

## Insect Resistance to Bt Toxins in GM Insect Resistant Crops (Summary)

November 2011

Resistance to Bt crops is on the increase and has been confirmed in five different pest species:

- moth pests in Bt cotton in India (2010) and US (2008).
- moth pests in maize in Puerto Rico (2007) and S Africa (2007).
- a beetle pest in maize in the US (2011).

So far the breakdown in resistance of the pink bollworm in Bt cotton in India has caused the most significant problems for farmers. However the resistance of the western corn rootworm in Bt Maize in the Illinois, Iowa and beyond in the US is potentially more serious.

Pesticide costs in Bt cotton in Gujarat have increased by nearly a third as a result of insect resistance developing. Claims that Bt cotton is a “pro-poor” technology have been challenged as “selective and misleading” because they fail to take into account the variability of performance due to a range of agronomic, socio-economic and institutional factors.

Bt insect resistance initially develops in crops with just one Bt gene where concentrations of the Bt toxin are not sufficient to kill the pest and levels may also vary in different parts of the plant or at different times in the growing cycle (increasing the chances of resistance developing in target pests).

The Bt crop strategy is two-fold:

- To ensure that susceptible pest received 25 times the lethal dose of Bt toxin and to provide non-GM refuge to prevent resistant pests becoming dominant. Crops with two or more “pyramided” GM traits targeting the same pest can delay the development of resistance.
- To use non-GM crop refuges of 20% of the sown area, which may delay the development of resistance by ensuring there are sufficient non-resistant adults to breed with resistant insects, meaning recessive resistant genes are not expressed in the next generation. Resistance breakdown arises when small numbers of resistant individual survive and breed with other resistant insects.

However GM solutions are now also showing the signs of resistance developing, and failure to implement refuge strategies correctly is partly to blame for Bt resistant insects evolving. Further difficulties may arise:

- Resistance is usually a recessive gene, but some research has indicated that it could become more dominant meaning spread of resistance could become more rapid.
- Some entomologists are concerned that the plans to provide refuges through adding 10% non-GM seeds into Bt seeds sold to farmers in the US (“refuge in the bag”) may not work because pests could receive sub-lethal doses of the Bt toxin leading to resistance.

Long-term solutions must involve agroecological approaches, including an end to short rotations and monocultures and replacing them with much longer rotations, greater crop and varietal diversity and crop breaks and the use of natural predators and control agents.