EPA Science Forum 2003
Partnering to Protect Human Health and the Environment

The Evolution of Resistance to Plant Incorporated Protectants by Targeted Insect Pests

Uwe Stolz, Mike Blum, Mark Bagley - Office of Research and Development, National Exposure Research Laboratory, Ecological Exposure Research Division

Agricultural Pesticides:
Intended *and* unintended effects

Human Health Effects

Unintended Environmental Impact

Targeted Insect Pest

80 million acres of corn planted per year.

Western Corn Rootworm (WCR) is major pest of corn.

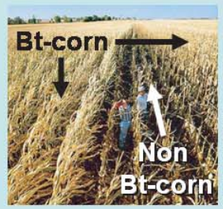
Conventional insecticides applied to 14-18 million acres per year.

WCR responsible for 1 out of 7 insecticide applications for all agricultural crops!

Biotechnology May Offer a Solution...

+

=

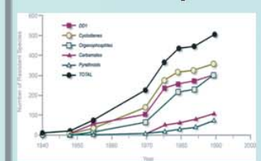


Bt-corn eliminates the need for conventional pesticides: Good for Farmers, Good for Human Health, Good for the Environment.

Some genetically modified corn hybrids contain a gene from the soil bacterium ***Bacillus thuringiensis*** (Bt), which produces an insecticide (known as a plant incorporated protectant) specific for beetles. Corn varieties containing the Bt gene are known as Bt-corn.

...But, the Evolution of Bt-Resistance is an Environmental Problem

WCR resistance to Bt-toxin would eliminate the benefits of Bt-corn and require a return to the use of conventional pesticides.



More than 500 insect species have evolved resistance to a variety of insecticides.

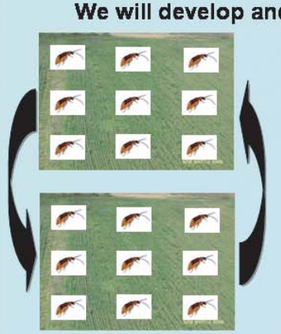
How long will it take for pests to evolve resistance? It depends on Bt-crop use and the genetics of the crop pests.

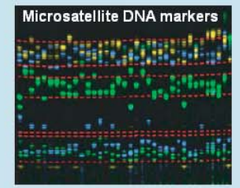
Most scientist believe continued use of Bt-crops will result in the evolution of resistance – they just don't know when.

Emerging Technologies

Understanding the Population Genetics of Western Corn Rootworm May Help Delay Onset of Bt-Resistance

We will develop and use genetic markers to measure gene flow between populations and genetic variation within populations.





Measuring gene flow and genetic variation in the WCR will:

1. Improve accuracy of genetic models currently used to predict how fast Bt-resistance will evolve.
2. Help determine how Bt-corn should be grown to ensure its continued usefulness.

Therefore, our work will help preserve the environmental, human health, and economic benefits of Bt-corn for as long as possible.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Partnering to Protect Human Health and the Environment