THE POTENTIAL USE OF POLYMER-COATED UREA AS A SPRING NITROGEN SOURCE FOR WHEAT

E.M. Lentz and J. W. Johnson[1]

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. Growers compensate for this potential loss by applying more N at green-up or split spring applications, both of which add costs. A slow release N fertilizer may reduce the need for more N or split applications. One of the new time release N products is polymer-coated urea (PCU). However, little is known about its potential use as an N source for wheat. The objectives of this wheat study are 1) to determine yield effects of spring applications of PCU and urea, 2) to determine yield effects of PCU/urea mixtures compared to PCU or urea alone, and 3) to determine yield effects of similar PCU products with different N release rates.

Material and Methods

A spring nitrogen fertilizer study for wheat was established in 1996/97 on a Hoytville silty clay loam at the Vegetable Crops Branch of the Ohio Agricultural Research and Development Center (Fremont, OH). Variety 'Hopewell' was planted at 110 lb./A. Previous crop was soybeans.

Experimental design was a complete randomized block consisting of 22 N treatments replicated four times. Nitrogen sources were urea, and Pursell Technologies polymer-coated urea, POLYON®AG PCU with an N grade of 44% (PCU-44) and POLYON®AG PCU with an N grade of 43.5 (PCU-43.5). All treatments received 20 lb./A of N in the fall except for the zero check (Table 1). All other N applications were spring topdress. Seven urea treatments were N controls (0 – 120 lb./A at 20 lb. increments) applied at first green-up. Other treatments were PCU alone or in combination with urea applied at green-up. Urea was used at Feekes growth stage 6 applications. Fertilizer was applied with a Gandy 1010 drop spreader.

Head counts were determined by sampling a three foot row in three random areas of each plot. A chlorophyll meter was used to estimate plant N differences at Feekes growth stage 7 and at anthesis

Plots consisted of thirteen 75-foot long rows. Rows were 7 ½ inches apart. Center nine rows were harvested for yield and grain moisture. Statistical analysis was ANOVA.

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[1]Assistant Professor, Department of Extension and Professor, School of Natural Resources, The Ohio State University. Findlay and Columbus, OH, respectively

Results and Discussion

Mild conditions prevailed for most of the growing season. Temperatures were warmer than normal for most of the winter. Rainfall was near normal except dry conditions during flowering and grain fill. Hot temperatures occurred during much of the grain fill period. Weather conditions were such that disease was not a factor in plots.

Yield, harvest moisture, and head count are given for each treatment (Table 2). There were no statistical differences between treatments for harvest moisture. Significant differences were detected for yield and head count.

Yields ranged from 59 to 83 bushels per acre (Table2). Treatments with total N rates greater than 40 lb. had significantly greater yields than the 20 and 0-lb. treatments. Yields were similar for treatments with N rates greater than 60 lb. except for PCU treatments at the 60-lb. total N rate. At this rate, the urea topdressed at green-up had yields that were 13% more than the PCU-44 treatment and 8% more than the PCU-43.5 and urea/PCU mixes. Polymer-coated urea treatments were statistical similar to urea treatments at other N rates.

Most of the treatments had similar yields. Possibly this occurred because yields did not increase at N rates above or equal to 60 lb., and most treatments were above 60 lb. Yield responses may have been more frequent if more N treatments were 40–80 lb., rather than 60–100 lb. In addition, our yield goals were for several treatments to reach at least 100 bushels per acre. However, high temperatures during grain fill decreased the yield maximum to around 80 bushels per acre.

Number of heads ranged from 45 to 66 (Table 2). All N treatments had significantly more heads than the zero N treatment. Urea green-up treatments generally had the most heads at a given total N rate. In most cases, head counts from green-up treatments were not statistical different than the urea check at a given total N rate, except for the 60 lb. PCU-44 treatment at the 80-lb. total N rate. This treatment had 13% fewer heads than the urea check.

Only the 100-lb. total N rate had treatments with split spring applications. Yields were similar between the split spring and green-up applications. However, the green-up urea treatment at this rate had the most heads. The split spring applications of urea had more heads than the PCU treatments, but were not statistical different.

Yields were similar between treatments that had urea applications at green-up and urea applications at Feekes growth stage 6. Urea treatments at green-up tended to have more heads than treatments of urea at Feekes growth stage 6, but was only significant at the 100-lb. total N rate. At the 60-lb. total N rate, PCU green-up treatments yielded less than the application of urea at Feekes growth stage 6, but only the 40-lb. PCU-44 treatment was significant.

Yields and head counts were similar between the two PCU products at a given total N rate. Mixtures using urea and smaller amounts of PCU also had similar yields to PCU treatments at the same N rate, but head counts were variable. This would suggest that there was not a benefit from using thicker coatings and that mixtures may be more desirable than PCU products alone.

Summary

This study did not find a significant yield advantage between PCU and urea. This is not unexpected because weather conditions were not conducive to N losses. This study would suggest that mixtures of urea and PCU were as effective as PCU and may be more economical for production practices. Also the use of a thicker membrane would not be an advantage for spring applications of N. This study will be continued another year since N losses were not observed in 1998. In most years, N loss is a problem in this part of the country.

Table 1. Nitrogen rates and application times for urea and/or polymer-coated urea on wheat.

Treatment	Total N rate	Time of Application and N Source				
		Fall[a]	Green-up[b]			Feekes 6[c]
			Urea	PCU-44[d]	PCU-43.5[e]	
	lb./acre					
1	0	0	0	0	0	0
2	20	20	0	0	0	0
3	40	20	20	0	0	0
4	60	20	40	0	0	0
5	60	20	0	40	0	0
6	60	20	0	0	40	0
7	60	20	20	20	0	0
8	60	20	0	0	0	40
9	80	20	60	0	0	0
10	80	20	0	60	0	0
11	80	20	40	20	0	0
12	80	20	20	40	0	0
13	80	20	0	0	0	60
14	100	20	80	0	0	0
15	100	20	20	60	0	0
16	100	20	40	40	0	0
17	100	20	40	0	40	0
18	100	20	40	0	0	40
19	100	20	0	40	0	40
20	100	20	20	20	0	40
21	100	20	0	0	0	80
22	120	20	100	0	0	0

[a]topdress N applied as urea before planting; [b]topdress N applied March 12, 1998; [c]topdress N applied as urea, April 7, 1998; [d]PCU-44 = polymer-coated urea with a N analysis of 44%; [e]PCU-43.5 = polymer-coated urea with a N analysis of 43.5%

Table 2. Wheat yield, grain moisture, and head count for various N rates of urea and polymer-coated urea (PCU).

Treatment	N Rate	Nitrogen Source	Yield	Moisture	Heads
	----------lb./acre----------		Bu/acre	---%---	--/ft²-
1	0	None	59	12.8	45
2	20	20, UF[a]	67	12.5	49
3	40	20, UF + 20, UG[b]	72	12.8	51
4	60	20, UF + 40, UG	82	12.7	58
5	60	20, UF + 40, PCU-44G[c]	72	12.7	52
6	60	20, UF + 40, PCU-43.5G[d]	76	12.8	52
7	60	20, UF + 20, UG + 20, PCU-44G	76	12.8	49
8	60	20, UF + 40, UFS[e]	78	12.5	53
9	80	20, UF + 60, UG	81	12.8	63
10	80	20, UF + 60, PCU-44G	83	12.6	55
11	80	20, UF + 40, UG + 20, PCU-44G	78	12.9	63
12	80	20, UF + 20, UG + 40, PCU-44G	81	12.6	61
13	80	20, UF + 60, UFS	78	12.7	59
14	100	20, UF + 80, UG	81	12.4	66
15	100	20, UF + 20, UG + 60, PCU-44G	81	12.4	60
16	100	20, UF + 40, UG + 40, PCU-44G	81	12.7	59
17	100	20, UF + 40, UG + 40, PCU-43.5G	80	12.5	60
18	100	20, UF + 40, UG + 40, UFS	80	12.7	61
19	100	20, UF + 40, PCU-44G + 40, UFS	80	12.8	59
20	100	20, UF + 20, UG + 20, PCU-44G + 40, UFS	79	12.8	59
21	100	20, UF + 80, UFS	79	12.6	59
22	120	20, UF + 100, UG	79	12.7	61
	$LSD_{0.05}$		5	n.s.	7

[a]UF = urea topdressed in fall, [b]UG = urea topdressed at first green-up in spring, [c]PCU-44G = polymer-coated urea with a N analysis of 44% topdressed at first green-up, [d]PCU-43.5G = polymer-coated urea with a N analysis of 43.5% topdressed at first green-up, [e]UFS = urea topdressed at Feekes growth stage 6

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Program Chair:
Dr. David Franzen
North Dakota State University
229 Walster Hall, Box 5758
Fargo, ND 58105
701-231-8884

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