Current challenges in managing corn rootworm

Erin W. Hodgson
Iowa State University, ewh@iastate.edu

Aaron J. Gassmann
Iowa State University, aaronjg@iastate.edu

Follow this and additional works at: http://lib.dr.iastate.edu/extension_ag_pubs

Part of the Agricultural Education Commons, Agricultural Science Commons, Agronomy and Crop Sciences Commons, and the Entomology Commons

Iowa State University Extension and Outreach publications in the Iowa State University Digital Repository are made available for historical purposes only. Users are hereby notified that the content may be inaccurate, out of date, incomplete and/or may not meet the needs and requirements of the user. Users should make their own assessment of the information and whether it is suitable for their intended purpose. For current publications and information from Iowa State University Extension and Outreach, please visit http://www.extension.iastate.edu.
Corn rootworm is a major pest of corn in the United States. In the last decade, Iowa farmers have seen many changes for managing corn rootworm. With the commercial release of transgenic Bt-rootworm corn in 2003, many farmers reduced or eliminated soil-applied insecticides to manage larvae. Western corn rootworm is adapting to transgenic technologies throughout the Corn Belt. Some continuous cornfields have larvae that can now survive at high numbers and cause severe root injury to Bt corn. We encourage farmers to use multiple strategies to protect corn.

**Western corn rootworm resistance to Bt**

In 2009, the Department of Entomology at ISU began receiving reports of severe corn rootworm injury in Bt corn. In all cases, western corn rootworm was the predominant species in these fields. The Gassmann Lab at ISU compared survivorship of western corn rootworm collected from these problem fields versus beetles from control fields not associated with performance issues. The results were recently published in 2011 (see Online References #1). Survival on Cry3Bb1 corn was significantly higher for larvae from problem fields compared to control fields. All problem fields were growing continuous corn with the same Bt trait for at least three years. The publication also showed no cross-resistance with Cry34/35Ab1 for fields sampled in 2009.

This research reports the first time a beetle has evolved resistance to a Bt crop in the field. Although we expected corn rootworm to eventually adapt to transgenic technologies, finding resistant populations within six years after the commercial release of Bt traits was a surprise. Since then, resistance to Cry3Bb1 has expanded geographically in Iowa (i.e., northern third of Iowa). Resistance to Cry3Bb1 has also been confirmed in Illinois, and is suspected in Nebraska, Minnesota, and North Dakota. Recent data indicate that rootworm populations with resistance to Cry3Bb1 also are less susceptible to mCry3A.

**Management recommendations**

Western corn rootworm is an adaptable pest, and will eventually overcome any strategy that is used continuously. The longer a field is in continuous corn, the more inputs will be needed to protect yield. In order to keep growing profitable corn, farmers must use multiple tactics to prolong the effectiveness of commercially available tools.

The single most effective tool in Iowa is to rotate corn to soybean or another crop. Breaking the cycle of continuous corn, even once every 4-6 years, will dramatically improve corn rootworm management. Corn rootworm cannot survive on non-corn crops, and therefore crop rotation will break the life cycle of this pest. A farmer should expect nearly zero root injury after rotating back to corn, and could significantly reduce the management costs in first-year corn. If crop rotation is not an option, farmers should incorporate a diversified management strategy, including the following options:

- Use pyramided corn rootworm transgenic traits, like SmartStax® (Cry3Bb1 and Cry34/35Ab1) or Agrisure® 3122 (Cry 34/35Ab1 and mCry3A). But understand if rootworm populations have developed resistance to one trait, the second trait is likely controlling most of the larvae. Using pyramided traits continuously will increase the chances of developing resistance to both traits, which is the “worst case scenario” and something that we are trying to avoid at all costs. We would strongly encourage rotating pyramided traits every 2-3 years.
Scout every field, every year!
Iowa farmers should monitor fields for larval corn rootworm injury, regardless of which management strategy they use. Evaluate root injury on the ISU's 0-3 rating scale to determine corn rootworm pressure and product efficacy (see Online References #3, 4). To help properly time when to scout, subscribe to ICM News (see Online References #2) for an annual update of predicted egg hatch.

Larval scouting. Root pruning by larvae causes yield loss. Under drought-stressed conditions, measurable loss can occur at just 0.25 nodes destroyed (i.e., 2-3 roots). So ideally, a root rating of <0.25 nodes is highly desirable, and indicates the product is adequately protecting the roots. Having 1 node destroyed or greater can significantly impair plants from taking up water and nutrients, and make plants more susceptible to lodging.

Adult scouting. We also strongly recommend scouting for adult corn rootworm in corn, especially in continuous corn, non-Bt fields and suspected Bt-resistant fields. The distribution of adults within and between fields is not uniform. The adults are constantly moving and creating hotspots that can quickly dissipate. This is due, in part, to uneven corn silk emergence within an area. Adults will “chase” greening silks, their preferred food source, in the summer. Monitoring adult populations will provide information about the larval density belowground. It will also help to make management decisions for the next growing season.

Online references
2. ICM News, www.extension.iastate.edu/cropnews/
3. Iowa State University Corn Rootworm, www.ent.iastate.edu/dept/faculty/gassmann/rootworm

A heavily damaged root (on right) is an indication of high corn rootworm larval densities. Assessing larval injury, or root pruning, will help determine future management strategies.