to build small houses so that the rest of their land was available to be gardened. But with modernisation, urbanisation and the spread of consumer society, this age-old custom almost disappeared. More recently, however, initiatives have been taken to encourage the population to resurrect and protect this important contribution to food self-sufficiency. The Guadeloupe Regional Council, the country's chief political body, is becoming aware of the potential offered by these gardens. The struggle for food sovereignty has only just begun here, and it can count on the creativity and energy of the Guadeloupian people.

2 See the thesis by Nathalie Rigal and explanations by Dr Henry Joseph, "Henry Joseph: la patate douce a démontré ses vertus santé", in the online magazine LaNutrition.fr. http://tinyurl.com/a3h9oh

3 Marc Divirin, "Les évolutions de l'agriculture en Guadeloupe: caractéristiques et enjeux", Report of a seminar, 21–24 November, Bouillante, Guadeloupe. http://tinyurl.com/94fjbm

4 Alain Galladine, "Agriculture paysanne et contrat durable: la vision de l'UPG", 18 August 2004. http://tinyurl.com/9ox7w8

5 UPG, "Accueil", 2008. http://tinyurl.com/74xluz

Genetically modified (GM) soya was introduced into Argentina in 1996 without any kind of debate either in Congress or among the public. Since then, its cultivation has spread across the country like wildfire. Today more than half of the country's arable land is planted with soya. No other country in the world has devoted such a large area to a single GM crop. Argentina provides a unique opportunity to investigate the consequences for a country of intensive GMO cultivation.

Twelve years of GM soya in Argentina

a disaster for people and the environment

GRAIN

With this year's planting season well under way, it is estimated that Argentina will be planting soya on a record 18 million hectares, about half of the country's farming land. Almost all of the soya planted today is Monsanto's Roundup Ready (RR), a type of soya that has been genetically modified to be resistant to the Roundup herbicide – largely composed of glyphosate – which is also manufactured by Monsanto. So what have the consequences been for the people and for the country?

Perhaps those who have suffered most have been small farmers and peasant families. Even before RR soya was introduced, the Argentine government adopted policies that favoured big farmers, deciding that farming units smaller than 200 hectares were "uneconomical", and predicting that at least 200,000 farmers would have to leave the land.[1] Since then, government policies have not changed. Thousands of peasant families have been evicted violently from their land for trying to resist the advance of soya. Members of the Movimiento Campesino de Santiago del Estero (Mocase), a peasant movement in northern Argentina linked to Via Campesina, and of the Movimiento Nacional Campesino Indígena suffer constant harassment for trying to halt the advance of the soya front.

The families that manage to stay on the land have also been badly affected, particularly by chemical contamination, which has grown worse in recent years. When it introduced RR soya, Monsanto promised that there would be a dramatic decline in herbicide use. As RR soya had been genetically modified to be resistant to glyphosate, Monsanto argued that it would be possible to kill all weeds by applying the herbicide just once, early on in the planting season. In fact, this advantage never materialised as strongly as the company predicted. Instead of falling, national consumption of glyphosate has risen dramatically: Argentina

1 Lilian Joensen, Stella Semino and Helena Paul, "Argentina: A Case Study on the Impact of Genetically Engineeered Soya", The Gaia Foundation, 2005.

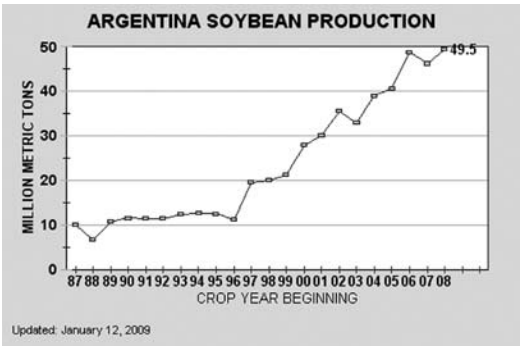
* In November 2008 the third meeting of Rural and Urban Women for Food Sovereignty was held in Santa Fé in Argentina. One of the working groups decided to hold their two-day seminar on the railway line owned by the private company Belgrano Cargas, which is used during harvest to transport soya beans. It was a protest, the women said, against the "soya model" and against the privatisation of the railways. For 48 hours they halted all traffic on the line, causing losses to the rail company estimated at US$200,000.

These are extracts from the document that the women issued to explain their action:

- The soya model contaminates our environment and, by concentrating land and the means of production, expels peasant communities from the land they have occupied for many years, increasing the vulnerability of all, but particularly of women and children.
- You only have to look along the edges of the so-called "roads of production" to catch a glimpse of the life to which expelled people are condemned. They are forced to live in dark, forgotten places, where the only light comes from gambling dens and bars. The women are economically and sexually exploited, not only by men but by a whole ideological system validated by our society.
- To attack women is to attack food sovereignty, since women produce 80 per cent of the food that the world consumes. It is for this reason that the struggle for food sovereignty, the struggle to stay on the land and recover our capacity to produce what we eat, is also a struggle to regain sovereignty over our bodies.
- As we women are responsible for feeding our families, we have to be to be at forefront of the struggle to replace a model of consumption, commercialisation and production that fills the coffers of transnational companies at the expense of the well-being of our people.
- We are fighting for a new economy that respects people and nature, that includes everyone and guarantees the just distribution of all production so that everyone can live a life of dignity, happiness, autonomy and sovereignty.
- NO TO MONOCULTURE! YES TO TRAINS FOR ALL (BUT NOT FOR SOYA)!

is estimated to have used 200 million litres of glyphosate in 2008, compared with 13.9 million litres in 1996.[2] In other words, while the Argentine soya harvest has increased fivefold during the period, consumption of glyphosate has increased fourteenfold.

The intense application year after year of a single herbicide – glyphosate – has led to the emergence of weeds that have become resistant to this chemical. Some of the better known of these "super-weeds", as they are popularly called, are: *Hybanthus parviflorus* (Violetilla), *Parietaria debilis* (Yerba Fresca), *Viola arvensis* (Violeta Silvestre – Field pansy), *Petunia axillaris* (Petunia), *Verbena litoralis* (Verbena), *Commelina erecta* (Flor de Santa Lucía – Slender dayflower), *Convolvulus arvensis* (Correhuela – Field bindweed), *Ipomoea purpurea* (Bejuco – Morning glory), *Iresine difusa* (Iresine) and recently *Sorghum halepense* (Sorgo de alepo – Johnson grass), which, because it is a difficult weed to control, has caused considerable alarm among farmers.[3]



Source: USDA

To deal with these weeds and also with "volunteer" soya – that is, soya that sprouts out of season – soya farmers have started spraying the land with stronger herbicides before planting. It is estimated that today 20–25 million litres of 2,4-D, 6 million litres of atrazine (banned in the European Union in 2004 because it contaminates groundwater) and 6 million litres of endosulfan (a highly toxic organochlorine insecticide) are used on the soya fields each year.[4] Experts quoted in a study by Friends of the Earth believe that an additional 25 million litres of non-glyphosate herbicides will be required each year to control Johnson grass.[5]

The soya farmers make little effort to prevent chemicals being carried by the wind into the homes and on to the land of the rural population. As a result, the chemicals have seriously affected the health of both people and domestic animals, damaged food crops and contaminated the soil, water courses and the air. Even though there are no official statistics for the overall picture, organisations have collected detailed information on hundreds of cases and have repeatedly complained to the authorities.[6]

2 Secretaría de Ambiente y Desarrollo Sustentable, "El avance de la frontera agropecuaria y sus consecuencias", March 2008.

3 Walter A. Pengue, "El glifosato y la dominación del ambiente", Biodiversidad, July 2003; Monsanto, "Se confirma la resistencia de un biotipo de Sorghum halepense a glifosato en Tartagal, Salta", 16 August 2006. http://tinyurl.com/7wdzcu

4 Friends of the Earth, "Who benefits from GM crops? The rise in pesticide use", January 2008, p. 19.

5 Ibid., p. 20.

6 Diego Domínguez and Pablo Sabatino, "La muerte que viene en el viento. Los problemática de la contaminación por efecto de la agricultura transgénica en Argentina y Paraguay", November 2008.

Protest against GM soya, Buenos Aires

Urban dwellers, too, have been indirectly hurt by the soya boom. The export model dominated by soya has threatened the country's food sovereignty. Argentina used to produce plentiful quantities of cheap meat, dairy produce, lentils, beans and other vegetables. Mixed farming, with livestock and crops in rotation, provided good yields. Soya monocropping has changed all that. The number of dairy farms fell 50 per cent between 1988 and 2003, from 30,000 to 15,000.[7] National production of most staple foods has declined sharply. Argentina, which used to be called "the granary of the world", is having to import food. People are even going hungry. It is not only food crops that have been affected: cotton production has fallen by 40 per cent in the province of Chaco and 78 per cent in the province of Formosa.

While the majority of farmers have been greatly harmed, the adoption of GM soya has clearly strengthened some groups within the country. Big farmers, many of whom are linked to "pools" of financial investors, have greatly extended their control over the farming sector. Financial returns on soya are not high per hectare, so, in order to make large amounts of money, the pools have been leasing vast stretches of land from thousands of small and medium-sized farmers, many of them dairy cattle farmers or food producers, driven out of business by the export-oriented economic policies.

One of the advantages of GM soya for big farmers is that it facilitates "no-till" farming – that is, farming without ploughing the land, which means that they need few labourers. Indeed, it is estimated that only one labourer is required for every 500 ha of soya. So the farmers are able to farm intensively, using gigantic machines. They pay little attention to the long-term health of the soil, particularly if they are leasing the land and returning it to its owners once its fertility has been exhausted. Huge profits are possible by farming this way: one of the bigger producers, Grupo Los Grobo, which has 150,000 ha under soya, has an annual income of US$400m and expects to double its turnover this season.[8]

The price Argentina pays for these few financial groups' high profits is the mortgaging of its long-term future. Each year more than 200,000 ha of native forest are felled as the agricultural frontier advances.[9] With the intense monocropping come leaching, erosion and soil degradation. It has been estimated that the deforestation results in 19–30 million tonnes of soil being washed away each year. Moreover, soya cultivation extracts nutrients from the soil and absorbs water, embedding them in the crop. In practice, this means that 1 million tonnes of nitrogen and 160,000 tonnes of phosphorus are "exported" each year, along with 42.5 billion cubic metres of water.[10] These are serious losses. Argentina will need these resources in the future for its agricultural development.

The costs of the soya boom have rippled out beyond the country's borders, for Argentina was used by Monsanto as a gateway for the expansion of GMOs into the rest of the southern cone. For six years a small group of Brazilian consumers and environmentalists fought doggedly in the courts to keep GMOs out of their country, but their battle was fatally undermined by the smuggling of RR soya over the frontier from Argentina. Seduced by the extravagant promises made by salesmen, Brazilian farmers bought the illegal seeds on such a scale that the official ban on GMOs became meaningless and was revoked by president Lula. Similar tactics were used to spread RR soya into Paraguay and Bolivia.

Harvesting the vast soya fields, Argentina

7 Secretaría de Ambiente y Desarrollo Sustentable, "El avance de la frontera agropecuaria y sus consecuencias", March 2008.

8 "Los Grobo esperan duplicar su facturación el próximo año", Clarín, 28 February 2008. http://tinyurl.com/8l7tfw

9 Secretaría de Ambiente y Desarrollo Sustentable, "El avance de la frontera agropecuaria y sus consecuencias", March 2008.

10 Walter A. Pengue, "'Agua virtual', agronegocio sojero y cuestiones económico ambientales futuras", Instituto Argentino para el desarrollo económico, Realidad Económica No. 223, 24 November 2006. http://tinyurl.com/9p52ng

The RR soya frenzy, which is turning the southern cone into what has been called the "Republic of Soya", has led to no increase in productivity, despite all the promises made by the salesmen. Indeed, a recent investigation by the University of Kansas shows that RR soya has an average yield that is 6–10 per cent lower than that of conventional soya.[11]

"Soya monoculture = death", says a banner on an anti-GM protest march in Argentina

Prospects

"Superweeds" created by ecological imbalances inherent in monocropping with a GM crop, long predicted by ecologists, are jeopardising the long-term economic and environmental viability of RR soya. But instead of rethinking the whole agricultural model and encouraging farmers to return to mixed farming, where natural balances make it far easier to control weeds, the Argentine authorities are offering their full support to Monsanto, which is planning over the next five years to introduce a new form of GM soya. The new soya will have a gene inserted into it which makes it resistant to dicamba, a herbicide that kills broadleaf weeds.

According to Robert Hartzler, a weed specialist at Iowa University, dicamba brings its own problems.[12] The compound's volatility means that it will kill off broad-leaved plants on fields and in houses up to half a kilometre away, which will undoubtedly cause yet further serious problems for the rural population. Monsanto is confident that resistance won't become a serious problem, but Hartzler is not so sure. "I don't think we can say that resistance won't develop", says Hartzler, "but it is a much lower likelihood than with other herbicide classes. But then, that's what they originally said about glyphosate."[13]

Another technical fix and another swathe of problems for Argentina's communities. How long will this madness prevail?

11 Silvia Ribeiro, "¿Quiere bajar la producción? ¡Use transgénicos!", La Jornada, Mexico, 19 July 2008. http://tinyurl.com/8asylc

12 Heidi Ledford, "Geneticists create 'next generation' of GM crops: Soya beans could be treated with alternative herbicide", Nature, 24 May 2007. http://tinyurl.com/7gatxz

13 Ibid.

Going further (with videos, protests and analysis)

Campaña Paren de Fumigar
http://www.grr.org.ar/campanapdf/index.php

Soja para Hoy, Hambre para mañana
http://sojahambre.blogspot.com/

Redaf
http://redaf.org.ar/noticias/?p=329

Fundación Proteger
http://www.proteger.org.ar/soja

La Soja Mata
http://www.lasojamata.org/es

Instituto de Investigaciones Gino Germani
http://www.iigg.fsoc.uba.ar/pub_rural.htm

GEPAMA
http://www.gepama.com.ar/

Video Hambre de Soja
http://www.dailymotion.com/video/xu9kc_hambre-de-soja

RR, La cosecha Amarga
http://www.rrlacosechaamarga.blogspot.com/

For further information

GRAIN
www.grain.org

Biodiversidad en América Latina y el Caribe
www.biodiversidadla.org

Nerica: a "wonder" rice?

GRAIN

A cross between African and Asian rice – dubbed New Rice for Africa (Nerica) – is being hailed as a "miracle crop" that can bring Africa its long-promised Green Revolution in rice. A powerful coalition of governments, research institutes, private seed companies and donors are leading a major effort to spread varieties of Nerica seeds to all of the continent's rice fields. They claim that Nerica can boost yields and make Africa self-sufficient in rice production. But is Nerica living up to the hype? In a recent report[1] GRAIN explains the origin of Nerica and assesses its success.

Rice has a long and varied history in Africa. African farmers probably domesticated this grain at the same time as Asian farmers – about 3,000 years ago. African farmers developed the species *Oryza glaberrima*, while Asian farmers developed *Oryza sativa*. *Oryza sativa* was introduced to Africa about 500 years ago, however, and peasants there have adapted it to their rice production systems, developing many local varieties of the Asian species and turning Africa into an important secondary source of diversity.

Nerica was developed using complex embryo rescue techniques to cross the Asian *Oryza sativa* rice with the African *Oryza glaberrima* rice. The first Nerica variety was developed in 1994 by researchers at WARDA,[2] using an *Oryza sativa* japonica variety (WAB 56-104) and an African *Oryza glaberrima* variety (CG 14). WARDA researchers developed several other hybrids, working with Japanese researchers on the Inter-specific Hybridisation Project (IHP), financed by the Japanese government, the US Rockefeller Foundation and the United Nations Development Programme (UNDP). These inter-specific hybrids were supposed to combine the high yield of their Asian parent with the adaptability to local conditions of their African parent.

At first, the Nerica researchers insisted that they did not intend Nerica to replace local diversity. Indeed, the incorporation of new seeds is nothing new for African farmers. New varieties are often mixed with old and become part of the selection process, contributing to the local genetic heritage.[3] The Nerica project researchers could have used these peasant seed systems as the point of departure for their programme, but the project team feared that the formal seed systems of the national research programmes would be too slow. So they chose instead to stay in their laboratories and work with hybrids from the CGIAR's gene bank. It was only after developing the Nerica hybrids that the researchers sought out the farmers.

Map compiled by GRAIN, January 2009

Where Nerica seeds are being tested or supplied to farmers

Experience among farmers since the first Nerica varieties were introduced in 1996 has been mixed, GRAIN found, with reports of a wide range of problems. Perhaps the most serious concern with Nerica is that it is being promoted within a larger drive to expand agribusiness in Africa, which threatens to wipe out the real basis for African food sovereignty – Africa's small farmers and their local seed systems. The political and financial support for Nerica given by all the ministries of agriculture and the national and international agricultural research institutes in Africa makes it clear, if there were still any doubt, that governments and scientists are interested only in "modern" varieties, and care little for traditional varieties that farmers have adapted to local conditions. If Africa is to move towards food sovereignty – which entails, broadly, producing what it consumes and consuming what it produces – then it needs to value the centuries-long work of African rice farmers. As a Benin proverb says, "it is to the end of the old piece of rope that we need to attach the new piece". Africa's local seed systems are the necessary basis for its food sovereignty.

1 GRAIN Briefing, "Nerica: another trap for small farmers in Africa", January 2009. www.grain.org/briefings/?id=215

2 WARDA (the Africa Rice Group – formerly the West Africa Rice Development Association), is a member of the Consultative Group on International Agricultural Research (CGIAR). WARDA has 22 members: Benin, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Egypt, Gambia, Ghana, Guinea, Guinea Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Uganda, Senegal, Sierra Leone, Central African Republic, Republic of Congo, Democratic Republic of Congo and Togo. In January 2005, the Centre moved its offices from Bouaké, Côte d'Ivoire to Cotonou, Benin, because of the civil war in Côte d'Ivoire. It has regional research stations near St Louis in Senegal and at the International Institute of Tropical Agriculture (IITA) at Ibadan in Nigeria. http://tinyurl.com/5msnje

3 Edwin Nuijten, "Farmer management of gene flow: The impact of gender and breeding system on genetic diversity and crop improvement in The Gambia", thesis, University of Wageningen, 30 November 2005.

Grabbing land for food

GRAIN

As was widely reported around the world in November, Daewoo Logistics, a subsidiary of the South Korean conglomerate Daewoo Corporation, is seeking to secure rights to 1.3 million hectares of farm land in Madagascar – half of the country's arable land. The land will be used to produce maize for export back to South Korea. Daewoo says that the deal will help South Korea to obtain food security, but that is not the way many Koreans see it. In an interview with GRAIN (available on our website),[1] Han Young Me, from the Korean Women Peasants Association, said: "The government should think of how to secure self-sufficiency in Korea instead of overseas and the government should be working together with farmers, side by side. But the government is not doing this and in 2008 our level of food self-sufficiency went down. If you go out into the fields, you will see that farmers have left produce to rot because they can't find a market where they can sell it."

What is happening in Madagascar forms part of a global trend. In a report published in October 2008,[2] GRAIN describes how a host of nations – China, South Korea, Japan, Saudi Arabia, Kuwait and others – have been scouring the globe in search of arable land to buy or to lease for the production of crops for food or biofuels. What attracts attention is not just the amount of land involved – some of the deals involve more than a million acres – but the logic underlying the transactions. For this is not land that is being primarily acquired to produce crops to sell on the world market or to feed the local population. These crops are to be sent back to the nation that has acquired the land. Using its economic clout, the investing nation is taking over land – and, with it, the soil fertility and the water that are needed to cultivate crops – so that its people back home can have food to eat and fuel to put into their cars. It's a modern-day version of the 19th century Scramble for Africa.

It is not difficult to see what is driving this land grab. To a large extent, it stems from the global financial crisis (to which the world food crisis is linked). There are two parallel agendas driving two kinds of land grabbers. The first track is food security. A number of countries that rely on food imports and worry about tightening markets are seeking to outsource their domestic food production by gaining control of farms in other countries. Saudi Arabia, Japan, China, India, Korea, Libya and Egypt all fall into this category. High-level officials from many of these nations have been on the road since March 2008 in a diplomatic treasure-hunt for fertile farmland in places such as Uganda, Brazil, Cambodia, Sudan and Pakistan. The second track is financial returns. Given the current financial meltdown, all sorts of players in the finance and food industries – the investment houses that manage workers' pensions, private equity funds looking for a fast turnover, hedge funds driven off the now collapsed derivatives market, grain traders seeking new strategies for growth – are turning to land, for both food and fuel production, as a new source of profit.

But while their starting points may differ, the tracks eventually converge. Where they come together is the private sector, which in both cases will be firmly in control. So whichever of the two tracks you look at, they point in one direction: foreign private corporations getting new forms of control over farmland to produce food not for the local communities but for someone else. Did someone say colonialism was a thing of the past?

What does it all mean?

One of the clear consequences of the global land grab is that workers, farmers and local communities will inevitably lose access to land for their food production. The very basis on which to build food sovereignty is simply being bartered away. And it is not only the questionable issue of giving foreigners control of domestic farmland but also the restructuring of the farming sector that this process entails. For these lands will be transformed from smallholdings or forests or whatever they may be into large industrial estates connected to far-off markets. Farmers will never be real farmers again, job or no job.

1 Interview with Han Young Me, Chief of Policy, Korean Women Peasants Association (KWPA), Dae-gu, South Korea, 4 December 2008, available in transcript and in audio. http://www.grain.org/videos/?id=194

2 GRAIN Briefing, *Seized: The 2008 land grab for food and financial security*, with accompanying annex listing more than 100 cases of land-grabbing for offshore food production, October 2008. http://www.grain.org/briefings/?id=212

La Gazette - dgi
VENDREDI 21 NOVEMBRE 2008

Politique 3

Des Coréens ont acquis 1,3 million d'hectares

Madagascar est-elle à « vendre » ?

Depuis quelques semaines, ce n'était que rumeur. Dès septembre, *« La Gazette »* a cherché, en vain, à connaître la teneur d'un accord entre l'Etat malainsi que les *« dessous »* de ce contrat…

L'accord en question, conclu au mois de juillet dernier à Antananarivo, consiste à louer à

4ème importateur mondial de maïs (11 millions de tonnes par an).

Autre détail (qui n'en est pas un) : les négociations, qui ont finalement abouti à ce fameux accord

Somapalm soit absorbée par ce conglomérat sud-coréen.

Où est la valeur ajoutée pour Madagascar ? Peut-être dans la

Malgaches qu'ils ne sont bons que pour cultiver des patates, du riz, du manioc…

Les différents régimes qui se

plantation d'oranges... Et pourquoi aussi l'Etat malgache refuse-il aux Mauriciens d'exploiter les 30 000 hectares à Ankazobe, un souhait

"Is Madagascar for sale?" asks Antananarivo's La Gazette de la Grande Ile *of 21 November 2008, in its headline to the story about the South Korean company's acquisition of 1.3 million hectares of Madagascar's farmland.*

Valentina Hemmeler Maïga works for the peasant farmers' association in Switzerland, Uniterre, which is a member of La Via Campesina. She is responsible for Uniterre's food sovereignty campaign.

Valentina Hemmeler Maïga

A Farida Akhtar
B Benny Haerlin
C Carlos Correa
D David Quist
E Johnson Ekpere
F Francisca Rodriguez
G German Velez
H Hope Shand
I Ibrahim Ouedraogo
J Jack Kloppenburg
K Joseph Keve

Tell us a bit about your life. What explains your commitment to the fight for food sovereignty?

I was born in Geneva in 1973. I'm married and I have a little boy. I don't come from a farming family. In fact, I've spent most of my life in cities. I began to be interested in the relationship between North and South when I was 15, and I made several trips to West Africa. I would say that it was mainly in Africa that I learned about agriculture and its importance. When I left secondary school, I decided to study agronomy at the Polytechnic in Zurich. My aim was to get a relatively broad-based education and then a job that would give me the opportunity to travel abroad. But my life took a new turn during my studies. It was then that I discovered Swiss agriculture in its all its complexity, and I became aware of just how important it was that it survive and go on developing. I had a work placement on a highly diversified organic farm, and I decided that it was perhaps more useful and effective to work in Switzerland, in a situation that I really understood and where I could advance the cause of farming both at home and abroad.

Once I had finished my studies I became a member and supporter of the peasant farmers' association, Uniterre. I took part in several activities organised by Uniterre, in particular developing the concept of food sovereignty for the Geneva region and helping to mobilise support for the idea on the fringes of the WTO negotiations. In 2005 an opportunity came up at the Uniterre secretariat and I had no hesitation in applying for a permanent staff position with the association. Knowing the organisation as I did, and aware of its links with farmers' associations that were members of La Via Campesina, this was a dream job for me. I started work in January 2006. It is not a mainstream organisation but one which is incredibly active on various fronts, both national and international. Since the mid-1990s Uniterre has been spearheading the campaign for food sovereignty in Switzerland, and because of my background I was given responsibility for this area. My job has been to raise awareness amongst the various stakeholders in Switzerland about the concept of food sovereignty whilst strengthening our international relationships in this area.

What does food sovereignty mean to you?

For me, food sovereignty is a real alternative to the neoliberal dogma that tries to make the various world economies compete with each other to the benefit of the middlemen, whether these are transnational firms or national intermediaries such as the major retailers. It is an opportunity for a region or a country to define its own agricultural and food policy and to stop dumping food on third-world countries. Food sovereignty makes it possible to have a kind of agriculture that concentrates primarily on local production, produces high-quality food and responds to the expectations of our societies whilst generating profits for both farmers and agricultural workers. It is a political concept that should guarantee that farmers have access to land, loans, seeds and other natural resources. It means that, if necessary, national governments should be able to protect their agriculture from cut-price imports, which inevitably destroy local markets. By providing protection of this kind, it becomes possible to pay prices for agricultural products that cover the costs of production. At the same time, it means that farmers no longer need to rely on any kind of export subsidy in order to make a living.

Food sovereignty is about implementing an agricultural and food policy that involves all citizens, with the guarantee of a real social debate

about the roles, rights and responsibilities both of people working in the agricultural sector and those who benefit from it, namely consumers and citizens. They must be able to have access to healthy, culturally appropriate food that is free of GMOs. This political concept needs to be applied both in the South and in the North. From my point of view, this is the only real way forward. This is why we are thinking of launching a popular initiative that would establish food sovereignty as a fundamental part of the Swiss Constitution. In doing this we would be responding to the expectations of La Via Campesina, which at the movement's international conference in Mozambique in October 2008 made this one of its priorities.

During the last 50 years the food industry in Europe has become increasingly concentrated. What can be done in these conditions to build a strong popular movement to defend food sovereignty?

It is true that most people in Europe buy most of their food from supermarkets. In the beginning, these were cooperatives whose aim was to act as a sales outlet and a link between farmers and the consumers. Over the years, however, they have expanded their role considerably. Over the last 15 years in Switzerland, production prices have fallen by 25 per cent whilst consumer prices have increased by 8–15 per cent. There is absolutely no doubt that the middlemen have made a lot of money. On top of that, they act as a lobbying group to push for the conclusion of free-trade agreements. By demonstrating that it is possible to create new forms of production, marketing and consumption, I think we will manage to build a popular movement. This is what we are doing with our pilot projects, which are bringing producers and consumers together through local contracts.

Some large firms, such as Nestlé and Syngenta, are based in Switzerland. Many people rely on these companies for their jobs. Isn't it difficult to mobilise support in Switzerland against the domination of food companies such as these?

It's true that firms like Nestlé or Novartis, just like the major banks, are part of our "national heritage". They are to some extent "sacred cows", and for a long time a significant section of the population took a dim view of challenging these symbols. But these companies have not been entirely free from scandal. Nestlé, for example, hired a surveillance firm to spy on anti-globalisation movements in Switzerland. Their "moles" infiltrated groups such as Attac, which were preparing to mobilise support against the G8 and which were gathering evidence on the Swiss firm's actions abroad. It was called "Nestlégate" in the press and many citizens were shocked. As far as Syngenta is concerned, there was a huge media campaign about paraquat, a herbicide that is banned in Switzerland but that the company was still selling in a number of countries in the South. It's fair to say that the Swiss firm's image was tarnished by the affair. And then, in 2007, a Brazilian security firm hired by Syngenta assassinated a militant from the MST [Brazil's Landless Rural Workers Movement]. The story attracted a lot of media coverage and questions were raised in our parliament. I don't think we will ever get as many people out on to the street against these multinationals as they do in Brazil or India, but it is none the less possible to campaign in various innovative ways against the way our national firms are behaving abroad.

Last year we experienced a global food crisis with very marked fluctuations in the prices of agricultural products. Do you think that Europeans have become more aware of the importance of food sovereignty as a result?

Yes, without question. The level of awareness has increased right across society. The positions Uniterre has taken have been widely covered in the media. We have taken part in a large number of media and community debates on the theme of food sovereignty and the food crisis. I think we need to use this time to promote the idea of food sovereignty. We're not talking about going back to state-controlled agriculture or promoting self-sufficiency, but about choosing a new way that is designed to benefit people rather than the shareholders of multinational firms. The fact that the latter have benefited significantly from the crisis by increasing their profits proves – if proof were still needed – that they are the only winners in the current monopoly situation.

We have heard that at the European level La Via Campesina has reorganised itself. What do these changes involve?

Uniterre is a founding member of the European Farmers Coordination (CPE). In June 2008 this was enlarged to become the European Coordination Via Campesina, an umbrella group of 25 organisations. All the European members of La Via Campesina are part of the organisation. Clearly that will strengthen the movement. It is important because we need to define at an international level the problems that are specific to Europe, such as getting young people established in farming, the need for agricultural policies that create a fairer relationship between production and producers, the influence of the major retailers, Europe's role in free-trade agreements, and so on. I think the Coordination also has a key role to play in disseminating the concept of food sovereignty in Europe.

L Laxmamma
M Lorenzo Mulas Hurtado
N Ndiogou Fall
O Sharif Omar
P João Pedro Stédile
Q Darrin Qualman
R Ramón Vera
S Daycha Siripatra
T Tim Lang
U Ulrich Oslender
V Valentina Hemmeler Maiga

For the last five years the people of Mangabal, a small community beside the Tapajós river in the Brazilian Amazon, have been trying to win definitive rights over their land. They won their case in court, but now they are in more danger than ever of being expelled from their land: the territory they occupy is wanted to make way for hydroelectric power stations to supply energy to big mining companies. But the very process of fighting this latest threat is empowering the community. Mangabal's *ribeirinhos* or riverbank dwellers have in the past viewed neighbouring indigenous groups as rivals or enemies, but now they are learning that they face many problems in common, and that only by mobilising together will they make real advances.

Biodiversity or dams?

An Amazon community fights for its land

GRAIN

During Brazil's rubber boom in the late 19th century, rubber barons lured thousands of poor peasant farmers from the drought-ridden north-east to the Amazon basin by offering what appeared to be good rates of pay for rubber-tapping. Between 1872 and 1900 the population of the states of Pará and Amazonas more than doubled, from 329,000 to 695,000. There was another intense migratory move into the Amazon basin during the Second World War, when demand for rubber on the world market exploded.

Many of the migrants were single men. One "solution" to the gender imbalance was for them to kidnap women from nearby indigenous groups. Dona Raimunda Araújo, born in 1938, who lives in Mangabal on the Tapajós river, remembers her family talking about the way her grandfather, a peasant farmer from the north-eastern state of Ceará, stole her grandmother, a Munduruku Indian. This was no isolated case: in their studies of the genetic make-up of the urban populations in the Amazon region, scientists have discovered that genes transmitted by men are largely Iberian in origin, while those transmitted by women are largely indigenous in origin.[1]

The kidnappings were undoubtedly carried out with considerable violence but, as Cristina Scheibe Wolff has pointed out in her study of women living along the Juruá river in the state of Acre, it is important not to see the women merely as victims. Such an approach "does not offer anything for the future, as it leads to an emphasis on defeat, subjugation and annihilation. If we do this, we are imposing another violence on the women. However, if on the contrary we think of these women as subjects, who are integrated into the rubber-tapping communities as such, new elements can be found for understanding their society."[2] One of these new elements is the women's role in bringing to the rubber-tappers' way of life part of

1 Sidney E.B. Santos, Jackson D. Rodrigues, Ândrea K. Ribeiro dos Santos and Marco A. Zagom, "Differential contribution of indigenous men and women to the formation of an urban population in the Amazon region as revealed by mtDNA and Y-DNA", in *American Journal of Physical Anthropology*, no. 109, 1999.

2 Cristina Scheibe Wolff, "Marias, Franciscas e Raimundas: uma história das mulheres da floresta Alto Juruá, Acre – 1870–1945", Thesis for doctorate in social history, Faculdade de Filosofia, Letras e Ciências Humanas, Universidade de São Paulo, 1998.

the vast knowledge of the ecology of the Amazon forest acquired over centuries by the indigenous communities.

Although the women undoubtedly carried on with some of their indigenous practices from the earliest days after their capture, they had at first to work in secrecy. This was because the rubber barons, anxious to maintain control over the rubber-tappers, who were scattered over a vast area, turned food supply into a mechanism of domination. They forbade the families from practising agriculture and told them that they must purchase all items, including food, from the *regatão*, the travelling salesman who plied the rivers and sold goods at exorbitant prices.[3] Severe punishments were meted out to those who infringed this regulation.

However, this system of social control collapsed in 1912, when the price paid for rubber fell spectacularly on the world market, with the arrival of much cheaper rubber grown on plantations in south-east Asia. The rubber barons lost interest in the trade, abandoning the rubber-tappers to their fate. As the vast majority were unable to fund the 2,000-km journey back to the north-east, they had to learn how to survive in the forest. With the women's help, they built a new life based on crop cultivation, animal husbandry, fishing, hunting and the collecting of forest products. It can best be described as forest peasantry.

Photo: Maurício Torres

In Mangabal, Rosildo toasts cassava flour. Cassava accounts for more than 85 per cent of the food eaten by ribeirinho *communities in the Amazon.*

This way of life survives today. The geographer Maurício Torres recently studied a group of 120 families living in two hamlets, Montanha and Mangabal,[4] along the Tapajós river, one of the main tributaries of the Amazon.[5] Although the families cultivate some exotic species, such as mango (*Mangifera indica*), water melon (*Citrullus vulgaris*) and cashew (*Anacardium occidentale*), their staple food is cassava (*Manihot esculenta*).

Each family clears a small area in the forest, between one and four hectares in size, and sets fire to the felled vegetation so that the nutrients of the plants are incorporated into the soil. They cultivate this area for three years and then abandon it so that the area can "rest". After 7–10 years, the vegetation has recovered sufficiently for another round of slash-and-burn. This kind of farming is encountered throughout the Amazon basin.

On closer examination, however, Torres discovered the families' relationship with their ecosystem to be more complex than it at first seemed. They farm the land in a way to satisfy their basic food needs while at the same time taking measures to protect their ecosystem and to enhance the genetic diversity of their main crop. The families cultivate more than 30 different varieties of cassava, most of which are unknown to the Brazilian government's research body, EMBRAPA (Empresa Brasileira de Pesquisa Agropecuária). The different varieties have different qualities, and together they ensure that all the community's cassava needs are satisfied.

The families want tasty *farinha* (cassava flour) to eat at home. This is provided by the Paraísa variety, the one known as the "mother of all cassava". But Paraísa takes at least a year to grow and at times the community needs food quickly. Another variety – Seis-Meses (six months) – responds to this need, for it can, as its name suggests, be harvested after just six months. *Farinha* is the community's main cash crop. The families sell small quantities on the local market to raise the money to purchase goods that they cannot produce for themselves. Many customers, particularly gold-panners (who, the farmers say, are obsessed by anything that glitters), prefer *farinha* with a strong yellow hue. The Najá variety takes a long while to grow and doesn't taste as good as Paraísa, but *farinha* made from it has this tint and is thus easy to sell. Other varieties have a moister texture and are thus better for making *tucupi*, a sauce used in cooking. Yet other varieties don't rot, even if they are left in the

3 Octávio Ianni, *A luta pela terra: história social da terra e da luta pela terra numa área da Amazônia*, Petrópolis, Vozes, 1979.

4 In this article, "Mangabal" is used to refer to the two communities.

5 Maurício Torres, "A despensa viva: un banco de germoplasma nos roçados da floresta", unpublished paper. Additional information is supplied by Torres for this article.

Photo: Maurício Torres

Like many other forest people, the people of Mangabal are struggling to stay on their land. Only if they obtain effective control over their collective lands will forest devastation be stopped.

ground for three years, and thus guarantee food even if something unforeseen occurs.

Cassava is usually propagated by cutting stalks from the plant. These stalks, which last for at least six months without deterioration, are then broken to into shorter pieces and planted in the ground, where they will sprout. Although extremely practical, this type of propagation does not permit breeding, as all plants are obviously genetically identical. So the *ribeirinhos* also allow some of the plants to flower and to reproduce sexually. In this way they can cross plants and produce new varieties with different characteristics. In fact, the difference between one variety and another is quite blurred. In practice, the community is managing a living seed bank, with constant evolution and change.

The families have other practices that reveal their indigenous links. The areas that are "abandoned" for 7–10 years so that the vegetation can recover are in fact used in many different ways. Some of the sprouting plants are good to eat, such as native varieties of sweet potato (*Ipomoea batata*), water yam (*Dioscorea alata*) and *ariá* (*Maranta lutea*), and the families use them to enrich their diet. Others provide good material for fishing rods, fishing nets and house construction. The cleared areas with their fresh vegetation also attract animals and so become hunting fields located conveniently near the community.

The farmers get significantly higher yields from their cassava than those obtained by other communities in the region that were established more recently, without the incorporation of indigenous women. The *ribeirinhos* attribute this to the care they take in choosing the variety of cassava, the location for the crop and its treatment during the growing season. Conditions vary from year to year, and the farmers need to adapt their practices to the circumstances of that particular year. Their approach differs greatly from the "one size fits all" attitude of so-called modern farmers using chemical inputs.

The Mangabal community has documentary evidence that some of their forebears were living in the region in 1871. Yet images captured by Landsat satellite between 2001 and 2007 show that after at least eight generations living in the area they have caused no signficant damage to the ecosystem. Torres attributes this to the way the families have combined extractive activities (gathering forest products, fishing and hunting) with crop farming. Practising this combination makes it possible for the families to have a constant supply of food without carrying out harmful activities, such as the clearance of large areas of forest.

Land rights

The community is currently engaged in a fierce struggle to retain possession of its land. The first threat came in 2004 when a company from the southern state of Paraná went to court, claiming ownership of the land and saying that the families were "invaders". With the assistance of Torres himself and the federal public ministry, the community managed to prove that it had been living there for generations and, after a long struggle, the courts acknowledged their right to

Photo: Maurício Torres

After a 12-day journey – including stretches in a non-motorised canoe, in the back of a lorry, by boat and by plane – Mangabal leaders reached Brasilia. Their aim was to put pressure on the government to sign the decree that will turn their lands into a Resex (a type of conservation unit)

stay on the land. In June 2006 the courts gave sovereignty to the community over a 70-kilometre stretch along the Tapajós river. It was the first time that a non-indigenous community was granted collective rights to its land.

However, the celebrations were short-lived. "Today the families are facing their greatest threat, which comes, paradoxically, from Brazil's first left-wing government", said Torres. To guarantee their permanent control over their lands, the communities asked for the creation of a *reserva extrativista* (*Resex*) – a type of conservation unit that was created after the assassination of Chico Mendes in 1988 to allow rubber-tappers in the state of Acre permanent rights to their lands. The Mangabal communities went through all the necessary bureaucratic steps, which included carrying out a rigorous consultation process (in which they obtained the unanimous support of all families for the initiative). For more than a year the decree for the creation of the reserves has been ready, waiting for President Lula's signature.

Perplexed by the long delay, the federal public ministry asked for an explanation. President Lula's office and Eletronorte, a subsidiary of the state-owned electricity utility Eletrobrás, issued a joint statement in which they said that they plan to construct two dams along the Tapajós river and that a conservation unit should not be created because it would interfere with these dams. It is believed that another three dams, along the Jamanxim, the largest tributary of the Tapajós, are also under consideration. Torres is outraged:

> *"The government says that a* Resex *would interfere with their plans for dams, but this is completely the wrong way of seeing things. The people were here first. The dams would upset their lives. If dams are now planned for the river, it is more urgent than ever that a* Resex *is created, so that the people's rights are respected. The refusal to take this step is extremely worrying because it suggests that the government doesn't want to respect the community's rights."*

But why does such a remote area of the Amazon basin need so much energy? The giant US aluminium mining company, Alcoa, is installing a huge smelter in the region. Aluminium smelting uses vast quantities of electricity, with Alcoa already consuming, at subsidised prices, 1.5 per cent of Brazil's total electricity output. "Most of the aluminium, produced at the cost of damaged lives and degraded forest, will be exported, mainly to Europe. People there need to know at what price they are receiving their aluminium", says Torres. "It is a heinous crime that these communities that represent so much cultural and social wealth should be seen as an obstacle to development."

Photo: Mauricio Torres

In Mangabal, proximity to the river and the forest means that people have ready access to many important products that they need for everyday life.

The federal public ministry is considering whether there are grounds for an appeal to the Convention on Biological Diversity. "I think political pressure is more effective than judicial action", said Torres. "On 13 May 2008 the Mangabal community, for the first time in its history, sent a delegation to Brasilia. President Lula didn't send a representative to speak to them but others listened. The situation has never before been so bad, but they have never felt so empowered. This gives me hope." As well as making the community feel stronger, the very process of struggle is changing the way it views its history. Traditionally, Mangabal and other communities saw their takeover of Indians' land and the capture of indigenous women as part of a "heroic" struggle to establish themselves in the region. Today perceptions are different. Dona Santa, a 80-year-old blind woman, who is still the de facto authority in Mangabal, told Torres how years ago her uncle had been killed in a clash with Indians. She stopped in the middle of her story and turned to him: "Today I have a very different view of what happened. I realise that what we did then to the Indians is exactly what the *grileiros* (land thieves) are doing to us today." This new awareness, also growing in other parts of the Amazon, is leading to new alliances between indigenous and non-indigenous groups. In the midst of all the problems, this too is a reason for hope.

Women, Communities and Plantations in Ecuador:

Testimonials on a Socially and Environmentally Destructive Forestry Model

Ivonne Ramos and Nathalia Bonilla (Acción Ecológica)

World Rainforest Movement, Uruguay, 2008, www.wrm.org.uy

review by GRAIN

Over the last 20 years the Word Rainforest Movement (WRM) has been documenting the impact of monoculture tree plantations in countries throughout the world and supporting local struggles against them. For some time it has been focusing on Ecuador, because this country brings together some of the most serious problems created by such plantations. Ecuador has plantations of the types of tree used most commonly in the world (eucalyptus, pine and oil palm), as well as monocultures of tropical species. It has plantations that serve as "carbon sinks" and plantations with Forest Stewardship Council (FSC) certification. Communities have been severely affected. (Prior to this book, WRM had already published two studies on Ecuador.)

This book dashes the hopes of those who believed that the election to the presidency in 2006 of the left-of-centre politician, Rafael Correa, would lead to real advances on the environmental front. After all, Correa said he was committed to constructing a "new form of socialism, appropriate for the 21st century". Although he has taken some interesting initiatives in other areas, Correa has done nothing to halt the advance of the monoculture plantations: in February 2008 he approved Executive Decree 931, which paves the way for the implementation of the National Forestation and Reforestation Plan. Among other measures, this plan commits the government to providing tax incentives and financial resources for the establishment of 750,000 hectares of commercial monoculture tree plantations.

This book provides ample evidence of the damage caused by this kind of monoculture. One of the people interviewed said: "When I was little, we made a living by grazing animals and growing crops. But now all the native trees and medicinal plants have been lost. There are none left. There used to be little springs but everything is gone. Even in the big rivers the water level has dropped, and some of them have dried up." Another interviewee commented: "Before, we had everything: native forests for firewood, grass for the animals. Now we can't grow grass and food like we used to. Within 50 metres of the pines nothing grows. The land doesn't produce anything." Because of the dry conditions, many plantations face the threat of fire. Most are located at high altitudes where there are strong winds and, when a fire breaks out, the wind fans the flames and spreads the fire.

When the first plantations were established, the authorities made so many promises about the advantages that they would bring that some local communities organised *mingas*, a form of collective action involving men, women and children, and worked for free to prepare the land. Now that people know what these plantations bring in their wake, the mood of the communities has radically changed. Some residents even admit to have considered arson, although there is no evidence that it has actually occurred.

This book looks, in particular, at the impact of the plantations on the indigenous women of the Andean highland plains. In the past, these women carried out small-scale subsistence farming, with which they were not only able to meet their own families' food needs, but could also sell or barter their surplus crops. The plantations have destroyed these local economic systems. Food sovereignty has been damaged

Photo: Juta Kill/SinksWatch, from www.wrm.org.uy

Cloud forest on the western slopes of the Andes, near Mindo, Ecuador

and families have become more dependent on cash earned by men outside the communities.

The plantations have also seriously harmed the communities' spiritual life. To quote the book: "When the water and vegetation of the highland plains vanished, they took with them the spirits who inhabited the forests and springs, the myths, legends and rituals that gave life meaning and purpose. The plantations marked the end of peace, water and fertile land, and replaced them with violence, destruction and erosion."

The model of large-scale plantations has not yet been completely consolidated. There is still time for the Correa government to listen to what people on the ground are saying and give them the chance to build an alternative. To quote the book again: "Women can play a key role in this process. Not only are they the ones who can most clearly see everything they have lost since the arrival of the plantations; they are also the ones with the greatest desire and need to seek alternatives. Not to return to the past, but rather to build a future that ensures the conservation of resources and improves the quality of life of everyone – women and men alike."

Food sovereignty in Europe and Africa - two new booklets from BEDE*

review by GRAIN

Promoting peasant farming and an ecological, solidarity-based agriculture in Europe

BEDE, October 2008, 33pp + CD
available in English and French

This booklet takes a look at some important initiatives and actions occurring at the local and national levels in Europe. The book splits these into three areas: collective organising, on-farm processing and adding value to products, and the impact of European regulations. It is really a list of different experiences that BEDE has been involved with in Bulgaria, France, Italy, Hungary, Portugal, Romania, and Spain. The "collective organising" section includes some cooperation agreements between farmers and research institutions, particularly seed banks. Some are for farmers to gain access to ancient – and lost – varieties of seeds, but much of the work is also for researchers within institutions to learn more about the loss of farmers' seeds and varieties. As the book points out, there is still much difficulty in getting many institutions to recognise the importance of farmer involvement and *in situ* conservation of seeds. France is one country where, thanks to the work of the French Peasant Seed Network, there has been closer collaboration between *ex situ* and *in situ* conservation of varieties. Other national seed networks include Red de Semillas (Spain), Colher para Semear (Portugal) and Rete Semi Rurali (Italy). The last chapter is a reality shock, as it describes one of the principal problems of working with seeds in Europe: the strict EU legislation that makes the use of non-registered varieties practically impossible. There are examples here, however, of how some are managing to organise via legal loopholes and growing public resistance. But it is not only the restriction on the use of seeds that is strict in Europe, but also sanitary regulations, which end up hobbling the small farmer or pastoralist. The book cites examples of people resisting these sanitary norms. It also, of course, cites resistance to GMOs and the contamination of seeds. The booklet includes a CD – playable on any computer – which provides further laws, documentation and articles.

Peasant seeds - the foundation of food sovereignty in Africa

BEDE, October 2008, 64pp + CD
available in English and French

In 2007, more than 600 people from 80 countries met in Nyéléni to share their knowledge, experiences, and hopes for a world free of hunger, injustice, and corporate greed; and to express their aspiration to food sovereignty. Before this meeting the Coordination Nationale des Organisations Paysannes du Mali (CNOP), together with BEDE and the International Institute for Environment and Development (IIED), organised a preparatory workshop in Bamako on the privatisation of seeds in West Africa. The objectives of this meeting were: "To better understand how peasant farmers' rights to conserve and re-sow their seeds are suppressed through regulations and laws", and "to build collective instruments to reinforce peasant farmers' right to and control over their seeds". This booklet brings together a summary of these issues under the headings "Supporting the use of peasant seeds for food sovereignty", "Impeding the privatisation of seeds and biopiracy", "Banning GMOs on African soil", and "Furthering exchanges between peasant farmers and peasant innovations". The booklet also has continual pointers to the accompanying CD, which contains copies of presentations, articles and documents, audio clips and short videos from the workshop, field visits and farmer exchanges. It provides a good overview of the issues around the privatisation of seeds and the

Photo: Ralf Roletschek

A farmer ploughing in the lowland Baltic German state of Mecklenburg-Vorpommern

* BEDE – Biodiversité: Echange et Diffusion d'Expériences – protects and promotes peasant agriculture through information and networking. It is based in Montpellier, France. Email: bede@bede-asso.org, Website: http://www.bede-asso.org. Address: 47, place du Millénaire, 34000 Montpellier, France. Tel: +33 4 67 65 45 12. To order the books, please contact BEDE or visit their website.

"We blew it"

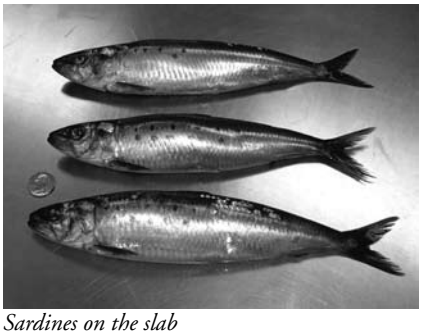
It is surprising what US presidents say after they leave office! In a keynote address for World Food Day on 23 October 2008, former US President Bill Clinton said:

"We need the World Bank, we need the International Monetary Fund, we need all the big foundations, we need all the governments to admit that for 30 years we all blew it, including me, when I was President. We blew it. We were wrong to believe that food is like some other product in international trade. And we all have to go back to a more environmentally responsible, sustainable form of agriculture."

Well, it's a start. But what he means by "a more environmentally responsible, sustainable form of agriculture" may well be very different from what we in GRAIN mean by the phrase...

Fishy business

A nine-year study by the University of British Columbia in Canada has found that 90 per cent of small fish caught in the world's oceans every year are processed to make fishmeal and fish oil to be used in animal feed. Factory-farmed fish, pigs and poultry are consuming 28 million tonnes of fish a year.



Sardines on the slab

Senior researcher Jacqueline Alder said: "Society should demand that we stop wasting these fish on farmed fish, pigs, and poultry. Although feeds derived from soya and other land-based crops are available and are used, fishmeal and fish oil have skyrocketed in popularity because forage fish are easy to catch in large numbers and, hence, relatively inexpensive."

Dr Ellen Pikitch, executive director of the US-based Pew Institute for Ocean Science, which funded the research, said: "It defies reason to drain the ocean of small, wild fishes that could be directly consumed by people in order to produce a lesser quantity of farmed fish."

GM dwindle

A study published in November by the Austrian government identified serious health threats linked to genetically engineered (GE) crops. In one of the very few long-term feeding studies ever conducted with GE crops, the fertility of mice was found to be seriously impaired, with mice fed on GE maize producing fewer offspring than mice fed on non-GE crops.

Mice look to a narrowing future

The study, sponsored by the Austrian ministries for agriculture and health, was presented at a scientific seminar in Vienna. Professor Dr Jürgen Zentek, Professor of Veterinary Medicine at the University of Vienna and lead author of the study, summarised the findings: "Mice fed with GE maize had fewer offspring in the third and fourth generations, and these differences were statistically significant. Mice fed with non-GE maize reproduced more efficiently. This effect can be attributed to the differences in the food source."

"GE food appears to be acting as a birth control agent, potentially leading to infertility – if this is not reason enough to close down the whole biotech industry once and for all, I am not sure what kind of disaster we are waiting for", said Dr Jan van Aken, GE expert at Greenpeace International. "Playing genetic roulette with our food crops is like playing Russian roulette with consumers and public health."

To bee or not to bee

Finally the authorities around the world are taking action on colony collapse disorder (CCD) – the term coined for the catastrophic collapse in the number of bees that has occurred in recent years, especially in the USA. In December the European Food Safety Authority (EFSA) announced a €100,000 grant to a consortium of European scientific institutions to investigate the problem. Earlier in the year the US Department of Agriculture had provided US$4m in funding to the University of Georgia for similar research.

There is now a consensus that the problem has become very serious. The bee population in commercially managed hives in the USA is estimated to have declined by 32 per cent in 2006 and 36 per cent in 2007. "Nature works in cycles but we've been constantly losing more and more bees", said Ed Levi, secretary of the Apiary Inspectors of America. "We used to think that the problem would just go away but today I think it's the canary in the mine." The bees are mainly affected by two types of infestation: a tracheal mite and the varoa mite that attacks their intestines.

While as yet no scientist has come up with an explanation, it is almost certain that the collapse is linked in one way or another to the rapid expansion in industrial farming. The natural diet of bees is pollen and honey – a mixture rich in enzymes, antioxidants and other nutrients. However, partly because of the decline in natural foraging areas, beekeepers in industrialised countries are increasingly supplementing this natural food with a mixture of artificial supplements, protein and glucose/fructose syrup. It is now believed that

This section of *Seedling* is devoted to short topical items. We welcome contributions from readers. Please send them to seedling@grain.org or to our postal address in Barcelona.

Attacking the varoa mite with a fungus

this diet may have weakened the bees' immune system. Pesticides used on crops have also been affecting bees. For instance, the insecticide imidacloprid disrupts the bees' homing behaviour. For more than a decade French beekeepers have been calling for a complete ban on the insecticide, saying that it is causing "mad bee disease".

There are also other factors. Beekeeping in the USA has become a multi-billion-dollar industry. Many beekeepers make much more money renting out bees to pollinate food crops than they ever made selling honey. Juggernauts stacked with hundreds of hives travel huge distances, carrying the bees from one monoculture crop to another. The bees are stressed by the journey and have difficulty finding their bearings in alien ecosystems. Mortality rates are high. There is also growing concern that the bees may have been harmed by feeding on GM maize, which now accounts for more than half of the maize in US fields.

It is possible that CCD has multiple causes, with different factors combining to weaken the bees. As *The Ecologist* pointed out 18 months ago, "The single coherent thread that connects all the various theories of CCD is a massive failure of these creatures' immune systems. It is entirely possible that CCD is the inevitable result of an overwhelming, ongoing assault on their immune systems." If this is indeed the case, it will be a difficult problem to solve. It is likely that, at best, the scientific studies currently under way will come up with a technical fix of one kind or another. This will not solve the underlying problem.

Albert Einstein once famously declared: "If the bee disappeared off the surface of the globe, then man would only have four years of life left. No more bees, no more pollination, no more plants, no more animals, no more man." As yet, bees are reported to be alive and well in areas of the world with little industrial farming. Yet there is good reason for all of us to feel extremely concerned.

Intravenous GM

Advocates of biotechnology often cite the case of GM insulin to demonstrate the safety of GM products. They say that GM insulin has been used for many years and has never caused any problem. But evidence continues to emerge that this is not the case. To cite just one example, the Australian *South Gippsland Sentinel Times* carried a story in September about the terrible side effects suffered by a diabetic who had unknowingly been using GM insulin for over 20 years. His symptoms included extreme tiredness, weight gain, memory loss, mental confusion, fluctuations in the level of sugar in his blood, constant tiredness, and pain in his joints. Moreover he lost the symptoms associated with hypoglycaemia, which makes the condition dangerous and even life-threatening. He also developed Crohn's disease – a serious complaint that causes inflammation of the intestine and can cause arthritis, eye inflammations and skin eruptions.

Once he discovered that he was using GM insulin, the patient decided to return to natural insulin obtained from animals. He says that the fluctuations in his sugar level ended immediately and he was able to reduce the amount of insulin in his daily injections by 15 per cent. Many of his other symptoms also improved markedly over time. In the fortnight following publication several readers wrote in about similar side effects caused by GM insulin.

Indeed, diabetes sufferers in other parts of the world have for some time been calling for more rigorous investigations into the safety of GM insulin, also known as human insulin. According to the UK-based Insulin Dependent Diabetes Trust, "The first research in 1980 using GM 'human' insulin, by Professor Harry Keen, involved 17 healthy non-diabetic men, and in 1982 'human' insulin was given a licence for general use. This is a remarkably short time for a new drug, especially as 'human' insulin was the first ever genetically engineered drug to be used on people." The Trust's website (http://www.iddtinternational.org/gmvsanimalinsulin/index.htm) contains numerous cases of side effects similar to those reported in Australia.

Injecting insulin

Photo: GRAIN

GRAIN programme staff after their annual meeting and GRAIN's board meeting, Puerto Iguazu, Argentina, 9 November 2008

GRAIN held its annual planning and strategy meeting in the north of Argentina in October 2008. Our small staff (15 people) is scattered around the world and our annual meeting is the only time in the year when we actually meet. Of course, we are in constant contact, a process faciliated by internet phone services and other technological advances, but it is still important and satisfying once a year to get together. After the staff meeting, GRAIN also held its annual board meeting, which was attended by six board members.

A considerable part of both meetings was taken up by a lively discussion on the inter-connected financial, climate and food crises and how GRAIN should respond. Our special focus is the way these crises impact on farmers and on movements struggling against privatisation and corporate control in the areas of food, biodiversity and agriculture. Over the next year we shall be attempting to provide in *Seedling* and our other publications information on the global situation that feeds into these struggles, as well as using our outlets as a space in which movements can express their views and describe their struggles.

As always with our meetings, we took advantage of our location to visit groups with whom we work. One day we visited an indoor market run by small farmers working with the Movimiento Semillero de Misiones. They told us about their struggle to promote and exchange local seeds, to stem the advance of pine plantations and to prevent the introduction of genetically modified seeds. On another day we crossed the border into Brazil and visited Conquista na Fronteira, one of the oldest and best-known of the settlements run by the Movimento dos Sem Terra (MST), Brazil's Landless Movement. The MST won this land through an occupation in 1986, and now a second generation of activists is beginning to take over the day-to-day farming activities. We were shown around by a couple of articulate and motivated young men in their early 20s, one of whom had been born in the settlement.

One bonus of holding our meetings in northern Argentina was our proximity to the breathtaking Iguazu waterfalls. After several long days of meetings, it was a delightful change to spend the day in the nature reserve on the Argentine side of falls. It had been raining heavily in the weeks prior to our visit, so the volume of water tumbling over the two-kilometre-long falls was huge. By chance, the sun was shining bright and hot on the day of our visit, so we had the best of both worlds. The shifting rainbows caused by the spray from the falls caught in the sunlight, through which hundreds of swallows threaded their flight, were quite spectacular.

Photo: GRAIN

Part of the Iguazu falls, Argentine side of the Rio Iguazu, Misiones, Argentina, November 2008

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