THE POTENTIAL USE OF POLYMER-COATED UREA AS AN IN-FURROW FERTILIZER FOR CORN

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Most of the soils in Northwest Ohio are medium to fine texture with poor internal drainage. Tile drainage has improved these fields, but nitrogen loss still often occurs from denitrification, especially during cold and wet springs. The use of no-till practices has accentuated the problem. Starter fertilizers at planting have often improved the early growth of corn under these cold and wet conditions. However, weather conditions may prevent timely sidedressing after planting, and cause N deficiency in the crop. One way to overcome this problem is to use higher N rates in starter fertilizers, but this answer may cause salt damage for in-furrow placement. Polymer-coated urea (PCU) is a potential product that may reduce the risk of salt damage from in-furrow placement. This product uses a membrane polymer to release N at a slower rate than urea. It is not known whether this time release is adequate to provide ample N for the corn crop and reduce the potential for salt damage. The objectives of this corn study are 1) to determine yield effects of in-furrow applications of PCU and urea, 2) to determine population effects for in-furrow applications of PCU and urea, and 3) to determine yield effects of similar PCU products with different N release rates.

Materials and Methods

A starter fertilizer study for corn was established in 1997 on a Hoytville clay at the Northwestern Branch of the Ohio Agricultural Research and Development Center (Custar, OH). Countrymark Co-op Seed Brand N6800Bt was planted into a no-till site at 28,000 seeds per acre. Previous crop was soybeans.

Experimental design was a complete randomized block consisting of eleven N treatments replicated four times. Treatments included in-furrow and 2 X 2-band placement. In-furrow treatments were applied via planter insecticide boxes at a planting speed of 1 mile per hour. Band placements used conventional planter fertilizer boxes. Planter was a John Deere Max Emerge 7000. Polymer-coated urea was Pursell Technologies POLYON®AG PCU with a N grade of 44.5% (PCU-44.5) and a N grade of 44% (PCU-44), which has a thicker release membrane than PCU-44.5. In-furrow treatments consisted of the following N rates (lb./A): 7.5 and 40 for urea, PCU-44.5, and PCU-44, and 20 for both polymer-coated urea material. A 40 lb./A N rate of urea and PCU-44.5 were applied in 2 X 2 bands. A zero N starter rate was used as a control. Urea-ammonium nitrate (28%) was broadcast applied to all treatments at growth stage V6 (sixth leaf collar) so that each treatment would have a total N rate of 150 lb./A (starter plus sidedress).

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Ten whole plants were collected from each treatment at growth stage V6 for N plant analysis. Analysis was completed at the Research-Extension Analytical Laboratory (Wooster, OH).

Yield and harvest grain moisture was determined from the two inner rows of a four-row 10 X 75-foot plot. Statistical analysis was ANOVA.

Results and Discussion

Weather conditions were generally cool and wet throughout the growing season. Planting conditions were good, but cool and wet conditions were prevalent during the month of May. Drier and warmer conditions returned in June. Precipitation was adequate for the rest of the season. Temperatures were mild during July and August.

Treatment means for yields, harvest moisture, harvest population, and N content are shown in Table 1. Each measurement had significant differences. For yield measurements, treatments were not statistically different than the 0 pound N treatment, suggesting no yield benefit from starter fertilizer.

Each in-furrow treatment of PCU had higher yields than the corresponding urea treatment, but was not statistical significant (Table 1). Yields generally decreased with higher rates of in-furrow N, including PCU. Even though the 40-lb. N rates yielded 4% less than the 10-lb. rate, the differences were not significant. This trend would suggest that some damage to the root system may have occurred at more concentrated N rates. Further evidence of damage is suggested by the 40-lb. banded urea treatment, which had significantly higher yields than all 40-lb. in-furrow treatments. Other in-furrow treatment rates were not significantly different than the 40-lb. banded urea.

Differences between polymer thickness were not evident. Yields were similar between the two polymer-coated urea products at the 10-lb., 20-lb., and 40-lb. in-furrow N rate (Table 1).

There were significant differences for harvest moisture between treatments, but not a general trend (Table 1). Polymer-coated urea treatments were not statistically different then the corresponding urea treatments.

Populations were significantly different between treatments, but were not correlated with yields (data not shown). The same was true for plant N content. Polymer-coated urea in-furrow treatments generally had lower plant N content than corresponding urea treatments, but were not statistically different.

Summary

In-furrow treatments of PCU did not negatively affect yields, harvest moisture, harvest population or plant N levels compared to urea checks. Even though not significant, PCU had larger yields than the corresponding urea check. The data would suggest that there is no yield advantage of applying more than 10-lb N in-furrow; and the potential for yield reduction may occur at rates higher than 20 lb. Various rates of urea and PCU did not affect population; thus emergence was not affected by either product in-furrow. There was no advantage using a slower N release product (thicker release membrane) for yield or population. Thus, it would be more economical to use the thinner membrane product (PCU-44.5). Overall, this data would suggest that PCU may have

benefits over urea for in-furrow use. This study will be continued for another year, particularly since there was not a yield benefit from starter fertilizer. Yield benefits from starter fertilizers generally occur on the lake bed soils of Northwest Ohio.

Table 1. Corn yield, moisture, population, and plant N content for various rates of urea and polymer-coated urea.

N rate / N source	Yield	Moisture	Population	Plant N
	Bu/acre	------%-----	Plants/acre	----%----
None	189.9	21.2	22,000	4.22
10 lb. Urea IF[a]	188.9	21.2	23,200	4.60
10 lb. PCU-44.5[b] IF	193.5	20.5	22,200	4.48
10 lb. PCU-44[c] IF	195.8	20.5	23,000	4.55
20 lb. PCU-44.5 IF	193.3	20.3	23,200	4.58
20 lb. PCU-44 IF	191.5	20.5	23,500	4.23
40 lb. Urea IF	181.1	20.3	22,300	5.08
40 lb. PCU-44.5 IF	186.5	20.7	22,000	4.40
40 lb. PCU-44 IF	185.6	20.8	23,400	4.50
40 lb. Urea Band[d]	197.5	19.1	22,100	4.73
40 lb. PCU-44.5 Band	190.3	20.1	22,200	5.00
$LSD_{0.05}$	9.5*	1.1*	1,100*	0.47*

[a]IF = in-furrow; [b]PCU-44.5 = polymer-coated urea at an N rate of 44.5%; [c]PCU-44 = polymer-coated urea at an N rate of 44 %; [d]Band = 2 inches below and 2 inches side of seed

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