Scientists offer recommendations for delaying resistance to Bt corn in western corn rootworm

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Corn that contains proteins that protect it from insect damage has been grown in the U.S. since the mid-1990s. Known as Bt corn, because the proteins are derived from a bacterium called *Bacillus thuringiensis*, these plants have been widely grown by farmers.

While Bt corn has been highly effective against the European corn borer, it has been less so against the western corn rootworm, which has been documented to show resistance to the Bt proteins. In a new article in the *Journal of Integrated Pest Management*—an open-access, peer-reviewed, extension journal—the authors explain why this has occurred, and they recommend an integrated pest management (IPM) approach to address it.

In "Resistance to Bt Corn by Western Corn Rootworm (Coleoptera: Chrysomelidae) in the U.S. Corn Belt," Drs. Aaron Gassmann (Iowa State University), Michael Gray (University of Illinois), Eileen Cullen (University of Wisconsin), and Bruce Hibbard (University of Missouri) examine why Bt corn has been more effective against the European corn borer, which tunnels in the stem of the plant, and less so against the rootworm, which attacks the roots.

First, Bt proteins intended for the European corn borer are produced at a higher dose than the ones intended for rootworms; this ensures that fewer corn borers are likely to survive, which lowers the chances of them producing offspring that may be resistant. Second, corn borer moths travel farther before mating, which increases the chances of potentially resistant insects mating with non-resistant ones that have not been exposed to Bt proteins; this lowers the chances of them producing resistant offspring. Finally, fitness costs—or negative effects—of resistance in rootworms appear to be low.

"One approach to IRM is not necessarily optimal for all insect pests," according to the authors, who recommend that growers use the following IPM approaches to delay further rootworm resistance to Bt corn:

- Rotate to soybean or other crops to break the corn rootworm life cycle between growing seasons.
- Occasionally rotate to a non-Bt corn hybrid and consider use of a rootworm soil insecticide during planting.
- Consider using corn that contains different Bt proteins than ones that may have performed poorly in the past.
- Consider using pyramided Bt hybrids, which is defined as corn that contains multiple Bt proteins targeting corn rootworm .
- If crop rotation is not an option and corn containing multiple Bt proteins is not available, suppression of rootworm adults by using insecticides for one or two growing seasons may be an

appropriate remediation step.

- Most importantly, implement a long-term integrated approach to corn rootworm management, based on scouting information and knowledge of corn rootworm densities, that uses multiple tactics such as rotation with other crops, rotation of Bt proteins, and the use of soil insecticides at planting with a non-Bt hybrid. Integration of tactics across seasons is fundamental to prolonging the usefulness of any effective management strategy.

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