THE CHANGING INSECT COMPLEX IN SWEET CORN AND HOW IT AFFECTS MANAGEMENT OPTIONS

A. M. Shelton and Dan Olmstead
Department of Entomology
Cornell University, NYSAES
Geneva, New York 14456

BACKGROUND: Typically, the most common lepidopteran (caterpillar) pests of sweet corn have been the European corn borer (ECB), which is a resident in New York, and the corn earworm (CEW) and fall armyworm (FAW), which are annual migrants from southern states. Typically, New York growers have targeted much of their control practices against ECB because it has been the most consistent pest and has several flights. However, over the last several years ECB and FAW have increased in numbers and, in some areas of the Northeast, have occurred earlier. It has been speculated that this is due to increased temperatures and earlier wind pattern movements from southern states that carry them into our area. Research in some areas of the country has also indicated that ECB populations have declined because of the widespread use of genetically engineered insect resistant field corn, i. e., corn producing proteins from the bacterium, *Bacillus thuringiensis*, and referred to as Bt field corn. Nationally, the percent of field corn that is Bt corn is about 60%, but the adoption of Bt sweet corn has been much lower. We estimate that about 10% of the total fresh market sweet corn in the United States is Bt sweet corn, but only a very limited amount of Bt sweet corn is presently used for processing. While Bt sweet corn is effective against ECB, high populations of ECB and FAW still necessitate the use of supplemental sprays. The increasing populations of CEW and FAW also affect the use of conventional insecticides that have typically been targeted against ECB. To follow up on our previous work on management of the total caterpillar complex with the use of newer insecticides, we conducted trials in 2010 using a series of newly labeled (or soon to be labeled) conventional insecticide products as well as an experimental Bt sweet corn that produces multiple Bt proteins and is reported to have better control of CEW and FAW.

2010 TRIAL WITH CONVENTIONAL INSECTICIDES: A trial was conducted at the Cornell University Agricultural Experiment Station's Fruit and Vegetable Research Farm located in Geneva, NY. A randomized complete block design with four replicates was used. Foliar application treatments were made using a 5-row CO_2 pressurized Hagie 200 High-Boy tractor with 3 nozzles per row (one over the top and one drop nozzle on each side aimed at the ear zone) equipped with flat fan 11003 tips, delivering 42.5 GPA at 45 psi and a speed of 2.3 mph. The first treatment was applied on 18 August when corn was in the green tassel stage and follow up treatments were applied on 25 August, 31 August and 7 September. Evaluations were made on 13 September by selecting 25 ears from each of the middle three treated rows of a treatment plot and evaluating them for ear injury as well as number of live insects.

In the untreated check, only 5% of ears were unaffected by feeding damage caused by Lepidoptera (Table 1). In contrast, only the high rate of Voliam Express was able to produce >90% clear ears and this was statistically higher than several other treatments, including the commonly used Warrior II. CEW had an average density of 22.3 larvae per 25 ears in the untreated check and represented 98.5% (n=191) of the total Lepidoptera collected across all treatments. All treatments significantly reduced ear damage compared to the control ($F=17.4787$; $df=9$; $p<0.0001$) and significantly reduced CEW pressure ($F=22.1837$; $df=9$; $p<0.0001$).

2010 TRIAL WITH BT SWEET CORN: Two varieties of Monsanto Bt sweet corn (MON QHB9004 and MON QHB9001) and one conventional, non-Bt variety ('Obsession') were established in a randomized complete block design that contained four replications. Each replicate included subgroups that received 1) no pesticide treatment, 2) 4 applications of Warrior II (2 week spray interval) at a rate of 1.92 fl oz/A and 3) 8 applications of Warrior II (7 day interval) at a rate of 1.92 fl oz/A. Spraying and harvesting were done in a manner similar to the trial described above.

Both Monsanto Bt varieties performed exceptionally well in this trial. CEW pressure was very high, with a mean of 52.3 ± 6.0 CEW per 25 plants and >95% ear damage in plots of 'Obsession' where pesticide applications were withheld (Table 2). Despite these numbers, both MON QHB9004 and QHB9001 exhibited negligible damage and CEW counts even without any insecticide applications.

Table 1. Evaluation of Treatments Against Lepidoptera on Sweet Corn, 2010

Treatment/ Formulation	Active Ingredient	Fl oz/A	Lb AI/A	% Clean Ears	Mean Larvae/25 plants	
					CEW	ECB
Untreated	---	---	---	5.0 ± 0.7a	22.3 ± 2.0a	0.5 ± 0.2a
VoliamXpress	Chlorantroniliprole /lamba cyhalothrin	9.0	0.03/ 0.06	92.4 ± 0.9d	0.5 ± 0.4e	0.0 ± 0.2a
Belt 480 SC + Baythroid XL	Flubendiamide + β-cyfluthrin	3.0 + 2.4	0.09 + 0.01	86.3 ± 0.1cd	2.0 ± 0.5cde	0.0 ± 0.0a
Coragen	Chlorantroniliprole	3.5	0.05	85.0 ± 0.5cd	2.0 ± 0.4cde	0.0 ± 0.0a
Voliam Xpress	Chlorantroniliprole /lamba cyhalothrin	7.0	0.02/ 0.05	85.0 ± 0.5cd	1.3 ± 0.8cde	0.0 ± 0.0a
Radiant SC	Spinetoram	4.0	0.03	76.2 ± 0.2bc	4.8 ± 1.0b	0.0 ± 0.0a
Belt 480 SC	Flubendiamide	3.0	0.09	74.7 ± 0.4bc	3.8 ± 0.3bc	0.0 ± 0.0a
Hero	Zeta-Cypermethrin/ Bifenthrin	6.0	0.06	73.9 ± 0.6bc	2.8 ± 0.6cd	0.0 ± 0.0a
Warrior II	Lamba-cyhalothrin	1.92	0.03	70.5 ± 0.4bc	4.0 ± 1.0bc	0.3 ± 0.2a
Baythroid XL	β-cyfluthrin	2.4	0.01	63.7 ± 0.8b	4.5 ± 1.3bc	0.0 ± 0.0a

Means (±S.E.) followed by the same lower-case letters within a column are not significantly different (Fishers LSD means separation test, $P>0.05$)

Table 2. Evaluation of Monsanto Bt sweet corn varieties combined with Warrior II applications against Lepidoptera, 2010

Variety	Warrior II Applications	% Clean ears[a]	Mean CEW/ 25 plants[b]
MON QHB9004	unsprayed	100.0 ± 0.0a	0.0 ± 0.0a
	4	99.0 ± 1.0a	0.3 ± 0.3a
	8	100.0 ± 0.0a	0.0 ± 0.0a
MON QHB9001	unsprayed	99.0 ± 1.0a	0.3 ± 0.3a
	4	100.0 ± 0.0a	0.0 ± 0.0a
	8	100.0 ± 0.0a	0.0 ± 0.0a
Obsession	unsprayed	6.0 ± 3.5a	52.3 ± 6.0a
	4	10.0 ± 2.0a	41.8 ± 3.9a
	8	18.0 ± 10.9a	44.3 ± 13.3a

[a]An arcsine(square root) transformation was used to achieve normality, and un-transformed means are presented. Means (±S.E.) followed by the same lower-case letters within a column are not significantly different (Fishers LSD means separation test, $P>0.05$)

[b]Transformation was not necessary. Means (±S.E.) followed by the same lower-case letters within a column are not significantly different (Fishers LSD means separation test, $P>0.05$).

OVERALL CONCLUSIONS: These trials confirm the increased importance of controlling CEW since they represented the largest percentage of caterpillars. Some of the newer conventional insecticides performed better than the standard, Warrior II. The Monsanto Bt sweet corn varieties performed exceptionally well against CEW and did not need supplemental insecticidal sprays.