'EFSI' assesses the risks of genetically engineered maize – teosinte hybrids

Testbiotech exposes “European Food Safety Industry” (EFSI) as unacceptable collusion between European Food Safety Authority (EFSA) and regulated industry.

24 April 2018

Why is teosinte an issue in Europe?

Teosinte is a plant species native to Mesoamerica and is a wild ancestor of maize. It is therefore able to hybridise with maize plants to produce viable offspring. It has been known since at least 2009 that newly introduced teosinte is growing and spreading rapidly in maize fields in Spain, the country in the EU where the most genetically engineered plants are cultivated. Teosinte has already spread over several hundred hectares in Spain causing substantial economic harm. Apparently, the teosinte found in Spain has already successfully hybridised with maize plants - whether in Spain or elsewhere is unknown.

In 2017, a paper published by Swiss researchers revealed that teosinte plants found in Spain cannot be grouped with any of the currently recognised teosinte taxa (Tritikova et al., 2017). Instead, these plants seem to be of mixed origin, most likely with teosinte and maize as parental plants. Experimental crosses indicate that there is ongoing hybridisation between teosinte growing in Spain and maize cultivated there. These research findings indicate that transgenic maize cultivated in Spain will in all likelihood be able to pass its transgenic DNA on to teosinte plants.

These findings have to be seen against the backdrop of pending EU applications for cultivation of transgenic maize: Monsanto, DuPont and Syngenta have all filed requests for marketing their seeds, which would be sold, in particular, to Spanish farmers. The maize produces insecticidal toxins (MON810, Bt11 and maize 1507) and is resistant to the herbicides glyphosate (GA21) and glufosinate (Bt11 and maize 1507). MON810 is already being cultivated and is currently awaiting renewal of authorisation. Bt11 and 1507 were assessed by European Food Safety Authority (EFSA) and could be allowed by the EU Commission to be grown in the fields. Approval of GA21 is still at an early stage of the approval process.

EU regulations and gene flow from transgenic plants

EU regulations require the assessment of gene flow from genetically engineered plants to other related plant species with which they can interbreed. This is a critical issue in risk assessment since hybridisation may lead to the uncontrolled spread of transgenes, enhance the weediness of an alien weed and severely impact farmers and the environment. In the applications filed by Monsanto, DuPont und Syngenta for cultivation of insecticidal maize MON810, Bt 11, maize 1507 and GA21, gene flow to related wild and weedy plant species is explicitly excluded. Even after it was known that teosinte is growing and spreading as a weed in Spain, the companies failed to provide any new data to assess potential gene flow. It was only after Testbiotech, together with other NGOs, alerted the EU Commission in 2016 that the EU Commission and EFSA started to deal with the matter.

In 2017, the EU Member States voted on the cultivation of three genetically engineered maize variants that produce insecticidal toxins (MON810, Bt11 and Maize 1507). No overall majority was reached in the vote. Therefore, the EU Commission could now authorise cultivation at any time. However, there is a risk of teosinte crossing with transgenic maize and possibly becoming a new super-weed that will produce insecticides and become resistant to herbicides.

Creative Commons:

EFSI: a new joint effort of industry and the European Food Safety Authority, EFSA

A joint paper published by experts from EFSA and the biotech industry reported on the risks of gene flow from genetically engineered maize to teosinte under field conditions in Spain (Devos et al., 2018). The authors went to great lengths to try and dispel concerns about potential gene flow.

The paper itself could be called a 'hybrid product' derived from close collaboration between EFSA and industry: the main author, Yann Devos works for EFSA. Another co-author, Alan Raybould, works for Syngenta, which wants to sell its genetically engineered seeds for cultivation in Spain. Many other experts from EFSA were also involved: Amongst others, also Elisabeth Waigmann, head of the GMO department at EFSA, contributed with their comments and helped to finalise the document.

Devos et al. (2018) discuss what they call worst case scenarios of potential economic and environmental harm from the establishment of hybrids between GE maize MON810, Bt11, 1507 and GA212 and teosinte in the fields in Spain:
“There is no information on the expression of transgenes in teosinte × GM maize hybrid plants; therefore, to be conservative, the worst-case assumption is that any teosinte × GM maize hybrids will express/manifest the traits that the transgenes confer. Information on the ecology of teosinte suggests that acquisition of insect resistance is unlikely to increase hybrid abundance or population dynamics in ways that could be ecologically harmful. Glyphosate tolerance could exacerbate weed problems if recommendations not to grow glyphosate-tolerant maize continuously and to apply the relevant herbicides repeatedly or exclusively are not followed. However, any increase in persistence of glyphosate-tolerant teosinte × GM maize hybrid plants would remain confined to agricultural fields, and could be managed, minimising the harm that could result from these effects.”

The authors acknowledge that currently there is no *“information of the expression of the transgenes in the hybrid plants”*. But it seems, they do not deem such data to be necessary. Instead, they simply state that a *“worst-case assumption is that any teosinte × GM maize hybrids will express/manifest the traits that the transgenes confer”*. Thus, ‘EFSI’ experts assume that once the transgenes have escaped to teosinte they will somehow preserve the intended biological trait originally inserted. They seem to think of the transgene as an inert BioBrick, which has a predictable function that is independent of the rest of the organism and its interaction with the environment.

This is wrong. For example, the enzyme transferred to the plants to make them resistant to glyphosate can also confer increased plant fitness: In 2018, research from China revealed that the additionally inserted genes can enhance the potential for uncontrolled spread into the environment (Fang et al., 2018). Where there is gene flow from the plants into the natural populations, the offspring can show increased fitness and can spread their transgenic DNA more effectively than assumed. Surprisingly, it was found that this risk to the environment is solely dependent on the additionally inserted gene, and not on the application of glyphosate. The effect can be enhanced by specific stressors such as drought and heat.

According to the research from China, the additional enzyme (EPSPS) produced in the plants not only makes the plants resistant to glyphosate, it also interferes with plant metabolism for growth and fecundity. The Chinese researchers stated that the potential cause of the observed effects could be a higher production of the hormone auxin in the transgenic plants. This plant hormone plays a key role in growth, fecundity and adaptation to environmental stressors.

EFSA - the general problem

Currently, there are neither EFSA guidelines nor methods for making detailed assessments of the risks associated with genetically engineered plants emerging from unintended crossings and next generation effects. Current risk assessment of genetically engineered plants mostly concentrates on plants that are grown for just one season and are re-sown each year.
Devos et al (2018) try to escape this factual complexity by stating that risk assessment “focuses the assessment on the phenomena that are important for decision-makers and away from the multitude of other changes that may interest scientists, but which are irrelevant for ERA”. This approach is clearly failing by design: In many cases, there is no clear cut difference between environmental risk

Creative Commons:

assessment (ERA) and basic research on the biological characteristics of genetically engineered plants.

We have to be aware that there is a very basic gap in current risk analysis. Current risk assessment of genetically engineered plants is mostly concerned with plants that are grown for just one growing season in the fields and re-sown each year. This enables the company to check the seeds in regard to their most relevant economic characteristics before they go into the fields. However, potential teosinte × GM maize hybrids and their offspring will not undergo any additional quality or safety checks before they appear in the fields. Instead, they are simply new, untested, never risk assessed transgenic plants. Therefore, they cannot be allowed to emerge and persist in the environment. This problem does not depend on the question of whether teosinte will spread beyond sites of agricultural production.

EFSI - the general problem

The authors *"express our gratitude to the organisers of the 14th International Symposium on the Biosafety of Genetically Modified Organisms (ISBGMO14) "Environmental Risk Assessment of Genetically Modified Organisms: Past, Present and Future"*. This meeting took place in Guadalajara, Mexico, in June 2017 (http://isbr.info/ISBGMO14 [1]). Guadalajara is supposed to be an inspiring place. But what is behind ISBGMO and this conference? The organiser of the conference was the International Society for Biosafety Research (ISBR). This organisation is closely linked to the biotech and agrochemical industry as well as other similar organisations, such as the International Life Science Institute (ILSI) that is fully funded by industry.

However, there is very little information available on how the ISBR is funded. The only published information is that its conferences (such as the ISBGMO) are regularly sponsored by biotech corporations such as Monsanto, Bayer, Dow AgroSciences, DuPont and Syngenta, as well as the international federation of the genetic engineering industry, CropLife International. Further, the ISBR Board consists almost exclusively of experts from industry or who have strong ILSI affiliations. In 2016, Yann Devos joined the board ostensibly as a program director (see: https://www.testbiotech.org/node/1663 [2]).

This specific collaboration can be described as the starting point of what we are calling the "European Food Safety Industry" (EFSI). Up to now, EFSA has never managed to develop guidance to protect their independence from being compromised through cooperation with academics closely allied to the interests of those industries that should be regulated by EFSA (www.testbiotech.org/en/node/2009 [3]). Further, the existing, relatively weak guidelines for external experts on the panels do not apply to EFSA´s own employees, such as Devos and Weigman. Thus, it seems there are no sufficient restrictions on close collaboration between EFSA employees and regulated industries.

We fully expect 'EFSI' as a concept to continue and expand, especially if Bernhard Url, the executive director of EFSA, manages to obtain more funding from the EU to increase its staff – this is something currently being discussed in the EU Parliament.

References:

Devos, Y., Ortiz-García, S., Hokanson, K. E., & Raybould, A. (2018). Teosinte and maize× teosinte hybrid plants in Europe− Environmental risk assessment and management implications for genetically modified maize. Agriculture, Ecosystems & Environment, 259, 19-27. https://www.sciencedirect.com/science/article/pii/S0167880918301075 [4]

Fang, J., Nan, P., Gu, Z., Ge, X., Feng, Y. Q., & Lu, B. R. (2018) Overexpressing exogenous 5-enolpyruvylshikimate-3-phosphate synthase (EPSPS) genes increases fecundity and auxin content of transgenic Arabidopsis plants. Frontiers in plant science, 9, 233. https://www.frontiersin.org/articles/10.3389/fpls.2018.00233/full [5]

Trtikova, M., Lohn, A., Binimelis, R., Chapela, I., Oehen, B., Zemp, N., ... & Hilbeck, A. (2017) Teosinte in Europe–Searching for the origin of a novel weed. Scientific Reports, 7(1), 1560.

Creative Commons:

https://www.nature.com/articles/s41598-017-01478-w [6]

Further information:

Testbiotech (2016) Cultivation of genetically engineered maize: Risks not under control. https://www.testbiotech.org/node/1759 [7]

Impressum | Datenschutzerklärung

Quellen-URL:https://www.testbiotech.org/node/2194

Links
[1] http://isbr.info/ISBGMO14 [2] https://www.testbiotech.org/node/1663 [3] http://www.testbiotech.org/en/node/2009 [4] https://www.sciencedirect.com/science/article/pii/S0167880918301075 [5] https://www.frontiersin.org/articles/10.3389/fpls.2018.00233/full [6] https://www.nature.com/articles/s41598-017-01478-w [7] https://www.testbiotech.org/node/1759

Creative Commons: