**INTRODUCTION**

- Nitrogen (N) fertilizer rate, plant population, and hybrid selection are some of the most important decisions made by a farmer each year in the production of corn (Zea mays L.).
- These decisions interact with soil N status and plant N demand depending on the environmental conditions and the corn hybrid.
- Narrowing row spacing increases plant-to-plant spacing within the row, and is potentially a better arrangement to accommodate higher plant densities for most hybrids.
- Maximizing a hybrid's yield potential requires correct environmental placement and implementing the appropriate agronomic management.

**YIELD RESPONSES TO MANAGEMENT**

- Exceptional yields were obtained in the unfertilized (check) plots in 2017 at all locations, which led to less yield response to N fertilization than expected (Table 2).
- There was a wide range in yields amongst the 44 hybrids tested at each location in response to each N level (Table 2).
- Averaged across all hybrids and locations, the plant density increase from 79,000 to 94,000 plants ha⁻¹ contributed to the greatest yield response, while minimal yield was gained when increasing to 109,000 plants ha⁻¹.
- On average, the 51 cm row spacing was a better arrangement of the highest plant density (Table 2), although there was a high degree of variability among the hybrids (Figure 3).

**HYBRID CHARACTERIZATION**

- ‘Workhorse’ index (WHI) is based on the check plot yield (yield at 0 kg N ha⁻¹) and the yield response to low N (RTLowN; yield change between 0 and 67 kg N ha⁻¹).
- ‘Racehorse’ index (RHI) is comprised of the yield response to: high N (RTN; yield change between 0 and 280 kg N ha⁻¹ at 79,000 plants ha⁻¹), intermediate plant density (RTIntPop; yield change between 79,000 and 94,000 plants ha⁻¹ at 314 kg N ha⁻¹), high plant density (RTHiPop; yield change between 94,000 and 109,000 plants ha⁻¹ in a 76 cm row spacing), and row spacing (RTRS; yield change between 76 and 51 cm row spacing at 109,000 plants ha⁻¹) evaluations.
- Hybrids were ranked by their yield responses to each parameter and ‘Racehorse’ and ‘Workhorse’ indices for each hybrid were estimated using a multiple regression approach with the Smith-Hazel index.
- Index weights calculated for each parameter suggest that Check plot yield or RTN and RTRS were the most important in determining a hybrid's WHI or RHI, respectively (Table 3).
- Hybrids of similar yield potential with contrasting WHI and RHI suggest the potential for those hybrids to respond differently to N loss or intensified agronomic management (Table 4).

**DATA MATERIALS AND METHODS**

**Hybrids:** 68 commercial hybrids representing a broad germplasm spectrum and ranging in relative maturity from 104-120 days.

**Locations:** Yorkville (41°N), Champaign (40°N), and Harrisburg (39°N), Illinois.

**Nitrogen:** broadcast applied at the V₃ growth stage as urea (46-0-0) and protected with Limus.

**Treatments:** hybrids were evaluated across the two row spacings, three plant densities, and three N rates outlined in Table 1. Treatments were arranged in a split-split block experimental design with four replications.

**Table 1. Six treatments used in the evaluation of commercial corn hybrids for their yield responses to N fertilization, plant density, and row spacing.**

**Table 2. Final grain yield as affected by nitrogen rate (79,000 plants ha⁻¹), plant density (at 314 kg N ha⁻¹ and 76 cm row spacing), and row spacing (at 109,000 plants ha⁻¹) at three locations in Illinois in 2017.**

**Table 3. Relative weights for each parameter used in the characterization of hybrids at three sites in Illinois in 2017.**

**Table 4. Ten hybrids ranked by their yield under standard management (314 kg N ha⁻¹ and 79,000 plants ha⁻¹) and their corresponding ‘Workhorse’ (WHI) and ‘Racehorse’ (RHI) indexes averaged across three sites in Illinois in 2017.**

**CONCLUSION**

- Commercial corn hybrids differ drastically in their ability to tolerate low N environments and their responses to N fertilization, plant densities, and row spacing.
- Highest yields of 2017 were achieved with ‘Racehorse’ type hybrids at high densities in narrow rows.
- Narrow rows are a better arrangement of high densities for most hybrids.
- Typical variety testing trials under standard management do not accurately represent a hybrid’s yield stability across yield environments or responsiveness to intensive agronomic management.

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