Herbicide tolerant maize (T25): food safety in doubt; herbicide safety in doubt; environmental dangers.

Janet Cotter
Greenpeace Research Laboratories Technical Note 04/2007
April 2007

Brazil is considering allowing cultivation of a genetically engineered (GE) herbicide tolerant maize known as T25. This maize is tolerant to the herbicide known as "Liberty" or "Basta", which contains the active ingredient, glufosinate. However, there are many problems with this GE herbicide tolerant maize. There are concerns regarding its food safety; concerns regarding the safety of the herbicide, glufosinate. Cultivation of this GE herbicide tolerant maize has been banned in several EU countries, and the herbicide looks set to banned in the EU.

Cultivation of the GE herbicide tolerant maize in Brazil will undoubtedly lead to weeds resistant to glufosinate, resulting in more and more herbicide being applied - a pattern that has been seen with other GE herbicide tolerant crops. GE maize cannot be contained. There is ample evidence to suggest that cultivation of GE maize will contaminate neighbouring non GE crops, resulting in environmental, health and economic concerns.

Food safety in doubt

When an application was filed for cultivation of T25 in the EU (where it was called Chardon LL), the outcry and controversy resulted in an extra-ordinary public hearing in the UK 2000-2002[1]. During this hearing, the data submitted for approval of T25 in the EU[2], was reviewed and found to be seriously deficient by independent scientists. Although the maize was intended as cattle feed in the EU, no feeding or toxicity studies had been performed on cattle. A UK scientist said that given the inadequate testing: "*I would not drink milk from [cattle fed] the forage"* [3]. Therefore, this herbicide tolerant maize cannot be considered safe for food or animals. Austria banned T25 in 2000 because of concerns regarding the lack of information on the environmental implications of growing the GE crop. This decision was recently (December 2006[4]) upheld by the vast majority of the EU's Environment Ministers.

Herbicide (glufosinate) is unsafe for humans or the environment

A review of the safety of the herbicide associated with T25 GE maize, glufosinate, the active ingredient of Basta, or Liberty, was conducted by the European Food Safety Authority[5]. This review found risks to farmers from spraying the herbicides, to insects in the surrounding areas (and hence the animals that rely on them) and also for consumers from residues on certain crops (to very small children from potatoes sprayed with glufosinate). The environmental fate of some of the degradation products of glufosinate was also called into question. This negative review is likely to lead to calls for a ban of this herbicide in the EU.

Withdrawn from the EU

After the lengthy hearing, T25 was finally granted approval for cultivation through the flawed EU process in 2004. But then, Bayer withdrew T25 from the market. This shows that either Beyer weren't confident that they could prevent GE contamination of conventional and organic maize, or that the measures the EU asked to be put in place to prevent widespread contamination made it uneconomical to grow. Either way, it shows that the GE maize was unnecessary and unwanted by farmers.

Environmental "benefits" unfounded

The UK Farm Scale Evaluations (FSE) of GE crops included this type of herbicide tolerant maize. Initial results in 2003 appeared to show that T25 was more environmentally friendly (i.e. increased biodiversity) than conventional maize. However, these results were obtained when the GE herbicide tolerant maize was compared with conventional maize using a herbicide that is now banned in the EU (atrazine). When the results were re-evaluated, the "benefits" of GE maize proved to be unfounded. This has been confirmed by a recent study that showed any biodiversity benefits from GE maize are short lived and would not be cumulative year-on-year[6].

Increasing weed resistance

The introduction of GE herbicide-tolerant crops tolerant to other herbicides such as glyphosate or Roundup, has caused an increase in weed resistance where they are widely planted. The same can expect to happen to Liberty or Basta tolerant GE crops if they too are widely planted.

Glyphosate use dramatically increased[7] with the introduction of Roundup GE crops since their introduction a decade ago. Now, glyphosate-resistant weeds are occurring in direct association with Roundup GE crop cultivation in many parts of the US[8,9,10,11]. In Argentina, new weeds, thought to be resistant to glyphosate are replacing the usual weeds found in the fields, as a result of cultivation GE herbicide tolerant soya[12]. Other, more notorious herbicides are herbicides are now being advertised to control glyphosate resistance weeds[13].

GE crops tolerant to Liberty or Basta have not been widely planted, but if they are, weed resistance to these herbicides will undoubtedly become a problem. This has economic implications, because of the extra herbicide costs to farmers, and environmental because of the increased and stronger herbicides that will become necessary.

GE maize will contaminate non-GE maize

There are many studies confirming long distance pollination events from GE maize up to 1,000 m away[14]. Maize has been shown to be the most difficult GE crop to contain in terms of high out crossing rate and the large distances that viable maize pollen can travel. GE maize is described as presenting a "medium to high risk" for cross-pollination with other crops by the European Environment Agency, an official body of the European Union.[15]

Maize plants could survive from one growing season to the next and seed can germinate from spilled grain, or grain inadvertently left on farm machinery. Should any of these GE maize plants inadvertently grow near a maize crop, the resulting pollen could cross-pollinate with maize in fields, producing genetic contamination. Such contamination has consumer concerns, as people may unknowingly eat GE maize; health concerns, as GE maize cannot be considered safe to eat; environmental concerns as strong herbicides may

be needed to eliminate GE volunteers and economic concerns, as farmers will lose money if their non GE crop is contaminated, especially of it organic maize.

Maize landraces and creolized varieties have been developed over centuries and are cultivated throughout Brazil and are of socio-economic importance for the family farming systems[16]. Therefore, contamination of these landraces would be a cultural violation, with a possible economic cost, in addition to the environmental risks associated with contamination.

Conclusions

There are numerous reasons why GE herbicide tolerant (T25) should not be cultivated, nor enter the human or animal food, chain anywhere in the world. The food and feed safety of T25 are unknown. The herbicide used in association with the GE maize is unsafe for humans and the environment. The use of GE herbicide resistant maize will increase weed resistance, resulting in more and stronger herbicides being used. If GE herbicide tolerant maize planted in Brazil, it will contaminate non-GE maize (both conventional and organic).

Greenpeace is opposed to the release of GE organisms because of the irreversibility of such releases and the potential of GE organisms to cause serious harm to the environment.

---

[1] UK government: http://www.defra.gov.uk/planth/pvs/gmrep1.htm

[2] Commission Decision 98/293/EC of 22nd April 1998 concerning the placing on the market of genetically modified maize (*Zea mays* L. T25), pursuant to Council Directive 90/220/EEC. Official Journal of the European Communities - 05.05.1998 - L 131 P. 0030 – 0031.

[3] Professor Bob Orskov, evidence to the Chardon LL Public Hearing, 18th October 2000. Available at http://www.defra.gov.uk/planth/pvs/chardon/001018.pdf

[4] http://www.foodnavigator.com/news/ng.asp?n=72943-austria-gm-corn-gm-ban

5 EFSA 2005. Conclusion regarding the peer review of the pesticide risk assessment of the active substance glufosinate finalised: 14 March 2005 EFSA Scientific Report 27: 1-81.

[6] Heard et al. 2006. Effects of successive seasons of genetically modified herbicide-tolerant maize cropping on weeds and invertebrates. Annals of Applied Biology 149: 249–254.

[7] Benbrook, C.M. 2004. Impacts of Genetically Engineered Crops on Pesticide Use in the United States: the First Eight Years. AgBioTech InfoNet Technical Paper Number 7 http://www.biotech-info.net/Full_version_first_nine.pdf

Nandula, V.K., Reddy, K.N., Duke, S.O. & Poston, D.H. 2005. Glyphosate-resistant weeds: current status and future outlook. Outlooks on Pest Management August 2005: 183-187.

[8] Baucom, R.S. & Mauricio, R. 2004. Fitness costs and benefits of novel herbicide tolerance in a noxious weed, Proceedings of the National Academy 101: 13386–13390.

[9] van Gessel, M.J. (2001) Glyphosate-resistant horseweed from Delaware. Weed Science, 49, 703-705.

[10] http://www.weedscience.org/Summary/UspeciesMOA.asp?lstMOAID=12&FmHRACGroup=Go

[11] Zelaya, I.A., Owen, M.D.K. (2000). Differential response of common water hemp *Amaranthus rudis* Sauer) to glyphosate in Iowa. Proc. North Cent. Weed Sci. Soc., 55, 68. and Patzoldt, W.L., Tranel, P.J., & Hager, A.G. (2002) Variable herbicide responses among Illinois waterhemp (*Amaranthus rudis* and *A. tuberculatus*) populations Crop Protection, 21, 707-712.

http://www.weedscience.org/Case/Case.asp?ResistID=5269

[12] Vitta, J.I., Tuesca, D. & Puricelli, E. 2004. Widespread use of glyphosate tolerant soybean and weed community richness in Argentina. Agriculture, Ecosystems and Environment, 103, 621-624.

[13] See, e.g. http://farmindustrynews.com/mag/farming_saving_glyphosate/index.html

[14] Jarosz, N., Loubet, B., Durand, B., Foueillassar, X. and Huber, L. 2005. Variations in maize pollen emission and deposition in relation to microclimate. Environmental Science and Technology 39: 4377 – 4384.
Halsey, M.E., Remund, K.M., Davis, C.A., Qualls, M., Eppard, P.J. & Berberich, S.A. 2005. Isolation of maize from pollen-mediated gene flow by time and distance. Crop Science 45: 2172-2185.
Treu, R. & Emberlin, J. 2000. Pollen dispersal in the crops Maize *(Zea mays*), Oil seed rape *(Brassica napus* ssp *oleifera*), Potatoes *(Solanum tuberosu*m), Sugar beet *(Beta vulgaris* ssp *vulgaris*) and wheat *(Triticum aestivu*m).A report for the Soil Association from the National Pollen Research Unit. Available at http://www.soilassociation.org.
Eastham, K. & Sweet, J. 2002. Genetically modified organisms (GMOs): the significance of gene flow through pollen transfer. Expert's Corner Series, European Environment Agency, Copenhagen. http://www.eea.eu.int/

[15] Treu, R. & Emberlin, J. 2000. Pollen dispersal in the crops Maize *(Zea mays*), Oil seed rape *(Brassica napus* ssp *oleifera*), Potatoes *(Solanum tuberosu*m), Sugar beet *(Beta vulgaris* ssp *vulgaris*) and wheat *(Triticum aestivu*m).A report for the Soil Association from the National Pollen Research Unit. Available at http://www.soilassociation.org.

[16] Carvalho, V.P., Ruas, C.F., Ferreira, J.M., Moreira, R.M.P. & Ruas, P.M. 2004. Genetic diversity among maize (*Zea mays* L.) landraces assessed by RAPD markers. Genetics and Molecular Biology, 27: 228-236.