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Comparison of Diverse Management Tools for Control of Corn Rootworms

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Abstract
In this study we evaluated soil-applied insecticides, seed treatments, and transgenic corn for their effectiveness in protecting corn roots from injury due to feeding by corn rootworms.

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Introduction

In this study we evaluated soil-applied insecticides, seed treatments, and transgenic corn for their effectiveness in protecting corn roots from injury due to feeding by corn rootworms.

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 is 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 helps ensure a high abundance of rootworm eggs the following season. The experimental design for the study was a randomized complete block with four replications (i.e., blocks). Treatments in the study were paired rows 75 ft in length. Seeds were pre-bagged and planted with a four-row John Deere Max Emerge™ 7100 integral planter that had 30-in. row spacing. The seedcorn was planted at a population of 35,600 seeds/acre on May 13, 2008. Granular insecticide formulations were applied with modified Noble metering units mounted on the planter. For all hybrids tested, seed treatments (Poncho 250, Poncho 1250, or Cruiser Extreme 250) were commercially applied. Transgenic corn hybrids evaluated in the study produced insecticidal toxins derived from the bacterium *Bacillus thuringiensis* (Bt), which kill corn rootworm. These included the Yieldgard hybrids of Monsanto that produce the Bt toxin Cry3Bb1 and the Herculex hybrids of Pioneer and Dow that produce the binary Bt toxin Cry34/Cry35. The liquid products, A14974, 250 CS (experimental), and Capture LFR, were applied at planting with a compressed-air system. Both of these liquid treatments were applied either T-Band or Furrow using Teejet XR80015 spray nozzles at 21 psi to deliver 5 gallons/acre of finished spray. To evaluate rootworm feeding damage, roots were laid out by replication and evaluated following the Iowa State Node-Injury Scale (0–3). The product consistency (%) was calculated for each treatment as the percentage of times a treatment limited feeding injury to 0.25 node or less (Table 1).

Results and Discussion

Results in Table 1 reflect means among treatments during this one-year study for root injury and product consistency. Corn rootworm feeding pressure was moderately heavy with a range of 1.81 to 2.87 nodes injured in the unprotected corn hybrids (i.e. CHECKS). All treatments, with the exception of Poncho 1250 seed treatment, had significantly lower node-injury scores than the CHECKS. The hybrid (DKC61-69, YieldGard VT Triple), had only a 0.08 node-injury rating and was not significantly greater than the treatments that added an insecticide on top of the YieldGard VT Triple.

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Additional Information

The 2008 Insecticide and Plant-Incorporated Protectants final report is available online at www.ent.iastate.edu under latest news.

Table 1. Average root-injury and product consistency for evaluation of insecticide treatments and plant-incorporated protectants. Yield study Nashua, IA, 2008.[1]

Treatment[2]	Formula	Rate[3]	Placement[4]	Node-injury[5,6,7]	Product consistency[7,8]
YGVT + Capture	LFR	0.49	Furrow	0.00[a]	100[a]
YGVT + Aztec	2.1G	6.7	Furrow	0.01[ab]	100[a]
YGVT + Fortress-SB	5G	3.0	Furrow	0.03[abc]	95[ab]
YGVT + Counter-SB	15G	6.0	Furrow	0.06[abcd]	100[a]
My-HxXTRA + Fortress-SB	5G	3.0	Furrow	0.07[abcde]	100[a]
YGVT	------	------	------	0.08[abcde]	90[ab]
My-HxXTRA	------	------	------	0.09[abcde]	95[ab]
YGVT + Poncho1250	600FS	1.25	ST	0.10[abcd]	95[ab]
Aztec + DKC 6172	2.1G	6.7	T-Band	0.13[bcdef]	85[ab]
My-HxXTRA + Counter-SB	15G	6.0	Furrow	0.19[cdef]	75[ab]
Pi-HxXTRA	------	------	------	0.22[def]	80[ab]
Aztec + CB[9] + DKC 61-72	2.1G	6.7	Furrow + ST	0.26[efg]	70[ab]
Aztec + DKC 6172	2.1G	6.7	Furrow	0.31[fgh]	75[ab]
Aztec + BB[9] + DKC 61-72	2.1G	6.7	Furrow + ST	0.31[fgh]	75[ab]
Force + DKC 6172	3G	4.0	T-Band	0.31[fgh]	40[abcd]
Force + Pioneer 35K03	3G	4.0	Furrow	0.34[fgh]	60[ab]
YGVT + Aztec-SB	4.67G	3.0	Furrow	0.35[fgh]	55[ab]
Capture + DKC 61-72	LFR	0.49	Furrow	0.55[ghi]	35[abcd]
Capture + DKC 61-72	LFR	0.49	T-Band	0.59[ghi]	45[abcd]
A14974[10] + DKC 61-72	250CS	4.0	Furrow	0.61[ghi]	35[abcd]
Force + DKC 61-72	3G	6.7	Furrow	0.66[hi]	35[abc]
A14974[10] + DKC 61-72	250CS	4.0	T-Band	0.70[hi]	45[abcd]
AB[9] + DKC 61-72	------	------	ST	1.02[i]	35[bcd]
DKC 61-72 + Poncho1250	600FS	1.25	ST	1.45[j]	5[cd]
DKC 61-72	------	------	------	1.81[jk]	0[d]
Mycogen 2J665	------	------	------	2.27[kl]	0[d]
Pioneer 35K03	------	------	------	2.87[l]	0[d]

[1]Planted May 13, 2008; evaluated August 6, 7, 8, 2008
[2]My-HxXTRA = Mycogen brand Herculex XTRA (Mycogen 2J669); Mycogen 2J665 (isoline);
Pi-HxXTRA = Pioneer brand Herculex XTRA (Pioneer 35K04); Pioneer 35K03 (isoline)
YGVT = YieldGard VT Triple (DKC61-69); DKC 61-72 (isoline).
[3]Insecticide listed as ounces per 1,000 row-ft; seed treatment (ST) listed as mg a.i/seed.
[4]T-band and Furrow = insecticide applied at planting time; SB = SmartBox application at planting time;
ST = seed treatment.
[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]AB, BB, CB = experimental seed treatments provided by Bayer CropScience.
[10]A14974 (liquid Force) = experimental insecticide provided by Syngenta.