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Late-Season Nitrogen Fertilizer Application in Soybean

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Summary

Field experiments were conducted at the North Central Kansas Experiment Field near Scandia, KS, in the summer of 2014 to evaluate effect of late-season nitrogen (N) fertilizer application on modern soybean genotypes under dryland and irrigated environments. The main objective was to determine if the N application late in the season has an agronomical benefit to soybean producers. A unique fertilizer N source (urea) was applied at five N rates (0, 40, 80, 120, and 160 lb N/a) to soybean at the R3 growth stage. Overall soybean yields under dryland conditions ranged from 73 to 89 bu/a, whereas yield variation in the irrigated environment was narrowed and ranged from 90 to 99 bu/a. Application of late-season N fertilizer did not significantly increase soybean yields either under full irrigation or in the dryland environment. Under irrigation, maximum soybean yield was documented at 99 bu/a with the 0-N fertilizer rate, whereas dryland soybean yield was maximized at 89 bu/a with 120 lb N/a.

Introduction

Increasing soybean yields is associated with larger N demand. The ability to sustain N fixation by the rhizobia during the late season can be compromised, restricting the capability of the crop to supply all of the N required for optimum grain-filling and final grain N content. Previous studies investigating the effects of late-season N fertilizer application have shown very different outcomes. A common pattern is to report fertilizer N responses in sites where average soybean yields are above 50 to 60 bu/a. Therefore, the effect of extra N application late during the crop growing season might be an important factor to consider in high-yielding soybean systems.

Procedures

For both scenarios (dryland and irrigated), the soybean variety was Pioneer 39T67 planted on May 20 in 30-in. rows at a population of 140,000 seeds/a, with no fertilizer applied before planting. For the irrigated environment, the soil type was minimal crete, whereas the dryland site soil type was a crete. Fertilizer N rates were applied at 0, 40, 80, 120, and 160 lb/a. Each fertilizer treatment was replicated four times, providing a total of 20 plots per experiment. Plot size was 10 ft (4 rows) × 50 ft. Fertilizer N was applied close to the R3 growth stage (August 15). The soybean was harvested on October 15.

Results

Late-season N fertilizer application did not statistically increase soybean yields in either water environment (irrigated or dryland) (Table 1). Overall yield level at the Scandia irrigated environment was 96 bu/a, whereas dryland yield was 83 bu/a. In these environments, the application of extra N late in the season did not increase soybean yields over the no-N application check (0-N) treatment. For Scandia dryland, the largest fertilizer N application of 160 lb/a did statistically decrease soybean yields (73 bu/a) compared with the rest of the treatments.

Application of late-season N fertilizer produced no significant improvement in grain protein, but an increasing trend in grain protein was documented as the N application increased from the check (0-N) to the highest fertilizer N rate (120-N), in both dryland and irrigated systems (from 34.2 to 35.0 in dryland, and from 34.6 to 35.2 in irrigated).

Table 1. Yield and grain protein for the late-application nitrogen (N) soybean research trial at Scandia, North Central Kansas Experiment Field, 2014

	Scandia			
	Yields at 13% moisture, bu/a		Grain protein, %	
N rates, lb/a	Dryland	Irrigated	Dryland	Irrigated
0	80.9 a[1]	98.9	34.2	34.6
40	85.4 a	90.4	34.5	34.5
80	85.8 a	93.5	34.5	34.9
120	88.9 a	98.7	34.8	34.5
160	73.3 b	96.4	35.0	35.2
$P > 0.05$	*	NS[2]	NS	NS

[1] Values with the same letters are not significantly different ($P > 0.05$).
[2] Not significant, $P > 0.05$.