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Protecting Sweet Corn From Corn Earworm

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Description

Sweet corn is one of the few crops for which insect pests drive most of the pest management program. A number of caterpillar pests attack sweet corn, infesting ears and rendering the ear and the whole planting unmarketable. In addition, caterpillars will also attack whorl-stage sweet corn, and other insect pests can occasionally cause economic damage by themselves to the ears. This document focuses on the primary sweet corn pest, the corn earworm. Fall armyworm typically can be found in the region starting in mid-July and management may be necessary prior to silking. Sap beetles and stink bugs may also be present and require management in the absence of earworm or armyworm. European corn borer populations are low enough to generally not be a significant threat in many areas of Delaware.

There is nothing more attractive to the corn earworm than tasseling and silking sweet corn. An adult female can lay between 500 and 3,000 eggs singly instead of in egg masses like the fall armyworm or European corn borer. Eggs are laid on silks, and hatch in 2 – 5 days, depending on temperature. Once they hatch, larvae quickly move into the silk channel where they are protected from insecticides.

Sweet corn silk can grow as much as 1.5 inches per day during the first several days of silking, leaving a large amount of tissue unprotected for moths to lay eggs on. By day 10, silks generally stop growing. Thus, spray programs should be more aggressive during the first 10 days. Sprays should be initiated at 10% first silk, the stage when at least a single silk strand is visible.

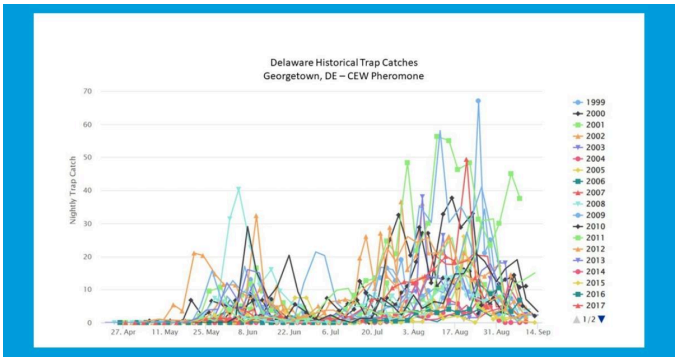
Corn earworm populations can and should be monitored using pheromone traps placed as close to silking sweet corn as possible. Local moth activity can be very different in just a short distance. For instance, two pheromone traps placed a half mile from each other can differ greatly in trap catch. There are two types of pheromone trap – a wire mesh cone trap and a commercially available cloth Scentry Heliothis trap. https://gemplers.com/products/scentry-heliothis-trap)

Traps are baited with synthetic corn earworm female sex pheromone lures https://www.greatlakesipm.com/monitoring/lures/hercon/glhc313810-hercon-luretape-corn-earworm-10cs

Lures should be replaced every 2-3 weeks, and traps should be checked 2-3 times per week.

Typically, the Delmarva has two major earworm flights: Late May – Mid-June and mid-July-September. There can be a great deal of variation in the timing and intensity of the moth flight from year to year.

Silk Emergence Husk



Nightly Corn Earworm trap catches from Georgetown, DE from 1999 to present. Image from: agdev.anr.udel.edu/trap/index.php

The University of Delaware recommends using a pheromone-baited wire cone trap with the following spray interval based on moth captures. Please note that other states use these numbers for the less efficient Scentry trap, but I am more comfortable using a more conservative spray schedule in part because the economic damage potential from corn earworm is so high, earworm are susceptible to insecticides for only a very short period of time before they move into the ear, and there is partial insecticide resistance, especially later in the season.

Number of Corn Earworm Moths Caught			
Per Week	**Per 5 Days**	**Per Day**	**Spray Interval**
<1.4	<1	<0.2	No Spray
1.4 – 3.5	1.0 – 2.5	0.2 – 0.5	6 Day
3.5 – 7.0	2.5 – 5.0	0.5 – 1.0	5 Day
7.0 – 91.0	5.0 – 65.0	1.0 – 13.0	4 Day
91.0 +	65.0 +	13 +	3 Day

From: https://www.udel.edu/academics/colleges/canr/cooperative-extension/sustainable-production/pest-management/insect-trapping/

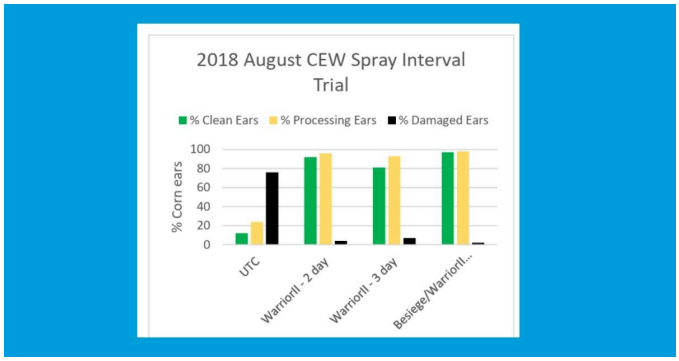


Fig. 1:CEW damage to sweet corn treated with pyrethroid at 2 or 3 ay interval or with a rotation of Besiege rotated with a pyrethroid, both applied at a 3 day interval.

If the daily high temperature is above 82°F, and the corn is in the first 10 days of silking, spray schedules should be tightened by one day (ex. using a 2 day spray schedule instead of a 3 day spray schedule with high moth count). UD tested this recommendation from other states in 2018. Plots sprayed with WarriorII every 2 days had 92% clean ears compared to 81% clean ears from WarriorII applied every 3 days. Plots sprayed with Besiege rotated with Warrior every 3 days provided the best control with 97% clean ears (Fig. 1). This to me suggests that in high pressure, high temperature situations, a 2-3 day schedule would be sufficient: 2 days following a pyrethroid and 3 days following a Besiege or Elevest.

The spray trial also highlights the importance of rotating chemistries. There are only 4 insecticide

modes of action, or, 'families', labeled for silking sweet corn.

Group 1 – carbamates: methomyl (Lannate) – highly toxic to people. No residual activity. Ovicidal. Often tank mixed with pyrethroids. Not recommended by itself.

Group 3 – pyrethroids: lambda-cyhalothrin (WarriorII), beta-cyfluthrin (Baythroid XL), zetacypermethrin (Mustang), bifenthrin (Brigade), esfenvalerate (AsanaXL). Broad spectrum. Partial resistance well documented using adult vial tests and should not be relied upon by themselves, especially after early July (See below chart Fig. 2).

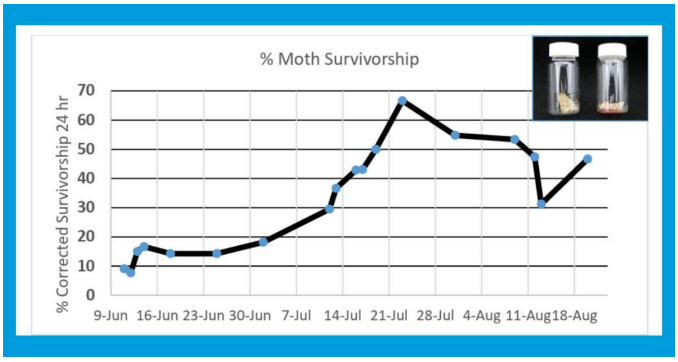


Fig. 2: Percent moth survivorship after 24 hours of exposure to a pyrethroid in vial testing. Wild moths were collected from Sussex Co DE from June through August 2022 and exposed to 5 µg Cypermethrin for 24 hours. Starting in July, moth survivorship increased, demonstrating partial resistance to pyrethroids in DE moth populations. Surviving moths are capable of flying. Treatment mortality was corrected for control group mortality using Abbott's Formula.

Group 5 – spinosyns: spinosad (Blackhawk, Entrust), spinetoram (Radiant). These materials do not perform well by themselves, and may be a weak point if used alone in a rotational program. However, spray trials from 2021 and 2022 demonstrated that a pyrethroid-spinosyn tank mix provides equivalent protection to a Besiege or Elevest / pyrethroid rotation.

Group 28 – diamides: chlorantraniliprole (Coragen and Vantacor). Excellent worm product with longer residual in other crops, but performance is variable in spray trials and does not control sap beetles. Two premix products are available: Besiege (chlorantraniliprole + lambdacyhalothrin) and Elevest (chlorantraniliprole + bifenthrin). Depending on product and rates used, only 2-4 applications of these materials can be made to sweet corn during the entire cropping cycle.

A typical sweet corn spray program rotates Besiege or Elevest with a Pyrethroid + Lannate. Besiege is labeled for 6 – 10 fl oz./acre, but only a maximum of 31 ounces may be used per acre per year. Thus, we only get 3 to 4 applications. Elevest's high label rate will only provide for 2 applications. Because of pyrethroid resistance, pyrethroids should never be relied upon by themselves for ear protection. Some producers do not apply Lannate due to toxicity concerns. Inclusion of Besiege in the rotation is critical for such a spray program. Among the pyrethroids, 2019 UD spray trials in sweet corn and sorghum, 2020-2022 UD spray trials, 2019 Virginia Tech sweet corn spray trials, and 2017 Virginia Tech soybean spray trials suggest that there are significant efficacy differences among pyrethroid active ingredients when used alone (Figure 3). The most consistent products tested have been Hero (applied at or very near its high label rate of 10.3 fl oz. /acre) and Baythroid XL. If using Lannate is not an option, these two products maybe an option in the rotation. Also, 2021-2022 UD spray trials demonstrated that Lannate can be substituted with spinosyns in a pyrethroid tank mix and achieve good control.

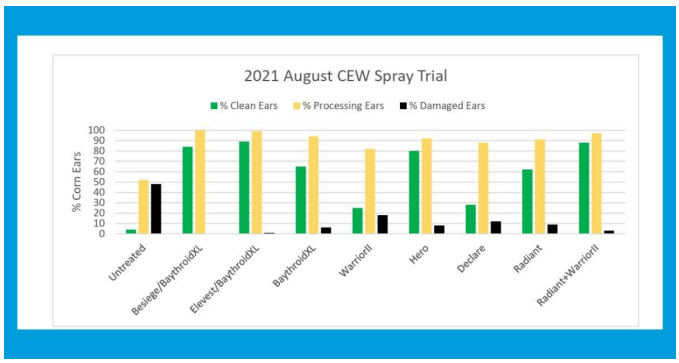


Fig. 3: Percentage of clean, clean + tip damaged (processing), and damaged ears after 6 insecticide applications applied at high rates. Note that such treatments may not be allowed per label restrictions. The label is the law. Besiege and Elevest were rotated with Baythroid XL every other application.

There are several Bt sweet corn varieties on the market. When first released, they provided 80+% control of corn earworm, but earworms have since

developed resistance to all but the Vip3A trait found in Attribute II and Attribute Plus varieties. See handy Bt sweet corn trait table: https://www.texasinsects.org/uploads/4/9/3/0/49304017/20230317_bttraittable_sweetcorn.pdf. When not sprayed, Attribute (ear on the right) and Performance sweet corn (Obsession II on the left in the photo below) can receive heavy damage. Because earworms have not yet developed resistance to the Vip trait in Attribute II sweet corn, and because earworm populations are extremely high in late July and August, if your market allows for Bt sweet corn, planting Attribute II sweet corn may be recommended if silking is expected during the month of August (Figure 4).

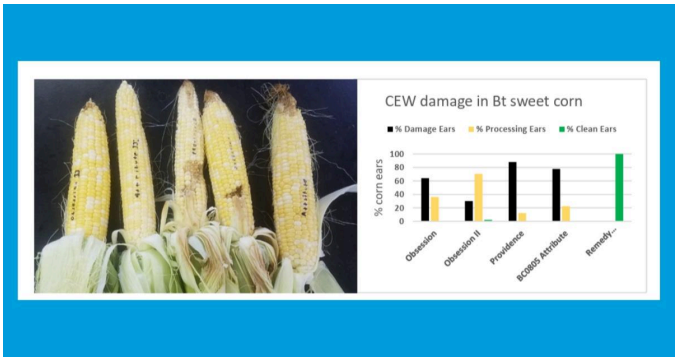


Fig. 4: Ear damage can be high in Bt sweet corn not treated with foliar insecticides except for Attribute II or Attribute Plus varieties containing the Vip3A protein.

While earworms are resistant to Performance sweet corn, larvae take longer to develop in the ear, and as such, smaller larvae and less damage is present at harvest. It may be possible to either slightly relax a spray program on Performance sweet corn by a 1-day interval under certain circumstances. However, based on spray trials from 2019 and 2020 under high temperature, high moth population conditions, there were nearly identical levels of earworm damage using the same spray program (Figure 5).

This to me suggests that Performance and Attribute sweet corn should be treated the same as non-Bt sweet corn even if the Performance sweet corn under certain conditions allows some greater level of flexibility. It should also be noted that Performance sweet corn still performs quite well on fall armyworm. Beginning in mid-July, fall armyworm often infests whorls, tassels, and ears. Sometimes this feeding is damaging enough pre-silking to require an insecticide application. Unfortunately, the best treatments use chlorantraniliprole. The labels restrict how much chlorantraniliprole may be applied to a crop and we need all of it for ear protection at silking. Thus, while there are still uncertainties about how best to implement a silk-protection IPM program with Performance sweet corn on earworm, it has benefits for fall armyworm and could thus let us 'keep' our best insecticides for when they are critically needed at silking.

Beginning in mid-July, it is very important to scout sweet corn for the presence of fall armyworm and European corn borer. In 2021, a spray trial was conducted with some treatments starting several days prior to silk emergence. Based on those trial results, in the absence of whorl or tassel infesting fall armyworm, European corn borer, or corn earworm, a pre-silk application is not necessary. However, that same year we visited fields in which fall armyworm had already caused ear damage when the first silks were emerging. All UD sweet corn spray trial results can be found at our Research and Demonstration Results page: https://www.udel.edu/academics/colleges/canr/cooperative-extension/sustainable-production/pestmanagement/insect-management-reports/.

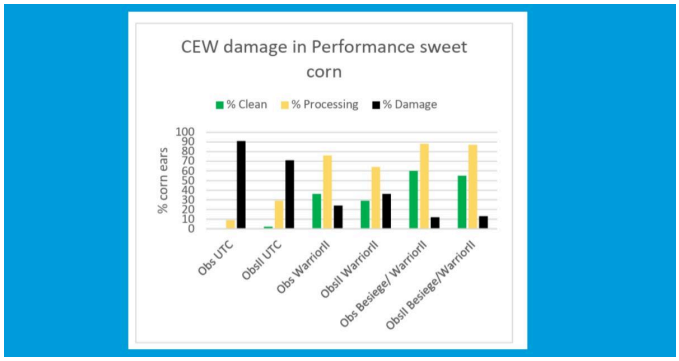


Fig. 5. Ear damage in non-Bt and Performance sweet corn with the same spray programs.

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