CORN RESPONSE TO APPLICATION TIMINGS OF N SOURCES AND RATES OF ESN IN NORTHEAST MISSOURI

Kelly Nelson
Research Agronomist

Peter Motavalli
Assistant Professor

An increase in government regulations of anhydrous ammonia and ammonium nitrate may affect the availability and price of these nitrogen sources in the future. This research evaluated corn response to timings of N sources and rates of ESN in Northeast Missouri.

This study was arranged as a randomized complete block design in plots 10 by 50 ft with four replications on a Putnam silt loam soil near Novely, MO in 2005. The field location was selected due to soil conditions that may encourage N loss due to denitrification. The field was flat with relatively poor internal drainage. A broadcast application of 30-80-120 was made on March 31, 2005. Asgrow 'RX 752YG/RR' corn was no-till planted at 30,000 seeds/acre in 30 inch rows on May 3, 2005. Nitrogen sources were broadcast applied four weeks prior to planting on April 5 (early preplant), at planting on May 3 (preplant), and approximately four weeks after planting on June 3 (sidedress), except anhydrous at the sidedress timing. ESN was applied at 50, 75, 100, and 150 lbs/a. Other nitrogen sources were broadcast applied at 150 lbs N/acre. Anhydrous was knife injected following mole knives. Rainfall events for the period were reported in Figure 1. All data were subjected to analysis of variance and means separated using Fisher's Protected LSD (p=0.05). The concentration of protein, oil, starch, and grain density was determined with a Foss Infratec1241 near-infrared reflectance grain analyzer.

Weather conditions prevented fall application timings in 2005. There was no effect of N application timing or ESN rate on corn population density or grain oil in 2005 (data not presented). Reduced rates of ESN at an early preplant timing had a greater yield reduction than preplant or sidedress application timings (Figure 1). Low rates of ESN at the sidedress timing had grain yields similar to the highest yielding sidedress ESN treatment (Table 1). ESN at 150 lb N/acre had grain yields similar to the other N sources at the same application rate. Corn grain protein with ESN at 150 lb/a was greater than or equal to all early preplant and preplant N source application timings except a preplant anhydrous ammonia application (Table 2). In general, protein content was greatest with all sidedress application of N sources except ESN at 100 and 150 lb N/acre. There was an inverse relationship between starch and protein (Tables 2, 3). High starch corn had low protein levels. There was no rate response of ESN on starch levels at the preplant and sidedress application timings. Corn grain density was greater than 1.28 for all treatments except preplant ESN at 50 and 75 lb/a and sidedress ESN at 50 lb/a (Table 4). ESN at 100 lb N/a had starch, grain yield, and grain density similar to 150 lb/a; however, protein levels were greater at 150 lb/a at all application timings.

Research in 2006 was expanded to include rates of urea along with rates of ESN. In addition, fall applied treatments were included.

Table 1. Corn grain yield for ESN rates and N sources applied early preplant (April 5), preplant (May 3), and sidedress (June 3) in 2005.

Nitrogen source	Rate	Early preplant	Preplant	Sidedress
	lbs N/acre		bu/acre	
Untreated		79	[a]—	65
ESN	50	80	109	117
	75	110	120	117
	100	117	127	138
	150	125	128	131
Urea	150	115	128	131
Urea + Agrotain	150 + 1 gal/ton	107	124	124
Anhydrous ammonia	150	136	137	—
Ammonium nitrate	150	122	120	122
28% UAN	150	123	118	130
Organic N	150	—	74	—
LSD (p=0.05)			22	

[a]Treatment was not applied.

Table 2. Corn grain protein for ESN rates and N sources applied early preplant, preplant, and sidedress in 2005.

Nitrogen source	Rate	Early preplant	Preplant	Sidedress
	lbs N/acre		%	
Untreated		6.75	[a]—	6.45
ESN	50	7.10	8.05	7.53
	75	7.70	8.25	8.23
	100	8.20	8.10	8.45
	150	8.80	8.88	9.08
Urea	150	8.15	8.33	8.78
Urea + Agrotain	150 + 1 gal/ton	8.50	8.45	8.98
Anhydrous ammonia	150	8.83	9.20	—
Ammonium nitrate	150	8.85	8.93	9.22
28% UAN	150	8.13	8.68	9.30
Organic N	150	—	6.60	—
LSD (p=0.05)			0.31	

[a]Treatment was not applied.

Table 3. Corn grain starch for ESN rates and N sources applied early preplant, preplant, and sidedress in 2005.

Nitrogen source	Rate	Early preplant	Preplant	Sidedress
	lbs N/acre		%	
Untreated		73.78	[a]—	74.20
ESN	50	73.63	73.05	73.38
	75	72.85	73.35	73.13
	100	72.85	73.20	73.00
	150	72.78	72.88	72.70
Urea	150	73.20	73.08	72.73
Urea + Agrotain	150 + 1 gal/ton	72.73	73.30	72.68
Anhydrous ammonia	150	72.90	73.03	—
Ammonium nitrate	150	72.80	72.63	72.53
28% UAN	150	73.28	73.23	72.63
Organic N	150	—	73.98	—
LSD (p=0.05)			0.72	

[a]Treatment was not applied.

Table 4. Corn grain density for ESN rates and N sources applied early preplant, preplant, and sidedress in 2005. Density is a common measurement for food grade corn grain quality. Values greater than 1.28 are desirable.

Nitrogen source	Rate	Early preplant	Preplant	Sidedress
	lbs N/acre		g/cm^3	
Untreated		1.268	[a]—	1.266
ESN	50	1.277	1.284	1.278
	75	1.277	1.288	1.285
	100	1.290	1.292	1.290
	150	1.290	1.286	1.293
Urea	150	1.288	1.289	1.288
Urea + Agrotain	150 + 1 gal/ton	1.286	1.290	1.286
Anhydrous ammonia	150	1.292	1.292	—
Ammonium nitrate	150	1.294	1.290	1.286
28% UAN	150	1.284	1.290	1.287
Organic N	150	—	1.268	—
LSD (p=0.05)			0.009	

[a]Treatment was not applied.

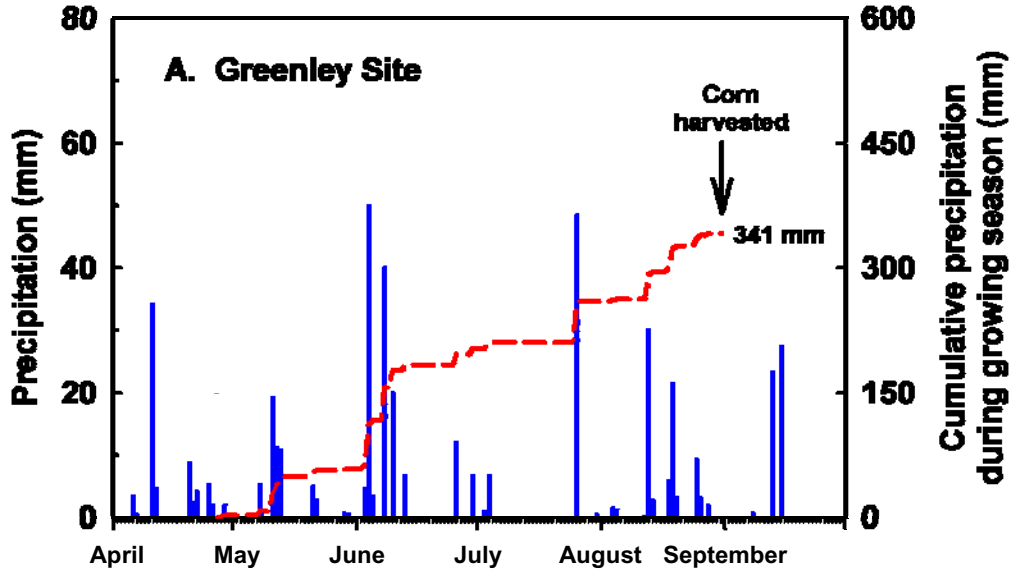

Figure 1. Rainfall at the Greenley Research Center at Novelty, MO for 2005.

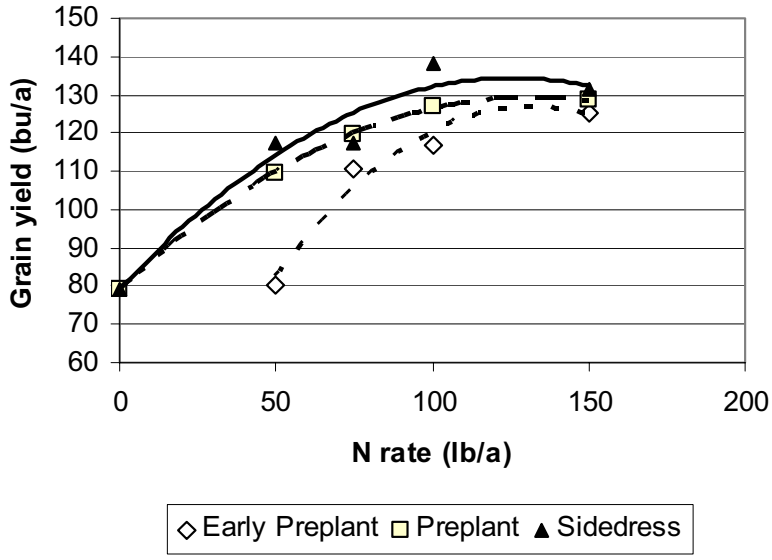

Figure 2. The effect of ESN rate applied early preplant (4 weeks before planting), preplant (at planting), and sidedress (4 weeks after planting) timings on corn grain yield in 2005. LSD (p=0.05) was 22.