Northern Corn Rootworm and Extended Diapause

- Northern corn rootworm is one of the two prominent corn rootworm (CRW) pests in the Midwestern states.
- Extended diapause allows eggs to overwinter, remain dormant during summer, overwinter again, and hatch the second summer.
- The most notable CRW injury is damage to the root system. Adult CRW feeding is primarily focused on silk clipping, which can interfere with pollination.
- Successful CRW management is possible with multiple best management practices (BMPs).

Identification and Comparison

The Northern corn rootworm (Diabrotica barberi Smith & Lawrence) (NCRW) and the Western corn rootworm (Diabrotica virgifera virgifera LeConte) (WCRW) are he prominent corn rootworm (CRW) pests in the Midwestern states. The NCRW adult is cream to tan in color upon emergence, but turns to pale green and is about 1/4 inch long (Figure 1). The WCRW adult is yellow to green in color, has black stripes on the wing covers, and is about 5/16 inch long (Figure 2).[1] The male's stripes usually appear wider and may coalesce. The females of the two species are generally larger than the males.

Figure 1. Northern corn rootworm adult.

Figure 2. Western corn rootworm adult.

Life Cycle

Both NCRW and WCRW have a similar lifecycle: egg, larva, pupa, and adult. The eggs of the two species overwinter and begin hatching in late May or early June. Carbon dioxide (CO_2), emitted from corn roots, provides an irresistible attractant for the larvae.[2] While feeding for three to four weeks, the larvae pass through three growth stages or instars.[1] After the last instar, pupation occurs and the adults begin to emerge in late July and August and start feeding on leaves, pollen, and silks.[2]

Northern Corn Rootworm Extended Diapause

In a number of areas within the upper Midwest, NCRW has developed an adaptation known as extended diapause. This common adaptation, which is an ability to produce eggs that remain dormant for one or more growing seasons, is a significant feature that sets NCRW apart from WCRW. This positions the hatching eggs into many first-year corn fields following soybean. Without root protection, damage from larval feeding can become economically important. Areas in Iowa have been affected by this genetic variant more than other Midwestern states (Figure 3).

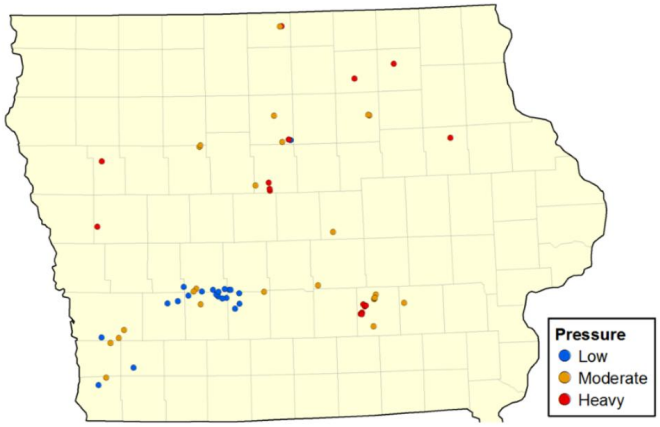

Figure 3. Locations on the map represent NCRW pressure where first year corn, following soybean, had economic damage from root feeding and silk clipping.*

*Affected fields were identified by farmer reports of down or lodged corn. Monsanto brand representatives or licensed retail agronomists scouted fields and confirmed NCRW as the predominant species. Root samples were extracted from affected fields and nodal injury scored. Often, Pherecon® yellow sticky insect trap cards were posted to document adult CRW numbers and species. Corn products were verified with farmers, traits checked, and validated as above-ground only or no rootworm B.t. traits. Often, fields had multiple seed brands and dots represent a myriad of seed corn brands.

A Minnesota study conducted in 2002 to determine the potential yield loss resulting from NCRW extended diapause resulted in a 32 bu/acre loss.[3] Farmers may not see this response in a typical field as the study was conducted in a field with heavy NCRW pressure. Oviposition, or egg laying, in the current corn crop can help determine management decisions two years away when a non-host crop is planted in the field.

Northern Corn Rootworm and Extended Diapause

Best Management Practices

Regardless of CRW species, effective management begins with scouting. Scouting information is invaluable in making decisions regarding the integrated approach for control tactics including crop rotation, planting of corn products with pyramided traits for CRW protection, and when warranted, use of foliar insecticides to control adult beetles.

Scout and Protect Roots - The most notable injury from CRW larval feeding is the injury to the root system (Figure 4). Root injury subjects the plant to increased effects from drought, compaction, inadequate fertility, and other stresses, and can increase the potential for significant yield reduction. Root lodging is also a possibility, which can make harvest difficult. In continuous corn operations where CRW populations are known to exist and where NCRW extended diapause variants were known to be present in a corn crop two years prior and root lodging occurred, corn products with insect protection should be considered. If non-B.t. protected corn products are planted into continuous corn situations or when extended diapause variants were known to be present in a corn crop two years prior and root lodging occurred, a soil applied insecticide (SAI) should be considered; however, SAIs may be difficult to handle, require expensive application equipment that most growers who rotate are lacking, add costs, and have been known to be inconsistent in their performance. Additionally, root digs, which normally occur in late-July are imperative to help evaluate CRW larval damage and assess CRW management strategies. The Iowa State Node-Injury Scale can be used to evaluate feeding damage (www.ent.iastate.edu).[5] Weeds and volunteer corn should be managed in soybean fields as pollinating weeds and corn can attract CRW beetles.

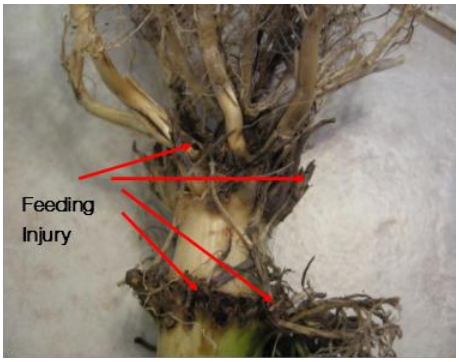

Figure 4. Rootworm feeding injury.


Figure 5. Adult corn rootworm beetles feeding on silks.

Scout and Protect Silks - Adult CRW populations should be monitored around tasseling to determine if adult control measures are warranted to protect silks from clipping (Figure 5). Silk clipping can prevent ovule fertilization, which results in aborted kernels (Figure 6). In some regions, the economic threshold of five beetles/plant may justify a foliar insecticide application to protect silks.[4] University guidelines should e followed for the thresholds. Adult scouting can also help determine the potential for infestation in future corn crops.


Figure 6. Poor kernel set as a result of silk damage caused by corn rootworm.

Scout to Suppress Egg-Laying - An additional reason for managing beetles is for the suppression of egg-laying which may prevent large populations. But keep in mind, successful adult management programs require a grower commitment to regularly scout crops throughout the grain fill period.

Sources

[1] Corn rootworms. 2009. Field Crops IPM. Purdue University. https://extension.entm.purdue.edu/. [2] Sandall, L., Pilcher, C., and Namuth, D. 2003. Corn rootworm— part 1: description of corn rootworm and other early season corn pests. Plant & Soil Sciences eLibrary. USDA, NIFA. https://passel.unl.edu/. [3] Ostlie, K. 2002. [Presentation] Roots of evil: corn rootworms and crop rotations. University of Minnesota. Learning Ace. http://www.learningace.com/. [4] Cullen, E. 2012. Corn rootworm beetle emergence and feeding in corn fields. Integrated Pest and Crop Management. University of Wisconsin. http://ipcm.wisc.edu/blog/. [5] VanDyk, J. 2001. Interactive Node-injury scale. Iowa State University. www.ent.iastate.edu. Web sources verified 3/13/17. 140825160453