Effects of Polymer Coated Urea on Corn Yield

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Background

Approximately 225 million pounds of nitrogen are applied to corn annually in Kentucky. Since the price of nitrogen has risen dramatically, farmers are currently looking for ways to improve nitrogen use efficiency by improving application timing and/or decreased overall fertilizer rates. Nitrogen is by far the largest fertilizer input for these farmers. Fertilizer recommendations used by the University of Kentucky recommends reducing total N application by 35 lbs/a when nitrogen is applied to corn approximately 1 month after planting. By delaying N applications for approximately one month, the potential for N loss via denitrification and leaching are dramatically reduced. Although farmers realize that they can potentially save money by applying N later and reducing the rate, few are actually doing this because they don't have the time (because of planting soybeans) or equipment needed for side-dress applications. Polymer coated urea (PCU) offers a potential remedy for this problem. Ideally, PCU could be applied a week or two in advance of corn planting, and because of it's slow release would not be subject to as much loss a standard urea. This study was initiated to compare PCU to urea applied at planting and also to compare pre-plant PCU to urea applied at the V6 growth stage.

Research Approach

The study was initiated in the spring of 2003 on imperfectly drained soils located near Lexington and Princeton, KY. The objective was to compare application timing of PCU (product name is ESN manufactured by Agrium Inc.) and ammonium nitrate (AN) for corn production. Pre-plant application of either PCU or AN at 0, 50, 100, 150, and 200 lbs N/a were applied. In addition to the pre-plant treatments, additional treatments were established to mimic best management practices for corn production. These treatments consisted of a 50 lbs N/a (AN) applied at planting and 0, 50, 100, and 150 lbs N/a (AN) applied at V6. Ammonium nitrate was selected to prevent volatilization loss and assure maximum yield. Corn was planted on April 14 at Princeton (Cropland Genetics 818RR-BT) and May 1 at Lexington (Pioneer 31R88). Data collected included dry matter and N uptake at V6 (for the preplant applications only) and grain at maturity.

Results and Discussion

Early season temperature and precipitation (from planting to V6) was cooler and wetter than normal (Fig. 1 and 2), but growing conditions overall were very good and yield potential for both sites was very high.

The measured plant responses to fertilizer source and application timing are given in Table 1. There was not a significant source by rate interaction for any of the parameter measured. Although not significant, there was a trend for both dry matter and N uptake at the V6 growth stage to be higher for the PCU treatment as compared to the AN treatment. At the Princeton location, N uptake at V6 was significantly ($p<0.10$) higher for PCU than AN. Dry matter and N uptake increased as N rate increased at both locations.

There was not a significant source by rate interaction or source main effect for grain yield at either location (Fig. 3 and 4). As expected, grain yield increased as N rate increased. Average grain yield for each treatment is listed in Table 2.

Conclusions

For this year of the study, PCU applied prior to planting produced yields equivalent to split application of ammonium nitrate. This demonstrates that nitrogen from the PCU was not lost via volatilization, and that the release of N from the PCU was quick enough to obtain maximum production. This research will be repeated in 2004 at three locations to test PCU's performance in a second year and on less well drained soils.

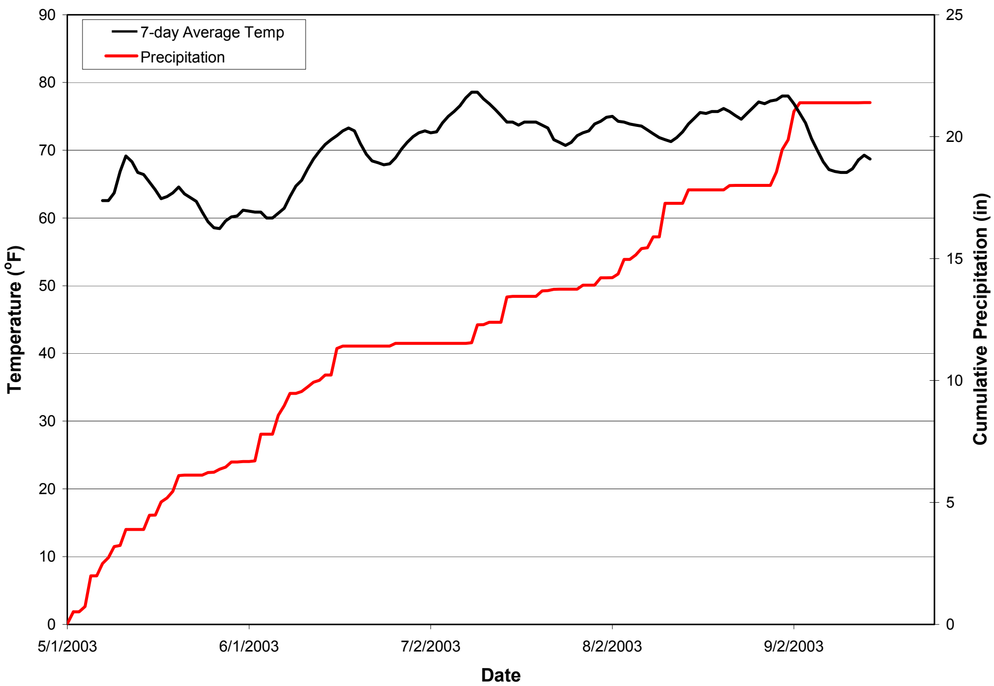

Figure 1. Seven-day moving average air temperature and cumulative precipitation for the Lexington site, 2003.

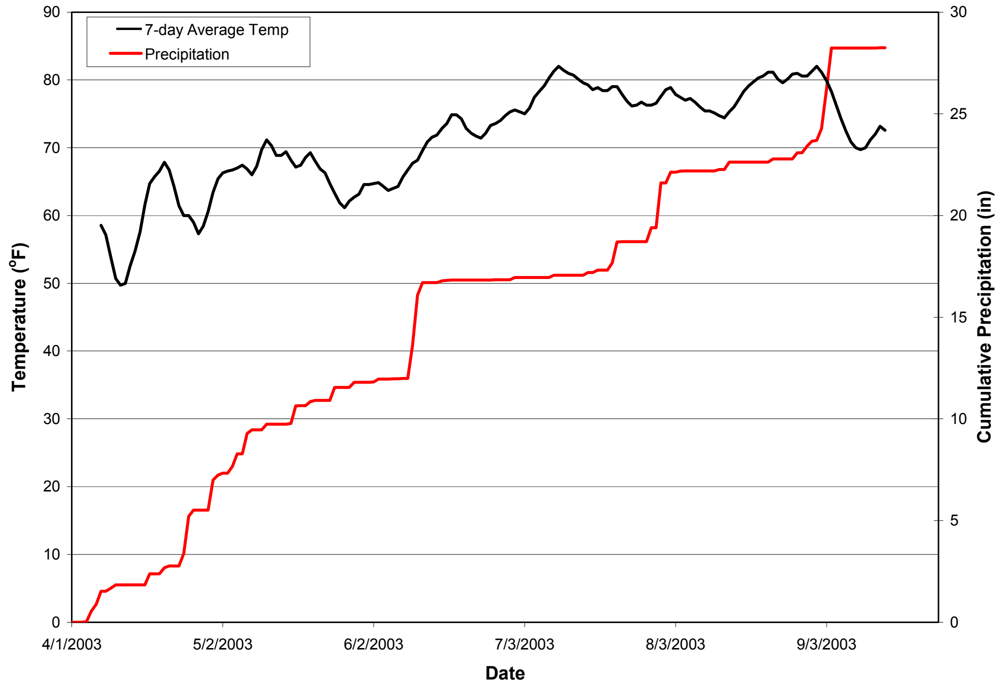

Figure 2. Seven-day moving average air temperature and cumulative precipitation for the Princeton site, 2003.

Table 1. Dry matter and N uptake at V6 for the Lexington and Princeton locations, 2003.

	Lexington		Princeton	
	V6 Dry Matter	V6 N Uptake	V6 Dry Matter	V6 N Uptake
	---------- lbs/a ----------			
Source				
Amm. Nitrate	453	14.45	363	12.22
PCU	463	15.59	391	13.92
LSD $_{(0.10)}$	NS	NS	NS	1.55
Rate				
0	332	8.08	230	6.19
50	468	13.08	322	10.02
100	419	13.39	372	12.57
150	443	15.42	404	14.38
200	501	18.18	412	15.32
LSD $_{(0.10)}$	62	2.16	53	1.93

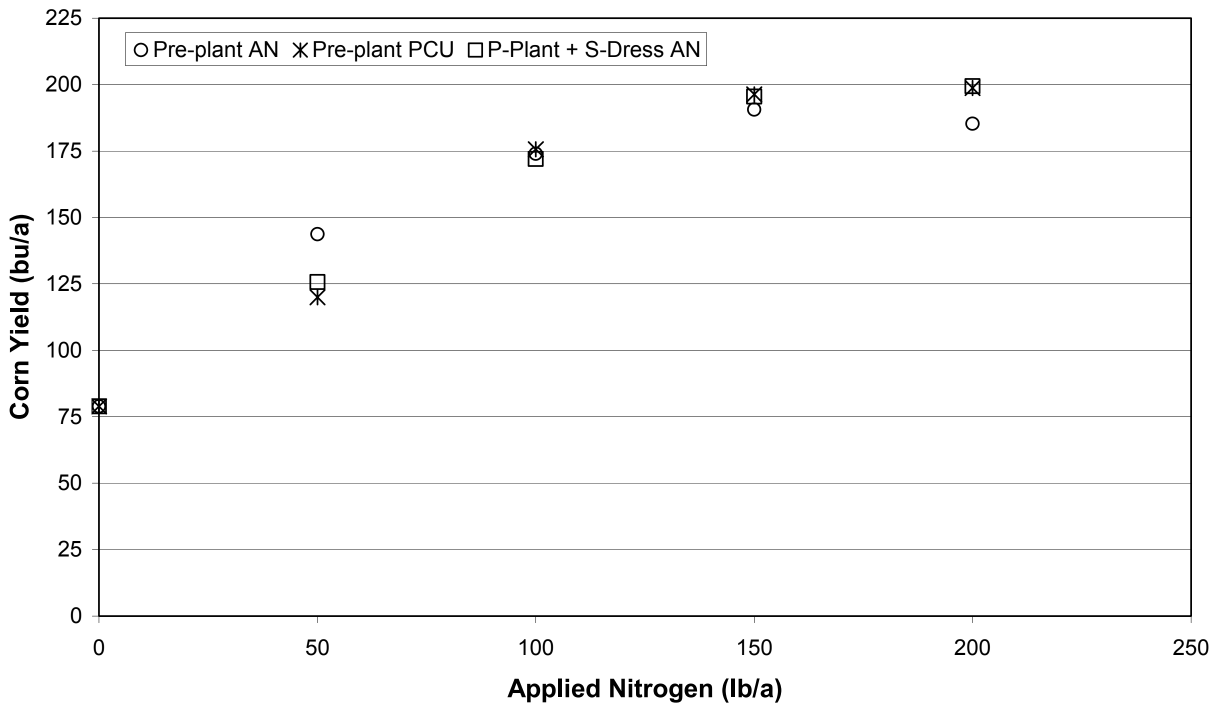

Figure 3. Corn yield for pre-plant PCU, pre-plant AN, and side-dress AN treatments at Lexington, 2003.

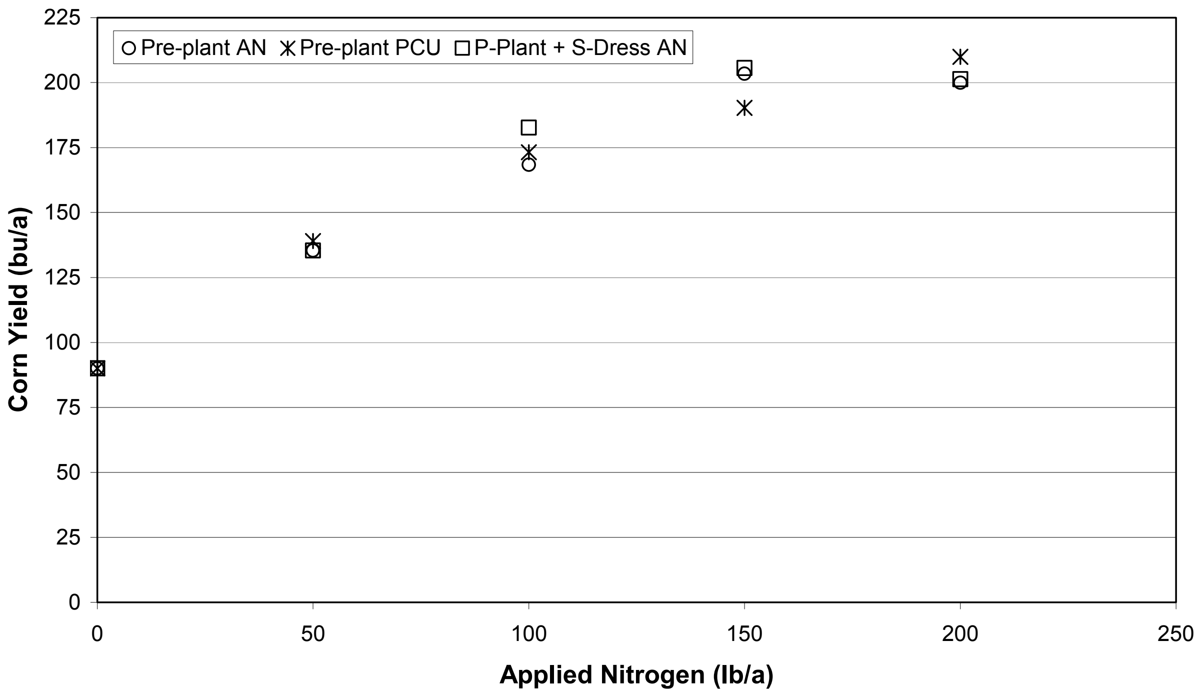

Figure 4. Corn yield for pre-plant PCU, pre-plant AN, and side-dress AN treatments at Princeton, 2003.

Table 2. Corn yield as affected by N rate and source for Lexington and Princeton, 2003.

	Lexington			Princeton		
Nitrogen Rate	Pre-Plant		Side dress	Pre-Plant		Side dress
lbs/a	AN	PCU	AN	AN	PCU	AN
	--------------- lbs N/a ---------------			--------------- lbs N/a ---------------		
0	78.9			90		
50	144	120	126	135	139	135
100	174	176	172	168	173	183
150	191	196	195	203	190	206
200	185	198	199	199	209	201