

Comparison of ESN and Aqua Ammonia as Sources of Fall- and Spring-Applied N Fertilizer for Corn Production

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Introduction

We continue to search for methods and products that will increase nitrogen (N) use efficiency in corn production. Several years ago a controlled release N fertilizer was developed. The fertilizer is urea coated with a substance that controls the rate of N release based on the temperature and amount of soil water. It is currently sold in Iowa as ESN. The objective of this study was to compare the response of corn to addition of fall- and spring-applied ESN and aqua ammonia (AA) at different N rates.

Materials and Methods

The study was conducted from 2006 through 2007 at the Northern Research Farm (NRF) and at the Curtiss Farm near Ames. ESN and aqua ammonia were applied to small plots at rates of 0, 60, 120 and 180 lb N per acre in late fall and in the spring just prior to planting in both years. Both N sources were incorporated within hours of application. The previous crop at the NRF was soybean. The previous crop at Ames was corn. The experiments were harvested in mid- to late-October each year by combining the two center rows of each 4-row plot. The treatments were arranged as a factorial in a randomized complete block design with 4 replications each year. The two factors were fertilizer material to include at the time of application and N rate.

Results and Discussion

Northern Research Farm. Corn grain yields increased with N rate both years (Table 1). Yields varied somewhat among years reflecting differences in growing season weather. Comparison of the fertilizer materials, averaged over N rates, shows mixed results. In 2006, the fall-applied ESN and both spring-applied treatments yielded more than the fall-applied urea treatments. There was a trend for spring-applied treatments to have higher yields than the fall-applied treatments in 2007 although the differences were not statistically significant.

Ames. Corn grain yields increased with N addition in both years of the study (Table 1). The yields varied somewhat between 2006 and 2007 with the highest yields occurring in 2006. Fall-applied urea treatments had the lowest average yields both years ($p > F = < 0.0001$). It was wet in the spring both years at this site which undoubtedly resulted in losses of N from the root zone. In 2007, rainfall during the summer was less than normal, which resulted in lower overall grain yields, but losses of N due to spring precipitation must have occurred.

Conclusions

Based on these results we believe that use of ESN for fall-applied N is a reasonable alternative to the use of urea alone as long as the yield increase from the ESN is worth more than the extra cost of the ESN fertilizer. Producers should not expect a positive response to ESN with spring applications every year. However, in years when weather conditions result in losses of N it is likely that ESN will be a more efficient N source than urea.

Table 1. Corn grain response to fall- and spring-applied ESN and aqua ammonia fertilizers.

N Treatment	N rate	Grain yield ^a			
		Northern Farm		Ames	
		2006	2007	2006	2007
	lb/a	-----bu/a-----			
Fall AA	0	119	108	100	77
	60	110	162	138	104
	120	156	171	133	120
	180	172	194	148	131
Average		139	159	130	108
Fall ESN	0	119	96	111	88
	60	169	165	171	113
	120	185	185	194	135
	180	185	195	214	171
Average		164	160	172	127
Spring AA	0	97	103	114	100
	60	152	164	162	128
	120	177	197	182	163
	180	198	198	204	187
Average		156	166	165	145
Spring ESN	0	123	135	95	73
	60	173	160	169	128
	120	191	190	185	180
	180	201	189	211	205
Average		172	168	165	147
Statistics		-----p > F-----			
N rate		<0.0001	<0.0001	<0.0001	<0.0001
N Treatment		<0.0001	NS	<0.0001	<0.0001
N rate*N Treatment		0.0165	0.0699	0.0131	0.0001

^a15.5% moisture.