



The Pennsylvania INTEGRATED PEST MANAGEMENT PROGRAM



Pennsylvania Department of
AGRICULTURE

Pennsylvania Fresh-market Sweet Corn IPM

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Pennsylvania sweet corn production ranks in the top ten nationally with more than 20,000 acres worth about \$25 million annually. Farms are both large and small- from only 2.5 acres to more than 2,500 acres. A recent university study showed the majority of growers incorporate IPM tactics, with 92% using crop rotations, 91% scout for weeds and 77% scout for insects before applying herbicides or insecticides (paipm.cas.psu.edu/newsreleases/NRcornipm.html). This same study found that IPM in Pennsylvania sweet corn produced economic benefits of about \$7 million annually to the growers and approximately the same amount of benefit to the environment through reduced pesticide applications. While pesticide costs were reduced, however, information-gathering costs, such as labor costs for scouting, increased. Overall, however, growers that adopted IPM spent \$100/A less with increased net revenues of almost \$300/A. An important component on the Pennsylvania sweet corn IPM program is a website (www.pestwatch.psu.edu) that provides region-wide scouting information for important insect pests. See the *Pennsylvania Commercial Vegetable Production Recommendations* at: <http://hortweb.cas.psu.edu/extension/images/PA%2005%20Commercial%20Veg%20Recommends.pdf> for pesticide recommendations. An overview of sweet corn insect management is at <http://www.ento.psu.edu/extension/factsheets/pdfs/insectMgmtSweetCorn.pdf>. In-season insect management that affect most insecticide sprays are based on the timing and intensity of pressure from three Lepidoptera: the corn earworm (CEW), European corn borer (ECB), and fall armyworm (FAW). CEW infests from tips of the ears. ECB and FAW enter tips, sides and bottoms. Transgenic cultivars are available and effective for CEW and ECB, help control FAW, and sometimes need control from sap beetles or silk-feeding insects.

Pheromone Traps & ECB Phenology Models

For the 3 Lepidoptera, lures have been developed based on the sex pheromone that the female of each species uses to attract males. Traps are placed in the near silking corn and are checked weekly. Each week the trapped insects are counted. Lures are replaced as every other week. For one species, the ECB, phenology models help estimate the time when the different life stages are expected to be present. Neither insect traps nor phenology models alone should not be relied on for management decisions, but should be used in conjunction with direct plant inspections in vegetative corn. Trap catches can be affected by many factors (growth stage of nearby corn, weather, trap design, trap placement, trap maintenance, pesticide applications) as well as pest population pressure. Variability in insect trap catches can be minimized if the overall trapping program is consistent.

Scouting Procedure Timeline

Planting

Use cultivars resistant to Stewart's wilt for early plantings, or use seed treated with neonicotinoid insecticide seed treatments.

Rotate fields. Do not plant corn following corn. 1-year rotations are sufficient.

Pre-tassel / Whorl-stage / Vegetative Sweet Corn

Considerations at this stage:

- Usually European corn borer (ECB) and occasionally fall army worm (FAW) are concerns at this stage.
- If infestation rates are low, wait until row-tassel stage since a single spray timed at this stage will be effective.
- However, for multiple plantings, controlling the early season populations reduces problems later in the season.
- It is important to control the first (over-wintering) generation ECB moving into the first or second planting to prevent the second generation from spreading into later plantings.
- Generally the worst whorl-stage infestations are seen on the earliest sweet corn, particularly corn planted under plastic.
- Best control if insecticides are applied at approximately 25% egg hatch, using high gallonage and pressure.

Scouting:

- Scout to determine the % infested plants.
- Phenology models can help estimate when to scout
- "Infested" means damage or presence of live larvae or eggs of either pest (ECB + FAW).
- Scout each field of 10 acres or less once per week, starting at least one week after the first moths are caught in pheromone traps - either your traps, or traps in the region
- Move in a V or U shaped pattern in the field in order to get a representative sample.
- Examine at least 50 plants (five plants in a row in ten sites) per field.
- Check for ECB eggs (clusters of tiny pale fish scales) on undersides of leaves. Note: if eggs in "blackhead" stage, they are almost ready to hatch.
- Check for ECB damage to the leaves and the whorl. ECB damage results in small holes ("shot-hole" damage) as the larvae eat through the tightly wrapped young leaves within the whorl. As the leaves grow out of the whorl, the feeding can be seen as several holes in a line across the width of the leaf. The chewing of very small larvae will not go all the way through the leaf surface, sometimes creating a "window paning" effect. If you see feeding damage, you can frequently find the larvae by pulling out and carefully unrolling the whorl leaves.
- For late plantings still in the whorl stage, also check for FAW damage. FAW larval feeding results in large, irregular holes visible in the young leaves as they unfold. Plants infested with larger larvae look ragged and torn, and there is usually a lot of moist, brown frass on the plant.

Thresholds Based on Scouting Results for Vegetative Corn:

- 15% infestation for early and short-season plantings. (NY: over 20% of plants with egg masses only.)
- 30% infestation for later and full-season planting if you are at least two weeks away from silk. As you approach silking, reduce thresholds to ensure larvae do not move into developing ears.

Pheromone Traps

- Provide information on moth activity and when to start scouting.

Thresholds Based on Pheromone Traps:

- None for vegetative corn

Early Tassel / Green Tassel / Row-Tassel Sweet Corn

Considerations at this stage:

- Tassels can be seen emerging from the top of the plant, but have not unfolded from the whorl.
- Corn at this stage is very attractive to moths.
- ECB and FAW and CEW are the concerns.
- Control measures need to begin at this stage. Waiting until silking is too late for controlling ECB and FAW.
- If you had ECB in earlier growth stages, but below threshold, a spray timed at row-tassel helps avoid them moving into the ears.

Scouting:

- Use the procedure described under pre-tassel corn.
- Pay particular attention to the tassel as it emerges from the whorl, because larvae of different ages may be present.
- Frass or newly-broken tassels (“flags”) indicate the presence of larvae in the tassel.

Thresholds Based on Scouting Results:

- 15% infestation (ECB + FAW) for early tassel and tassel stage sweet corn.

Pheromone Traps

- Provide information on moth activity, but are not infallible.
- Trapping procedures are outlined in:
<http://www.ento.psu.edu/extension/factsheets/pheromonetrap.htm>
- A bucket trap using pheromone lures has been developed for monitoring fall armyworm and care needs to be taken to make sure they are not look-a-like species
<http://www.ento.psu.edu/vegetable/armyworm/armyworm.html>.
- Can run a set of traps on your own farm, and/or access trap counts on the web (<http://pestwatch.psu.edu>).
- Look at trends in counts over time as well as counts for that week.
- Note what is happening in surrounding areas, especially to areas warmer than you. For much of Pennsylvania, that is to the south and east, but in parts of Pennsylvania that may be to the south or west.

Thresholds Based on Pheromone Traps:

We do not have well-developed thresholds for ECB based on pheromone traps for reproductive corn. What we have are thresholds designed for CEW, and later adapted to include ECB. The following table provides an estimate of ECB thresholds and recommended spray frequency in the absence of CEW.

ECB Catch per Week	ECB Catch per Day	Spray Frequency
< 18	<2	No treatment
19-36	3-5	6 day
36-70	6-10	5 day
>70	>10	4 day

Silk Stage Sweet Corn

Considerations at this stage:

- ECB, FAW and CEW are all concerns at this stage. Tolerance levels at this stage are very low for fresh market sweet corn.
- Corn at this stage is very attractive to moths, especially CEW and ECB.
- When the treatment threshold is reached, apply foliar insecticides, using high-gallonage and targeting the ear zone, and repeat as needed.
- Stop sprays when silk turns completely dry and brown, or 5-7 days prior to harvest, depending on the pre-harvest interval of the insecticide.

Scouting:

- Many feel that scouting at this stage is not practical because of the short lead time, and the inability to detect eggs laid on silks, and low tolerance levels for ear damage. Others find scouting a very useful tool in making insect management decisions at silk stage. It is necessary to check more plants (maybe 100 per field) in order to accurately detect low infestation levels. But even some quick scouting can yield important information such as species of pest, size of larvae, and a general sense of the level of infestation.
- Scout only the ear zone of plants – that includes the ear, and one leaf up and one leaf down from the ear - rather than the entire plant. Check the ear, between the ear and the stalk, and the silk for the presence of larvae, frass, or damage. To check silk, carefully tease apart the silks down to the ear tip, inspecting for eggs, larvae, damage or frass. Then gently squeeze the silks back to their original position. Scout at least 100 plants unless infestations are obviously over threshold after fewer plants are sampled.

Thresholds Based on Scouting Results:

- 5% infestation (ECB + FAW + CEW) in the ear zone.

Pheromone Traps

- Look at trends in counts over time as well as counts for that week.
- Note that web page shows data as an average “catch per day” regardless of how often traps are checked.

Thresholds Based on Pheromone Traps:

The following table provides thresholds for CEW:

	CEW Catch per Week	CEW Catch per Day	Spray Frequency
Almost absent	<14	<2	Spray at green silk, reassess after next trap catch
Very low	14-35	3-5	5-6 days
Low	36-70	6-10	4-5 days
Moderate	71-350	11-50	3-4 days
High	>350	>50	2-3 days

If CEW is not a problem, then use ECB thresholds in the following table:

ECB Catch per Week	ECB Catch per Day	Spray Frequency
< 18	<2	No treatment
19-36	3-5	6 day
36-70	6-10	5 day
>70	>10	4 day

If sprays are withheld from silking corn (due to low pressure, or due to the use to Bt-cultivars, then scout the silks for silk-feeding by any of several species of adult beetles. Silk-feeding species that are causing problems in Pennsylvania include Japanese beetles, western corn rootworm, and northern corn rootworm. Also check for sap beetles. Spray when silk-feeding is occurring at a rate fast enough to prevent pollination.

Sprays are not recommended for corn leaf aphid. Populations of natural enemies are usually sufficient to prevent corn leaf aphid from causing any yield or quality affect. Only spray for corn leaf aphid if populations are so high on the wrapper leaves to affect ability to market the crop.

Check Off List

Do they have a copy of the Pennsylvania *Commercial Vegetable Production Recommendations* and are familiar with them? There are several mid-Atlantic Vegetable IPM guides from other states that might qualify as well. (if no, disqualify).

Are they familiar with:

- Reentry Intervals
- Pre-harvest Intervals
- Pesticide Efficacy Tables

Have them show weekly pheromone trap catches and for which species.

How often did they change pheromone lures? Most lures only last from 2-4 weeks for these pests

Do they have weekly scouting records for crop injury to support decisions made on trap catches? If no, disqualify.