PROGRESS REPORT FOR 2007 FIELD SEASON

Title: Can Arkansas Corn Growers Increase their Profit Margin by Using Agrotain?

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BACKGROUND INFORMATION

The project will evaluate the potential of a urease inhibitor (Agrotain) for reducing N losses (ammonia volatilization) from the surface applied urea. The growers will benefit from an increase in N-use efficiency and profit margin. The outcomes will enhance the long-term economic and environmental viability of corn production in Arkansas.

The 2007 cropping season was the first year of this three year project. Field studies were conducted to evaluate the effect of urea and urea treated with Agrotain on leaf N concentration, corn grain yield, and grain N content. At the end of the study we will use the results to 1) evaluate the effect of urea and urea plus Agrotain on grain yield and grain N uptake, 2) investigate the effect of urea and urea plus Agrotain on residual soil N, and 3) investigate site characteristic where the growers can benefit from Agrotain use.

PROCEDURES

Five replicated field experiments were conducted at multiple locations on soils commonly used for corn production in Arkansas. Three of the sites were on commercial farms in Clay (CLZ71), Cross (CRZ71) and Jackson (JAZ71) County. The other two sites were located on University of Arkansas Agricultural Experiment Station Research Stations in Lee (LEZ71) and Mississippi (MSZ61) County. Information on previous crop, corn cultivar, and agronomically important dates are listed in Table 1. Soil samples were collected from the 0- to 6-inch depth at each site and composited by replicate prior to planting and fertilization. Soil samples were processed and analyzed by standard methods of the University of Arkansas Soil Testing and Research Laboratory in Marianna Arkansas extracted with Mehlich-3 solution and the concentration of elements in the extract was measured by Inductively Coupled Plasma Atomic Emission Spectroscopy. When needed P, K, S, and Zn fertilizers were applied to each site following University of Arkansas Cooperative Extension Service soil-test recommendations for corn. All sites were irrigated and irrigation timing was managed by the cooperating growers or using the University of Arkansas Cooperative Extension Service Irrigation Scheduler program at AES sites.

Plots were 25-ft long and 4-rows wide. The experimental treatments were arranged in a factorial design of two N sources and (urea only and urea treated with Agrotain) and six total N rates. Nitrogen fertilizer was applied in split applications at total-N rates of 0, 60, 120, 180, 240, and 300 lb N/acre. Prior to or at planting, 20 lb N/acre as ammonium sulfate was side-dressed at all sites to all plots except the 0 N control plots. The balance of each total-N rate was sidedressed as urea only or urea treated with Agrotain by hand when plants were at the 5-to 9-leaf stage. Prior

to the application of sidedressed N, soil samples were collected from the 0 N plots from the 0-to 12-inch soil depth and processed as described previously for soil NO_3-N concentrations.

At the AES sites, the two center rows of each plot were harvested with a plot combine. At commercial farm sites, one 15-ft long section from the two center rows of each plot was hand harvested. .

Each experiment design was a randomized complete block with four or five replications of each N rate. Analysis of variance (ANOVA) was performed using the GLM procedure of SAS. Sites were analyzed separately. Mean separations were performed by the Waller Duncan minimum significant difference (MSD) test at significance levels of 0.05 and 0.10.

2007 RESULTS

In the 0-to 6-inch depth the soil texture ranged from sandy loam to clay loam (14-47% clay), soil pH ranged from 5.6 - 6.6, and preplant soil NO_3-N ranged from 18 to 73 ppm (Table 2). Corn grain yield response to N source by N rate interaction effect was not significant ($P \geq 0.2695$) at any of the sites (Table 3). However, N rate significantly ($P < 0.0001$) increased corn grain yield at all sites except CRZ71 ($P=0.4047$). Lack of response to N fertilization at this site can be attributed to high residual N level in the soil (Table 2). At N responsive sites corn grain yields were 15-174 bu/acre in the unfertilized control plots and 101-242 bu/acre for the highest N rate of 300 lb N/acre (Table 3). The N rates required to produce near maximal yields were 180-300 lb/acre and were consistent with N-rate trials studies conducted in previous years (Mozaffari et al., 2006; 2007). Nitrogen source significantly ($P \leq 0.024$) affected corn grain yield at JAZ71 and MSZ71 and did not have any significant effect ($P \geq 0.2805$) on corn grain yield at LEZ71 and CLZ71 (Table 4). Averaged across all N rates, application of Agrotain increased corn grain yield by 15 and 21 more bushels at JAZ71 and MSZ71 sites respectively.

Table 1. Selected agronomic information for corn N-fertilization experiments conducted at Agricultural Experiment Stations and commercial fields in Arkansas during 2006.

Site ID	Previous crop	Cultivar	Planting date	N application dates		Harvest date
				1st	2nd	
CLZ71	soybean	Pioneer 33P67	4-April	10-May	30-May	27-Aug
CRZ71	soybean	Pioneer G17BTRR	21-April	22-May	5-June	28-Aug
JAZ71	corn	Pioneer31G71RR2	4-April	8-May	25-May	30-Aug
LEZ71	corn	Pioneer 32B32	13-April	6-May	4-June	15-Aug
MSZ71	corn	Pioneer 32B32	23-April	9-May	29-May	17-Aug

[a] Seedling emergence occurred 7-10 days after planting

Table 2. Selected soil chemical property means (0 -to 6-inch depth) of samples taken before planting in corn N- fertilization trials conducted at Agricultural Experiment Stations and commercial fields in Arkansas during 2007.

Site ID	Soil pH	Soil NO_3-N	Mehlich-3-extractable nutrients							Soil physical properties			
			P	K	Ca	Mg	Mn	Cu	Zn	Sand	Silt	Clay	Texture
		(ppm)								(%)			
CLZ71	5.7	50	70	152	1126	270	383	1.3	8.6	2	71	27	Silt loam
CRZ71	5.7	73	38	98	1438	279	159	1.2	5.0	2	72	26	Silt loam
JAZ71	6.1	29	103	185	656	86	169	0.7	4.9	74	13	14	Sandyloam
LEZ71	6.6	26	51	104	1007	932	135	1.1	1.6	30	56	14	Silt loam
MSZ71	5.6	18	73	263	3154	659	112	4.0	5.9	31	22	47	clay

[a] Soil pH was measured in a 1:2 (weight:volume) soil-water mixture.
[b] NO_3-N measured by ion-specific electrode.

Table 3. Effect of N-fertilizer source (urea and urea plus Agrotain) and rates on corn grain yield in five trials conducted at Agricultural Experiment Stations and commercial farms in Arkansas during 2007.

Total-N rate	CLZ71			CRZ71			JAZ71		
	N source		Mean of N sources	N source		Mean of N sources	N source		Mean of N sources
	Urea	Urea + Agrotain		Urea	Urea + Agrotain		Urea	Urea + Agrotain	
lbs N/acre	---------- Grain yield (bu/acre) ----------								
0	174	160	168	151	120	135	107	131	119
60	204	216	210	150	159	154	186	208	195
120	225	233	228	143	146	144	197	221	208
180	230	241	235	168	141	154	188	221	204
240	237	258	247	151	160	155	210	212	210
300	242	240	241	156	150	152	202	226	213
MSD 0.05 [a]	interaction was NS		14	interaction was NS		NS	interaction was NS		22
MSD 0.10 [b]	interaction was NS		12	interaction was NS		NS	interaction was NS		19
p value	interaction =0.3199		<0.0001	interaction =0.2817		0.4074	interaction =0.9118		<0.0001

[a, b] Minimum significant difference at P=0.05 and P=0.10 as determined by Waller-Duncan

Table 3. (continued) Effect of N-fertilizer source (urea and urea plus Agrotain) and rates on corn grain yield in five trials conducted at Agricultural Experiment Stations and commercial farms in Arkansas during 2007.

Total-N rate	LEZ71			MSZ71		
	N source		Mean of N sources	N source		Mean of N sources
	Urea	Urea + Agrotain		Urea	Urea + Agrotain	
lbs N/acre	Grain yield (bu/acre)					
0	45	43	44	15	19	16
60	67	81	73	74	103	86
120	101	82	91	106	118	111
180	83	85	84	139	142	140
240	101	91	95	142	159	151
300	101	115	105	162	170	166
MSD 0.05 [a]	interaction was NS		15	interaction was NS		16
MSD 0.10 [b]	interaction was NS		13	interaction was NS		14
p value	interaction =0.2695		<0.0001	interaction =0.1446		0.7728

Table 4. Effect of N-fertilizer source (urea and urea plus Agrotain) on corn grain yield averaged across all N rates in five trials conducted at Agricultural Experiment Stations and commercial farms in Arkansas during 2007.

Nitrogen source	Study Site				
	CLZ71	CRZ71	JAZ71	LEZ71	MSZ71
	Yield (bu/acre)				
Urea only	218	152	181	84	104
Urea plus Agrotain	228	145	202	79	119
P value for N source	0.1849	0.2805	0.0040	0.7020	0.0244

[a] Minimum significant difference at $P=0.05$ as determined by Waller-Duncan test.

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