University of Massachusetts Cooperative Extension System
Vegetable Integrated Pest Management Program

Managing Corn Earworm in New England Sweet Corn : Current Suggestions for Organic Growers

Throughout the Northeast, corn earworm is a key obstacle to successful, season-long production of organic sweet corn . There have been virtually no options for controlling this pest organically. Most organic farmers find themselves putting wormy corn on the stand at some point during the season unless they are located in regions which have no corn earworm activity. This drastically reduces sales and eliminates wholesale marketing. Cutting off infested tips before sale is a time-consuming option which some growers use, but preventing damage in the first place would be much preferred. Recent research is exploring some options for control that can be used by organic growers.

Corn Earworm Biology

Corn earworm is a widespread pest which is also known as tomato fruitworm on tomato, and cotton bollworm in cotton and tobacco. It's scientific name is *Helicoverpa zea*, recently changed from *Heliothis zea.* Corn earworm moths migrate annually into New England, primarily from mid-July through September. Adult moths are about 1 1/4 inches in length, covered with light tan scales. Distinctive features are a dark dot on the forewing, a dark band near the margin of the hindwing, and bright light-green eyes.

Female moths attract males for mating by emitting sex pheromones. Pheromone traps are a good indicator of the population density of both males and females. The recommended trap that is commercially available is the *Heliothis* net trap produced by Scentry, baited with Hercon^{tm} luretapes for corn earworm. This trap should be placed with the base at about ear height in freshly silking corn. Capture numbers are a good predictor of how serious the ear damage from earworm caterpillars will be. Higher captures of males indicate greater numbers of female laying eggs (the population is usually about 50:50 male and female), and therefore more eggs and newly-hatched larvae to control.

Female moths are attracted to the odor of corn silk, and lay eggs singly on the silk as well as other parts of the plant. Females lay on the average about 5.5 eggs per day over their 7-14 day life span. After silks have been pollinated and dry up, they are no longer attractive as ovipositional sites. Eggs hatch in 2-7 days, depending on temperature. Larvae move down the silks and into the ears to begin feeding at the tip of the ear. Feeding is usually limited to the ear tip, which is why the earworm is also called "tipworm."

Silk Growth.

When corn plants begin to produce silk, the growth of the fresh silk is very rapid. Studies at the University of Massachusetts and other institutions have indicated that about 75% of the growth occurs in the first day, and growth is 95% complete in 2 days. However, not all plants in a stand produce silk at that same time. Given a relatively even stand, 60-80% of silk emergence is concentrated in a 3-4 day period. About 48 hours after growth is complete (called "full brush"), the silk begins to turn brown at the tips and dry up.

Direct Silk Application of Oils.

Corn earworm larvae enter the ear via the silk channels at the neck of the ear. Oil which is applied directly to the silks in the neck acts as a barrier and kills the larvae, probably by suffocation. This is an "old-fashioned" technique which was used before the arrival (and regulation) of synthetic insecticides. Vegetable and mineral oils are not sold or distributed as pesticides and are food products or for internal use; these characteristics appear to exempt them from regulations regarding pesticides and food tolerances. If you wish further clarification of their regulatory status, contact your state pesticide regulatory agency or regional EPA office.

Trials have been conducted at the University of Massachusetts, on organic farms, and by other Universities, examining the effect of vegetable and mineral oils on CEW damage. The results suggest that oils can reduce damage by corn earworm and other caterpillars and warrant further testing by farmers and researchers. The following results were observed:

- Both vegetable (including cottonseed and canola oils) and mineral oil effectively reduced CEW infestation. *In 1993 trials conducted at U. Mass.*, there was no difference in the control from vegetable oil compared to mineral oil.

- To avoid tip fill problems, oil must not be applied until 48 hours after silk is fully grown. *Earlier applications can reduce pollination and result in poorly filled tips.* This timing can be determined by flagging silks on a few plants and watching them grow, or by noting when the fresh silk started to dry at the tips, which occurs at two days past full brush. In U. Mass 1992 trials, 2 ml/silk of canola oil applied at 48 hours after full brush caused a 6% reduction in ear fill. In 1993 trials, both mineral and vegetable oils applied at this time in amounts up to 0.5 ml per ear caused no reduction in ear fill.
- Too little oil may be ineffective, but excessive quantities can "pre-butter the ears"! Some growers have reported that one or two drops per ear, applied directly to the neck, was a sufficient quantity to achieve control. In 1992 trials we used about 2 ml (equivalent to approx. 20 drops). This appeared to be excessive, as oil moved down the ear onto the kernels and was still present at harvest. 1993 trials found better control with 0.5 ml (equivalent to 5 drops) than with 2 drops per silk, with no oil found on ears at harvest time. We have concluded that 0.5 ml is an optimum dose. Note that this oil must be applied directly into the hollow in the neck of the ear, not on the silk hanging outside the ear, to be effective.
- One application to each block of corn has been adequate. All ears that were close to the ideal age were treated. If the silk emergence is very uneven, it may be necessary to go through the stand twice to achieve optimal control without tip fill problems. In this case, treated ears need to be marked in some way, such as with a hole punched through the flag leaf or a thumb print from an ink pad carried on the belt.
- Eye droppers, syringes, or oil cans set to deliver a small amount have been used for the application. A can may be carried on the belt to refill whatever applicator is used. Growers have experimented to figure out the most efficient method for them. Time spent in application is the major cost of this method. In 1993 U. Mass trials, we used a metal "pistol oiler" oil can with a block under the handle to calibrate it, so that it delivered the desired amount on each squeeze. The time required for application was the equivalent of 8-10 hours per acre.
- Mixing a BT product that is labeled for sweet corn (Dipel ES™, MVP™, or Condor OF™) with the oil may increase control. In 1993 trials, adding MVP to vegetable oil increased marketable ears from 82% to 95%. Similarly, Pyrellin™ mixed with oil gave improved control over oil alone in trials at Oklahoma State Univ. NOTE: application must be made in accordance with the product label.
- Oil also prevented damage from 2nd-generation European corn borer and fall armyworm that entered through the neck of the ear. However, both of these pests also burrow through the side of the ear. Side damage, especially from ECB and FAW present in at early tassel stage, can be reduced by using BT sprays before silking.

Trichogramma Releases for CEW Control

Several species of the tiny egg parasitoid *Trichogramma* are available commercially for annual release in crops. *Trichogramma pretiosum* is mass-reared and readily available, and *H. zea* is its host. It is adapted to parasitize eggs that are laid singly, like *H. zea* eggs. It has been shown to be quite effective in reducing damage by *H. zea* in tomato and cotton. However, it is *not* effective in reducing H. zea damage in sweet corn. This may be because of difficulty in locating host eggs on the silk, or it may be because, even if the parasite is 90% effective, it only takes one caterpillar per ear to make the ear unmarketable. Growers who have released *T. pretiosum* in sweet corn report that it is ineffective when CEW is present.

Other species of *Trichogramma* have been studied for controlling European corn borer, with more promising results. *T. maidis* is mass-reared and released in commercial fields in Europe with good success. *T. brassicae* (which may actually be the same species; taxonomists disagree on this) has been mass-reared on a trial basis by CIBA-Geigy in Ontario, Canada and has been studied in field trials in 1992 and 1993. Results appear to be mixed, and the prospects for commercial availability are not promising at this time. *T. ostriniae* was imported from China in 1990, readily parasitizes ECB, and may have the important characteristic of being able to survive the New England winter. It is currently under evaluation at the University of Mass. and Cornell University, but is not commercially available. *T. nubilale* is another species that has been shown to be effective against ECB at high release rates, but is also not commercialized. *T. pretiosum* has been released against ECB by several growers in Massachusetts, who report that it is effective; however, both lab and field studies by researchers at several Universities have found poor results with *T. pretiosum* against ECB. This species has not been evaluated in Massachusetts in trials with non-release plots for comparison.

by Ruth Hazzard, Vegetable IPM Specialist
Univ. of Mass. Cooperative Extension System
Vegetable IPM Program
Pub. VEGICM 94-2