Well-timed diamide applications effectively control earworm in sweet corn

2017 NYSVGA Expo – Sweet Corn Session

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Purpose

The general purpose of this trial was to evaluate new insecticide timing options and an alternative insecticide for improving control of corn earworm (CEW) damage in sweet corn. Experiment I was designed to evaluate the performance of Warrior II w/Zeon Technology when applications were timed following either the standard IPM schedule or the new IPM schedule coupled with a 3- or 5-day spray interval. The standard IPM schedule spans a window from green silk to harvest with the frequency of sprays based on numbers of CEW moths captured in pheromone traps. The new IPM schedule spans an earlier and narrower window from 50% tassel to 25% dry silk, but the spray frequency is on either a 3- or 5-day interval. Experiment II was designed to evaluate the efficacy of Coragen SC and Warrior II w/Zeon Technology when applied following the new IPM schedule at either a 3- or 5-day interval.

Materials and Methods

A single planting of Seminis Obsession™ sweet corn (non-Bt isoline) was established at Cornell University's NYSAES Fruit and Vegetable Research Farm located near Geneva, NY on 8 July 2016. Experiments I and II were conducted simultaneously within the same planting and shared particular treatments. There were a total of 6 treatments arranged in a randomized complete block design replicated 5 times (**Table 1**). Each plot contained three rows that received insecticide treatments and were flanked by one border row for a total of five rows. Plot length was 25 ft.

Coragen SC (chlorantraniliprole) and Warrior II w/Zeon Technology (lambda-cyhalothrin) were applied at rates of 5.0 fl oz/acre and 1.92 fl oz/acre, respectively. Foliar applications were made using a 3-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 135 L/HA at 40 psi and a speed of 5.2 kph. The adjuvant Dyne-Amic (a modified vegetable oil and organosilicone surfactant blend) at 0.1% v/v was added to all treatments.

Flight activity of CEW moths adjacent to our test site was monitored to determine the frequency of insecticide applications for the standard IPM schedule. CEW male moths were captured using three Heliothis pheromone traps baited with Hercon™ pheromone lures and changed every 14d. Traps were checked Mondays and Thursdays beginning when first tassels were detected until harvest. Trap catch was calculated by dividing the total number of moths captured in a trap by the number of days between sampling dates to determine number of moths captured per day. These numbers from each of the three traps were averaged. Based on mean number of moths captured per day and guidelines on the standard IPM spray schedule, the decision to spray and how many days to wait before next application was determined (**Figure 1**).

Market-sized ears were harvested and assessed for CEW damage on 29 September 2016. Additionally, all caterpillars infesting ears were identified to species and tallied (**Figure 2**). To assess the number of damaged ears and the type of ear damage, 25 primary ears were randomly collected from the three center rows in each plot. Ears were shucked and considered undamaged if insects were absent and there was no evidence of feeding or caterpillar frass. Ear damage was classified as localized to the tip (first inch), middle or base. However, for the purpose of this study, we were primarily interested in classifying ears as either marketable or not marketable for processing. Therefore, the dependent variable was the percent unmarketable ears for processing (= any damage to ears below the first inch from the tip). Data were analyzed using ANOVA and Tukey HSD means separation tests at $P<0.05$ (JMP 12.0, SAS Institute, Cary, SC).

Results

Experiment I. The percent of unmarketable ears in treatments that received Warrior II w/Zeon Technology applied on a 3-day schedule (5 sprays total), regardless of whether applications were based on the standard or new IPM schedule (treatments 1 and 4), were significantly lower than the percent unmarketable ears in the treatment sprayed on a 5-day schedule (treatment 5; 3 sprays total) and the untreated check (**Table 2; Figure 3**). These results suggested that insecticide applications made late in ear development after silks are brown may not be necessary and that standard IPM spray guidelines could be revised to reflect this new information. Additional research is needed to determine how reliable the new IPM schedule will be for CEW control.

Experiment II. Coragen SC applied following the new IPM schedule (50% tassel to 25% dry silk) at either 3d- or 5d- spray intervals (treatments 2 and 3) produced significantly fewer unmarketable ears than those treated with Warrior II w/Zeon Technology following the same IPM schedule and time intervals (treatments 4 and 5) and those in the untreated check (**Table 3; Figure 4**). The percent undamaged ears in plots treated with the more intensive spray schedule with Warrior II w/Zeon Technology (3d spray interval; 5

sprays) was significantly lower than those sprayed less intensively with Warrior II w/Zeon Technology (5d spray interval) (**Table 3; Figure 4**).

Conclusions

Coragen SC provided excellent CEW control. Coragen SC sprays resulted in only 10% or less damaged ears; rarely have we observed such low levels of damage under such high pressure. In contrast, Warrior II w/Zeon Technology did not reduce the number of damaged ears to a level that would be commercially acceptable. While Coragen SC is more expensive than Warrior II w/Zeon Technology, the superior control provided by Coragen SC compared with Warrior II w/Zeon Technology should be considered for CEW management in the future.

Table 1. Treatments included in sweet corn Experiments I and II in Geneva, NY in 2016.

Trt #	Insecticide[1]	Period of applications	Application interval	Number of Applications
1	Warrior II w/Zeon Tech.	Green silk to harvest (IPM)	4.5 day average	5 sprays
2	Coragen SC	50% tassel to 25% dry silk	3 day	5 sprays
3	Coragen SC	50% tassel to 25% dry silk	5 day	3 sprays
4	Warrior II w/Zeon Tech.	50% tassel to 25% dry silk	3 day	5 sprays
5	Warrior II w/Zeon Tech.	50% tassel to 25% dry silk	5 day	3 sprays
6	Untreated	-	-	

[1] Rate of Warrior II was 1.92 fl oz/A and the rate of Coragen SC was 5.0 fl oz/A.

Table 2. Mean percent unmarketable ears in Experiment I in which treatments were applied with Warrior II w/Zeon Technology following different spray programs. Ears were considered unmarketable if a caterpillar damaged the ear anywhere below 1 inch from the ear tip. Means followed by different letters are significantly different ($P<0.05$).

Trt #	Insecticide	Period of applications	Application interval (# of sprays)	Mean % unmarketable ears
1	Warrior II w/Zeon Tech.	Green silk to harvest (IPM)	4.5 day average (5)	24.4 b
4	Warrior II w/Zeon Tech.	50% tassel to 25% dry silk	3 day (5)	24.6 b
5	Warrior II w/Zeon Tech.	50% tassel to 25% dry silk	5 day (3)	51.2 a
6	Untreated	-	-	44.0 a

Table 3. Mean percent unmarketable ears in Experiment II obtained from treatments in which different insecticides were applied following either a 3-day or 5-day spray interval beginning at 50% tassel and ending at 25% dry silk. Ears were considered unmarketable if a caterpillar damaged the ear anywhere below 1 inch from the ear tip. Means followed by different letters are significantly different ($P<0.05$).

Trt #	Insecticide[1]	Period of applications	Application interval (# of sprays)	Mean % unmarketable ears
2	Coragen SC	50% tassel to 25% dry silk	3 day (5)	8.0 c
3	Coragen SC	50% tassel to 25% dry silk	5 day (3)	10.2 c
4	Warrior II w/Zeon Tech.	50% tassel to 25% dry silk	3 day (5)	24.6 b
5	Warrior II w/Zeon Tech.	50% tassel to 25% dry silk	5 day (3)	51.2 a
6	Untreated	-	-	44.0 a

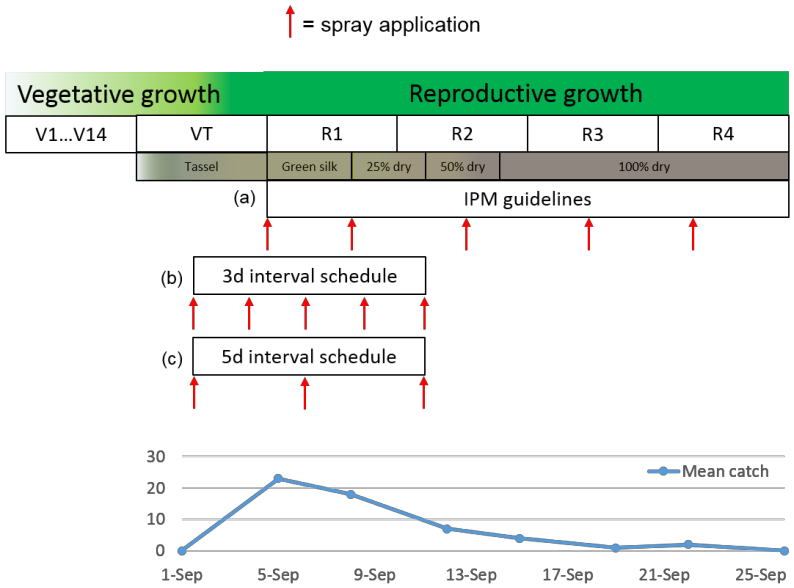

Figure 1. Timing of insecticide applications for (a) standard IPM schedule using CEW trap catch to determine application frequency from green silk to harvest; (b) new IPM schedule applying insecticides from 50% tassel to 25% dry silk using a 3 day-interval, and (c) new IPM schedule applying insecticides from 50% tassel to 25% dry silk using a 5 day-interval. The blue line illustrates the number of CEW moths captured per pheromone trap on dates traps were inspected. Peak CEW captured occurred at the end of tassel and beginning of green silk.

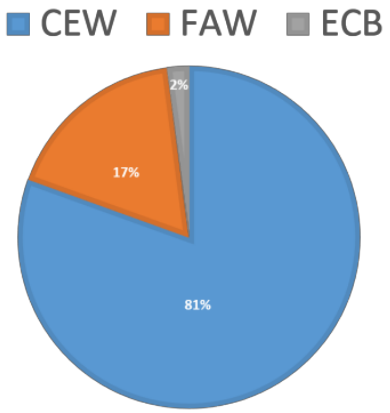

Figure 2. Percent caterpillar species composition in harvested sweet corn ears in Geneva NY in 2016.

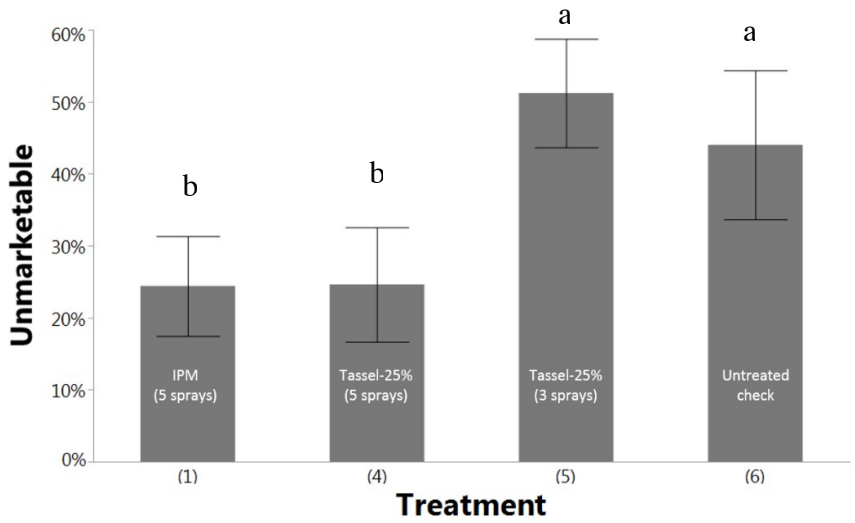

Figure 3. Mean percent unmarketable ears in Experiment I in which treatments were applied with Warrior II w/Zeon Technology following different spray schedules. Ears were considered unmarketable if a caterpillar damaged the ear anywhere below 1 inch from the ear tip. Means followed by different letters are significantly different (P<0.05).

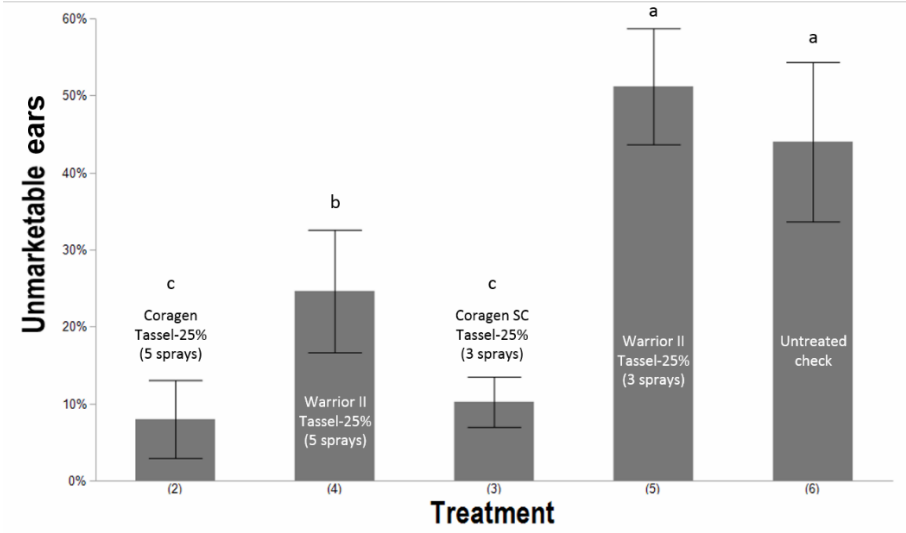

Figure 4. Mean % unmarketable ears in Experiment II from treatments in which insecticides were applied following the new IPM schedule from 50% tassel to 25% dry silk and either a 3 day- or 5-day interval (5 sprays or 3 sprays, respectively). Ears were unmarketable if a caterpillar damaged the ear anywhere below 1 inch from the ear tip. Means with different letters are significantly different (P<0.05).