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Update on Corn Rootworm in Iowa

ICM News

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By Erin Hodgson and Aaron Gassmann

Overall, corn rootworm populations have been dampened in Iowa this season. A few factors likely contributed to this decrease:

1. An exceptionally harsh winter may have increased mortality of overwintering eggs.
2. Saturated soils in June may have increased mortality of corn rootworm larvae.
3. Some fields with extremely high corn rootworm populations were likely rotated out of corn, which disrupts the pests' life cycle. Since 2011, **corn production has decreased in Iowa by one-half million acres according to the USDA.**
4. Cooler summer temperatures translate to a slower growth for corn rootworm larvae in the soil, and this may increase natural mortality from insect-killing fungi and other factors.



Update on Corn Rootworm and Bt Corn. In 2011, Gassmann et al. confirmed **field-evolved resistance to Cry3Bb1 corn by western corn rootworm in Iowa**. This was the first Bt trait for corn rootworm, and was released in 2003. In 2014, Gassmann et al. showed **field-evolved resistance by western corn rootworm in Iowa to mCry3A corn**, which was released in 2007. In addition, this paper also found cross-resistance between Cry3Bb1 and mCry3A. Cross-resistance is defined as reduced susceptibility to multiple toxins through a common mechanism, and can result in populations being resistant to toxins to which they have never been exposed. In this case, it means that a population of western corn rootworm that develops resistance to either mCry3A corn or Cry3Bb1 corn will be resistant to both mCry3A corn and Cry3Bb1 corn, even if one of the traits has never been used against that population. Additionally, all of the Bt pyramids targeting corn rootworm contain either mCry3A or Cry3Bb1, which raises concerns about the long-term durability of these pyramids.

Planting Pyramided Bt Hybrids. A pyramided Bt hybrid has multiple Bt toxins that target the same pest. In Iowa, we have observed good performance of pyramided Bt hybrids that contain the Cry34/35Ab1 trait pyramided with either Cry3Bb1 or mCry3A. However, some cases of heavy feeding injury to corn with Cry34/35Ab1 Bt toxin have been observed in Iowa. Because of resistance to mCry3A and Cry3Bb1, good stewardship of pyramided Bt corn will be important.

Crop Rotation: Rotating fields out of corn production breaks up the life-cycle of corn rootworm. This remains an extremely effective way to manage corn rootworm in Iowa. Western corn rootworm in Iowa remain susceptible to crop rotation. Resistance to crop rotation by northern corn rootworm does occur in Iowa through extended diapause, although this variant is limited in distribution. In fields where large populations of northern corn rootworm are observed, and where the presence of rotation resistance is suspected, farmers should protect first-year corn against northern corn rootworm larvae.

What Can Farmers Do this Year? Assessing injury to corn roots from larval feeding is

an important step in managing corn rootworm. We recommend using the [0 to 3 node injury scale developed at Iowa State University](#). For every node of roots destroyed, corn yield is reduced by 15% to 17%, on average. In general, the goal of larval management is to achieve less than 0.25 nodes of injury, on average, within a field.

Farmers and crop consultants can also measure adult rootworm abundance in fields to anticipate larval injury the next growing season. Place at least four unbaited Pherocon AM sticky cards throughout a field during the period of peak adult abundance (late July through the middle of August). Replace cards weekly and count the number of adults collected per card. Based on a recent economic analysis by Dunbar and Gassmann in 2013, if the average number of adult northern and western corn rootworm captured exceeds two per card per day, then the field should be managed for larval rootworm the next season.

Develop a Long-Term Management Plan. In order to successfully manage corn rootworm, develop a strategy that rotates among a variety of management approaches over multiple seasons. This is the best way to guard against the build-up of large populations and the development of Bt resistance.

1. Rotate fields out of corn production at least every 4 to 5 years.
2. Plant Bt hybrids pyramided with multiple traits targeting larval rootworm.
3. Rotate between Bt hybrids without soil-applied insecticide and non-rootworm Bt hybrids with soil-applied insecticide.

Injury to Bt Corn this Year. The [Department of Entomology](#) at Iowa State University is interested in understanding and monitoring the scope and severity of western corn rootworm resistance to Bt corn in Iowa. If you observe a field of Bt rootworm corn with high levels of feeding injury, extensive lodging, or a high abundance of adult corn rootworm beetles, please contact Aaron Gassmann or Erin Hodgson.

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