Foliar N Fertilization of Soybeans - 2005

Clay Center, Nebraska

Dr. Richard Ferguson - UNL Extension Soils Specialist
Glen Slater - UNL Research Analyst

Rationale

In recent years, irrigated producers in south central Nebraska have experienced near optimal growing conditions for soybean, yet yields have tended to stagnate in the 50-70 bu/acre range. Consequently, producers are interested in what factors might be limiting yield potential of soybean, and what practices could help boost yields when climatic conditions are favorable for high yields. The widespread adoption of Roundup-Ready® soybean has created an opportunity for including fertilizer or other inputs when the crop is treated with glyphosate herbicide.

Objective

A study was conducted in 2005 to explore the impact of foliar fertilization on yield potential of irrigated soybean in south-central Nebraska. Foliar fertilizer was applied with glyphosate at V4 (4-trifoliate vegetative stage) and/or at the R3 (beginning pod stage).

Procedures

The study was located at the University of Nebraska's South Central Agricultural Laboratory near Clay Center, Nebraska. The study was a randomized complete block design with four replications. Individual plot dimensions were 8 rows (20 ft) wide by 30 ft long. The site was located on one soil series – Crete silt loam, 0-1% slope (Ce), on a linear sprinkler-irrigated field. Initial soil sampling took place March 14, 2005.

Table 1. Initial soil fertility levels.

Soil Test	Mean Values	
%Organic matter	2.8	
pH	7.0	
P (ppm)	19.0	
K (ppm)	367	
Zn (ppm)	1.0	
S (ppm)	10.8	
Mg (ppm)	234.3	
Ca (ppm)	1595.8	
CEC (meq/100)	10.9	
0-8"NO_3N	14.5 ppm	35.0 lb/ac
8-24"NO_3N	5.3 ppm	25.3 lb/ac
24-36"NO_3N	2.3 ppm	8.3 lb/ac
Total profile nitrate		68.5 lb/ac

The preceding crop at this location was irrigated corn. Pioneer 93M11 (Roundup-Ready) soybeans were ridge-planted into the shredded corn stalks May 5, 2005 at a population of 180,000 seeds/ac. An 8-row planter was used (30-inch rows). Foliar fertilizer treatments were applied @ V4 on June 20, 2005 with a boom-mounted sprayer. Air temperatures were 87-90º F, with a south wind at 10 mph. Foliar fertilizer treatments were again applied @ R3 on July 15,

2005. Air temperatures were 85-90º F; with a south wind 0-10 mph. Each time, the N treatments were added to a tank mix of 22 oz./ac *Roundup WeatherMax®*. Chlorophyll meter readings were collected from the uppermost fully developed trifoliate July 13 and July 29 to evaluate potential effects on canopy "greenness" following foliar fertilization. Leaf samples of the uppermost fully expanded trifoliate were collected July 14. Rainfall from April 1 through October 1 at the South Central Agricultural Laboratory totaled 13.65 inches (71% of normal). This was supplemented with 9.17 inches of irrigation (6 events). The center two rows of each plot were harvested Sept. 27, 2005 with a Gleaner K2 plot combine. Seed samples were retained for nutrient analysis.

Table 2. In-season treatment effects on leaf tissue

Foliar Treatment		N Timing	Jul 13	Jul 29	Jul 14 Leaf Analysis		
			SPAD (Early R3)	SPAD (R4)	%N	%P	%K
1	Untreated Check	---	40.75 a	43.43 a	5.46 ab	0.398 a	2.37 ab
2	Roundup Only	V4 & R3	40.38 ab	42.98 a	5.56 ab	0.385 a	2.40 ab
3	9-18-9 (3 gal/acre)	V4	40.23 ab	42.60 a	5.65 a	0.395 a	2.33 b
4	9-18-9 (1.5 gal/acre)	V4 & R3	39.88 b	45.90 a	5.39 ab	0.393 a	2.48 a
5	9-18-9 (3 gal/acre)	R3	40.18 ab	43.40 a	5.33 b	0.378 a	2.33 b
6	3-18-18 (3 gal/acre)	V4	40.58 ab	43.05 a	5.44 ab	0.378 a	2.40 ab
7	3-18-18 (1.5 gal/acre)	V4 & R3	40.43 ab	43.00 a	5.54 ab	0.383 a	2.34 b
8	3-18-18 (3 gal/acre)	R3	40.33 ab	42.83 a	5.50 ab	0.403 a	2.41 ab

Roundup used on treatments 2-8.
Effects with the same letter are not different at the 0.05 level of significance

Table 3. Treatment effects on grain quality

Foliar Treatment		N Timing	Grain Yield (bu/ac)	Harvested Grain Analysis		
				Total N	%P	%K
1	Untreated Check	---	84.4 ab	6.176 a	0.5925 a	1.9225 a
2	Roundup Only	V4 & R3	81.3 b	6.140 a	0.6100 a	1.9500 a
3	9-18-9 (3 gal/acre)	V4	82.9 ab	6.160 a	0.6175 a	1.9700 a
4	9-18-9 (1.5 gal/acre)	V4 & R3	84.6 ab	6.156 a	0.6150 a	1.9500 a
5	9-18-9 (3 gal/acre)	R3	85.5 ab	6.160 a	0.6100 a	1.9550 a
6	3-18-18 (3 gal/acre)	V4	84.1 ab	6.120 a	0.6025 a	1.9475 a
7	3-18-18 (1.5 gal/acre)	V4 & R3	86.1 a	6.192 a	0.6050 a	1.9525 a
8	3-18-18 (3 gal/acre)	R3	86.0 a	6.168 a	0.6075 a	1.9350 a

Roundup used on treatments 2-8.
Effects with the same letter are not different at the 0.05 level of significance

Results & Summary

Treatment influences on crop growth and nutrient uptake were primarily evaluated during the growing season by collecting spectral information at two growth stages – R3 & R4, and leaf tissue analysis at R3. There was little effect of treatments on leaf chlorophyll (Table 2). Nutrient uptake in the leaves was also not greatly affected by the foliar treatments. There was a trend

toward higher chlorophyll readings in the absence of any Roundup application. Overall, yields in the study area were at very high levels in 2005 due to ideal growing conditions. Although there was a trend toward slight improvements in yield with foliar treatments (Table 3), the only statistically significant yield effect was a yield reduction when Roundup was applied compared to the application of 3-18-18 at R3 or V4+R3. Nutrient content of the grain was not influenced by any of the treatments.