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Aaron J. Gassmann
Iowa State University, aaronjg@iastate.edu

Patrick J. Weber
Iowa State University, pjweber@iastate.edu

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Evaluation of Various Technologies for Management of Larval Corn Rootworm

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

Introduction

The purpose of this study was to evaluate the effectiveness of several technologies for management of corn rootworm larvae. Evaluation of Bt hybrids included DeKalb YieldGard VT Triple RIB, DeKalb SmartStax RIB, Pioneer Optimum AcreMax1, and Pioneer Optimum AcreMax XTreme. All of these products, along with corn lacking a rootworm active Bt trait, were tested with and without the soil-applied insecticide Aztec-HC 9.34G.

Materials and Methods

Study location. The study was conducted in a field at the ISU Johnson Farm, Story County, Iowa. The field site 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 results in a high abundance of rootworm larvae the following year.

Field plot design. This study was a randomized complete block design with four replications. Treatments were two rows wide, and 75 ft long. Plots were cut to 70 ft long to facilitate root digging.

Planting. This study was planted May 4, 2016, 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).

Insecticide application. The Aztec-HC 9.34G insecticide treatment was applied with modified SmartBox metering units mounted on the planter. 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. An inverted 1 liter Nalgene bottle attached to the top provided a secure and sealed container for insecticide used by the SmartBox units. Clear plastic tubes directed the granular insecticides to the in-furrow placement.

Root injury. After the majority of corn rootworm larvae had finished feeding, roots were dug August 10, 2016 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 ISU Johnson Farm's root washing station. Roots were first soaked in water for 2 hours, then washed with a hose to remove any remaining soil. Roots were evaluated August 12, 2016 for rootworm feeding injury following the Iowa State Node Injury Scale (0-3) (Table 1).

Node Injury Scale (0-3).

- 0.00 No feeding injury (lowest rating that can be given).
- 1.00 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 noted 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).

Data analysis. Data on node injury and product consistency were analyzed with analysis of variance (ANOVA) in SAS 9.4. When a significant treatment effect was present, pairwise comparisons were made among means with an experiment wise error rate of $P < 0.05$.

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

Results and Discussion

Rootworm feeding injury at this study location was moderate to light, with the two untreated checks suffering injury of between 0.75 and 0.32 nodes (Table 1). In general, all products tested suffered low levels of feeding injury. Performance of CryBb1 corn (DeKalb VT3 RIB) was numerically similar to one of the untreated checks (DeKalb non-RW Bt) for both root injury and product consistency. This

may have resulted from Cry3Bb1-resistant western corn rootworm at the study location. With the exception of Cry3Bb1 corn, non-RW Bt corn with soil-applied insecticide and Bt corn without soil-applied insecticide showed similar performance, and we did not observe an additional benefit of adding soil-applied insecticide to Bt corn.

Acknowledgements

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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 study on corn rootworm larvae: ISU Johnson Farm, Ames.¹

Treatment²	Form.	Rate³	Placement⁴	Node injury^{5,6,7}	Product consistency^{7,8}
DeKalb VT3 RIB + Aztec-HC	9.34G	0.14	Furrow-SB	0.06a	95a
DeKalb non-RW Bt + Aztec-HC	9.34G	0.14	Furrow-SB	0.07a	100a
DeKalb SSTX RIB + Aztec-HC	9.34G	0.14	Furrow-SB	0.07a	100a
Pioneer AMX + Aztec-HC	9.34G	0.14	Furrow-SB	0.08a	100a
Pioneer AMXT + Aztec-HC	9.34G	0.14	Furrow-SB	0.10a	100a
Pioneer non-RW Bt + Aztec-HC	9.34G	0.14	Furrow-SB	0.12a	95a
DeKalb SSTX RIB	-----	-----	-----	0.12a	95a
Pioneer AMX	-----	-----	-----	0.13a	90a
Pioneer AMXT	-----	-----	-----	0.16a	85a
DeKalb VT3 RIB	-----	-----	-----	0.32a	75ab
DeKalb non-RW Bt	-----	-----	-----	0.32a	70ab
Pioneer non-RW Bt	-----	-----	-----	0.75 b	45 b

¹ Planted May 4, 2016; evaluated August 12, 2016.

² Non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand VT2P (DKC 58-89); DeKalb VT3P RIB = DeKalb brand YieldGard VT Triple Pro RIB (DKC 58-83); DeKalb SSTX RIB = DeKalb brand Smartstax RIB (DKC 58-87); Pioneer non-RW Bt = Pioneer brand RR (P9675R); Pioneer AMX = Pioneer brand Herculex XTRA (P9675AMX); Pioneer AMXT = Pioneer Optimum AcreMax XTreme (P9675AMXT).

³ Insecticide listed as ounces a.i. per 1,000 row-feet.

⁴ Furrow-SB = insecticide applied with SmartBox system 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 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.