GREENPEACE

Peer-reviewed scientific studies on the probable harmful effects to the environment from the cultivation of MON810

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Since 1998, there have been several scientific studies on the probable harmful effects to the environment arising specifically from the cultivation of Monsanto's genetically modified (GM), insect resistant (*Bt*) maize, MON810, in Europe. These studies are in addition to further published work on the dangers of other genetically modified *Bt* maize varieties (e.g. Bt11) and of *Bt* crops in general.

The following summaries are of scientific studies that have been published in peer-reviewed scientific journals. They show that there is an alarmingly broad range of probable harmful effects to the environment from the cultivation of MON810. Not included in this list are the environmental effects associated with the emergence of *Bt* resistance in the corn borer, although this is widely predicted to occur with loss of effectiveness of *Bt* sprays, an important tool in organic agriculture. Nor are the scientific concerns with the current risk assessment addressed here. For example, the possibility that the *Bt* toxin can affect organisms higher up the food chain than directly affected organisms, nor the inadequacy of the proposed monitoring, are not addressed here.

Several studies finding no adverse environmental effects of *Bt* crops, including MON810, were published as a collection of papers in *Environmental Entomology* in November 2005. However, like many such studies finding no adverse effects, these were mostly either written or funded by the biotechnology industry and not considered here. Only independent studies are considered here.

Summaries

- Hernandez et al. (2003) sequenced the genetic insert in MON810. They found that the "**structure of the transgene differs notably from the original plasmid construct as reported in the safety assessment by Monsanto**". They found a probable rearrangement at 3' end - explaining the partial loss of the inserted gene.

- Dively et al. (2004) found adverse effects from MON810 on monarch butterfly larvae in North America, a non-target organism. In long-term (2 years) field experiments, over 20% fewer larvae reached the adult butterfly stage when exposed to naturally deposited *Bt* pollen. Before this research, short-term studies (duration of several days) had concluded that MON810 did not cause acute adverse effects on monarch butterfly larvae (Hellmich et al. 2001; Stanley-Horn et al. 2001), although further studies on the effects of long term exposure were considered necessary (Stanley-Horn et al., 2001). **No such short-term or long-term experiments on non target butterfly and moth (lepidoptera) species have been conducted in Europe**. Further, mapping of the coincidence of monarch butterfly breeding areas and maize fields was considered important (Hellmich et al. 2001, Dively et al., 2004). No such mapping exercise of vulnerable non-target species and maize fields ahs been conducted in Europe.

- Saxena and Stotzky, (2001) found an **unexpectedly higher lignin content in MON810** (and several other GE *Bt* maize varieties) compared to their sister lines. These findings have been confirmed by Poerschmann et al. (2005). Lignin is well-known for its capability to influence palatability of plant material to herbivores and could slow the decomposition of *Bt* maize residues in the soil. Indeed, Flores et al. (2005) showed that ***Bt* maize, including MON810 decompose less in soil**, and considered this might be related to the higher lignin content.

- Saxena et al. (2002) showed that the ***Bt* toxin is exuded by the roots of MON810.** Once in the soil, the *Bt* toxin may be adsorbed onto clay particles and thus persist in the soil whilst remaining biologically active (Stotzky, 2004)

- **The Cry1Ab *Bt* protein exuded by MON810, has been shown to persist in the soil whilst remaining biologically active** (Zwahlen et al. 2003; Stotzky, 2004, Baumarte & Tebbe, 2005). This is especially true for areas such as Europe that experience relatively cold winters. The long-term, cumulative effects of the continued growth over several years of GE *Bt* maize has not been adequately considered in a European context, even though they are thought to be highly important in terms of the risk assessment (Marvier, 2002; Andow and Hilbeck, 2004).

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