Northern Corn Rootworm and Extended Diapause

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

Identification and Comparison
The Northern corn rootworm (Diabrotica barberi Smith & Lawrence) (NCR) and the Western corn rootworm (Diabrotica virgifera virgifera LeConte) (WCR) are the prominent corn rootworm (CRW) pests in the Midwestern states. The two species are very similar; however, the NCR has developed a genetic variation known as the “extended diapause” variant. A third species, the Southern corn rootworm (Diabrotica undecimpunctata howardi Barber), is rarely of economic importance in Midwestern corn because it does not overwinter in colder climates; therefore, the larvae are not present to feed.

The NCR adult is cream to tan in color upon emergence, but turns to pale green and is about 1/4 inch long (Figure 1). The WCR adult is yellow to green in color, has black stripes on the wing covers, is about 5/16 inch long (Figure 2). The male’s stripes usually appear wider and darker. The females of the two species are generally larger than the males.

Life Cycle
Both NCR and WCR 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 (CO₂), emitted from corn roots, provides an irresistible attractant for the larvae. While feeding for three to four weeks, the larvae pass through three growth stages or instars. After the last instar, pupation occurs and the adults begin to emerge in July and August and start feeding on leaves, pollen, and silks.

Extended Diapause of NCR
A significant feature that sets NCR apart from WCR is its ability to produce eggs that hatch after a dormant period of two winters and one growing season (Figure 3). This positions the hatching eggs into many first-year corn fields following a non-host crop, such as soybean. Without root protection, damage from larval feeding can become economically important. Areas in Minnesota, Iowa, South Dakota, and Wisconsin have been affected by this genetic variant more than other Midwestern states.

A Minnesota study conducted in 2002 to determine the potential yield loss resulting from NCR extended diapause resulted in a 32 bu/a disadvantage for a two-crop rotation. A corn/sugar beet/corn rotation returned 150 bu/a while a corn/sugar beet/pea/corn rotation returned 182 bu/a.¹

Best Management Practices (BMPs)
Successful CRW management is possible with multiple BMPs, such as rotation, scouting, insecticide applications when warranted, and by planting products with the Genuity® SmartStax® technology with dual
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Modes of action for CRW or single CRW mode of action Genuity® VT Triple PRO® in a comprehensive management plan. When extended diapause variants are present, additional management may be required.

- **Rotate to non-host crops to break the corn rootworm cycle.** Where extended diapause variants are suspected, non-host rotation should be for at least two years.
- **Use insecticides as needed.** Soil moisture status, application timing, and placement are important for the efficacy of insecticides to protect plants for the duration of the larval feeding period.
- **Plant products with the Genuity® SmartStax® technology.**
- **Scout regularly for early season larval feeding.**
- **Conduct root digs to assess root damage.**
- **Monitor adult populations around tasseling to determine if adult control measures are needed to protect silks and ears and to help predict infestation levels for the next corn crop.**
- **Manage weeds and volunteer corn in soybean fields (pollinating weeds and corn can attract beetles—Figure 4).**

**Rootworm Larval Damage**

The most notable injury from CRW larval feeding is the injury to the root system (Figure 5). Root injury subjects the plant to increased effects from drought, compaction, fertility, and other stresses, and can increase the potential for significant yield reduction. Root lodging is a possibility, which can cause poor fertilization in severely lodged plants and make harvest problematic. Since root damage cannot be seen above ground, root digs are imperative to help assess CRW management strategies. Normally, root digs to evaluate CRW larval damage should take place in mid-July. To do so, dig a series of corn root balls (one foot in diameter), shake off the soil, and wash roots. Root damage due to CRW larval feeding consists of brown feeding scars often along the side of the roots, tunneling inside the larger roots, and root pruning with the roots eaten back toward the base of the stalk. Injury may be limited to a single root, or consist of multiple whorls of roots chewed back. The Iowa State Node Injury Scale can be used to evaluate feeding damage (http://www.ent.iastate.edu).

Adult CRW damage is primarily focused on silk clipping (Figure 6). As the beetles emerge from the soil and feeding begins, leaves are usually the first to be fed upon. Scarification marks can be seen on leaf surfaces from their feeding. This feeding is generally more cosmetic than economic. As silks begin to emerge, the beetles migrate to the silks and clip the silks, which can interfere with pollination. Ovules that are not fertilized cannot develop into kernels. Insecticides may be warranted if beetle populations have met threshold levels and pollination is still occurring. University guidelines should be followed for the thresholds.

**Sources:**