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Introduction

Farmers are faced with hybrid selection decisions each year as new hybrids are introduced, including transgenic hybrids with several traits for insect and herbicide resistance. As problems with corn rootworm resistance to Bt corn continue to be found in Iowa, it is important to research methods to manage this pest. The objective of these trials was to compare corn hybrids on corn yield and/or resistance to corn rootworms.

Materials and Methods

In 2016, five trials comparing two or more corn hybrids were investigated (Table 1). All trials were conducted on-farm by farmer cooperators using the farmer's equipment. Strips were arranged in a randomized complete block design with at least three replications per treatment. Strip width and length varied from field to field depending on field and equipment size. All strips were machine harvested for grain yield.

In Trial 1, five hybrids (two Pioneer, two Golden Harvest, and one Dekalb) were compared on soybean ground (Table 2). The Pioneer hybrids and Golden Harvest GO2W74-3000 were conventional hybrids and the Dekalb and Golden Harvest GO7F23-3111 were transgenic hybrids containing Bt for rootworm. In Trial 2, three Agrisure® hybrids

were compared on corn ground with and without Force insecticide at 3.5 lb/acre. One was a conventional hybrid, one was Smartstax®, and one a VT3 hybrid. Root ratings were made in Trial 2 in late August using the Iowa State Node Injury (0-3) scale (Table 3). In Trial 3, two Smartstax® hybrids were compared with and without Aztec insecticide at 7.3 lb/acre on soybean ground. In Trial 4, four Agrigold hybrids were compared on soybean ground. One was a conventional hybrid, one a Roundup Ready, one a VT2, and one a SmartStax® hybrid. In Trial 5, two Pioneer hybrids were compared on soybean following a rye cover crop. One hybrid had corn borer and rootworm transgenic traits and the other did not.

Results and Discussion

In Trial 1, there were significant yield differences among the five hybrids, with Pioneer PO589R having the highest yield and Pioneer PO157R having the lowest yield ($P < 0.01$). Because one of the conventional Pioneer hybrids had the highest yield, it is likely the yield difference among hybrids was mainly due to differences in genetics and not to rootworm injury. In Trial 2, the conventional hybrid yielded less than either the SmartStax® or VT2 hybrid. The Force insecticide increased the yield of the conventional hybrid by 37 bushels/acre. The insecticide did not increase the yield of either of the transgenic hybrids. The conventional hybrid without insecticide had considerably more root feeding than the other hybrids, with more than an entire node of roots missing (Table 3). The insecticide treatment reduced the root feeding on the conventional hybrid. Very little root feeding was present on the transgenic hybrids, with or without the insecticide.

In Trials 3 and 4, there was no difference in yield among the various hybrids and hybrid/insecticide combinations, indicating corn rootworms were likely not a problem on the soybean ground in these two fields. In Trial 5, the hybrid with the Bt for rootworm trait (Pioneer PO157AM) yielded 20 bushels/acre more than the conventional

hybrid ($P < 0.01$), indicating this field likely has a problem with rotation resistant corn rootworms. These results show the importance of using numerous strategies in controlling corn rootworms.

Table 1. Variety, planting date, planting population, previous crop, and tillage practices in on-farm corn and soybean variety trials in 2016.

Exp. no.	Trial	County	Variety	Row spacing	Planting date	Planting population (seeds/ac)	Previous crop	Tillage
160826	1	Floyd	Pioneer PO157R, Golden Harvest GO2W74-3000, Pioneer PO589R, Dekalb DKC53-56RIB, & Golden Harvest GO7F23-3111	30	4/24/16	32,000	Soybean	No-till
160104	2	Sioux	Syngenta 58F-5222, N53W-3122, & N53W3	30	5/17/16	34,000	Corn	Conventional
160407	3	Kossuth	LG5499 & LG5499 Smart Stax	30	4/16/16	32,000	Soybean	Conventional
160502	4	Story	Agrigold 6416VT2, A6416, A6416RR, & A6416SS	30	4/26/16	34,000	Soybean	Spring field cultivate
160201	5	Buena Vista	Pioneer PO157 (PPST 250 Raxil, AQUAmax) & Pioneer PO157AM Blend (Roundup Ready 2, Liberty Link, Herculex 1, Yield guard corn borer, PPST 250 Raxil, AcreMax, AQUAmax)	36	5/20/16	34,7000	Soybean (followed by rye cover crop)	Spring field cultivate

Table 2. Yields for on-farm hybrid trials in corn in 2016.

Exp. no.	Trial	Treatment	Yield (bu/ac) ^a	P-value ^b
160826	1	Pioneer PO157R (Conventional)	197 d	<0.01
		Golden Harvest GO2W74-3000 (Conventional)	203 c	
		Pioneer PO589R (Conventional)	213 a	
		Dekalb DKC53-56RIB (SmartStax)	210 b	
		Golden Harvest GO7F23-3111 (Duracade)	205 c	
160104	2	Agrisure N58F-5222 (SmartStax) with Force at planting at 3.5 lb/ac	211 a	<0.01
		Agrisure N53W-3122 (VT3) with Force at planting at 3.5 lb/ac	193 b	
		Agrisure N53W3 (Conventional) with Force at planting at 3.5 lb/ac	194 b	
		Agrisure N58F-522 (SmartStax)	209 a	
		Agrisure N53W-3122 (VT3)	187 b	
		Agrisure N53W3 (Conventional)	157 c	
160407	3	LG5499 (Conventional)	231 a	P = 0.72
		LG5499 (Conventional) with Aztec at 7.3 lb/ac at planting	233 a	
		LG5499 (SmartStax)	227 a	
		LG5499 (SmartStax) with Aztec at 7.3 lb/ac at planting	229 a	
160502	4	Agrigold A6416VT2 (VT2)	232 a	P = 0.52
		Agrigold A6416 (Conventional)	228 a	
		Agrigold A6416rr (Roundup Ready)	229 a	
		Agrigold A6416ss (SmartStax)	220 a	
160201	5	Pioneer PO157 (Conventional)	214 a	P < 0.01
		Pioneer PO157AM (Herculex)	234 b	

^aValues denoted with the same letter within a trial are not statistically different at the significance level of 0.05.

^bP-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.

Table 3. Corn root ratings for Trial 2.

Exp. no.	Trial	Treatment	Root rating ^{ab}	P-value ^c
160104	2	Agrisure N58F-5222 (SmartStax) with Force at planting at 3.5 lb/ac	0.01 a	<0.01
		Agrisure N53W-3122 (VT3) with Force at planting at 3.5 lb/ac	0.01 a	
		Agrisure N53W3 (Conventional) with Force at planting at 3.5 lb/ac	0.35 b	
		Agrisure N58F-522 (SmartStax)	0.09 ab	
		Agrisure N53W-3122 (VT3)	0.02 a	
		Agrisure N53W3 (Conventional)	1.08 c	

^aIowa State Node-Injury scale (0–3). Number of full or partial nodes completely eaten.

^bValues denoted with the same letter within a trial are not statistically different at the significance level of 0.05.

^cP-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.