Experts suggest steps to stop spread of resistant corn rootworms

April 23 2012, by David Tenenbaum

(Phys.org) -- The discovery that more Western corn rootworms are resistant to the toxin contained in widely planted transgenic corn has sparked a warning that farmers must change tactics or lose a valuable management tool against a traditional corn pest.

In a March 5 letter to the Environmental Protection Agency, 22 entomologists working on corn rootworm suggested changes to prolong the utility of transgenic Bt corn. Committee chair Eileen Cullen, an extension specialist and associate professor of entomology at the University of Wisconsin-Madison, says a significant majority of Wisconsin field corn farmers grow corn containing one or more Bt genes, which replace chemical insecticides.

Bt derives its name from Bacillus thuringiensis, the bacterium that was the source of the gene for insect-killing protein.

"Although rootworms that resist Bt have been confirmed in Iowa, and suspected in Illinois, Minnesota and Nebraska, resistance has not been confirmed here. However, we have seen fields in Wisconsin with more rootworm feeding than you would expect with these hybrids," Cullen says, which suggests that resistance may be evolving here as well.

The Bt protein produced by transgenic corn kills corn rootworms, says Cullen. "But when broad acreages of corn contain the same insecticide active ingredient year after year, the stage is set for some insects in the population to adapt and become resistant to the toxin. That is apparently

what's happening in Iowa."

Although three distinct Bt proteins are now encoded in transgenic corn for corn rootworm control, the first and most common protein, called Cry3Bb1, is the focus of current resistance concerns.

Corn rootworm feeds on corn roots and can cause plants to collapse. Before transgenic corn was introduced about a decade ago, the insect was controlled with crop rotation or by applying insecticide to the soil at corn planting.

Transgenic seeds are convenient because they allow the farmer to avoid buying and applying insecticide, and reducing the use of insecticides produces an environmental benefit.

Several techniques can be used to stop or slow insect resistance to transgenic corn, Cullen says. Farmers are required by the Environmental Protection Agency to plant "refuges" of corn that lack the Bt toxin, where non-resistant rootworms can pass on their susceptible genes to the rootworm population. Farmers may also rotate through transgenic seeds containing different Bt toxins.

In any case, it's vital to monitor fields to detect problems early, says Cullen, who is also a UW extension specialist in field and forage crop entomology. "Resistance can definitely develop that people don't notice if they are not aware of the potential problem."

Planting transgenic corn that produces multiple toxins can also fight resistance, but that technique is less effective if the insects already resist one of those toxins, Cullen says.

In a parallel situation, several weeds have evolved resistance to glyphosate, the active ingredient in Roundup, a herbicide applied to

millions of acres of corn and soybean.

In all cases, if only resistant organisms can survive and multiply, resistance becomes widespread. The threat of resistance among insect pests is one reason that organic farmers, who sometimes rely on Bacillus thuringiensis to kill insects, opposed the transgenic Bt crops.

As the threat of insect resistance grows, Cullen says, farmers and their advisors need to take the issue seriously, by planting the appropriate refuges and choosing seeds carefully based on knowledge of insect pest pressure on the farm.

If resistance arises, Cullen suggests rotating to other Bt corn traits, or using conventional seeds and insecticides. This can be difficult because many top corn varieties are only sold as transgenics, and modern corn-planters often lack equipment for applying insecticide.

"Entomologists, biologists and farmers know that when you use one tactic for pest management, whether it's an insecticide or a Bt trait, insects can adapt," says Cullen. "The letter to EPA is an urgent reminder that an integrated approach will serve us best in the long term."

The letter to the EPA can be found here.

Provided by University of Wisconsin-Madison

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