

Interaction Among Nitrogen Rate, Planting Density, and Corn Hybrid

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Introduction

Despite extensive research on response to nitrogen in corn production, less is known on variation in nitrogen responses among hybrids and planting densities. The objective of this study was to quantify variation in grain yield response to nitrogen and planting density among corn hybrids.

Materials and Methods

Five hybrids were planted at five different nitrogen (N) rates (0, 60, 120, 180, and 260 lb N/acre) and five planting densities (23,500 plants/acre to 47,000 plants/acre) in all possible combinations (5 x 5 x 5) for 125 treatments. Treatments were replicated twice and planted in a split-split plot experimental design with N level as the whole plot factor, planting density as sub-plot factor, and hybrid as sub-sub-plot factor. Each sub-sub plot was four rows spaced at 30 in. and 22.25 ft long with an alley of 2.75 ft between plots. Sub-plots were planting densities and were five plots wide. Whole plots (N rate) were five sub-sub plots wide and 5 plots long (50 ft x 125 ft). Nitrogen was applied in liquid form using a GPS-enabled spray coupe. Plots were planted with a GPS-enabled precision air planter and harvested with a New Holland TR88 combine modified for research plot harvest. Plots were planted June 4, 2019, and harvested November 6, 2019.

Results and Discussion

Linear and quadratic covariates for nitrogen rate and planting density were set. Both nitrogen and planting density had quadratic responses. In addition, researchers found a highly significant 3-way interaction for hybrid x density x nitrogen rate demonstrating optimal planting density and N rates are interdependent and this relationship depends on hybrid.

Conclusions

Hybrids with LH195 as a parent had maximum optimal planting densities (planting density with highest grain yield) at lower nitrogen levels (less than 150 lb), whereas maximum optimal planting density occurred at higher nitrogen rates (150 lb or more) for the other three hybrids (Figure 1). The strong interaction among nitrogen, planting density, and hybrid demonstrates the need to develop methods to model interactions among all three management variables.

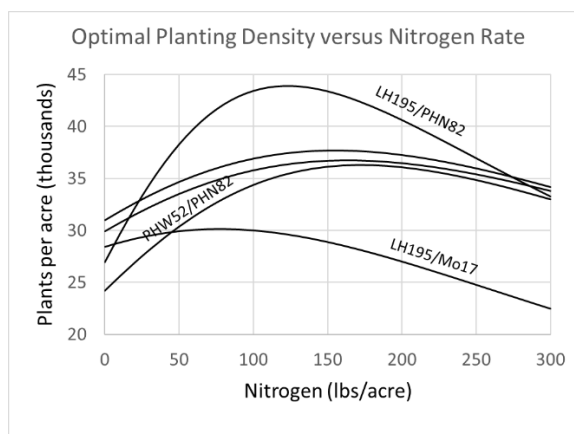


Figure 1. Optimal planting density versus nitrogen rate for three publicly available hybrids (labeled lines) and two propriety hybrids (unlabeled lines).