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Corn Yield Response to Plant Populations

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Abstract
Corn hybrid development with a focus on drought tolerance has emerged in recent years, and producers have questions about their yield performance across a range of plant populations. A three-year study was conducted to determine the yield of corn hybrids across several plant populations. Corn hybrids responded differently across three different yield environments in 2013, 2014, and 2015. In 2013, a lower yield environment occurred. The hybrid with drought tolerance had the greatest yield of 95 bu/a at a plant population of 21,500 plants/a, whereas the non-drought tolerant hybrid's greatest yield was 90 bu/a at a plant population of 13,500 plants/a. In 2014, the yield environment was the greatest in the three-year study. The hybrid with drought tolerance had the greatest yield of 174 bu/a at the greatest plant population of 35,500 plants/a, and the non-drought tolerant hybrid's greatest yield was 169 bu/a at a plant population of 29,500 plant/a. In 2015, overall corn yield was moderate compared to 2013 and 2014. The hybrid with drought tolerance once again had the greatest corn yield at 135 bu/a at the 29,500 plant/a population.

Keywords
Corn, plant populations, drought tolerance

Corn Yield Response to Plant Populations

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Summary

Corn hybrid development with a focus on drought tolerance has emerged in recent years, and producers have questions about their yield performance across a range of plant populations. A three-year study was conducted to determine the yield of corn hybrids across several plant populations. Corn hybrids responded differently across three different yield environments in 2013, 2014, and 2015. In 2013, a lower yield environment occurred. The hybrid with drought tolerance had the greatest yield of 95 bu/a at a plant population of 21,500 plants/a, whereas the non-drought tolerant hybrid's greatest yield was 90 bu/a at a plant population of 13,500 plants/a. In 2014, the yield environment was the greatest in the three-year study. The hybrid with drought tolerance had the greatest yield of 174 bu/a at the greatest plant population of 35,500 plants/a, and the non-drought tolerant hybrid's greatest yield was 169 bu/a at a plant population of 29,500 plant/a. In 2015, overall corn yield was moderate compared to 2013 and 2014. The hybrid with drought tolerance once again had the greatest corn yield at 135 bu/a at the 29,500 plant/a population.

Introduction

Corn yield can be affected by many factors in Kansas, including soil quality, fertility, crop production practices (planting date, plant population, and hybrid), and weed and pest management. The most significant factors that affect corn yield in Kansas are often related to moisture and heat stress. Several seed companies have devoted considerable resources to breeding hybrids with improved drought tolerance. Although the method of achieving drought tolerance in corn hybrids may differ among companies, the goal of improving water use efficiency can help increase yields of corn grown in water-limited environments. Producers have many questions surrounding the newer corn hybrids labeled as drought-tolerant, and data comparing yields across a range of plant populations need to be evaluated. A three-year study was conducted at the East Central Experiment Field in Ottawa, KS, to evaluate two corn hybrids and their yield responses to various plant populations.

Procedures

The experimental site was located on a Woodson silt loam. Plots were strip-till-fertilized into soybean stubble with a mix of 120 lb nitrogen per acre, 40 lb P_2O_5 per acre and 15 lb K_2O per acre. Corn was planted on 30-in. rows on April 4, 2013, with Channel hybrids 197-30 (Non-DroughtGard) and 198 (DroughtGard); on April 9, 2014, with Dekalb hybrids DKC50-48 (Non-DroughtGard) and DKC51-20 (DroughtGard); and on April 6, 2015, with Dekalb hybrids DKC50-48 (Non-DroughtGard) and DKC51-

20 (DroughtGard) (Monsanto, St. Louis, MO). The experiment was a randomized complete block design with 4 replications in a strip-plot arrangement. Plant population was the main factor, and hybrid was the subfactor. Plots were 4 rows wide, 35-ft long, and planted at 36,000 seeds/a. At the V6 growth stage when the growing point was above the soil surface, plots were thinned to several plant populations. Due to low plant emergence in 2013, plots were thinned to five populations: 10,000; 13,500; 17,500; 21,500; and 27,500 plants/a. In 2014 and 2015, seedling emergence was improved and plant populations were thinned to 17,500; 23,500; 29,500; and 35,500 plants/a. Plots were maintained weed-free throughout the season. Corn plots were harvested by a plot combine, plot weights were determined, and yields were adjusted to 13% moisture.

Results

Corn hybrids responded differently across the three years of the study (Figure 1). In 2013, a lower yield environment occurred due to drier than normal weather during mid-summer. In 2013, only 1.37 inches of rain fell through the month of June and the first 3 weeks of July. The hybrid with drought tolerance had the highest yield of 95 bu/a at a plant population of 21,500 plants/a, whereas the non-drought tolerant hybrid's highest yield was 90 bu/a at a plant population of 13,500 plants/a. In 2014, the yield environment was the greatest in the three years of the study because of cooler and wetter than normal conditions throughout the summer. The hybrid with drought tolerance had a peak yield of 174 bu/a at the highest plant population of 35,500 plants/a, and the non-drought tolerant hybrid's highest yield was 169 bu/a at a plant population of 29,500 plants/a. The highest plant population of 35,500 plants/a was likely not high enough to maximize yield with the drought-tolerant hybrid in 2014 and may have benefited from an increased seeding rate. In 2015, corn yields were less than in 2014 but better than 2013. Although corn yields in 2015 were not the greatest across the three years of the study, they were still greater than average for the area of east central KS. Similar to previous years, the highest overall yields in 2015 were observed with the drought tolerant hybrid with a maximum yield of 135 bu/a at the 29,500 plant/a population. The non-drought tolerant hybrid had a maximum yield of 125 bu/a at both the 23,500 and 29,500 plant/a population.

Table 1. Polynomial regression equations for corn yield response to plant population for hybrids planted at the Kansas State University Ottawa Research Station from 2013 to 2015

Year	Hybrid	Trait	Regression equation	R^2
2013	Channel 197-30vt	Non-DT	y = -1E-07x2 + 0.0034x + 55.979	0.57
2013	Channel 198DGvt	DT	y = -8E-08x2 + 0.0034x + 58.996	0.71
2014	Dekalb DKC5048	Non-DT	y = -2E-07x2 + 0.0119x - 21.64	0.98
2014	Dekalb DKC5120	DT	y= 8E-10x2 + 0.0015x + 119.83	0.99
2015	Dekalb DKC5048	Non-DT	y = -9E-08x2 + 0.0049x + 56.199	0.95
2015	Dekalb DKC5120	DT	y = -2E-07x2 + 0.0096x - 5.9112	0.99

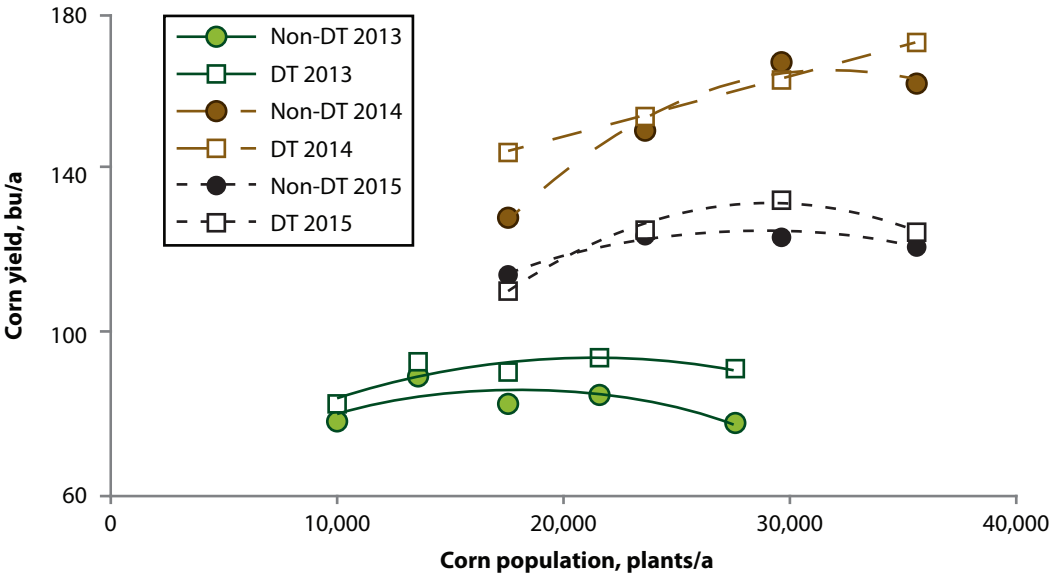

Figure 1. Corn yield response to plant populations at the Kansas State University Ottawa Research Station from 2013 to 2015. Corn hybrids included drought-tolerant and non-drought-tolerant traits.