

CORN ROOTWORM RESISTANCE MANAGEMENT WITH Bt CORN

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The potential for the development of resistance to Bt-rootworm corn is considered to be so high that all growers who use the technology must follow an approved, structured, resistance management plan. EPA approval for Bt-rootworm corn requires all growers who purchase seed to sign contracts stating that they will comply. This EPA-approved plan requires the use of refuge corn, a hybrid that does not contain the Bt-rootworm technology. This preventive approach to resistance management is similar to one in place for corn borer (Entfacts 128 and 140) but has some distinct differences in the locations of refuges and the permissible insect control practices.

Key Elements:

- The creation of a non-Bt-rootworm corn refuge with the planting of any acreage of Bt-rootworm corn.
- The refuge must be at least equal to 20% of the acreage of the Bt-rootworm corn.
- The refuge must be in blocks adjacent to the Bt-rootworm corn or planted as in-field strips.
- If an adjacent field is used, then the refuge field should have a similar rotational history as the Bt-rootworm field.
- When planting the refuge as in-field strips, the strips must be at least 6 rows wide, preferably 12 consecutive rows wide.
- The grower may apply insecticide treatments for control of corn rootworm larvae with the refuge corn.
- Applications of insecticides to control the adult corn rootworm beetles are NOT permitted in the refuge unless the Bt-rootworm corn is treated in a similar manner.
- The grower must sign a compliance contract.

With the EPA-approved plan, non-Bt-rootworm corn acreage on each farm serves as a refuge, allowing corn rootworms to survive without exposure to Bt corn. Then if a rare resistant corn rootworm were able to survive on

a Bt-corn plant, it would most likely mate with a susceptible corn rootworm. Corn rootworms produced from this mating would only be partially resistant, and should not be able to survive if they feed on Bt-rootworm corn. This strategy tries to prevent mating between resistant corn rootworm beetles. If this happens, then the corn rootworm produced may be fully resistant to the Bt-rootworm corn.

Corn Borer and Rootworm Refuges

While corn borer and corn rootworm refuges are similar in size, the maximum distance that they may be planted from the Bt corn is different. This accounts for differences in the biology of the insects. Corn borer moths move considerably farther than rootworm beetles before mating. So a refuge planted 1/4 of a mile from the Bt-corn borer corn is close enough to ensure 'random' mating of the moths. Corn rootworm beetles mate soon after leaving the soil, so the Bt-rootworm refuge must be either within or adjacent to the Bt-rootworm corn.

Stacked Hybrids

Additionally, some Bt-rootworm corn hybrids may have stacked genes for both corn borer control and rootworm control (e.g. YieldGard Plus). Growers using these hybrids are required to comply with resistance management for corn borers and corn rootworms. There must be a non-Bt-corn borer refuge within 1/4 to 1/2 mile (depending on whether corn borers will be controlled with insecticides in the refuge) and a non-Bt-rootworm refuge adjacent to or within the Bt-corn field.



Western Corn Rootworm Adult

Another option is to use a common refuge for both corn borers and corn rootworms. This minimum 20% refuge would be either within or adjacent to the Bt-corn field. The corn planted in the refuge would not have either the Bt-corn borer or Bt-rootworm traits.

Resistance and Corn Rootworms

This responsibility must not be taken lightly. Development of resistance by corn rootworms to this type of corn is a real threat. The Western and Northern corn rootworms have demonstrated the ability to develop resistance to some insecticides and adapt to various crop rotation practices. In the Western corn belt, Western corn rootworm has developed resistance to several insecticides. In parts of Illinois, Indiana, and Ohio, the Western corn rootworm developed a soybean biotype that leaves corn fields to lay its eggs in other crops, rendering crop rotation ineffective. In parts of Iowa and South Dakota, the Northern corn rootworm has developed delayed diapause, a condition where only a portion of its eggs hatch the following year. The remaining eggs hatch two, three, four, and even five years later. In these later examples, first-year corn can sustain severe corn rootworm injury. Fortunately for Kentucky corn growers, we do not have the soybean biotype of the Western corn rootworm or delayed diapause with the Northern corn rootworm.

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