An IPM Approach for Insects of Sweet Corn

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There are three major insect pests of sweet corn in New England, European corn borer, corn earworm and fall armyworm. Of the three, only European corn borer can successfully overwinter here, yet all three pose an important threat to sweet corn. Integrated pest management (IPM) techniques, including field scouting and trapping to monitor pest populations, can significantly reduce pesticide applications for these pests. Under an IPM program, pesticide applications are made according to action thresholds that account for the economic impact of a pest population. Pesticides are recommended only when there is a true economic threat to the crop, based on regular sampling of pest populations in the field. While pest monitoring requires time and effort on the part of the grower and/or IPM scout, studies have shown that this improves the profitability of corn through reduced pesticide application and improved marketable yield. Listed below are the current IPM recommendations for the major sweet corn pests in New England.

European Corn Borer (ECB)

The European corn borer (ECB) moth is about one inch long with a wingspan of about one inch at rest. The moth varies in color from yellowish brown to dark tan with two dark, irregular, wavy bands across the front wings. European corn borer moths emerge in mid to late June. They spend the daylight hours hiding in grassy areas. On warm nights, they fly into sweet corn fields to lay their eggs. They may also lay their eggs on other hosts, such as beans, broccoli, peppers, potatoes, dahlias, and many weeds. The eggs, in masses of up to 50, resemble overlapping fish scales and are usually found on the underside of the corn leaves. The eggs hatch in four to nine days. The newly hatched larvae are very small (1/4 inch) and translucent yellow with a dark, shiny head. As they develop they become larger and darker in color. Fully-grown larvae are three-fourths to one inch in length. They are usually flesh colored but may range from light pink to tan or gray, with conspicuous small, dark brown spots on each segment.

In the early stages, European corn borer feeding damage looks like small “pinholes” in the leaves of whorl stage plants. Corn in the whorl stage need only be sprayed if fresh feeding injury is found on 30% or more of the plants scouted in a field. Once the corn reaches the pre-tassel stage, the control threshold is lowered to 15%. This is because larvae feeding on the later stages are more likely to move into the ears of the plant. Feeding damage in the tassels first appears as chewing and brown waste found in the florets of the emerging tassel. After the tassel has emerged from the stalk, the larvae chew into the stalk just below it, often causing the tassel to fall over. Sprays during the pre-tassel stage when both moths and larvae are present will reduce the opportunity for larvae to move into the stalks and ears of the plant, where they are protected from sprays. Good spray coverage of the plant provides the most effective kill of larvae as they move from one part of the plant to another. Rotating the type of insecticide used may also improve control. When corn reaches the silk stage sprays can be based on the number of corn borer moths caught in pheromone traps rather than just feeding injury. European

corn borer moths will lay eggs on flag leaves of silking corn and the larvae can move into the ears without leaving any visible feeding injury that would be noticed when scouting. Therefore, if more than five moths are caught in a week in a field with silking corn, a spray will be recommended.

At the end of the season, the full-grown larvae remain in the corn stalks and stubble throughout the winter. In the spring, the larvae pupate and emerge as moths in about two weeks. Plowing corn stalks and stubble under at the end of the season is an effective and important means of controlling the ECB.

Scouting and Control Thresholds
Whorl Stage (8 leaves): Scout 100 plants per field or block (20 plant samples in five locations). Look for pinhole injury in the leaves. Treat field if 30% or more of plants scouted show fresh feeding injury.

Pre-tassel stage: Scout plants as above, look for feeding damage on the leaves and in the developing tassels. Treat field if 15% or more of the plants scouted show injury.

Tassel - silk stage: Scout plants as above look for fresh feeding injury on leaves, in tassels or on the sides of ears, especially where the ears meet the stalk. Give the stalk a gentle twist near the ear to detect larvae in the stalk. Treat field if 15% or more of the plants scouted show fresh injury.

Pheromone traps: Two Scentry Heliothis^{tm} traps should be placed in grassy weeds bordering the field, spaced at least 100 feet apart. One trap should be baited with Scentry ECB I (NY strain) pheromone the other trap should be baited with Scentry ECB II (IA strain) pheromone. The base of the trap should be just at the top of the weed growth. In young corn (whorl-tassel) these traps should be used to judge the emergence of ECB - no threshold. In silking corn which has not yet been sprayed for corn earworm, treat field to protect the silks from egg-laying ECB moths if 5 or more moths are caught in the pheromone traps in a week.

Corn Earworm (CEW)
The corn earworm (CEW) moth has a wingspan of approximately 1.5 inches. The body of the moth is buff to grayish brown in color, with a dark spot in the center of each front wing and dark bands near the back of the wings. The hind wings are lighter tan with a dark band along the outer margins. The larvae vary tremendously in color, ranging from yellow to green to brown or even purple. Alternating dark and light colored stripes run the length of the body. The head of the newly hatched CEW is black, but it turns yellowish brown as the larvae mature. The larvae are also covered with many small bumps, each with a small, sharp spine. These bumps and spines give the body a rough appearance, unlike the fall armyworm, which has a smooth body. Fully grown, the CEW larva is slightly more than one inch in length.

Corn earworm is distributed worldwide but cannot overwinter in the northeastern United States. The moths migrate to Maine from southern states around mid-July. The night-

flying female moths search for fresh (green) corn silk on which to lay their eggs. The eggs are laid singly on the silk, although several may be laid on one silk mass. Each female can lay several hundred eggs. If fresh silk is not available, they may lay eggs on other hosts such as tomatoes or peppers. The eggs hatch in two to 10 days. The newly hatched larvae feed on the corn silk, working their way down the silk channel to the tip of the ear. Once there, the larvae feed on the silk and developing kernels. The feeding area becomes filled with moist waste. This damage causes severe economic loss, and may go unnoticed until harvest. Field scouting is not a practical method for detecting corn earworm, so pheromone traps are used to monitor the arrival and numbers of moths flying into a field. The arrival of this pest is only a concern for fields with corn in the silk stage. Fields not yet in silk do not need to be protected from corn earworm. However, when corn earworm moths start being caught at a site, all silking corn in the fields should be protected.

Scouting and Control Thresholds
Because corn earworm moths lay their eggs on the silks and the larvae crawl directly into the ears, field scouting is not an effective way to monitor for this insect. Therefore, control recommendations are made based on the number of corn earworm moths caught in pheromone traps on a nightly or weekly average.

Silk stage: Pheromone traps: Place one Scentry Heliothis^{tm} traps or Harstack 50:33 or 50:25 trap in cornfield at the fresh green silk stage. Place traps so that the base is at the same height as the silks. Traps should be checked at least once a week until the first CEW is caught, and checked two to three times a week thereafter. A treatment should be applied to any fresh silking corn as soon as more than one corn earworm is caught in a week. Spray intervals after the initial application should be based on the number of moths caught on a nightly basis as shown in the table below. Corn that is not yet in silk need not be sprayed. Once the silk has thoroughly dried the corn no longer needs to be sprayed, and the pheromone traps should be moved to corn with fresh silks.

Corn earworm spray thresholds based on average captures of corn earworm moths in Sentry *Heliothis* net traps:

Moths/week	Moths/night	Control spray interval
0.0 - 1.4	0.0 - 0.2	No spray
1.4 - 3.5	0.2 - 0.5	Spray every 6 days
3.5 - 7.0	0.5 - 1.0	Spray every 5 days
7.0 - 91	1.0 - 13.0	Spray every 4 days
More than 91	More than 13	Spray every 3 days

Note: If maximum daily temperature is less than 80^{o} F, lengthen the spray interval by one day.

Fall Armyworm (FAW)

The fall armyworm (FAW) moth is about three-fourths of an inch long with a wingspan from one to one-and two-thirds inches. The front wings of the male are brown to dark gray, and mottled. A slanting white bar occurs in the middle of the wing. The hind wings are grayish white and have a purplish color when viewed at a slight angle in sunlight. The female moth's coloration differs from the male's. The front wings are brown to dark gray but lack most of the mottling and the white bars.

Although the early stages of the larvae are grayish with some hairs, the later stages are smooth skinned, and vary in color form tan to green to nearly black. Three thin, yellowish white lines run the length of the back. On each side, next to the yellowish lines, is a wider dark stripe and below it, an equally wide, wavy, yellowish stripe with red markings. The larva also has four dark spots at its posterior end. The FAW has a noticeable white inverted Y on the front of its dark brown head. However, the Y marking is not always prominent enough to serve as a reliable characteristic. FAW larvae may also be confused with corn earworm larvae because of its similar appearance and habits.

Fall armyworm is found throughout most of the eastern United States, but it does not overwinter in New England because the pupae cannot survive where the ground freezes. When the moths emerge from their overwintering sites in the spring, they slowly make their way northward. The moths lay green to gray eggs in clusters of 50 or more and cover the egg masses with body hairs. The moths prefer to lay eggs on young corn. The eggs hatch within 10 days, and the newly hatched larvae begin feeding voraciously on the whorl, tassels, or ears, leaving large, ragged holes and masses of sawdust-like excrement. The FAW does its most serious economic damage by feeding on the ears, although feeding on the leaves is most commonly noticed.

The larvae reach maturity in about two to three weeks, and crawl down to the ground to pupate in soil near the plant's base. Within two weeks, the moths emerge. Only one generation is completed in the Northeast, as the partial second generation ends either with the larvae being killed by frost or the pupae being killed when the ground freezes.

Scouting and Control Thresholds

Whorl to silk: Scout at same time as European corn borer, i.e. 100 plants per field or block (20 plant groups in 5 locations). Examine the leaves for the "channels" left by young larvae and the large, ragged holes and waste left by older larvae. Treat field if 15% or more of the plants scouted show fresh feeding injury. If FAW injury is found in combination with ECB injury, count the two together, and recommend treatment if the combination of the two is 12% or greater.

Silk stage: Pheromone traps - Place Multi-pher^{tm} trap baited with Scentry FAW pheromone in corn field at silk height. If silking corn is not being sprayed for other pests (CEW) treat field based on pheromone traps catches as shown in the table below.

Fall armyworm spray thresholds for silking corn based on average captures of fall armyworm moths in Multi-Pher traps:

Number of moths per week	Control spray interval
2 or less	No spray
3 to 9	Spray every 7 days
10 or more	Spray every 5 days