ACTION THRESHOLDS FOR FRESH MARKET SWEET CORN

I. WHORL STAGES

Whorl-stage plants can tolerate a substantial amount of leaf and/or stem damage by ECB and FAW before the number and quality of marketable ears are affected. Most larvae feeding on the plant prior to the late whorl stages have little chance of invading the ear because they either pupate or die before the ear forms. However, the economic impact of these insects depends on the time of attack and the growth characteristics of the cultivar.

Many early season cultivars with short maturity periods cannot tolerate as much leaf injury and stem boring as the full season cultivars, which generally produce larger plants (such as Silver Queen). Also, the growing tip of younger plants (less than 18 inches tall) is more vulnerable to FAW feeding injury, which can result in stunting, abnormal tasseling and no ear development. For most whorl-stage infestations, insecticide treatment should be considered if more than 30% of the plants are infested with live ECB and/or FAW larvae. However, a whorl treatment may be required if more than 15% of very young plants are infested with FAW larvae. Note that larvae may not be present in injured plants due to natural mortality factors and pupation. If few larvae are found or worms are full-grown, then most of the feeding damage has already occurred and treatment may not be necessary. Usually one well-timed whorl application can control an economic infestation of ECB; however, repeated applications may be justified if heavy FAW infestations continue to exceed threshold levels. Note that most whorl applications are ineffective unless high gallonage/pressure combinations are employed.

II. PRETASSEL AND GREEN TASSEL

The emerging tassel stage (pretassel) is an excellent time to control FAW and ECB larvae, which at this stage are more likely to invade the ear. Larvae in the whorl often ride the tassel as it emerges and thus are more exposed to insecticide sprays. If not controlled as the tassels expand, many larvae disperse to the leaf axils near the ear shoot and eventually to the husks and silks of developing ears. In the mid-Atlantic states, CEW larvae as progeny of the overwintered population may also be found infesting green tassels during early June before silking occurs. Generally, if larvae are mostly full grown, they will soon leave the tassel and move to the soil to pupate, without causing internal injury to the developing ear. However, ear damage may result before pupation if young larvae are present in green tassels. In this situation, tassel infestations of young CEW larvae should be treated the same as FAW or ECB infestations.

An insecticide treatment is recommended if more than 15% of the emerging tassels are infested with ECB, FAW, and/or young CEW. Once a pretassel or green tassel spray is applied, scout fields again in three days to assess the degree of control and the need for retreatment. If more than 15% of the tassels remain infested with live larvae, a second treatment before silking may be warranted.

III. SILKING

Direct sampling for eggs and larvae of CEW, ECB, and FAW during silking is not practical because of the short lead time and low tolerance levels of ear damage. Large numbers of plants or ears would have to be sampled to avoid estimation errors in decisionmaking. Thus, scheduling of insecticide applications during silking is based primarily on action thresholds of moth activity determined by blacklight and pheromone trap monitoring. Decision guidelines are dependent on the tolerance level of ear damage, predominate pest in the area, insecticides to be used, and type of trap monitoring. For information on the most appropriate guidelines for your area, refer to the current year's state "Vegetable Production Recommendations" or call the local Cooperative Extension Service. Although action thresholds vary among states, silk spray decisions are generally based on one of the following approaches.

Decisions based on Blacklight Trap Monitoring. This approach was developed in New Jersey to schedule silk sprays for CEW, which is the most important pest in the coastal plain areas of the Northeast. It relies on moth activity information obtained primarily from blacklight traps operated daily on farms (see Trap Monitoring for procedures). Action thresholds and recommended spray intervals are conservatively set to prevent ear damage from exceeding 2% and assume that the most effective, longest residual insecticides are applied properly, preferably with high gallonage, drop nozzle-type sprayers.

An insecticide spray is applied to green silking corn as soon as the first CEW moth is captured on a farm. Repeated applications are made at 2 to 6 day intervals depending the cumulative number of CEW moths captured over the last five days (Table 1). Generally, sprays are discontinued regardless of the moth activity if the expected final harvest is less than six days away.

Table 1. Recommended insecticide spray intervals during silking based on blacklight trap information of CEW moth activity. Action thresholds are developed for the standard 15-watt AC-operated trap only.

Total number of CEW moths captured per trap per 5 days	Recommended control action or days between sprays
first moth captured	spray at green silk then reassess
1	6
2	5
3	4

4-30	3
greater than 30	2

If CEW moth trap captures call for no control action or schedules of silk sprays spaced 5 or 6 days apart, other insect pests may require tighter schedules to prevent economic ear damage. When this situation occurs on farms with previous sap beetle problems, sample each silking field and apply an insecticide treatment every 4 or 5 days if more than 10% of the ears are infested with sap beetle adults, eggs, and/or larvae. A change in the insecticide used alone or in combination may also be warranted if sap beetles are the major target of concern. For ECB or FAW, insecticide treatments should be applied every 5 to 7 days in silking fields if blacklight trap captures of ECB moths exceeds 10 per day or if pheromone trap catches of FAW moths indicate significant flight activity (see section below for action thresholds). If no trap information for these pests is available and spraying is not recommended for CEW, a 7-day spray schedule starting at early silk is suggested if whorl or tassel infestations exceed action threshold levels on the same farm.

Decisions based on Pheromone Trap Monitoring. Growers in many states do not use blacklight traps because of the cost, requirements for electrical power, and problems in differentiating moths of sweet corn pests from other insects captured. Thus, action thresholds for determining silk spray schedules are based on pheromone trap captures of moth species obtained on-farm or by calling one of the telephone IPM hotlines (see Trap Monitoring for procedures).

Similar to the previous approach, most pheromone trap-based guidelines have been developed primarily to make silk spray decisions for CEW control. Generally, an insecticide spray is applied to green silking corn as soon as more than one moth is captured over a five day period on a farm. Repeated applications are made at 2 to 6 day intervals depending on the cumulative number of CEW moths captured and the type of trap used (Tables 2 and 3). Sprays are normally discontinued when the expected final harvest is less than six days away.

Table 2. Action thresholds and insecticide spray intervals during silking based on pheromone trap information of CEW moth activity, using the **Scentry nylon mesh trap** and Hercon *Heliocoverpa zea* lure (see Trap Monitoring for procedures).

Average number of CEW moths captured per trap			Recommended control action or days between sprays
per day	per 5 days	per week	
less than 0.2	less than 1	less than 1.4	spray at green silk then reassess

0.2 - 0.5	1 - 2.5	1.4 - 3.5	6
0.5 - 1	2.5 - 5	3.5 - 7	5
1 - 13	5 - 65	7 - 91	4
>13	>65	>91	3

Table 3. Action thresholds and insecticide spray intervals during silking based on pheromone trap information of CEW moth activity, using the **wire mesh 50:33 trap** and Hercon *Heliocoverpa zea* lure (see Trap Monitoring for procedures).

Average number of CEW moths captured per trap			Recommended control action or days between sprays
per day	per 5 days	per week	
1 - 2	5 - 10	7 - 14	spray at green silk then reassess
2 - 5	10 - 25	14 - 35	6
5 - 10	25 - 50	35 - 70	5
10 - 50	50 - 250	70 - 350	4
>50	>250	>350	3

In the cooler areas of the Northeast, spray intervals should be lengthened by one day if daily maximum temperatures drop below 80°F. over a 2 to 3 day period. Furthermore, alterations of spray schedules to prevent ear damage from other pests are based on field scouting and/or pheromone trap information. If CEW moth activity calls for no control action or only a minimum spray schedule, insecticide treatments may still be necessary every 5 to 7 days in silking fields if whorl or tassel infestations of ECB and/or FAW exceed action threshold levels on the same farm or if trap monitoring indicates significant moth activity. Some New England states recommend that insecticide treatments be applied every 5 days during silking if 1) more than 10 FAW moths per week are captured in Multipher or Unitrap pheromone traps using a Sentry four-component lure or 2) more than 35 ECB moths per week are captured in two Sentry nylon net traps baited with either E- or Z-race lures. On farms with sap beetle problems, an insecticide treatment should also be applied every 4 or 5 days if more than 10% of the ears are infested with sap beetle adults, eggs, and/or larvae.

Decisions based on both Blacklight and Pheromone Trap Monitoring. This approach was

developed in Maryland and is commonly used in the mid-Atlantic states. The decision aid (Table 4) recommends treatment schedules of insecticides during silking for a combination of insect pests that attack ears of sweet corn. The action thresholds are set to prevent ear damage from exceeding 5%, assuming that proper application equipment and spray volume are used to achieve maximum insecticide coverage and control efficacy.

To make accurate predictions of spray schedules, at least two wire mesh 50:33 traps baited with the Hercon pheromone lure (see Trap Monitoring for procedures) are required for monitoring CEW moth activity on each farm. The standard 15-watt blacklight trap is also required for monitoring ECB moth activity; however, on-farm monitoring is not necessary. Current trap captures from regional networks can be obtained by calling a IPM telephone hotline in most states.

The action thresholds used in the decision aid are expressed as a running total of moths captured over a 5-day period. So, a tally of trapping data should begin at least 10 days prior to silking of the first sweet corn planting on the farm. Moth activity information should be evaluated during late tasseling, before silking commences, to give lead time for control actions. Sprays may be required up until 5 days from the final harvest date. However, if the weather is hot, pest populations are increasing, and more than five days have elapsed since the last spray, it may be necessary to apply a final treatment within 5 days of the final harvest.

To make spray decisions, use the most recent trap and field scouting information and select the recommended spray schedule among sets of alternatives with the same letter that best fits the insect activity/field conditions in each field. When the aid calls for a particular schedule, the first insecticide treatment is applied during early green silk (less than 30% silking), unless plant development is more advanced when the initial spray decision is reached. This recommended spray schedule is then maintained until changes in insect activity and field conditions warrant a different schedule or no treatment.

Table 4. Decision aid of action thresholds and insecticide spray intervals during silking based on pheromone trap captures of CEW moth activity, using the **wire mesh 50:33 trap** and Hercon *Heliocoverpa zea* lure, and on blacklight trap captures of ECB (see Trap Monitoring for procedures).

Field conditions/insect activity		Recommended action
B1. CEW pheromone trap catch is >250 moths/5 days Note: Use the tighter schedule if daily average temperatures exceed 80°F. over a 2 to 3 day period or >97% clean ears are required.		Spray every 2-3 days
B2. CEW pheromone trap catch is 51 to 250 moths/5 days Note: Use the tighter schedule if daily average temperatures exceed 80°F. over a 2 to 3 day period or >97% clean ears are required.		Spray every 3-4 days
B3. CEW pheromone trap catch is 26 to 50 moths/5 days		
	C1. Daily temperature are >85 degrees F. or ECB light trap catch is >100 moths/5 days	Spray every 4 days
	C2. Daily temperature are lower than 85 degrees F. **or** ECB light trap catch is 51 to 100 moths/5 days **or** FAW whorl infestation is >30% **or** sap beetle infestation is >10%	Spray every 5 days
B4. CEW pheromone trap catch is 10 to 25 moths/5 days:		
	C1. Daily temperatures are greater than 85 degrees F. **or** ECB light trap catch is 51 to 100 moths/5 days **or** FAW whorl infestation is >30% **or** sap beetle infestation is >10%	Spray every 5 days
	C2. Daily temperature lower than 85 degrees **and** ECB light trap catch is <50 moths/5 days **and** FAW whorl infestation is <30% **and** sap beetle infestation is <10%	Spray every 6 days
B5. CEW pheromone trap catch is <10 moths/5 days:		
	C1. ECB light trap catch is >100 moths/5 days	Spray every 4 days
	C2. ECB light trap catch is 51 to 100 moths/5 days **or** FAW whorl infestation >30% **or** sap beetle infestation >10%	Spray every 5 days
	C3. ECB light trap catch is 25 to 50 moths/5 days and FAW whorl infestation is <30% and sap beetle infestation is <10%	Spray every 6 days
	C4. ECB light trap catch is <25 moths/5 days and FAW whorl infestations is <30% and sap beetle infestation is <10%	No control required

ACTION THRESHOLDS FOR PROCESSING SWEET CORN

I. WHORL STAGES

Sweet corn varieties grown for processing generally tolerate higher levels of whorl infestations of ECB and FAW than do fresh market varieties. In many areas of the Northeast, processing sweet corn is planted early and thus plant development is usually beyond the critical stages of early whorl before heavy fall armyworm populations occur. New York and other states in New England do not recommend any whorl treatmnets for insect control. In the mid-Atlantic states, one whorl-stage treatment of insecticide for ECB control may be warranted on the earliest plantings if more than 50% to 75% of the plants are infested with live larvae. However, make sure that live larvae are present in injured plants.

II. TASSEL AND SILKING STAGES

Scouting and Trap Monitoring. The level of ear damage that can be tolerated for processing is much higher than for fresh market. Because action thresholds are higher, direct field scouting during silking is used by many processors to estimate the percentage of developing ears that are potentially at risk to insect damage. Field visits should commence at the beginning of green silking and continue every 3 to 5 days until about one week prior to the expected harvest date. The silk area at the tip of 20 primary ears should be inspected at each of five sites and a tally made of the number of ears infested with CEW eggs, SB eggs, or young larvae of any of four pest species. Only ears with larvae feeding on silks, flag leaves, or the husk outside the ear should be counted. In the same sampling process, every other plant (total of 50) should be examined for ECB and FAW egg masses on the middle 1/3 of the plant (including the flag leaves, ear leaf, and two leaves above and below the ear). It is not necessary to count all egg masses, just examine the specified leaf area until an egg mass is found and then tally the number of plants carrying at least one egg mass.

Pheromone or blacklight trap monitoring is also used alone or in combination with field scouting to make control decisions. Corn processors in New York rely almost entirely on pheromone trap monitoring of CEW and FAW moth activity (see Trap Monitoring for procedures). For ECB, management decisions are based on crop phenology or degree day predictions, increasing pheromone trap catches of either ECB E- or Z-race, and levels of egg masses in the field. During periods of high moth activity, treatment schedules can also be based on the combined CEW and ECB moth catches in blacklight traps. This approach requires the use of a network of traps which are operated annually by the Cooperative Extension Service in many mid-Atlantic states. Processors can obtain specific information on CEW and ECB moth activity for a particular region by calling one of the IPM telephone hotlines (see Trap Monitoring for more details). As a relative index of combined CEW and ECB moth activity, trap captures can be expressed in

terms of cumulative moth units recorded per trap over a 5-day period. To calculate moth units for a particular region, simply multiply the average number of CEW moths captures per five days times 5 and add the value to the average number of ECB moths captured per five days. The ear damage potential of a CEW moth is approximately 5 times higher because female moths deposit a few eggs directly on the silks of many developing ears.

Action Thresholds. In New York, an insecticide spray program should be initiated when pheromone traps indicate a drastic increase in CEW or FAW moth activity during tasseling through dry silking. For ECB, if the pheromone trap catch is increasing, then field scouting for egg masses should begin after 100 degree-day units (base 50° F.) have accumulated. If more than 5% of the plants are carrying an egg mass, a treatment is recommended 2 or 3 days later. Treatments are timed for early larval instars using degree-day forcasts.

The decision scheme used in the mid-Atlantic area is based on field scouting and blacklight trap data. If the cumulative number of moth units per 5 days is less than 75, a minimal schedule of insecticide treatments may be required; however, each field should be scouted as explained above. Depending on the quality standards of the final product, some processors may eliminate spraying all together under these conditions, while others may want to apply one or two insecticide applications during green silking. More accurate decisions to treat each field should be based on the percentage of developing ears at risk. A primary ear is considered at risk to insect damage if at least one of the following conditions exist: (1) the plant has one or more ECB or FAW egg masses on it; (2) there are one or more CEW or SB eggs in the silk area; or (3) young larvae of CEW, ECB, FAW or SB are feeding on the husk or in the silk area but have not yet moved into the ear.

To prevent ear damage from exceeding 20% tip injury or 5% side injury, an insecticide treatment should be applied according to the following action thresholds: **Green silk** - when less than 75% of the plants are silking, treat if 5% of the primary ears are at risk; **Wilted silk** - when 100% of the plants have silked and silks are wilting (about 13 to 18 days before harvest), treat if 10% of the ears are at risk; **Brown silk** -during brown silking within 7 to 12 days from harvest, treat if 20% of the ears are infested with young larvae feeding outside the ear. If average moth units remain below 75 per 5 days, continue field scouting to assess the need for additional treatments.

If moth units fall between 75 and 150 per 5 days, fixed schedules of 1 or 2 insecticide applications are recommended depending on the number of days to harvest and whether previous treatments have been applied. Apply two insecticide treatments 4 days apart starting at early green silk or at a later stage if corn maturity is greater than 14 days from harvest. Apply a single insecticide treatment to more advanced corn that is 7 to 14 days from the expected harvest date. Apply treatments immediately unless a previous application was made less than four days ago. Fixed schedules of 2 to 5 insecticide treatments applied 3 or 4 days apart are recommended if the average number of moth units exceed 150 per 5 days. Refer to Figure 4 to determine the specific schedule depending on the corn maturity in each field. Apply initial treatments immediately unless a previous application was made less than 3 days ago.

Figure 4. Recommended fixed schedules of insecticide treatments for control of ear-invading insect pests of processing sweet corn, when the overall moth activity is high (greater than 150 moth units per 5 days).

Days to harvest at time of decision	Approx. maturity stage at time of first treatment	Total number of insecticide treatments required	Number of days between treatments
24	late tassel	5	3, 3, 3, 4
21	green silk	4	3, 3, 4
18	wilted silk	3	3, 4
14	brown silk	2	4