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First Iowa Confirmation of Resistance to Bt Corn by Western Corn Rootworm

By Erin Hodgson and Aaron Gassmann, Department of Entomology

Starting in 2009, the Department of Entomology at Iowa State University received reports of severe corn rootworm injury in Bt corn in Iowa. In all cases, western corn rootworm was the predominant rootworm species in these fields (Fig. 1).



Figure 1. Western corn rootworm was the predominant species in fields with performance issues. Photo by Marlin Rice.

The Gassmann lab compared survivorship of western corn rootworm collected from these problem fields versus insects from control fields (not associated with performance issues). The results were recently published in an article by Gassmann et al. (2011), [Field-evolved resistance to Bt Maize by western corn rootworm](#). In general, survival on Cry3Bb1 corn was significantly higher for larvae from problem fields compared to control fields (Fig. 2A). Cry3Bb1 corn is sold commercially under the names YieldGard RW and YieldGard VT Triple. The publication also showed no cross-resistance with the Cry34/35Ab1 protein (Fig. 2B).

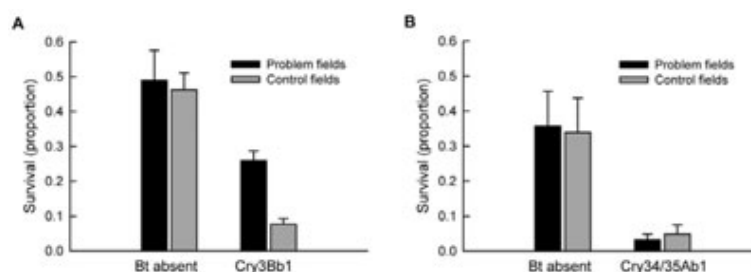


Figure 2. Survival of western corn rootworm larvae on Bt and non-Bt corn.
Figures are from the [Gassmann et al. \(2011\) paper](#).

This research reports the first time a beetle has evolved resistance to a Bt crop in the field. But maybe these findings are not a total surprise. The Bt proteins targeting corn rootworm are not considered high dose like they are for European corn borer. Additionally, resistant strains of western corn rootworm can be produced in a lab within three generations, which translates to three summers in an Iowa corn field.

Management Considerations

The number of fields with resistance to Cry3Bb1 corn is small at this time. But it should be noted that similar damage has been [reported in Illinois](#), Minnesota, [Nebraska](#) and South Dakota. This research highlights the importance of incorporating integrated pest management (IPM) and insect resistance management (IRM) into field crop production. All problem fields visited in 2009 had a production history of at least three years of continuous corn with the Cry3Bb1 protein, and this likely contributed to the development of resistance.

The most effective way to prevent widespread rootworm resistance is to use sound IRM and IPM for Bt corn targeting corn rootworm. Crop rotation is among the most effective management strategies for controlling western corn rootworm in Iowa. Also, consider rotating Bt proteins if planting continuous corn. Always comply with refuge requirements for the seed type, which can range from 5 to 20 percent. A soil-applied insecticide can be used with a non-Bt hybrid or could supplement root protection for Bt corn in areas with known high larval pressure. All corn fields should be evaluated annually by assessing root injury from corn rootworm and management strategies should be adjusted if injury above 0.5 nodes is observed for roots that are protected against corn rootworm (Fig. 3).



Figure 3. Severe corn rootworm injury can interfere with nutrient uptake and make plants unstable. Assessing root injury is important for determining larval pressure in a field. Photo by Erin Hodgson.

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