

2009

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Recommended Citation

Mallarino, Antonio P.; Clover, Matthew William; Butler, Jeff; and Havlovic, Bernard J., "Effect of Potassium Fertilization and New Corn Hybrids on Yield and Potassium Uptake in Continuous Corn" (2009). *Iowa State Research Farm Progress Reports*. 455.
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Effect of Potassium Fertilization and New Corn Hybrids on Yield and Potassium Uptake in Continuous Corn

Abstract

A three-year study was conducted at this farm to evaluate the effects of potassium fertilization and new corn hybrids resistant to rootworm on grain yield and potassium uptake in continuous corn. New corn hybrids may increase yield and change potassium (K) uptake or fertilization needs through improved traits that increase yield and root efficiency. Therefore, this study was planned to test this hypothesis by comparing continuous corn yield and response to K fertilization of hybrids with and without the rootworm resistant trait.

Keywords

Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences

Effect of Potassium Fertilization and New Corn Hybrids on Yield and Potassium Uptake in Continuous Corn

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Introduction

A three-year study was conducted at this farm to evaluate the effects of potassium fertilization and new corn hybrids resistant to rootworm on grain yield and potassium uptake in continuous corn. New corn hybrids may increase yield and change potassium (K) uptake or fertilization needs through improved traits that increase yield and root efficiency. Therefore, this study was planned to test this hypothesis by comparing continuous corn yield and response to K fertilization of hybrids with and without the rootworm resistant trait.

Materials and Methods

One trial was established in 2006 and was evaluated for 3 years (Site 1). A second trial was established in 2007 and was evaluated for 2 years (Site 2). Soils were Marshall and soil-test K was High to Very High (202 and 203 ppm). Treatments were two corn hybrids and five K fertilizer rates, which were replicated four times. One hybrid was resistant to glyphosate and corn borer and the other was an isoline with the addition of rootworm resistance. In 2006 the hybrids were DKC60-18 RR2/YGPL (YGCB/YGRW) and DKC60-19 RR2/YGCB. In 2007 they were DKC63-42 VT3 (RR2-YGRW/YGCB) and DKC63-46 RR2/YGCB. The K rates ranged from 0 to 180 lb K₂O/acre. No soil insecticide was applied. Measurements for all plots were grain yield and the nutrient concentration of ear leaves at the silking stage and of harvested grain. Rootworm injury, plant weights, and plant nutrient concentrations also were

measured in plots of three K fertilizer treatments at the silking stage. Rootworm injury was rated at the silking growth stage following the Iowa State University node injury scale (NIS). Corn was planted in rows spaced 30 in. apart. Fertilizer N and P were applied across all plots as needed.

Results and Discussion

Data summarized at this time include grain yield, rootworm injury ratings for all years at both sites, and the leaf K concentration for 2006 and 2007. Therefore, results and conclusions should be considered preliminary until all data are summarized, which will include a third year of Site 2 in 2009.

Rootworm injury ratings (Table 1) showed little feeding for the rootworm resistant corn hybrids and ranged from 0.01 to 0.10 in the 0 to 3 scale. Root injury was light to moderate for the susceptible corn hybrid and ranged from 0.06 to 0.76. Potassium fertilizer did not affect rootworm incidence consistently.

The yield data and statistics indicated that K fertilization did not affect corn grain yield. Some apparent differences between K rates were not consistent or statistically significant. Therefore, data shown in tables are only for the control and the average of all K rates.

The rootworm resistant (RW) corn hybrid yielded more than the susceptible hybrid in all years at both sites (Table 2). The average yield advantage across sites, years, and K rates was 9 bushels/acre but ranged from 2 to 17 bushels/acre. The yield advantage tended to be higher for sites and years with higher rootworm incidence but the overall correlation was poor.

Data in Table 3 indicate that K fertilization increased the K concentration of ear leaves in both sites. This result reveals luxury K uptake because the increased concentration did not result in grain yield increases. Data from Site 1 showed that leaf K concentrations and the concentration responses to K fertilizer were approximately similar for both hybrids. Data from Site 2 showed, however, that the leaf K concentration was greater for the RW hybrid and the response to added K was greater for the susceptible hybrid. The K concentration increase was 10 and 21% for the RW and susceptible hybrid, respectively, and the concentration difference between hybrids was much larger without K fertilization. Data from whole plants for selected K rates (not shown) reflected these results, but were more variable.

A difference in the tissue K concentration and uptake between hybrids may not be an important result because research has shown that often differences are unrelated to K nutrition, but a difference in K concentration response to fertilization would be important. In this study both results for Site 2 are important, however, because the K concentration of these hybrids should be

comparable. If similar hybrid genetics other than rootworm resistance are assumed, results from Site 2 (where rootworm incidence was highest) suggest that rootworm feeding reduced K uptake and increased the K uptake response to fertilizer. This was not observed at Site 1, however, and the difference at Site 2 did not translate into higher grain yield because soil-test K was high and there was no yield response to K fertilization.

The preliminary results showed no grain yield response to K fertilization because soil-test K was high. Rootworm incidence was light to moderate, and on average the RW hybrid yielded 9 bushels/acre more than the susceptible hybrid. Results of rootworm feeding or resistance effects on plant K uptake were inconsistent. The susceptible hybrid showed lower tissue K concentration and larger response to K fertilization at one site but there were no differences at another site. This study will continue for one more year.

Acknowledgements

This research was possible with partial support from Monsanto and the International Plant Nutrition Institute.

Table 1. Rootworm feeding ratings as affected by the corn hybrid and K fertilization.

Trial	Year	RW Resistant		RW Suscep.	
		No K	+ K	No K	+ K
----- Feeding rating* -----					
1	2006	0.01	0.01	0.06	0.08
1	2007	0.10	0.10	0.45	0.54
1	2008	0.05	0.04	0.24	0.18
1	Avg.	0.05	0.05	0.25	0.27
2	2007	0.10	0.10	0.70	0.66
2	2008	0.05	0.05	0.65	0.76
2	Avg.	0.08	0.08	0.68	0.71
Overall avg.		0.07	0.06	0.46	0.49

*ISU node injury rating from 0 to 3 assessed at the silking stage.

Table 2. Effects of rootworm resistance and K fertilization on corn grain yield.

Trial	Year	RW Resistant		RW Suscep.	
		No K	+ K	No K	+ K
----- bushels/acre -----					
1	2006	197	190	187	186
1	2007	181	171	171	171
1	2008	208	206	191	201
1	Avg.	195	189	183	186
2	2007	189	188	188	185
2	2008	209	215	194	195
2	Avg.	199	202	191	190
Overall avg.		197	195	187	188

Table 3. Effects of rootworm resistance and K fertilization on the K concentration of corn ear leaves at silking.

Trial	Year	RW resistant		RW suscep.	
		No K	+ K	No K	+ K
----- % -----					
1	2006	1.93	2.02	1.92	2.03
1	2007	1.42	1.64	1.43	1.66
1	Avg.	1.68	1.83	1.67	1.84
2	2007	1.54	1.70	1.44	1.75
Overall avg.		1.61	1.76	1.56	1.80