Technology Development & Agronomy by MONSANTO

Agronomic SPOTLIGHT

European Corn Borer Causes Economic Damage

- An area wide suppression of ECB populations has occurred due to the use *of B.t* corn products; however, annual yield losses continue to exist from ECB.
- Expected control of ECB larvae with insecticide applications ranges from 60 to 80%. Multiple applications may be necessary.
- An effective option is to use products with Genuity® VT Double PRO®, Genuity® VT Triple PRO®, or Genuity® SmartStax® technology to protect yield potential from ECB infestations.

Widespread use of *B.t.* corn products, first commercialized in 1996, has contributed to a significant suppression effect of European Corn Borer (ECB) populations.[5] According to USDA estimates, *B.t.* corn products for ECB, corn rootworm, and corn earworm were planted on 76% of the United States corn acres in 2013.[6] However, some yield loss continues to occur annually from ECB larvae infestations (Figure 1). Prior to widespread adoption of *B.t.* corn products, annual losses from ECB damage often exceeded one billion dollars in the United States.[2,3]

Figure 1. 2014 ECB field damage (left) and ear damage (right)

Table 1. Percentage Yield Loss Caused by European Corn Borers at Various Corn Growth Stages*

Plant Stage	Number of ECB larvae/Plant		
	1	2	3
Early Whorl	5.5	8.2	10.0
Late Whorl	4.4	6.6	8.1
Pre-tassel	6.6	9.9	12.1
Pollen Shedding	4.4	6.6	8.1
Blister	3.0	4.5	5.5
Dough	2.0	3.0	3.7

* Percentage yield loss are based on physiological stresses and do not include loss due to stalk breakage and/or ear breakage
Source: Krupke, C. H., et al. 2010. European corn borer in field corn. Bulletin E-17-W. Purdue University

B.t. Corn Products for ECB Control

Non *B.t.* corn plants are still at risk for ECB infestations, even though ECB populations have declined. According to Purdue University, an infestation averaging 1.0 ECB larva per plant just prior to tasselling may reduce potential yield by 6.6% (Table 1).[1]

Corn producers may want to consider protecting yield potential by selecting *B.t.* corn products that provide protection against ECB yield loss. Products with Genuity® VT Double PRO® technology offer dual modes of action against ECB and other above ground insect pests, as well as tolerance to Roundup® brand agricultural herbicides.

In addition, products with Genuity® VT Triple PRO® or Genuity® SmartStax® technology provide protection against ECB but also provide protection against corn rootworms. Contact your seed representative for further information concerning Genuity® products.

Life Cycle

ECB overwinters as a mature (fifth instar stage) larvae in corn stalks, stems of other host plants, or in plant debris on or in the soil. Overwintering ECB larvae begin pupation in the spring when temperatures reach 50° F and after 7 to 10 days emerge as adult moths. Female moths lay eggs for the first-generation in cornfields or on secondary grass hosts. Taller corn is preferred by moths as a first-generation egg laying site. Eggs hatch in approximately 5 to 7 days. Young larvae move to and feed in the whorl or leaf collar. As larvae mature to the 3rd or 4th instar stage they begin to tunnel into the stalk or leaf midrib where they develop and pupate.

Late-planted corn and fields that are tasselling are preferred by moths as an egg laying site for a second generation. Approximately 90% of the eggs are deposited on the undersides of the ear leaf and the three leaves above and below the ear. The second-generation larvae pass through the same larval stages as the first generation. A third generation may occur in southern areas including portions of Illinois, Indiana, and Missouri.[1,2,3]

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Identification

Female moths lay eggs in clusters averaging about 20 eggs per cluster, but they may lay as many as 60 eggs per cluster. One egg is about the size of a pinhead. Egg masses are creamy white when first laid, but later become more translucent. As larvae mature in the egg, the black/brown color of the head capsule is visible through the egg. This is known as the blackhead stage. Early ECB larvae instars are approximately 1/32 to 1/16 inch long, with translucent white bodies and brown heads. As the larvae mature, they become flesh-colored with blackish heads. Mature larvae are ¾ to 1 inch long and have two distinct brown spots (tubercles) on each abdominal segment. Also, larvae have three pair of true legs behind the head and five pairs of prolegs on their abdomen. Pupae are brown, ½ to ¾ inch long, and have a rounded head region and abdomen area tipped with a tiny hook.

Damage

Early-planted corn is most susceptible to larval feeding by first-generation ECB. Larvae feed on plant leaves in the whorl, chewing small holes in the leaves which creates a "buckshot" effect as leaves unfurl (Figure 2). Larvae leave the whorl and begin tunneling in leaf midribs and sheaths as they mature. After reaching the third instar stage (approximately 1/2 inch in length) larvae tunnel into the stalk, and feed until fully grown. The second-generation larvae are present on corn after tassels have emerged. They feed on pollen in leaf axils or on leaves. Later they feed on leaf sheaths, collars, and midribs as they become larger until they eventually enter the stalk. Second-generation ECB larvae also may enter the ear or ear shank (Figure 1, right). Yield losses are due primarily to physiological damage as larvae tunneling into the stalk affects the plant's ability to transfer nutrients. Stalk breakage and lodging, ear droppage, and secondary invasion of stalk rots into susceptible corn products also contribute to yield loss.

Figure 2. Corn leaf "buckshot" effect from ECB larvae feeding in the plant whorl.

Economic Thresholds and Insecticide Treatments

ECB economic thresholds are dynamic as they change based on expected yield and price per bushel, insecticide treatment cost per acre, and crop growth stage at time of infestation (Table 1). Additional field information such as percentage of plants with whorl feeding and average number of larvae per infested plant should be determined to assess first-generation infestation levels. For second and later generations, determine average number of egg masses per plant. ECB management worksheets are available from several state Extension Services which incorporate the previously stated economic factors to determine if an insecticide application is needed.

Timing of insecticide application is critical for ECB control. Once larvae begin boring into the stalk, insecticide applications are ineffective. Achieving adequate control for both first and second ECB generations may require multiple insecticide applications. Granular insecticide (aerial or ground application) or liquid applications (ground) directed over the whorl provide about 80% control of first-generation larvae.[1,2,3,4] Second-generation larvae control is estimated at 60 to 75%.[1,2,4] Field scouting is key to determining ECB populations.

Sources:

[1] Krupe, C. H., L. W. Bledsoe, and J. L. Obermeyer. 2010. European corn borer in field corn. Bulletin E-17-W. Purdue University. http://extension.entm.purdue.edu/ (verified 10/09/14); [2] Cook, K. A., S. T. Ratcliffe, M. E. Gray and K. L. Steffey. 2003. European corn borer. Integrated pest management. University of Illinois. https://ipm.illinois.edu/ (verified 10/09/14); [3] M. L. Boyd and W. C. Bailey. 2001. European corn borer: A multiple-crop pest in Missouri. Bulletin G7113. Outreach and Extension University of Missouri-Columbia. http://extension.missouri.edu/ (verified 10/09/14); [4] Bissonnette, S. M., N. R. Pataky, E. D. Nafziger, V. Davis, K. A. Estes, D. Jones, M. E. Gray, C. A. Bradley, T. Niblack and A. G. Hager. 2010. Field crop scouting manual. University of Illinois Extension. [5] Gray, M. E. 2014. Remember the European corn borer? The Bulletin, June 30, 2014. University of Illinois. http://bulletin.ipm.illinois.edu (verified 10/09/14); [6] Fernandez-Cornejo, J., S. Wechsler, M. Livingston, and L. Mitchell. 2014. Genetically engineered crops in the United States. Economic research report number 162. Economic Research Service. USDA. http://www.ers.usda.gov/ (verified 10/09/14).