

## Genetically modified crops do NOT belong in the EEA report

Ghent -11 March 2013. In January the European Environmental Agency (EEA) released an extensive report warning against repeating mistakes from the past. In the report, the authors bundled various chemical substances and technologies that - according to them - have long been known to be harmful to the environment and/or public health. The report 'Late lessons from early warnings' also dedicates a chapter to genetically modified crops (GMOs). The section about GMOs is very one-sided and focuses on the impact of multi-nationals. As the report is intended to assist policy makers in their decisions, VIB feels that it needs to respond in its capacity as a scientific institute. After all, GMO technology is a safe technology. In addition, GMOs in an integrated agricultural model can assist in providing solutions for the great challenges that agriculture is facing. Side-lining GMO technology due to unfounded fears and/or ideology would be a huge mistake.


### GM crops do not belong in the EEA report

In its report 'Late lessons from early warnings', the European Environmental Agency (EEA) claims that various products were admitted to the food chain and the environment even though there were indications that they were harmful (e.g. DDT, tobacco, lead in petrol).<sup>1</sup> The EEA wants to use these lessons from the past to provide a signal about avoiding future problems. VIB is convinced that food safety is a basic right for all consumers and that all initiatives to guarantee food safety must be encouraged. Alertness for new products is an essential part of this procedure. However, it is equally essential that the discussion about food safety is conducted based on scientific facts.

To our knowledge there isn't a single scientific, correctly performed study to date that demonstrates that the technology of genetic modification (GM) and/or the current commercial GM products are harmful to public health. On the contrary, there are many studies available that demonstrate that GM products are as safe as non-GM products.<sup>2</sup> Yet the EEA report states that there are "early warnings" that report the harmful nature of GMOs. The authors refer to studies by Gilles-Eric Séralini and list Arpad Pusztai as an "early warning scientist".

Arpad Pusztai stated in 1998 that rats fed GM potatoes developed abnormalities of the digestive system.<sup>3</sup> The GM potatoes in question produced a sugar-binding protein (lectin) from snow drops (*Galanthus nivalis*). As part of a research project, scientists wanted to determine whether this lectin could be used to protect plants against pests. It is known that lectins have a function in plant protection processes. They achieve this primarily by causing disruptions in the digestive system of herbivores or plant pests.<sup>4</sup> Some lectins, such as those in beans, are even toxic to humans and animals, which is why some beans must be cooked before being eaten.<sup>4</sup> This immediately explains why - when creating a genetically modified plant - it is more important to know which GM application is being used (e.g. lectin production) than the fact that GM technology is being used. The trial set-up used by Pusztai was only able to draw conclusions about the lectin-producing GM potato that was used, yet he used his data to draw into question the safety of all GM products and thus made a sweeping statement about GM technology in general. Pusztai is still cited - incorrectly - to this date in order to place GMOs in a bad light.

The studies by Gilles-Eric Séralini have the same goal. His study made international news at the end of last year due to the supposed health effects of GM corn.<sup>5</sup> Various scientific institutions, including EFSA<sup>6</sup> and VIB<sup>7</sup>, as well as ESTP<sup>8</sup> (European Society of Toxicologic Pathology) clearly demonstrated that the study was unreliable and scientifically incorrect. Therefore, it is a great shame that a European agency such as the EEA uses these unreliable references. The EEA report does not refer to



the many nutritional studies that reported no difference between a GM and non-GM diet.<sup>2</sup> There is also no mention of the Japanese study<sup>9</sup> in which rats were fed herbicide-tolerant GM soy for 2 years and that could not demonstrate any long-term harmful effects. In contrast to the study by Séralini, this Japanese study was performed in a scientifically correct manner. Therefore, based on food safety aspects, GMOs do not belong in the EEA report.

### **Multi-nationals and GMOs, the story is more nuanced**

In the chapter on GMOs, the EEA report is very critical about multi-nationals. Companies have indeed seen the limitless possibilities of GM technology from day 1 and it is right that they are gaining ever-increasing power in the biotech and seed industries. Today, the 10 largest seed companies account for 73 % of the global trade in seed for sowing.<sup>10</sup> The seed industry has undergone various structural changes in the last century, with the most significant change occurring in the 1980s. A wave of strategic mergers and take-overs saw certain companies aiming to maintain and expand their presence in the agrochemical sector.<sup>11</sup> It was important to combine biotechnology knowledge and access to sowing seeds in order to achieve this. The GM technology has definitely not reduced the “oligopolization” of the seed market, but also cannot be seen as the guilty party in this matter. The changes are in fact due to economic strategies rather than certain technologies. For example, not all large seed companies develop GMOs whereas governments and small biotech companies also develop GMOs.

Multi-nationals are inherent to every high-tech and capital-intensive sector. The computer industry is dominated by IBM and Apple, the companies Toyota, General Motors and Volkswagen own more than half of the motor industry and multi-nationals such as Johnson & Johnson or Pfizer are present in the pharmaceutical industry. All these sectors use Patent Law to protect their innovations and to earn back the money on the significant investments. Should we therefore encourage the fact that a handful of companies are gaining increasing power on the seed market? Absolutely not, but it is not correct to criticize the GM technology and the GM applications when one wishes to discuss globalization. This would be analogous to holding the art of printing responsible for the printing of politically unethical leaflets.

According to the EEA report, GMOs are products of the “top-down” innovation process (developments by companies that are marketed without input from the farmer). However, the authors forget that virus-resistant GM papayas have been planted in Hawaii since 1998. These papayas were developed by the public sector (the universities of Cornell and Hawaii) and saved the papaya production in Hawaii from collapse. In addition, the cultivation of GM papaya has reduced the burden of disease, which made it possible to re-introduce of the non-GM papaya. It is a local success story created entirely by the public sector in close consultation with the local farmers. A good example of a “bottom-up” GMO project (new agricultural solution from the sector involved). Furthermore, the patent rights were transferred to the Hawaiian association of papaya farmers. A special contract was drafted that guarantees that small farmers do not have to pay royalties for the technology.<sup>12</sup>

The EEA report also suggests that the “top-down” innovation by multi-nationals hampers the progress of “bottom-up” innovation. However, this has already been disproved in the field. In order to prevent soil erosion, North America and South America attempted to introduce the “no-tillage” agriculture method in the 1970s. The introduction was unsuccessful, as there was no effective weed management available. No-tillage only took off in 1996, when herbicide tolerant GM crops became available. Today, nearly 80 % of the Argentine fields are under no-tillage agriculture,<sup>13</sup> with all the resulting positive effects on the soil structure: less erosion, higher levels of organic matter, improved water management and less disruption to soil life.



## Also small farmers benefit from the GMO realizations

The EEA report states that the biotech sector does not offer solutions for the small farmers and that there are only a limited number of realizations. According to Clive James from ISAAA, last year nearly 100,000 farmers in Burkina Faso cultivated GM cotton on a total of 313,781 hectares.<sup>14</sup> The fact that this area has increased by 27 % compared to 2011 and the number of farmers has increased by 30 % indicates that the small farmer (3.16 hectare/farmer) does notice the benefits of GM cotton. Compared to traditional cotton farmers in Burkina Faso, GM cotton farmers had a yield that was nearly 20 % greater and they were able to reduce the number of insecticide treatments from six to two. This resulted in a net gain of 95.35 US dollars per hectare of GM cotton.<sup>14</sup>

The fact that the number of GMO applications has remained limited to date is largely due to the high costs of the current regulatory system. There are dozens of useful applications being developed by universities and research institutes, but without the help of large companies they will probably never be able to demonstrate their potential. This is still a difficult process even with industry assistance. The “Golden Rice Project” has been working together with Syngenta for years now in order to get rice that is rich in pro-Vitamin A into Asian fields. The World Health Organization (WHO) estimates that 250 million children suffer from vitamin A deficiency. Each year 500,000 of these children become blind and half of them die within a year.<sup>15</sup> The rice that is rich in pro-Vitamin A can solve these problems and will be made available to the local population without charge and without patent as part of a humanitarian project.<sup>16</sup> Yet the cultivation is being blocked on non-scientific grounds. It is demoralizing to see that society cannot benefit from such realizations as a result of a general culture of unfounded fear.

## The public sector is becoming increasingly active in the production of GM crops

Following the example of virus-resistant papaya in Hawaii, the public sector is increasingly becoming involved in the development of specific GM crops. The Brazilian agricultural research institute EMBRAPA has developed GM beans that are resistant to golden mosaic virus, one of the greatest pests in bean cultivation. The cultivation of these GM beans was approved in 2011 and they are expected to be sown on Brazilian fields in 2014. The beans were developed for the Brazilian farmers, completely independently from industry and can ensure a guaranteed harvest with fewer chemical pesticides.<sup>17</sup> Brazilian farmers will be able to keep part of the harvest as seeds for the next season and the beans may also be used for plant breeding programs.

Looking closer to home, there are the *Phytophthora*-resistant potatoes, developed by the University of Wageningen (The Netherlands) and the John Innes Institute (UK). The GM potatoes contain natural resistance genes against potato blight; a plague caused by the fungus *Phytophthora infestans*. A set of these GM potatoes from The Netherlands was recently tested under Flemish field conditions and appears to have a high resistance against the *Phytophthora* fungus.<sup>18</sup> The cultivation of these publicly developed potatoes can significantly reduce the use of fungicides.

Scientists at the Rothamsted Institute (UK) are conducting field trials with GM wheat. This wheat produces a substance ( $\beta$ -farnesene), which keeps aphids away from the field and which attracts natural predators of aphids. This aphid-resistant wheat will require fewer insecticides to remain disease-free and can therefore contribute to a more environmentally-friendly cultivation of wheat.<sup>19</sup> However, the question remains whether the GM potato and GM wheat will ever reach the European market as a public product. The time-consuming and extremely expensive registration procedures in Europe mean that only the capital-rich companies can commercialize GMOs. A survey by the large “agrobiotech” companies indicates that the costs for authorization tests and registration can reach 35 million US dollars, more than 25 % of the total development and marketing costs.<sup>20</sup> The high costs of authorization are also partly to blame for companies limiting their research to crops such as corn, soy and cotton that are produced on a global scale.



## GM crops as part of an integrated agricultural model

Agriculture is a complex field and it would be an over-simplification to see the GM technology as the only way of increasing food quality and food quantity AND to reduce the pressure on the environment caused by agriculture. We must move towards an integrated agricultural model that combines the best aspects of conventional agriculture with the best aspects of organic farming, but with the use of the latest technologies, including the targeted genetic modification of crops.

At a conference in Ghent on 6 December 2012, the Portuguese farmer Maria Gabriela Cruz illustrated that despite the very limited cultivation of GM crops in Europe (0.13 million of the 170.3 million hectares globally <sup>21</sup>), insect-resistant Bt corn forms an important part of the successful management of her agricultural company. The larvae of the European corn borer are common in southern Europe, but by using the insect-resistant genetically modified corn (MON810), Cruz does not suffer any damage as a result of the corn borer and she is able to cut out two insecticide treatments. Cruz also achieves 10 % extra yield and obtains corn that is of a higher quality because the reduced insect damage also causes reduced fungal infestation. In addition to the corn borer, soil erosion in Portugal is an enormous problem. A switch to no-tillage agricultural methods (see above) could offer a solution, but appears difficult to maintain due to a decrease in the number of herbicides that are permitted. Cruz pleaded for all available technologies - including herbicide tolerant GM crops - to be used in Europe.

Humans have been genetically modifying crops for 10,000 years by means of selection and breeding. This process has been intensified during the last century by the implementation of changes in the DNA (mutation breeding, e.g. red grapefruit <sup>22</sup>) or facilitating crosses that are impossible in nature (e.g. triticale, a cross between wheat and rye <sup>23</sup>). The targeted genetic modification of plants by means of GM technology is a safe technology and far less intrusive at the molecular level than some traditional breeding techniques. Therefore, GM crops do not belong in the EEA report. The correct “early warning” in this discussion is that it would be a missed opportunity if GM technology were unable to demonstrate its true potential due to unfounded fears and/or ideology.

## References

1. EEA rapport No 1/2013. Late lessons from early warnings: science, precaution, innovation. Beschikbaar via <http://www.eea.europa.eu/publications/late-lessons-2>
2. Snell C et al 2012. Assessment of the health impact of GM plant diets in long-term and multigenerational animal feeding trials: A literature review. *Food Chem Toxicol* 50, 1134-1148.
3. Eden SWB, Pusztai A 1999. Effects of diets containing genetically modified potatoes expressing *Galanthus nivalis* lectin on rat small intestine. *The Lancet* 354, 1353-1354.
4. Peumans WJ, Van Damme EJM 1995. Lectins as plant defense proteins. *Plant Physiology* 109, 347-352.
5. Séralini G-E et al 2012. Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize. *Food Chem Toxicol* 50, 4221-4231.
6. European Food Safety Authority; Final review of the Séralini et al. (2012) publication on a 2-year rodent feeding study with glyphosate formulations and GM maize NK603 as published online on 19 September 2012 in *Food and Chemical Toxicology*. *EFSA Journal* 2012; 10(11):2986. doi:10.2903/j.efsa.2012.2986. Beschikbaar online: [www.efsa.europa.eu/efsajournal](http://www.efsa.europa.eu/efsajournal)
7. VIB 2012. A scientific analysis of the rat study conducted by Gilles-Eric Séralini et al. Available via <http://www.vib.be/en/news/Pages/VIB-concludes-that-Seralini-study-is-not-substantiated-.aspx> and Grunewald W, Bury J 2013. Comment on “Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize” by Séralini et al. *Food Chem Toxicol* 53, 432-433.
8. Schorsch F et al 2013. Serious inadequacies regarding the pathology data presented in the paper by Séralini et al. (2012). *Food Chem Toxicol* 53, 465-466.
9. Sakamoto Y et al 2008. A 104-week feeding study of genetically modified soybeans in F344 rats. *J Food Hyg Soc Japan* 49, 272-282. Translated in English by ANSES.
10. Center for Food Safety, Save our Seeds Report: Seed Giants vs US Farmers. February 2013. Beschikbaar via [http://www.centerforfoodsafety.org/wp-content/uploads/2013/02/Seed-Giants\\_final.pdf](http://www.centerforfoodsafety.org/wp-content/uploads/2013/02/Seed-Giants_final.pdf)

- 
11. Schenkelaars P, de Vriend H, Kalaitzandonakes N 2011. Drivers of consolidation in the seed industry and its consequences for innovation. Report commissioned by COGEM.
  12. Goldman M 2007. The IP management of the PRSV-resistant papayas developed by Cornell University and the University of Hawaii and commercialized in Hawaii. In: Intellectual Property Management in Health and Agricultural Innovation: A handbook of best practices (eds. A Krattiger, RT Mahoney, L Nelsen, et al.). Available online [www.iphandbook.org](http://www.iphandbook.org)
  13. <http://www.aapresid.org.ar/images/cms/assets/docs/no-till%20area%20estimate%20in%20argentina-eng.pdf>
  14. James C 2012. Global status of commercialized biotech/GM crops: 2012. ISAAA Brief No. 44. ISAAA: Ithaca, NY.
  15. <http://www.who.int/nutrition/topics/vad/en/>
  16. <http://www.goldenrice.org/index.php>
  17. [http://www.cenargen.embrapa.br/comunicacao/2011/cenargenda/cenargenda62\\_en\\_2011.html](http://www.cenargen.embrapa.br/comunicacao/2011/cenargenda/cenargenda62_en_2011.html)
  18. VIB 2013. Field tests confirm the potential of genetically modified potatoes for sustainable potato cultivation. Available online: <http://www.vib.be/en/news/Pages/Field-tests-confirm-the-potential-of-genetically-modified-potatoes-for-sustainable-potato-cultivation.aspx>
  19. <http://www.rothamsted.ac.uk/Content.php?Section=AphidWheat>
  20. McDougall P 2011. The cost and time involved in the discovery, development and authorisation of a new plant biotechnology derived trait. A consultancy study for Crop Life International. Available online [www.croplife.org/PhillipsMcDougallStudy](http://www.croplife.org/PhillipsMcDougallStudy)
  21. James C 2012. Global Status of Commercialized Biotech/GM Crops: 2012. ISAAA Brief No. 44. ISAAA: Ithaca, NY. Executive summary, <http://www.isaaa.org/resources/publications/briefs/44/>.
  22. Hensz RA 1972. "Grapefruit tree" US Patent No. PP3,222. Wahsinton, DC: US Patent and Trademark Office.
  23. Ma X-F et al 2004. Polyploidization-induced genome variation in triticale. *Genome* 47, 839-848.

## VIB

VIB is a non-profit research institute in the life sciences in Flanders, Belgium, with 1300 scientists conducting strategic basic research on the molecular mechanisms that are responsible for the functioning of the human body, plants, and micro-organisms. Through a partnership with four Flemish universities - Ghent University, KU Leuven, University of Antwerp, and Vrije Universiteit Brussel - and a solid funding program, VIB unites the forces of 76 research groups in a single institute. Through its technology transfer activities, VIB strives to convert the research results into products for the benefit of consumers and patients. VIB develops and disseminates a wide range of scientifically substantiated information about all aspects of biotechnology. For more information, please visit [www.vib.be](http://www.vib.be).

## Contact

Wim Grunewald, VIB communication plant biotechnology - [wim.grunewald@vib.be](mailto:wim.grunewald@vib.be)