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Corn Earworm Control Study

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Abstract
Sweet corn growers frequently apply four to six insecticide sprays during the corn silking period to achieve the clean, worm-free ears demanded by consumers. Insecticides in the pyrethroid class are used extensively for this purpose and reports that the corn earworm (CEW) population is developing resistance to pyrethroid insecticides is cause for concern and necessitates that we reevaluate our approaches and products for controlling this pest. Therefore, the objective of this study was to evaluate the effectiveness of current and newly released insecticides for controlling corn earworms. New non-pyrethroid insecticides tested in this evaluation were Belt from Bayer, Coragen from Dupont, and Radiant from Dow. A Bt hybrid, Attribute BC 0805, also was included in a treatment comparison with Providence sweet corn, a non-Bt hybrid, and the insecticide treatments.

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Introduction

Sweet corn growers frequently apply four to six insecticide sprays during the corn silking period to achieve the clean, worm-free ears demanded by consumers. Insecticides in the pyrethroid class are used extensively for this purpose and reports that the corn earworm (CEW) population is developing resistance to pyrethroid insecticides is cause for concern and necessitates that we reevaluate our approaches and products for controlling this pest. Therefore, the objective of this study was to evaluate the effectiveness of current and newly released insecticides for controlling corn earworms. New non-pyrethroid insecticides tested in this evaluation were Belt from Bayer, Coragen from Dupont, and Radiant from Dow. A Bt hybrid, Attribute BC 0805, also was included in a treatment comparison with Providence sweet corn, a non-Bt hybrid, and the insecticide treatments.

Materials and Methods

Planting and plot design. The trial was planted on July 2, 2009, so corn ears would be silking during late August when peak corn earworm activity usually occurs. Plot design was a randomized complete block with three replications. A plot consisted of three rows spaced 30 in. apart and 25 ft long. After-emergence plots were thinned to a uniform population of 26,000/acre.

Fertility and irrigation. Water was applied as needed by center pivot irrigation system to supplement rainfall. Fertilizer was applied preplant incorporated at a rate of 60 lb/acre nitrogen (N) and 100 lb/acre potassium (K_2O). After corn emergence, an additional 60 lb/acre nitrogen (UAN) was applied through the irrigation system.

Weed control. Dual II Magnum, Atrazine 4L, and Callisto herbicides were applied crop preemergence.

Treatments. Insecticide treatments were started on August 24 (spray 1) when corn was at the row tassel stage of development and ears were starting to show silk emergence. Five more spray applications were made on a three to four day schedule (August 28, 31, September 4, 7, and 11) to keep emerging silks protected. Insecticides were applied with a backpack CO_2 pressurized sprayer with two nozzle boom aimed at ear region of corn plant. When sweet corn ears reached a marketable size, 20 ears were harvested from each plot and carefully husked to count worms and ascertain worm damage to kernels.

Results and Discussion

Worm pressure was strong at the start of corn silking confirmed by two wire traps using Trece pheromone lures averaging 20 CEW moths a night/trap. This number gradually decreased to less than one moth/night by harvest and data collection. Every single ear examined from Treatment 3 plots (conventional hybrid, no insecticide application) was infested with worms! Approximately 80% of larvae found in ears were identified as CEW while the rest were fall armyworms.

The top six treatments (16, 11, 12, 2, 15, and 8) in Table 2 that were most effective at reducing the number of worms in the ear and worm-damaged kernels consisted of mixed or alternated products with different modes of action. This raises some interesting questions as to why, but several products in this study

seemed to work better in treatments that included two modes of action for worm control.

There were two treatments using the Bt hybrid BC 0805 in the study. Treatment 1 consisted of BC 0805 and no insecticide applications. The Bt hybrid, when used by itself without insecticides (Treatment 1), provided a fair amount of worm control but small to medium-sized CEW and fall armyworms were still found in 22% of the ears. Treatment 2 also used BC 0805 but with the addition of Brigade insecticide sprays to ear silks on August 24 and again on August 31. These two insecticide applications improved control to 96% and reduced the amount of kernel damage to 0.4 kernels/ear on average. This level of control was equal to the best insecticide treatments in the study and confirms that using a Bt hybrid is an effective strategy for controlling worms but doesn't entirely eliminate the need for insecticide treatment during periods of strong worm pressure. The new, non-pyrethroid, insecticides Belt (Treatment 9 and 15), Coragen (Treatment 7 and 12), and Radiant (Treatment 8 and 13) provided good worm control when used in treatments that mixed products and mode of actions. Belt (Treatment 9), when used alone, did not provide the level of worm control expected based on previous experience. The reason for this is unknown. It could be heavier worm pressure this year or possibly the three to four day spray schedule used in this study was too long of interval between treatment applications. A Bayer Company representative advised the use of a surfactant or methylated seed oil with Belt in the future. Please note that Coragen is not labeled for use on sweet corn at this time but registration is expected in the future. Belt and Radiant are labeled for use on sweet corn but do have label restrictions on amount of product applied per season and number of consecutive applications–so, read labels carefully before use.

Table 1. Treatment descriptions and application schedule.

	Hybrid	Treatment (active ingredient)	Application[a]
1	BC 0805	Bt hybrid	No insecticide application
2	BC 0805	Bt hybrid + Brigade (bifenthrin) - 6.4 oz/A	Sprays 1 and 3
3	Providence	Conventional hybrid only	No insecticide application
4	Providence	Sevin XLR (carbaryl) - 1.5 qt/A	Sprays 1–6
5	Providence	Mustang Max (zeta-cypermethrin) - 4.0 fl oz/A	Sprays 1–6
6	Providence	Hero (bifenthrin+zeta-cypermethrin) - 4.4 fl oz/A	Sprays 1–6
7	Providence	Coragen (rynaxypyr) - 5.0 fl oz/A + MSO 1% v/v	Sprays 1–6
8	Providence	Radiant SC (spinetoram) - 6 fl oz/A	Radiant sprays 1,2, 4, 5
		Hero (bifenthrin+zeta-cypermethrin) - 10 fl oz/A	Hero sprays 3 & 6
9	Providence	Belt (flubendiamide) - 3.0 fl oz/A	Sprays 1–6
10	Providence	Baythroid (beta-cyfluthrin) - 2.8 fl oz/A	Sprays 1–6
11	Providence	Mustang Max (zeta-cypermethrin) - 4.0 fl oz/A + Lannate (methomyl) - 24 oz/A	Sprays 1–6
12	Providence	Coragen (rynaxypyr) - 5.0 fl oz/A + MSO 1% v/v	Coragen sprays 1, 3, 5
		Hero (bifenthrin+zeta-cypermethrin) - 10 fl oz/A	Hero Sprays 2, 4, 6
13	Providence	Radiant SC (spinetoram) – 6 fl oz/A	Spray 1–6
14	Providence	Brigade (bifenthrin) – 2.1 fl oz/A	Spray 1–6
15	Providence	Belt (flubendiamide) – 3.0 fl oz/A	Belt sprays 1, 3, 5
		Hero (bifenthrin+zeta-cypermethrin) – 8.0 fl oz/A	Hero sprays 2, 4, 6
16	Providence	Baythroid (beta-cyfluthrin) - 2.8 fl oz/A + Lannate (methomyl) - 24 fl oz/A	Sprays 1–6

[a]Treatment application dates: August 24 (Spray 1), August 28 (Spray 2), August 31 (Spray 3), September 4 (Spray 4), September 7 (Spray 5), and September 11 (Spray 6).

Table 2. Percent control, mean number of worm-damaged kernels, and mean number of worms per ear by treatment at harvest on September 21, 2009.

	Treatments	Percent control (worm-free ears)	Number of worm-damaged kernels/ear	Number of worms/ear
16	Baythroid + Lannate	98	0.1	0.02
11	Mustang Max + Lannate	98	0.3	0.04
12	Coragen/Hero	96	0.3	0.07
2	BC 0805 Bt hybrid + Brigade	96	0.4	0.11
15	Belt/Hero	96	0.4	0.09
8	Radiant/Hero	96	0.8	0.09
6	Hero	93	0.9	0.11
13	Radiant	91	1.2	0.18
14	Brigade	91	1.6	0.16
7	Coragen + MSO	89	0.9	0.18
5	Mustang Max	84	2.3	0.22
1	BC 0805 Bt hybrid	78	2.0	0.64
10	Baythroid	51	5.5	0.58
9	Belt	51	6.7	0.64
4	Sevin XLR	49	9.8	0.69
3	Providence, no insecticide	0	29.1	1.38
	LSD 5%	14	3.2	0.21