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On-Farm Corn Rootworm Trials

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Abstract
There are several methods to manage corn rootworms, including crop rotation, rootworm insecticides, and corn rootworm (CRW) transgenic traits. The use of CRW transgenic traits in corn hybrids has allowed farmers to manage CRW without using soil-applied insecticides. However, rootworm populations resistant to the transgenic traits have been confirmed in Iowa, leading some farmers to see if there is an economic return by adding an insecticide when planting CRW-Bt corn. There also are several transgenic traits now available for corn rootworm control on the market. On-farm trials allow farmers to see how these traits perform on their farms in side-by-side evaluations.

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Introduction

There are several methods to manage corn rootworms, including crop rotation, rootworm insecticides, and corn rootworm (CRW) transgenic traits. The use of CRW transgenic traits in corn hybrids has allowed farmers to manage CRW without using soil-applied insecticides. However, rootworm populations resistant to the transgenic traits have been confirmed in Iowa, leading some farmers to see if there is an economic return by adding an insecticide when planting CRW-Bt corn. There also are several transgenic traits now available for corn rootworm control on the market. On-farm trials allow farmers to see how these traits perform on their farms in side-by-side evaluations.

Materials and Methods

Five CRW trials were conducted in Sioux, Monona, and Story counties in 2014 (Table 1). In Trial 1, several SmartStax® and Duracade® hybrids were compared with a conventional hybrid (Table 2). In Trial 2, two SmartStax® and two Agrisure® hybrids were compared with a conventional hybrid with and without Force® 3G insecticide. In Trials 3 and 4, conventional hybrids were planted with and without Force® 3G insecticide. In Trial 5, a SmartStax® hybrid was compared with a Duracade® hybrid. All trials were conducted on corn ground in strips arranged in a randomized complete block design with at least three replications per treatment. Strip size varied from field to field depending on equipment size and the size of the field.

In Trials 1, 2, and 5, three to five plants/strip were dug in August and the roots assessed for CRW larval injury on the 0–3 node injury scale, where 0 is no damage and 3 is three nodes of roots eaten. Strips were evaluated for plant lodging in September in Trials 1 and 5 and strips were machine harvested for grain yield in Trials 2–5.

Results and Discussion

Root injury ratings in Trials 1, 2, and 5 indicated the corn rootworm pressure was relatively low, probably because the wet late spring and early summer resulted in the drowning of rootworm larva. In Trial 1, there was significantly more root feeding on the conventional hybrid than on several of the SmartStax® hybrids (Table 2), although the injury rating on the conventional hybrid (0.13) probably was not economical. A root injury rating of 0.25 is usually considered the economic threshold. There was significantly more plant lodging in one of the Duracade® hybrids than several of the SmartStax® hybrids or the conventional hybrid. Because of the low root injury ratings, differences in plant lodging may have been due to factors other than rootworm feeding. Although yields were not taken in this trial, it is likely any yield differences would have been due primarily to genetics and not differences in rootworm damage.

In Trial 2, there was no difference in root feeding with or without the insecticide with either the Agrisure® or SmartStax® hybrids, indicating that both transgenic traits are still providing adequate protection against rootworms in this field. The root injury rating for the conventional hybrid without the insecticide (0.41) was significantly greater

than with the two transgenic hybrids, although the two transgenic hybrids did not yield significantly more than the conventional hybrid without the insecticide. Although the root feeding was significantly less on the conventional hybrid with the insecticide than without, this did not result in a significant yield increase.

There was a significant yield increase with the use of a rootworm insecticide on a conventional hybrid in Trial 3 ($P < 0.01$) but not in Trial 4, indicating there likely was more corn rootworm pressure in Trial 3 than Trial 4.

In Trial 5, there was very little root feeding on either corn hybrid, but there was significantly more plant lodging with the Duracade® hybrid and this hybrid also yielded significantly less than the SmartStax® hybrid. Because there was little evidence of rootworm feeding in this trial, the yield difference was likely due to factors other than corn rootworms, although it may have been partly due to the difference in lodging. These trials show that in years with low corn rootworm pressure, such as 2014, the extra expense of corn hybrids with transgenic traits and/or the use of corn rootworm insecticides are less likely to be economical.

Table 1. Hybrid, row spacing, planting date, population, previous crop, and tillage in on-farm corn rootworm trials in 2014.

Exp. no.	Trial	County	Hybrid	Row spacing (in.)	Planting date	Planting popu-lation (seed/A)	Previous crop	Tillage
140318	1	Monona	5 smartstax, 2 duracade, and 1 conventional	38 (twin row)	4/22/14	31,000	Corn	Fall heavy disk, spring field cultivate
140122	2	Sioux	NK 53W3, NK 53W3122, and DeKalb 5438	30	5/6/14	34,300	Corn	Conventional
140506	3	Story	Golden Harvest G11U58	36	5/19/14	29,900	Corn	Conventional
140512	4	Story	Golden Harvest G11U58	36	5/19/14	29,900	Corn	Conventional
140317	5	Monona	Wyffels W7888 RIB & Golden Harvest G14H66-5122A	38 (twin row)	4/23/14	31,000	Corn	Fall disc, spring disc harrow

Table 2. Treatments, root injury ratings, percent lodging, and yields of on-farm corn rootworm trials in 2014.

Exp. no.	Trial	Treatments	Rootworm insecticide (Y/N)[1]	Root injury rating[2]	Percent lodging[2]	Yield (bu/A)[2]	P-Value (yield)[3]
140318	1	SmartStax (Renze 3232)	N	0.01 a	0.3 a		
		SmartStax (Renze 3244)	N	0.01 a	0.7 a		
		SmartStax (Renze 3264)	N	0.01 a	0.3 a		
		SmartStax (Renze 3222)	N	0.01 a	6.3 ab		
		SmartStax (Renze 3332)	N	0.04 ab	2.3 ab		
		Duracade (Golden Harvest G09M49)	N	0.07 ab	4.0 ab		
		Duracade (Golden Harvest G14H66-5122A)	N	0.04 ab	11.0 b		
		Conventional (Renze 2224)	N	0.13 b	0.7 a		
140122	2	SmartStax (DeKalb 5438)	Y	0.03 a		203 a	<0.01
		SmartStax (DeKalb 5438)	N	0.03 a		201 a	
		Agrisure (NK 53W3122)	Y	0.04 a		186 bc	
		Agrisure (NK 53W3122)	N	0.06 a		183 c	
		Conventional (NK 53W3)	Y	0.08 a		197 ab	
		Conventional (NK 53W3)	N	0.41 b		193 abc	
140506	3	Conventional (Golden Harvest G11U58)	Y			155 a	<0.01
		Conventional (Golden Harvest G11U58)	N			149 b	
140512	4	Conventional (Golden Harvest G11U58)	Y			199 a	0.49
		Conventional (Golden Harvest G11U58)	N			195 a	
140317	5	SmartStax (Wyffles W7888 RIB)	N	0.01 a	0.5 a	236 a	<0.01
		Duracade (Golden Harvest G14H66-5122A)	N	0.03 b	12.3 b	202 b	

[1]Insecticide was Force 3G at 5 oz/1,000 ft of row in-furrow in Trials 2, 3, and 4.
[2]Values denoted with the same letter are not statistically different at the significance level 0.05.
[3]P-Value = the calculated probability that the difference in yields can be attributed to the treatments and not other factors. For example, if a trial has a P-Value of 0.10, then we are 90 percent confident the yield differences are in response to treatments. For P = 0.05, we would be 95 percent confident.