Fundamentals of Agrobiodiversity

Issue Papers: People, Food and Biodiversity

A question of coexistence – genetically engineered crop plants in farmers' fields

Aerial photograph showing a test field for determining minimum spatial separation. Up to what distance can cross-pollination occur in conventional or organic maize crops? Field trials have been carried out in several EU countries and there is now a great deal of information available on maize, rape and other crops.

Source: www.biosicherheit.de /H. Pienz

Cultivation of genetically modified (GM) crops is increasing steadily all over the world. More than half of the countries in which these crops are grown are developing countries. Maize, soya and cotton are the main GM crops grown here (*for further information see the Issue Paper entitled 'Genetic engineering in agriculture: how does it impact on biodiversity?'*). Many consumers, farmers and conservationists are sceptical of GM plants and the products derived from them. In many European countries, there are calls for GM-free zones. While consumers are primarily worried about health issues, the concerns of farmers and conservationists centre on the consequences for the existing, unmodified crop cultivars and their relatives in the wild – consequences that are not yet fully understood. They also fear economic damage and increasing commercial dependence on GM seed producers. Wind and insects disperse the pollen of genetically modified cotton, maize and soya plants. The transgenic genetic material is thus intermixed with unmodified material.

Legal provisions on coexistence aim to prevent this intermixing as far as possible. This is also true for admixtures of GM products in organic or other non-GM produce. Significant organisational and financial efforts are required to prevent inadvertent admixture, from field to supermarket shelf. In the event of damage occurring, an insurance system would need to be established in law, but as yet no country has an adequate system in place.

The clear separation of GM and non-GM products is a challenge that even the industrialised countries are sometimes unable to meet. This challenge is likely to be a good deal greater for developing countries. As complete separation appears to be unrealistic, many countries have already established threshold values. Strict separation of GM and non-GM products during production, harvesting, storage, transport and processing in conjunction with the necessary monitoring systems can limit the admixture of genetically modified products to non-modified products to a GM content of 0.5-0.9%. This is in keeping with the threshold values adopted in many countries. The additional costs of staying within these limits are estimated to be in the region of 10% of the producer price.

Statutory requirements

Threshold values for admixtures

Legal and technical provisions governing the production, processing and marketing of GM products are currently still under development in many countries. In the European Union, for example, a regulation on genetically modified foods and

Coexistence

In farming, the term 'coexistence' refers to the parallel operation of production systems with and without genetically modified plants, neither of the two adversely affecting the other. Coexistence comprises the entire chain from cultivation to storage, transport, processing and sale.

Cartagena Protocol on Biosafety

The Biosafety Protocol regulates the safe transfer, handling and use of genetically modified organisms and establishes the standards for ecological risk assessments. The detailed design of the relevant rules, including coexistence, is a matter for the signatory countries.

gtz Sustainable management of resources in agriculture

On behalf of Federal Ministry for Economic Cooperation and Development

Combine harvesters are generally very hard to clean. The dispersal risk is largely dependent on the design of the machines.

Source: www.oekolandbau.de / © BLE/ Thomas Stephan

feedstuffs provides that food products must be labelled as 'genetically modified' if the admixture of genetically modified components is greater than 0.9%. The establishment of specific rules based on overall guidelines is a matter for the individual Member States. Fifteen Member States have so far adopted specific coexistence legislation and another three have produced relevant bills. In Germany, coexistence is governed by the Genetic Engineering Act and by a corresponding federal ordinance adopted in 2008.

Minimum distances and buffer zones

In order to avoid the admixture of GM and non-GM crops, most countries prescribe minimum distances to be kept between fields. These vary by crop. For example, for maize, different countries have prescribed distances between GM and non-GM fields of 25 to 400m, and 75 to 400m between GM and organic maize. For potatoes, the prescribed distances to non-GM potatoes range from 10 to 40m while distances between 20 and 60m must be kept to organic potatoes. Greater distances apply to seed production in some instances.

In addition to the minimum distances, buffer zones may be prescribed. These are a number of rows of non-GM crops which must surround the genetically modified plants in order to reduce outward pollen movement. In such cases the crop grown in the buffer zone is considered to be a genetically modified product.

Transportation and storage

As admixture can take place not only during production but also before and after the crop is grown, some countries have adopted additional legal provisions. For example, there may be a requirement to store seed of genetically modified cultivars separately from non-GM seed in closed, labelled containers. Similarly, storage of GM products in the field may have to be strictly separate with transport to the field in closed or covered vehicles. All equipment and vehicles used in the transportation, sowing, cultivation, harvesting, and processing of GM products may have to be carefully cleaned before they are used for any other product.

Liability and monitoring

Generally, where damage is caused by GM crops the producer is held liable. In some countries hauliers and processors are also held liable if damage is caused in the course of handling genetically modified products in their sphere of responsibility. Some countries have established special damage compensation funds which are financed from contributions paid by producers of GM products. In individual cases, provisions have been made for compensatory payments to be made by the state, but only if no one can be held liable.

Most countries maintain a register of producers of GM products and some countries also keep a register of the individual fields on which the crops are grown. Government authorities such as agriculture ministries or phytosanitary services check the information provided by way of random spot checks of fields and crop sampling.

Most EU countries have not adopted regional bans on the growing of genetically modified crops. However, some countries have prohibited or limited the production of such crops in nature reserves. The declaration of 'GM-free zones' in the EU is as yet merely political in character; it is voluntary and carries no legal obligation. Important producer countries of agricultural products such as China, Thailand, Brazil and Argentina have established GM-free zones in order to be able to continue to supply sensitive markets. Other countries such as Algeria, Benin, Peru and Ecuador have introduced moratoria which will be in force until such time as suitable national coexistence strategies have been established.

Patent law

Depending on the details of national patent law there may be a further risk to the farmer: if transgenes are found in a crop

Male pollen-producing inflorescence at the apex of a maize plant. Up to what distance can cross-pollination of conventionally or organically grown maize take place? Trials have been carried out in several EU countries to address this question, and a significant amount of scientific data and results have now been collected – not only on maize but also on oilseed rape and other crop species.
Source: www.biosicherheit.de /N. Lehmann

the farmer can be forced to pay licence fees to the patent holder no matter how contamination has taken place. A well known example is the case of the Canadian farmer Percy Schmeiser. In the late 1990s he was sued by Monsanto for patent infringement and sentenced to pay retrospective licence fees for his oilseed rape harvest. However, he maintained that he had not sown genetically modified oilseed rape. The transgenes originated in neighbouring fields which had contaminated his own crop.

Experience with coexistence so far

A study in Spain found the following: after six years of GM maize production it can be said that coexistence works and that contamination levels are between 0.5 and 0.9%. At the time the study was conducted in 2003, a total area of 460,000 hectares was cropped with maize of which 7% was planted under GM maize, 0.1% under organic maize, and the remainder under non-organic, non-GM maize. The production of GM-maize was concentrated in areas with high levels of pest infestation while in areas without disease pressure non-GM cultivars were preferred. Due to this large-scale separation of GM and non-GM maize little contamination occurred. Only two cases of contamination of organic maize came to light. No major difficulties are expected for the future, as even with a tenfold increase of the area under organic maize there would be few contact points. In the few areas where in the future GM maize will be grown side-by-side with organic or non-organic maize, buffer zones and minimum distances are considered sufficient to remain within the threshold values for contamination.

Other experience, however, highlights the difficulties which can arise in the field when attempting to separate GM and non-GM crops. Transgenes have already been discovered in important old landraces of maize in remote areas of Mexico which, as genetic hotspots, are indispensable for maize breeding worldwide. Similarly, in China genetic material from genetically modified rice cultivars has already been found in traditional rice cultivars due to outcrossing.

Contamination can quickly inflict major ecological and economic damage, as evidenced by the GM maize variety 'Starlink'. In 2000, 'Starlink' maize was planted on a mere 0.4% of the maize cropping area in the United States yet in the same year 10% of all maize samples tested had been contaminated with 'Starlink' through outcrossing and admixture. The genetic modification was found in 80 cultivars of yellow maize. In 2001 modified 'Starlink' genes were found in a 55,000 tonne shipload of maize. Ultimately 300 products had to be withdrawn and taken off the market. The damage caused to the US economy was estimated to be in the region of 1,000 million US dollars in 2001 alone.

A direct seeding machine in operation. Residual seed can be completely removed from seeding machines relatively easily.

Quelle: www.oekolandbau.de / © BLE/ Dominic Menzler

Similarly in the US, *Monsanto* conducted a trial with a non-approved genetically modified cotton cultivar in 2008. The test site was only 0.4 ha in size. From this site 0.25 t was harvested and accidentally mixed with the 60 t harvest from an adjacent field of non-GM cotton. The yield from both fields was taken to a 20,000 t storage facility of a processing plant, thus contaminating an amount of cotton 80,000 times the weight of the original GM product. Government authorities ordered the processor to withhold the contaminated cotton mix.

The situation in many developing countries is exemplified by that of Burkina Faso, where organic cotton production has been practised successfully for a number of years now. In 2003, the national research institute INERA began cultivation trials with genetically modified cotton. At the time there was no national biosafety legislation and the national Biosafety Committee, which would have been the competent authority, was not consulted. This *fait accompli* created uncertainties for producers and buyers, especially of organic cotton, as there was no information on the degree of contamination caused or the effectiveness of technical measures regarding seeds, cultivation and processing in terms of the separation of GM and organic cotton. Similarly, little information was available on the legal provisions in the event of damage. There are legitimate concerns as to whether coexistence rules can be economically applied and monitored by state authorities in a small-scale farming sector as is prevalent in countries like Burkina Faso. Producers, buyers and international financiers are now seeking to study the extent of contamination and analyse possible technical measures to limit it. They will also bear the cost of this study. While this contravenes the polluter-pays principle, no other way to do this can be found since the biosafety law adopted in Burkina Faso in 2006 lacks clear provisions on these matters. The law mentions neither the precautionary principle nor the polluter-pays principle. Nor does it contain any provisions on coexistence and liability.

Plots of traditional maize at varying distances from a field of transgenic maize.

Source: www.biosicherheit.de / Norbert Lehmann

Key challenges for development cooperation

The partner countries of German development cooperation pursue a variety of strategies on genetically modified crop plants and their coexistence with non-GM crops. Some countries designate cropping zones for both systems in order to serve specific markets. In other countries, the spread of genetically modified crop plants is due to individual proponents in the absence of prior development of political rules. Other countries again postpone the approval of genetically modified crops until such time as suitable strategies for parallel production have been developed.

Individual countries have different capacities for coexistence. In countries or regions with large-scale production of crops for export the separation of GM-zones and GM-free zones can quite easily be assured. However, separation is more difficult in countries or regions with small-scale family farms, high agrobiodiversity and weak monitoring systems. In such instances the introduction of coexistence rules may even be unsuitable on ecological, micro-economic and macro-economic grounds.

In the majority of countries information is lacking on the degree of the existing admixture of local seed with GM elements, on required distances between fields, and on sources of contamination between the field and the final processed product. Studies on background contamination levels prior to GM tests are often neglected, leading to a situation where contamination discovered at a later stage can not clearly be assigned to a source.

Tasks of German development cooperation may include the following:

- Support for partner governments in the development of strategies and legal provisions suited to their countries.
- Compilation of the required scientific and technical information and baseline studies.
- Provision to decision-makers and the public of objective information and lessons learned worldwide.

The "People, Food and Biodiversity" Issue Paper Series is designed for individuals and institutions engaged in development cooperation. Its aim is to:

- Arouse interest in the issues surrounding food and biodiversity and spotlight the various linkages.
- Showcase new topics and approaches.
- Rapidly and lucidly present proven approaches and experiences.
- Encourage and stimulate you to increasingly take up these issues in your work.

We look forward to your feedback, which helps us bring the series to its full potential.

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