2010

Evaluation of Transgenic Corn and Soil Insecticides for Control of Corn Rootworm

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Abstract
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Keywords
RFR A9084, Entomology

Disciplines
Agricultural Science | Agriculture | Entomology

Evaluation of Transgenic Corn and Soil Insecticides for Control of Corn Rootworm

RFR-A9084

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Introduction

The purpose of this study was to evaluate the effectiveness of transgenic corn or soil insecticides, either alone or in combination, for the control of corn rootworm.

Materials and Methods

The corn was planted in an area that had been planted the previous year with "trap crop." The seed planted for the trap crop was a mixed maturity blend with a greater proportion of late-maturing varieties. The trap crop constitutes a favorable environment for adult females late in the season when other fields are maturing and results in a high abundance of rootworm larvae the following year. The experimental design for this study was a randomized complete block design with four replications. Treatments were two rows wide and 75 ft in length. This study was planted on May 11 at a population of 41,000 seeds per acre. Seeds were pre-bagged and planted with a four-row John Deere Max Emerge™ 7100 integral planter that had 30-in. row spacing. Granular insecticide formulations were applied with modified SmartBox metering units mounted on the planter. The SmartChoice-SB 5G and Counter-SB 20G insecticide treatments were applied with modified SmartBox™ metering units. These products were applied as ounces per 1000 row foot. The commercial SmartBox™ units were removed from their large-base containers and sandwiched between a flat metal plate on the bottom and a custom-made, threaded plastic cap on the top. The bottom plate had been fabricated so that it could slide in and out of the same planter mounting brackets used for the Noble units. An inverted 1000 ml bottle, screwed into the top cap provided a secure and sealed container for insecticide. A short plastic tube attached to the dispenser opening of the metering unit could be connected to either the planter's T-band or furrow tubes. The two controllers mounted in the tractor cab were used to operate the SmartBox™ metering units. All treatments were applied at 4 mph using the "fixed speed mode" on the SmartBox™ controllers.

Results and Discussion

There were no differences among treatments for stand counts (Table 1). The rootworm feeding pressure in this study ranged from 0.00 to 0.37, indicating a light rootworm infestation (Table 2). The lower than anticipated rootworm pressure was likely due in part to the very heavy rainfall in June, which was a record for the Southeast Research Farm (19.7 cm). There were no significant differences among rootworm transgenic varieties (YieldGard VT Triple and Herculex XTRA) with or without a soil insecticide (Table 2). Additionally, non-rootworm Bt corn with a soil insecticide performed as well as the rootworm transgenic corn. However, injury was significantly higher in two of the three untreated checks (YieldGard, Corn Borer, and YieldGard Roundup Ready) than in the other treatments (Table 2). There were no differences among treatments for product consistency, percent lodging or yield (Table 3 and 4).

Acknowledgements

We thank Dow AgroSciences, and AMVAC for providing the funding for this study. Seed was provided by Dekalb and Dow AgroSciences.

Additional Information

The 2009 Insecticide and Plant-Incorporated Protectants final report will be available on-line at www.ent.iastate.edu under latest news soon.

Table 1. Average stand counts for evaluation of insecticides treatments and plant-incorporated protectants. Yield study: Crawfordsville, IA 2009[1].

Treatment[2]	Form.	Rate[3]	Placement[4]	Stand count[5,6]
YGVT3	------	------	------	35.75
YGCB	------	------	------	35.65
My-Iso	------	------	------	34.90
YGVT3 + SmartChoice-SB	5G	0.18	Furrow	33.80
YGCB + Counter-SB	20G	1.20	Furrow	33.60
My-HXT + Counter-SB	20G	0.90	Furrow	33.10
YGVT3 + Counter-SB	20G	0.90	Furrow	33.10
My-HXT	------	------	------	32.90
Dekalb-Iso	------	------	------	32.80
My-HXT + SmartChoice-SB	5G	0.18	Furrow	31.80

[1]Planted May 11, 2009; evaluated June 4 and September 29, 2009.
[2]My-HXT = Mycogen brand Herculex XTRA (Mycogen 2K662); My-Iso = Mycogen brand RR Isoline (Mycogen EXP660) YGCB = YieldGard CornBorer (DKC61-73); YGVT3 = YieldGard VT Triple (DKC61-69); DKC 61-72 (isoline); Dekalb-Iso = Dekalb brand RR Isoline (DKC 61-72).
[3]Insecticide listed as ounces a.i. per 1,000 row-ft; seed treatment (ST) listed as mg a.i/seed.
[4]Furrow = insecticide applied at planting time.
[5]Means based on 16 observations (2-row trt × 17.5 row-ft/treatment × 4 replications × 2 evaluations).
[6]No significant differences between means (ANOVA, $P \leq 0.05$).

Table 2. Average root-injury and product consistency for evaluation of insecticide treatments and plant-incorporated protectants. Yield study: Crawfordsville, IA 2009[1].

Treatment[2]	Form.	Rate[3]	Placement[4]	Node injury[5,6,7]	Product consistency[8,9]
My-HXT	------	------	------	0.00a	100
My-HXT + Counter-SB	20G	0.90	Furrow	0.00a	100
YGVT3 + SmartChoice-SB	5G	0.18	Furrow	0.00a	100
My-HXT + SmartChoice-SB	5G	0.18	Furrow	0.00a	100
YGCB + Counter-SB	20G	1.20	Furrow	0.01ab	100
YGVT3 + Counter-SB	20G	0.90	Furrow	0.02ab	100
YGVT3	------	------	------	0.04ab	95
My-Iso	------	------	------	0.14 bc	85
Dekalb-Iso	------	------	------	0.33 cd	60
YGCB	------	------	------	0.37 d	60

[1]Planted May 11, 2009; evaluated July 16, 2009.
[2]My-HXT = Mycogen brand Herculex XTRA (Mycogen 2K662); My-Iso = Mycogen brand RR Isoline (Mycogen EXP660) YGCB = YieldGard CornBorer (DKC61-73); YGVT3 = YieldGard VT Triple (DKC61-69); DKC 61-72 (isoline); Dekalb-Iso = Dekalb brand RR Isoline (DKC 61-72).
[3]Insecticide listed as ounces a.i. per 1,000 row-ft; seed treatment (ST) listed as mg a.i/seed.
[4] Furrow = insecticide applied at planting time.
[5]Chemical and check means based on 20 observations (5 roots/2 rows × 4 replications).
[6]Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten.
[7]Means sharing a common letter do not differ significantly according to Ryan's Q Test ($P \leq 0.05$).
[8]Product consistency = percentage of times nodal injury was 0.25 (¼ node eaten) or less.
[9]No significant differences between means (ANOVA, $P \leq 0.05$).

Table 3. Average percent lodging for evaluation of insecticide treatments and plant-incorporated protectants. Yield study: Crawfordsville, IA. 2009[1].

Treatment[2]	Form.	Rate[3]	Placement[4]	% Lodging[5,6]
YGVT3	------	------	------	0
YGVT3 + SmartChoice-SB	5G	0.18	Furrow	0
YGVT3 + Counter-SB	20G	0.90	Furrow	0
My-HXT	------	------	------	0
My-HXT + SmartChoice-SB	5G	0.18	Furrow	0
My-HXT + Counter-SB	20G	0.90	Furrow	1
YGCB	------	------	------	1
YGCB + Counter-SB	20G	1.20	Furrow	2
My-Iso	------	------	------	2
Dekalb-Iso	------	------	------	2

[1]Planted May 11, 2009; evaluated September 29, 2009.
[2]My-HXT = Mycogen brand Herculex XTRA (Mycogen 2K662); My-Iso = Mycogen brand RR Isoline (Mycogen EXP660) YGCB = YieldGard CornBorer (DKC61-73); YGVT3 = YieldGard VT Triple (DKC61-69); DKC 61-72 (isoline); Dekalb-Iso = Dekalb brand RR Isoline (DKC 61-72).
[3]Insecticide listed as ounces a.i. per 1,000 row-ft; seed treatment (ST) listed as mg a.i/seed.
[4]Furrow = insecticide applied at planting time.
[5]Means based on 8 observations (2-row trt ×17.5 row-ft/treatment × 4 replications).
[6]No significant differences between means (ANOVA, $P \leq 0.05$).

Table 4. Average yield for evaluation of insecticide treatments and plant-incorporated protectants. Yield study: Crawfordsville, IA. 2009[1].

Treatment[2]	Form.	Rate[3]	Placement[4]	Bushels/acre[5,6,7]
YGCB + Counter-SB	20G	1.2	Furrow	215
Dekalb-Iso	------	------	------	209
YGCB	------	------	------	206
YGVT3 + Counter-SB	20G	0.90	Furrow	205
YGVT3	------	------	------	204
YGVT3 + SmartChoice-SB	5G	0.18	Furrow	199
My-HXT + Counter-SB	20G	0.90	Furrow	199
My-HXT	------	------	------	199
My-HXT + SmartChoice-SB	5G	0.18	Furrow	187
My-Iso	------	------	------	179

[1]Planted May 11, 2009; machine harvested November 6, 2009.
[2]My-HXT = Mycogen brand Herculex XTRA (Mycogen 2K662); My-Iso = Mycogen brand RR Isoline (Mycogen EXP660) YGCB = YieldGard CornBorer (DKC61-73); YGVT3 = YieldGard VT Triple (DKC61-69); DKC 61-72 (isoline); Dekalb-Iso = Dekalb brand RR Isoline (DKC 61-72).
[3]Insecticide listed as ounces a.i. per 1,000 row-ft; seed treatment (ST) listed as mg a.i/seed.
[4]Furrow = insecticide applied at planting time.
[5]Means based on 3 observations (2-row trt x 68.75 row-ft/treatment x 3 replications).
[6]No significant differences between means (ANOVA, $P \leq 0.05$).
[7]Yields converted to 15.5% moisture.