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Managing Western Corn Rootworm with Bt Corn

By Aaron Gassmann and Erin Hodgson, Department of Entomology

During the summer of 2011, the ISU Corn Entomology Lab visited several fields in Iowa in response to complaints for rootworm injury to Bt rootworm corn, and to follow-up on fields that were visited in 2010 in response to grower complaints. To date, resistance of western corn rootworm has been found only for Bt corn producing Cry3Bb1, which was originally released as YieldGard Rootworm and is now the rootworm trait found in VTTriple and VTTriple Pro. Cry3Bb1 also is present as a pyramid with Bt toxin Cry35/35Ab1 in SmartStax.

Field visits in 2011 found some fields with severe root injury to Cry3Bb1 corn and to corn that produces Bt protein mCry3a, which is the Bt trait found in Agrisure (a Syngenta Product) and TRIsect (a Pioneer Product). We currently do not know the reason for the high level of rootworm injury observed for mCry3a rootworm corn, but this is an active area of research in the Gassmann Laboratory. So far in 2012, we have visited several fields with heavy rootworm feeding injury to Bt corn and patterns of injury are similar to 2011.

Table 1. Type of Bt toxin, level of root injury and number of fields visited in 2011.

Bt Toxin¹	Average Injury	Number of Fields Visited
Cry3Bb1	0 to 1 nodes	2
Cry3Bb1	1 to 2 nodes	3
Cry3Bb1	2 to 3 nodes	6
mCry3a	0 to 1 nodes	0
mCry3a	1 to 2 nodes	2
mCry3a	2 to 3 nodes	4
Cry34/35Ab1	0 to 1 nodes	2
Cry34/35Ab1	1 to 2 nodes	0
Cry34/35Ab1	2 to 3 nodes	0
Cry34/35Ab1 +Cry3Bb1	0 to 1 nodes	3
Cry34/35Ab1 +Cry3Bb1	1 to 2 nodes	0
Cry34/35Ab1 +Cry3Bb1	2 to 3 nodes	0

¹Cry3Bb1 is found in VTtriple and VTtriplePro (Monsanto); mCry3a is found in Agrisure (Syngenta) and TRIsect (Pioneer); Cry34/35Ab1 is found in Herculex (Dow and Pioneer); Cry34/35Ab1 + Cry3Bb1 is found in SmartStax (Dow and Monsanto).



Figure 1. A cornfield visited in Iowa during 2012 that was planted to Bt corn. The planting pattern in the photographed area alternated between 12 rows of Cry3Bb1 corn and 12 rows of mCry3a corn.

Data from field visits in 2011 and 2012 suggest that caution should be used when managing rootworm in continuous corn with either Cry3Bb1 traits or mCry3a traits. It is important to check continuous cornfields for rootworm injury. A high abundance of adult corn rootworm in a field is an indication of potential problems with larval management, but only digging and evaluating corn roots can confirm the presence of larval feeding injury. The relationship between root injury and yield is complicated and depends on several factors, such as soil moisture. A reasonable economic threshold for larval rootworm injury is 0.25 nodes, which means that ensuring less than 0.25 nodes of

injury on average is an economically sound management practice, but achieving further reductions in injury is not warranted.

As growers think about seed selection for 2013, they should be aware of current challenges encountered when managing corn rootworm with Bt corn, and use integrated pest management (IPM). Crop rotation, for example rotation to soybeans, is a highly effective way to manage western corn rootworm in Iowa. If farmers are concerned about extended diapause in northern corn rootworm, they can consider protecting first year corn with a soil-applied insecticide or Bt corn. In addition to crop rotation, growers should alternate their management tactics to control corn rootworm if they are growing continuous corn. Current options include rotation among single trait events, pyramided Bt events (corn that contains multiple traits targeting corn rootworm) and non-Bt corn with a soil-applied insecticide.

Aaron Gassmann is an assistant professor of entomology with research and teaching responsibilities in insect pest management. Erin Hodgson is an assistant professor of entomology with extension and research responsibilities; contact her at ewh@iastate.edu or phone 515-294-2847.

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