Interaction of Soybean Maturity, Row Spacing, and Seeding Rate

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Introduction

The adaptive nature of the soybean plant makes it relatively insensitive to small differences in within-row and between-row plant spacing. Timing of key growth stages and plant architecture can influence yield response to changes in plant density. Understanding how soybean maturity group, row spacing, and seeding rate interact will facilitate development of planting recommendations that account for all three factors to optimize yield.

Objective

The objective of this study was to determine if seeding rate should be adjusted for different maturities or row spacings to optimize planting practices for non-irrigated soybeans.

Materials and Methods

- Field experiments were conducted on silt-loam soils near Manhattan, KS in 2007, 2008, and 2009.
- Planting Dates:
  - June 5, 2007
  - May 23, 2008
  - June 8, 2009
- Varieties and Maturity Groups (MG):
  - Asgrow AG3006 MG 3.0
  - DeKalb DKB38-52 MG 3.8
  - Asgrow AG4403 MG 4.4
- Row Spacings:
  - 10 inches
  - 20 inches
  - 30 inches
- Seeding Rates (seeds per acre):
  - 40,000
  - 80,000
  - 120,000
  - 160,000
  - 200,000

- Partial funding supplied by the Kansas Soybean Commission

Figure 1. Photographs of 30-inch, 20-inch, and 10-inch row spacings taken 16 July 2007.

Results and Discussion

Variety Maturity

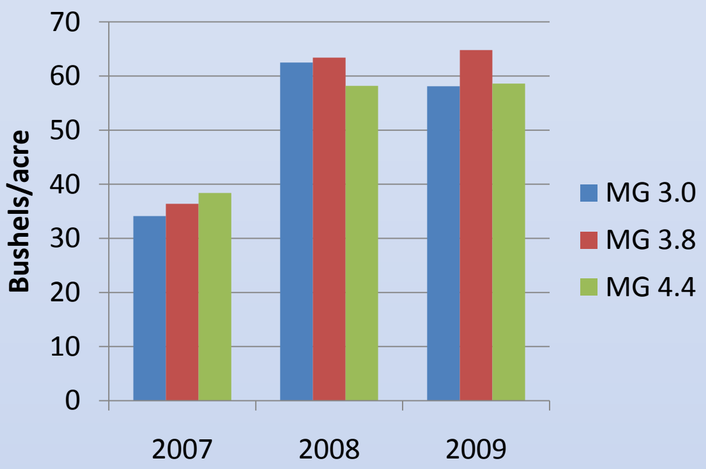

Figure 2. Yield by soybean maturity and year.

Within each year, variety x row spacing and variety x seeding rate interactions were NS (α = 0.05).

Varieties responded differently in each year (Fig. 2):

- Yields increased with increasing MG in 2007, but yield increments were relatively small (2 to 2.5 bushels per acre with each increase in MG).
- MG 3.0 and MG 3.8 yields were greater than MG 4.4 in 2008.
- MG 3.8 yielded more than MG 3.0 and MG 4.4 in 2009
- MG 3.8 variety was most consistent across years.

Row Spacing

Row spacing (Figure 1) had no effect (α = 0.05) on yield, lowest pod height, or yield components, regardless of variety or seeding rate (data not shown) with the exception of pods per plant, which was greater in 20-in. rows vs. 10-in. rows at 40,000 seeds per acre (Figure 3).

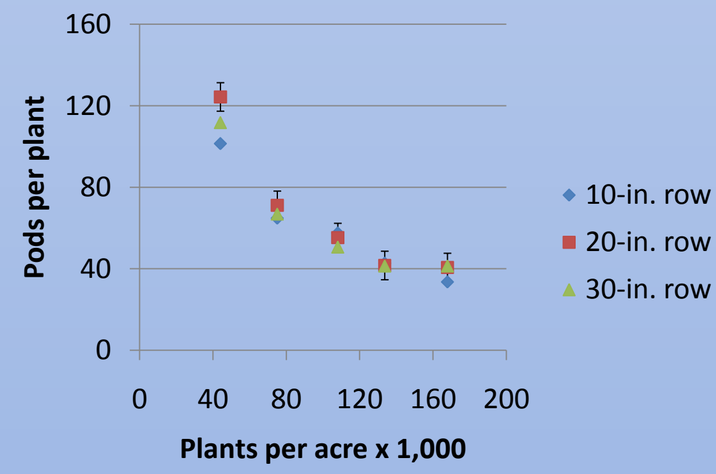

Figure 3. Relationship between plant density and pod number per plant.

Results and Discussion

Seeding Rate

Stand establishment differed each year (not shown):

- Stands were within 90% of seed drop for all seeding rates in 2007.
- Stands were within 90% of seed drop for seeding rates less than or equal to 120,000 seeds per acre and averaged 84% of seed drop at 160,000 and 200,000 seeds per acre in 2008 and 2009.

Yield response to seeding rate was evaluated using final stands (plants per acre) rather than seed drop.

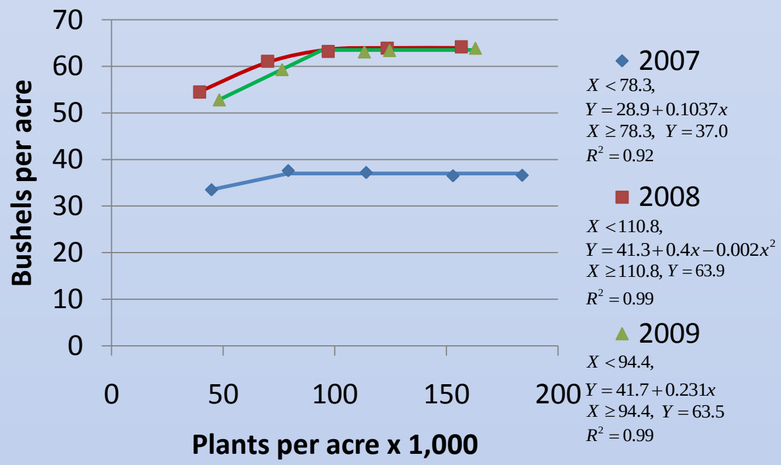

Figure 4. Yield response to plant density in each of three years.

Plateau models were used to characterize yield response to plant stands (Figure 4) because analysis of variance indicated no significant (α = 0.05) differences in yield beyond the second or third increment in plant stand.

- Response to plant stand was different each year, but varieties responded similarly in each year (variety x seeding rate interaction NS, α = 0.05).
- Yield did not increase beyond 78,300 plants per acre in 2007; 110,800 plants per acre in 2008; and 94,400 plants per acre in 2009.
- Pods per plant decreased significantly with the first three increments in plant density (Figure 3), but seeds per pod and seed size changed little in response to plant density (α = 0.05, not shown).

Conclusions

- Seeding rates did not have to be adjusted for variety maturity or for row spacing to maximize yield in non-irrigated soybeans.
- Seeding rates resulting in final stands close to 110,000 plants per acre maximized yield in non-irrigated soybeans.
- Soybeans adjusted the number of pods per plant to produce similar yields at plant densities greater than the minimum needed to maximize yield.