GREENPEACE

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GM crops: too many risks to ignore

State of play on GMOs

- **92.5%** of global arable land is GMO-free
- **176** out of 192 countries do not grow GMOs
- **4 countries** grow 90% of all GM crops – US (53%), Argentina (18%), Brazil (11.5%) and Canada (6%)
- **4 companies** own almost all GM crops currently in existence: Monsanto, Dupont, Syngenta and Bayer
- **2 traits** only (pesticide-producing and herbicide-tolerant) are present in virtually all GMOs grown.
- **0.119%** of EU agricultural land is planted with GM crops (4% is planted with organic crops)

The problem – The environmental risk assessment currently performed in the EU is inappropriate, as it is not capable of assessing the risks associated with GM plants (see Greenpeace environmental risk assessment reform briefing).

Pesticide-producing GMOs

In the past two years, **peer reviewed scientific studies have demonstrated that the effects of Bt maize varieties are far from predictable and that their harmful potential is even greater than previously thought** (see opposite column).

In February 2008, 37 scientists from 11 countries wrote an open letter to the EU Environment Commissioner Stavros Dimas supporting his proposal to reject the authorisation for cultivation of two GM Bt maize varieties (1507 and Bt11). They highlighted the "***lack of scientific consensus on the safety assessment of GM crops***", stressed that "***data quality on available studies is highly variable***" and argued for a "***temporary suspension of cultivation until a more rigorous risk assessment has been done***".[i]

Target insects develop resistance to pesticides produced by Bt GM crops.[ii] Farmers are forced to apply both greater quantities and additional varieties of insecticide to fight these resistant pests, benefiting pesticides manufacturers, which are often the same companies that produce GMOs.

In its submission to the WTO case, the European Commission criticised the EU environmental risk assessment for GMOs, particularly for Bt crops, by stating that "***the current state of Bt environmental risk assessment in Europe shows that there were and still are considerable grounds for concern about the toxin Bt, especially non-target effects.***"[iii]

Cultivating Bt maize means swapping one pest for another. Catangui et al. (**2006**)[iv] shows that in the US new insects (Western bean cutworm) are simply filling the niche of the pest organism killed by Bt maize (European corn borer).

Bt maize (including Bt11 and MON810) is unexpectedly susceptible to aphid infestation. Faria et al. (**2007**)[v] detects differences in amino acid concentrations not described in any of the applications for marketing of Bt maize. This shows that Bt maize is subject to unexpected and unpredictable effects and that plant-insect interactions are too complex to be assessed by the current EU risk assessment.

The Bt toxin from GM Bt maize may affect headwater stream ecosystems. Rosi-Marshall et al. (**2007**)[vi] demonstrates that GM crops producing Bt toxins can affect ecosystems via unexpected pathways, because interactions in the natural environment are complex and not fully understood.The current risk assessment does not consider all toxicity pathways and therefore all risks associated with GM plants.

The level of Bt toxin produced by MON810 varies. Nguyen, H. T. & J. A. Jehle (**2007**)[vii] shows that the level of Bt toxin produced by MON810 varies strongly between different locations and even between plants on the same field. The reasons for these differences are not known. This raises serious questions about the current capacity to assess the impact of Bt toxins on the environment.

Bt toxin affects behaviour of monarch butterfly larvae. Prasifka et al. (**2007**)[viii] shows that the larvae of the monarch butterfly which are exposed to Bt maize pollen behave in a surprisingly different way to other larvae exposed to non-Bt crops.

Environmental testing invalidated by unknown toxin. Rosati et al. (**2008**)[ix] shows that the Bt toxin actually produced by MON810 is likely to be different from the Bt toxin used in the crop's environmental testing. This invalidates most, if not all, MON810 environmental 'safety' tests.

Leaves or grain from Bt maize could be toxic to aquatic life in streams. Bøhn et al. (**2008**)[x] shows that GM Bt maize could be toxic to aquatic life (insects). This underlines the conclusions of Rosi-Marshall et al. (2007, above) that this unexpected pathway is important and has not been considered in the risk assessment of Bt crops.

Herbicide-tolerant GMOs

The introduction of GM crops tolerant to herbicides such as glyphosate (the active ingredient in Monsanto's 'Roundup') have caused an increase in weed resistance. This leads to significant changes in agricultural practices, namely **increased quantities of toxic herbicides being sprayed on the crops.**

The use of glyphosate has dramatically increased since the introduction of Roundup-Ready GM crops a decade ago.[xi, xii] Now, glyphosate-resistant weeds are developing as a result of Roundup-Ready GM crop cultivation in many parts of the United States. 34 cases of glyphosate resistance have been documented in nine species in the US since 2000.[xiii, xiv, xv, xvi]

In Argentina, new weeds thought to be resistant to glyphosate, are replacingweeds usually found in fields as a result of cultivating GM herbicide-tolerant soya.[xvii] Now farmers are recommended to spray stronger formulas and mixtures of notorious herbicides to control glyphosate-resistant weeds.[xviii, xix]

i The letter can be found on the internet at: http://www.vdw-ev.de/Scientists%20letter%20to%20Dimas.pdf.

ii Tabashnik, B.E., Gassmann, A.J., CrowdeDr, .W. &C arrière, Y. 2008 . Insect resistance to Bt crops: evidence versus theory. Nature Biotechnology 26: 199-202.

iii European Communities – Measures affecting the approval and marketing of biotech products (DS291, DS292, DS293). Comments by the European Communities on the Scientific and Technical Advice to the WTO Panel, para 128.

iv Catangui M.A. et al. 2006.Western bean cutworm, Striacosta albicosta (Smith) (Lepidoptera : Noctuidae), as a potential pest of transgenic Cry1Ab Bacillus thuringiensis corn hybrids in South Dakota Environmental Entomology 35 1439-1452.

v Faria, C.A., Wäckers, F.L., Pritchard, J., Barrett, D.A. & Turlings, T.C.J. 2007. High susceptibility of Bt maize to aphids enhances the performance of parasitoids of lepidopteran pests. PLoS ONE 2: e600. doi:10.1371/journal.pone.0000600.

vi Rosi-Marshall, E.J., Tank, J.L., Royer, T.V., Whiles, M.R., Evans-White, M., Chambers, C., Griffiths, N.A., Pokelsek, J. & Stephen, M.L. 2007. Toxins in transgenic crop byproducts may affect headwater stream ecosystems. Proceedings National Academy of Sciences of the USA 41: 16204–16208.

vii Nguyen, H. T. & J. A. Jehle 2007.Quantitative analysis of the seasonal and tissue-specific expression of Cry1Ab in transgenic maize Mon810. Journal of Plant Diseases and Protection.

viii Prasifka, P.L., Hellmich, R.L., Prasifka, J.R. & Lewis, L.C. 2007. Effects of Cry1Ab-expressing corn anthers on the movement of monarch butterfly larvae. Environmental Entomology 36:228-33.

ix Rosati, A., Bogani, P., Santarlasci, A. Buiatti, M. 2008. Characterisation of 3´ transgene insertion site and derived mRNAs in MON810 YieldGard maize. Plant Molecular Biology DOI 10.1007/s11103-008-9315-7.

x Bøhn, T., Primicerio, R., Hessen, D.O. & Traavik, T. 2008. Reduced fitness of Daphnia magna fed a Bt-transgenic maize variety. Archives of Environmental Contamination and Toxicology DOI 10.1007/s00244-008-9150-5.

xi 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

xii 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.

xiii 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.

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

xv http://www.weedscience.org/Summary/Uspecies MOA.asp?lstMOAID=12&FmHRACGroup=Go.

xvi 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.

xvii 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.

xviii See, e.g. http://farmindustrynews.com/mag/farming_saving_glyphosate/index.html.

xix Brooks, R.J. 2003. Saving glyphosate. Farming Industry News http://farmindustrynews.com/mag/farming_saving_glyphosate/index.html. Monsanto 2008b. Roundup PowerMAX™ is advertised as "proven on hard-to-control weeds".

The way forward:

1. Given all of the uncertainties and proven negative environmental effects of Bt crops, the precautionary principle must be invoked and the **cultivation of Bt maize prevented**;
2. **Assessments of impacts on non-target organisms and of long-term negative effects** of Bt crops on health and the environment are a legal requirement that must be respected;
3. Assessment of herbicide-tolerant GM crops must take into account **foreseeable changes in agricultural practices** (increased quantities and toxicity of herbicides) and their effects on human health and the environment;
4. Until a thorough assessment has been carried out, the negative effects of **herbicide-tolerant GM crops** can be prevented only by **excluding them from European agriculture.**