Corn is the staple food for millions of poor people around the world Photo: Jörg Böthling

Global food security does not need genetic engineering

Agri-genetic engineering – a means for fighting hunger?

To resolve the problem of hunger and ensure sustainable global food security, it will be necessary to increase agricultural production in the future. In this context the contribution of genetically modified plants is very limited. In fact, to this day there are no genetically modified food crops that have produced a higher yield. Even genetically modified plants (henceforth "GM plants") rely on progress made in conventional plant breeding for higher yields. Looking at food security from a global perspective, it should be noted that of the four predominant GM crops – cotton, maize, rapeseed and soy – only a fraction of the harvest is intended for human consumption.

First generation GM plants are bred primarily to resist or produce toxins against insect infestation (Gilbert 2013). The emphasis has been on technical properties to facilitate large, mechanised monocultures. While these plants may, in some cases, yield larger harvests, as a result of herbicide spraying, overall the potential harvest has not increased. In addition, these crops demand total herbicides, with a tendency towards increasing quantities (Benbrook 2012). As a consequence, water, soil and rural populations are increasingly exposed to harmful pesticides that damage health and the environment. Surveys carried out by organisations such as Médicos de Pueblos Fumigados in Argentina have shown what serious health consequences an increased application of pesticides, which often goes hand in hand with the cultivation of GM plants, can have (Naharro/Álvarez 2011). On this basis, it is doubtful that GM plants have any answers for the complex problems faced by smallholders.

Growing ever larger amounts of GM soy in emerging economies does not, for instance, improve food security. This can be seen in Argentina. Since the introduction of transgenic (GM) plants, the cultivated area for soy has expanded steadily – today, about two thirds of Argentina's agricultural land is used for soy. At the same time, the number of farmers has dropped significantly (Alvarez Kalverkamp 2013). Hunger is still present. According to the relief organisation Red Solidaria, official figures show that in Argentina 33 children die every day of conditions arising from malnutrition. About 15 per cent of all Argentina's children are not properly fed (Quesada 2008).

A sustainable increase in production can only be implemented as part of a complex strategy to overcome hunger. Production-based strategies to combat hunger that are skewed in favour of sim-

Rice harvesting in the Philippine island of Palawan Photo: Christof Krackhardt

plistic technical arguments ("If more is produced, more people can be fed") have failed. This is because hunger is rarely the result of a physical shortage of food on local markets. In fact, according to production figures, there is sufficient food available on Earth for all human beings. The United Nations Food and Agricultural Organisation (FAO) assumes that with the current level of technology, 12 billion people could be fed (FAO 2006). From a global perspective, hunger is a problem of distribution; not of production. People go hungry because they do not have sufficient income to buy food; or because they do not have the means to produce food themselves. Therefore, one new technology alone cannot disentangle complex political, social, ecological and economic problems.

Similarly, the attempt to improve food quality directly by changing the composition of ingredients through so-called green genetic engineering has not been successful either, as the example of the "Golden Rice" shows. This rice is held up as a prime example of a second generation GM plant crop which is supposed to create consumer benefits, rather than agricultural gains. "Golden Rice" contains increased amounts of provitamin A (ß-carotene) and is supposed to eliminate vitamin A deficiency, which can lead to blindness in developing countries. The urgency of controlling vitamin A deficiency is not disputed; it is debatable whether or not this new rice will in fact be the remedy. The question of diet is not exclusively a technical issue and people in the affected regions have already developed promising strategies of their own (UNSCN 2010). For example, the inhabitants of the Philippine island Bohol, which is considered at risk of vitamin A deficiency have long since added alternative sources of ß-carotene to their diet to solve the problem completely without genetic engineering. The producers of "Golden Rice" on the other hand, even after a testing period of more than 10 years, have not yet obtained permission to market the rice, due to a lack of required data.

Does agri-genetic engineering do anything for the income of smallholders?

GM development so far has been geared to industrialised agriculture rather than food security needs. Soybeans, cotton, maize and rapeseed are used as raw materials for biofuels, animal feed and the textile industry. Growing these crops requires subsequent purchases of seeds every year and entails high additional spending on pesticides and mineral fertilizers.

This production model has no relevance for many smallholders in developing countries. Reducing manpower for weed control is not their main problem. Their concerns focus on high capital risks such as the cost of expensive imported seeds, pesticides and fertilizers. If the promised yields do not materialise, farmers face major debts. This has been the case in India, where over the past decade many smallholders have run into serious debt, attributable in part to their cultivation of GM cotton (Weltspiegel 2013). They were hit by large crop shortfalls which have been caused in part by pests that have built up a resistance to the toxins in GM cotton. Cases of resistance to the insecticides produced by the GM plants have increased considerably over the past years (Tabashnik et al. 2013).

Smallholders, especially the poorest, do not usually have any money to buy fresh seeds after each growing season. To get round this problem, an informal market for seeds has emerged in many developing countries, making the free exchange of seeds and farmers' seed banks possible. It is mainly women who sustain this system, because they are in charge of storing and multiplication of seed. Through their informal seed system they have better access to resources for production. However GM plants are based on patent systems and threaten this low input system. Developing countries have been persuaded to pass restrictive seed legislation that aims to protect patents and intellectual property, while criminalising the informal market. In addition, the informal seed system is at risk of random contamination from cross-breeding with GM plants.

In the USA, where GM plants have been cultivated extensively over the past 20 years, the results have been ambiguous. Firstly, GM plants do not generally produce higher yields; secondly, the cost of patented seeds and the large amounts of pesticides required have risen significantly. Today, US farmers are once again asking for conventional seeds. However, conventional seeds are no longer available on the market – they have been replaced by GM seeds (Then 2013a).

Agri-genetic engineering – fewer pesticides through herbicide tolerance and insecticide-producing plants?

The main argument advanced for GM plants is that the use of pesticides for control of weeds and pests could be cut by manufacturing herbicide-tolerant plants and plants that produce their own insecticides (Bt plants). In the short-term, this works. However, adverse effects can occur sooner than expected. Here is what happened in some countries that cultivate GM plants:

USA: 20 years of GM cultivation

Resistance has become a major problem for herbicide-tolerant and Bt plants as weeds and pests have adapted to the new crop regimes. More than 80 weeds are now considered resistant to total herbicides in the USA (Heap 2014). These resistant types are called "superweeds". The result has been to increase herbicide doses or the use of even more toxic herbicides are needed (Union of Concerned Scientists 2013). Crops are being made to resist, amongst others, the weed killer 2,4-D, which is related to the Agent Orange defoliant used in the Vietnam War. This weed killer is considered to be significantly more toxic than glyphosate and can be contaminated by dioxins (Holt et al. 2010). Similarly, the formerly insect-resistant Bt plants are now being infested in many regions by insects that have become immune to the agent (Gassmann et al. 2012). New pests are also appearing (Catangui 2006). There is reason to believe that incorporating new insecticides will only provide short-lived relief.

Argentina: 18 years of GM cultivation

As in the USA, glyphosate-resistant superweeds are appearing more frequently in Argentina (Binimelis 2009). There is a growing body of evidence for health hazards arising from the greater use of glyphosate for growing GM soy (Paganelli 2010). There are also reports of environmental damage (Relyea 2012). In 2013 extremely high residual levels of glyphosate in soybeans have been reported (Then 2013b).

South Africa: 15 years of GM cultivation

2013, the cultivation of Bt maize "MON 810" was brought to a halt in South Africa, due to significant resistance in the maize stalk borer. MON 810 maize has been replaced by other Bt varieties that produce two types of insecticides. However, South African scientists doubt that this will solve the problem (Van den Berg et al. 2013).

India: 12 years of GM cultivation

So far, the Indian State has not permitted the cultivation of GM food crops. However, GM cotton with insecticides (Bt toxins) has been cultivated in India since 2001/2002. In fact, Bt cotton has fully replaced conventional cotton in several regions. Seeds are shared due to the absence of any government controls. In the meantime, pests have developed resistance (Monsanto). Any linkage between an increase in the number of suicides among farmers and crop shortfalls or expensive seeds is not officially recognised yet (Sheridan 2009). However, GM cotton contributes to the growing numbers of Indian farmers falling into debt, especially when yields decline (Haq 2012).

Agri-genetic engineering – without health risks?

Applying herbicides inappropriately and pesticides in greater quantities poses a threat to the health of many people around the world. In South America indigenous populations and smallholders are affected by pesticide poisoning. These people are not considered when pesticides are being sprayed – especially if they live in small enclaves in among thousands of hectares GM soy fields. Increased pesticide-related cancer rates in adults; birth defects and miscarriages are reported frequently in the media, yet there is a lack of comprehensive studies carried out in the field.

The question of whether or not eating GM plants harms human health is also unresolved. Genetically modified food has been eaten in North America for 20 years and in South Africa for 15 years, respectively. However, there is no requirement to label, nor have epidemiological studies tracked the consumption of these products. There is a series of laboratory studies to suggest that GM plants and foods can indeed affect the health of humans and animals (Ewen 1999). In particular, over-reactive immune systems have been observed. Independent, long-term studies of the impact of genetic engineering are needed but these have yet to be undertaken.

Agri-genetic engineering – safe for seeds and agricultural biodiversity?

The widespread use of GM seeds can have adverse effects on biodiversity. For instance, the decline of protected butterflies in the USA has been linked to growing herbicide-resistant soy (Pleasants 2012). Harmful effects on biodiversity and soil life have been confirmed by the European Food Safety Authority (EFSA 2012).

The agricultural focus on a smaller number of plant species and varieties leads to a simultaneous decline in the diversity of seed stocks. To adapt to climate change, agriculture needs a diverse range of species and varieties for further plant breeding.

Indigenous plant varieties around the world are being lost forever, since they are no longer grown. This can arise from GM plants taking precedence, or smallholders being pushed off their land, or because farmers are not allowed to develop their own seeds any more. Traditional knowledge about plants and how to cultivate them vanishes together with the plant varieties.

Access to GM seeds is not suited to the needs of smallholders. GM seeds are expensive, due to the licence fees imposed by seed corporations and smallholders cannot afford to buy them. At the same time, access to conventional seeds is often limited or obstructed by large corporations. In Argentina, the USA and parts of Brazil today, it can be difficult to procure non-GMO seed for commercial cultivation (Hubbard 2009).

Conclusion:

- Rural development is the key to feeding the world and ending rural poverty. The fight against hunger must be guided by the needs of smallholders: It must make better use of their under-valued abilities and skills to resolve the issues that they face.

- There are more efficient and economic ways to combat hunger than promoting genetically modified plants.

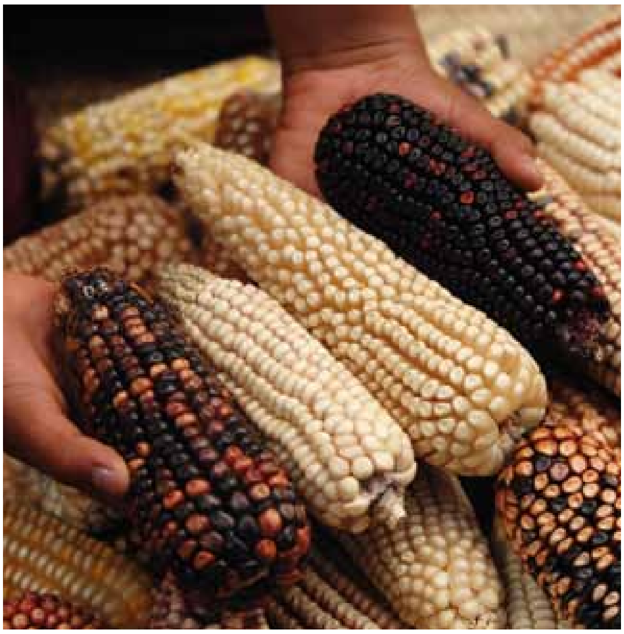
- Development policy needs to give recognition and priority to protecting biodiversity; it must also encourage agricultural production and techniques that are ecologically and socially sustainable, so as to strengthen and preserve the livelihoods of farmers in local agriculture.

- There is an urgent need to recognise and respect the rights of farmers and countries to retain their traditional seeds, their knowledge and native plant resources.

- The World Agriculture Report (IAASTD 2009) and its focus on agroecology represents a much better foundation for combatting hunger and improving life in rural areas than the one-sided technological approach of agri-genetic engineering.

Bread for the World partner in Mexico: Not all maize is the same

The Mexican organisation Grupo Vicente Guerrero is dedicated to the preservation of the enormous diversity of native maize varieties. This is achieved through seed banks and intensive lobbying. With scientific and legal support, the organisation managed to instigate legislation declaring Tlaxcala a state free of GM technology. The initiative was successful: The government is pledged to protect traditional varieties and to ensure their preservation.



Bread for the World partner in India: Seeds for life

The Indian partner organisation Navdanya sets up seed banks in villages to preserve, increase and exchange seed stocks of rice, wheat and vegetables. Navdanya conducts research on the development of traditional seeds and is active in the struggle against biopiracy through unjustified seed patents. Vandana Shiva, the head of the organisation, holds a doctor's degree in physics and received the Right Livelihood Award (Alternative Nobel Prize). She commits herself to preserving the diversity of varieties and to banning the use of genetic engineering in agriculture all over the world, not just in India.

Bread for the World partner in South Africa: Strong civil society against the power of genetic engineering corporations

The African Center for Biosafety (ACB) is well-known for its intensive work supporting sustainable food production in South Africa. In recent years, ACB has gained an international reputation through its studies on agri-genetic engineering and green revolution in Africa. ACB commissions scientific studies, materials to inform consumers and politicians, as well as running public campaigns. As a result, one of the campaigns successfully ensured that baby food would be at least partly GM-free in South Africa. ACB is currently working on the harmonisation of the seed legislation in African countries.

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