Evaluation of Soil-Applied Insecticides for Management of Corn Rootworm Larvae in Southeast Iowa

RFR-A1798

Aaron Gassmann, associate professor
Patrick Weber, agricultural specialist
Department of Entomology

Introduction

The purpose of this study was to evaluate the effectiveness of various soil-applied insecticides for management of corn rootworm larvae. This study used non-rootworm Bt seed DeKalb brand VT2P (DKC 62-98 VT2 RIB).

Materials and Methods

Field site. The corn was planted in an area that had been planted the previous year with a trap crop, which is a mixed-maturity blend with a greater proportion of late-maturing varieties. This trap crop constitutes a favorable environment for adult female rootworm late in the season when other fields are maturing, and often results in a high abundance of rootworm larvae the following year.

Field plot design. The experimental design was a randomized complete block with four replications. Treatments were two rows wide by 35 ft long.

Planting. All corn was planted with bulk seed hoppers May 9, 2017, using a four-row John Deere Max Emerge™ 7100 Integral Rigid Frame Planter with 30-in. row spacing. The study was planted at a depth of 2 in. with a spacing of 0.6 in. between seeds (35,600 seeds/acre).

SmartBox™ soil-applied insecticide. The Aztec-HC 9.34G and SmartChoice-HC 15G insecticides treatments were applied with modified SmartBox™ metering units mounted on the planter. These 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 it could slide in and out of the same planter mounting brackets used for the Noble units. An inverted one liter plastic bottle attached to the top provided a secure and sealed container for insecticide used with the SmartBox™ units. Clear plastic tubes directed the granular insecticides to the in-furrow placement.

Liquid soil-applied insecticide. The liquid products Capture LFR 1.5SC, Force 250CS, Force-HL 10G, and Index 2.80CS were applied in-furrow at planting with a compressed-air system built directly into the planter by Almaco manufacturing (Nevada, IA). All products were applied as ounces a.i./1,000 row ft using Teejet XR80015EVS spray nozzles at 21 psi, which deliver 5 GPA of finished spray at a tractor speed of 4 mph. All products used water as the carrier.

Before the field season, two new spray nozzles were installed per row (T-Band & In-Furrow) and calibrated with water to ensure proper application of product.

For these liquid applications, each row was checked for product, correct spray pattern prior to plot application, and monitored during application to ensure insecticides were applied correctly. Final incorporation was accomplished with drag chains mounted behind the closing wheels.

Stand counts. On June 2, early-season stand counts were measured in all treatments. These were measured by laying a stand count chain 17.5 ft long (1/1,000 of an acre for 30-in. row

spacing) between the two corn rows and counting the number of plants in both rows. Late-season stand counts were measured October 24 following the same procedure as early-season stand counts, but using a 2-in. PVC pipe cut to the length of 17.5 ft. Measurements for both dates were averaged to provide a single value for stand counts (Table 2).

Root injury. After the majority of corn rootworm larvae had finished feeding, roots were dug July 24, 2017, to assess feeding injury. Prior to leaving the field, all roots were labeled with the study name and plot number using a permanent marker. Roots were cleaned at the root washing station at the ISU Johnson Farm. Roots were first soaked in water for two hours and then washed with a hose to remove any remaining soil. Roots were evaluated July 26, 2017, for rootworm feeding injury, following the Iowa State Node Injury Scale (0-3). (Table 1).

Node-injury scale (0-3).

0.0 No feeding injury (lowest rating that can be given).
1.0 One node (circle of roots), or the equivalent of an entire node, pruned to within 1.5 in. of the stalk or soil line.
2.00 Two nodes pruned.
3.00 Three or more nodes pruned (highest rating that can be given).

Injury between complete nodes pruned was scored as the percentage of the node missing (e.g., 1.50 = one and a half nodes pruned and 0.25 = one quarter of one node pruned).

Harvest. This study was machine harvested October 24, 2017, with a modified John Deere 9410 plot combine owned by Iowa State University. Weights (lb) and percent moisture were recorded from a HarvestMaster brand plot harvest data collection system. These measurements were converted to bushels/acre of No. 2 shelled corn (56 lb/bushel at 15.5% moisture) in Microsoft Excel (Table 3).

Percent product consistency (Table 1) was calculated as the percentage of times a treatment limited feeding injury to 0.25 node or less (greater injury can result in economic yield loss, especially when plants are moisture stressed).

All data were analyzed with standard ANOVA procedures using SAS 9.4. When a significant treatment effect was present, pairwise comparisons were made among means with an experiment-wise error rate of $P < 0.05$.

Results and Discussion

Rootworm feeding pressure was very light in this study, and no differences were found among treatments for any of the variables measured. Average root injury never exceeded 0.25 nodes for any of the treatments evaluated or for the untreated check. Similarly, no differences were observed for product consistency or stand counts. In general, yields were good and ranged from 247 to 276 bushels/acre. No significant differences in yield were observed among treatments.

Acknowledgements

We thank AMVAC Corporation for providing the funding for this study and Monsanto for providing the DeKalb seed used. Thanks also to Myron Rees and his staff for their work in this study.

Additional Information

Annual reports for the Iowa Evaluation of Insecticides and Plant-Incorporated Protectants are available online through the Department of Entomology at Iowa State University: http://www.ent.iastate.edu/dept/faculty/gassmann/rootworm.

Table 1. Average root-injury and product consistency for AMVAC Aztec-HC efficacy and yield study: Southeast Research and Demonstration Farm, Crawfordsville, IA.[1]

Treatment[2]	Form.	Rate[3]	Placement[4]	Node-injury[5,6,7]	Product consistency[8,9]
DeKalb non-RW Bt + Aztec-HC	9.34G	0.14	Furrow-SB	0.07	100
DeKalb non-RW Bt + Force	250CS	0.12	Furrow	0.08	100
DeKalb non-RW Bt + SmartChoice-HC	15G	0.14	Furrow-SB	0.15	95
DeKalb non-RW Bt + Force HL	10G	0.14	Furrow	0.16	80
DeKalb non-RW Bt	-----	-----	-----	0.16	85
DeKalb non-RW Bt + Index	2.80CS	0.27	Furrow	0.18	85
DeKalb non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	0.19	80

[1]Planted May 9, 2017; evaluated July 26, 2017.
[2]Non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand VT2P (DKC 62-98 VT2 RIB).
[3]Insecticide listed as ounces a.i./1,000 row-ft.
[4]Furrow-SB = insecticide applied with SmartBox system at planting time; Furrow = insecticide applied at planting time.
[5]Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications).
[6]Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten.
[7]No significant differences between means (ANOVA, $P < 0.05$).
[8]Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less.
[9]No significant differences between means (ANOVA, $P < 0.05$).

Table 2. Average stand count for AMVAC Aztec-HC efficacy and yield study: Southeast Iowa Research and Demonstration Farm, Crawfordsville, IA.[1]

Treatment[2]	Form.	Rate[3]	Placement[4]	Stand counts[5,6]
DeKalb non-RW Bt + Index	2.80CS	0.27	Furrow	30.25
DeKalb non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	30.00
DeKalb non-RW Bt + Aztec-HC	9.34G	0.14	Furrow-SB	30.00
DeKalb non-RW Bt + Force HL	10G	0.14	Furrow	29.50
DeKalb non-RW Bt + Force	250CS	0.12	Furrow	29.50
DeKalb non-RW Bt + SmartChoice-HC	15G	0.14	Furrow-SB	29.25
DeKalb non-RW Bt	----	-----	-----	29.25

[1]Planted May 9, 2017; evaluated June 2 and October 24, 2017.
[2]Non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand VT2P (DKC 62-98 VT2 RIB).
[3]Insecticide listed as ounces a.i./1,000 row-ft.
[4]Furrow-SB = Insecticide applied with SmartBox system at planting time; Furrow = insecticide applied at planting time.
[5]Chemical and check means based on 16 observations (2 rows/ treatment x 17.5 row-ft/treatment x 4 replications x 2 evaluation dates).
[6]No significant differences between means (ANOVA, $P < 0.05$).

Table 3. Average lodging for AMVAC Aztec-HC efficacy and yield study: Southeast Iowa Research and Demonstration Farm, Crawfordsville, IA.[1]

Treatment[2]	Form.	Rate[3]	Placement[4]	Yield[5,6]
DeKalb non-RW Bt + Index	2.80CS	0.27	Furrow	276
DeKalb non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	275
DeKalb non-RW Bt + Aztec-HC	9.34G	0.14	Furrow-SB	275
DeKalb non-RW Bt + Force HL	10G	0.14	Furrow	270
DeKalb non-RW Bt	-----	-----	-----	261
DeKalb non-RW Bt + SmartChoice-HC	15G	0.14	Furrow-SB	259
DeKalb non-RW Bt + Force	250CS	0.12	Furrow	247

[1]Planted May 9, 2017; machine harvested October 24, 2017.
[2]Non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand VT2P (DKC 62-98 VT2 RIB).
[3]Insecticide listed as ounces a.i./1,000 row-ft.
[4]Furrow-SB = insecticide applied with SmartBox system at planting time; Furrow = insecticide applied at planting time.
[5]Chemical and check means based on 4 observations (2-row treatment x 33 row-ft/treatment x 4 replications).
[6]No significant differences between means (ANOVA, $P < 0.05$).