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Managing Corn Earworm in New England Sweet Corn :

Current Suggestions for Organic Growers

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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.

Use of direct silk application of oils for corn earworm control.

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 of synthetic insecticides, and which is being examined again by organic farmers and by some land-grant universities as an alternative to insecticides.

Here are some key things to remember about using oils for protecting the ears from corn earworm and fall armyworm. These recommendations are based on research at Oklahoma State University and the University of Massachusetts, and the experience of organic sweet corn farmers.

- Both vegetable (including cottonseed and canola oils) and mineral oil can effectively reduce CEW infestation of the ear. In 1993 trials conducted by U. Mass. Vegetable IPM program, there was no difference in the control from vegetable oil compare to mineral oil.
- Oil should not be applied until 48 hours after silk is fully grown. *Earlier applications can reduce pollination and result in poorly filled tips.* You can determine this by flagging silks on certain plants and watching them grow. Or, you can note when the fresh silk just begins 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: ears were 82% filled instead of 88% in untreated

plots. 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.

- The quantity should be enough to provide control, but not enough to "pre-butter the ears"! Growers have reported that one or two drops per ear, applied directly to the neck, were sufficient. 1992 U. Mass. trials used about 2 ml, which appeared to be excessive, as oil moved down the ear onto the kernels and was still present at harvest. 1993 U. Mass. on-farm 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.
- One application to each block of corn should be adequate. Treat all ears that are close to the ideal age. If the silk emergence is very uneven, it may be necessary to go through the stand twice. In this case, treated ears should be marked in some way -- perhaps with a hole punch or with 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. Experiment to figure out the most efficient method for you! Time spent in application is the major cost of this method. In 1993 U. Mass trials, we used an oil can calibrated to deliver the desired amount on each squeeze, and the time required was the equivalent of about 10 hours per acre.
- Mixing a BT product (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%. This may also be true of Pyrellin, which gave improved control over oil alone in trials at Oklahoma State. Caution should be used regarding the preharvest interval after application.
- Oil will also prevent damage by 2nd-generation European corn borer and fall armyworm that enter through the neck of the ear. However, both of these may also burrow through the side of the ear. To prevent side damage, especially from ECB and FAW present in the tassel before silking, use BT sprays before silking in addition to the oil application.

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 corn earworm is its host. It is adapted to parasitize eggs that are laid singly, like corn earworm 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 among 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* for earworm control in sweet corn report that it is ineffective.

Other species of *Trichogramma* have been studied for controlling European corn borer. *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) is being mass-reared by CIBA-GEIGY in Ontario, Canada and has been studied in field trials in 1992 and 1993. Results appear to be mixed. This species will probably be commercially available in the U. S. soon. *T. ostriniae* was imported from China in 1990, 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 Massachusetts and Cornell University, and 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. This species has not been evaluated here in trials with non-release plots for comparison.

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