

Evaluating the Efficiency of Nitrogen Extenders on Urea Applied on Wet Surface for Corn in 2016

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Urea is the cheapest, most readily available source of nitrogen to most crop producers. However, under certain conditions it is subject to losses through ammonia volatilization. If it is left on the surface in wet and hot conditions, the urease enzyme facilitates urea's reaction with water where the ultimate end product is ammonia gas and carbon dioxide. High soil pH further facilitates this process. Where tillage is used to incorporate urea right after application, the losses are insignificant because ammonia reacts with water turning into ammonium hydroxide which is not subject to volatilization. In a no-till management system, tillage would not be used for incorporating fertilizer, therefore a producer who wants to avoid nitrogen loss would either have to irrigate right after application or try to time the application before a significant rainfall event. Given that weather cannot be predicted with absolute certainty, there is always a chance that urea will sit on the surface for quite some time before rain can wash it into the soil.

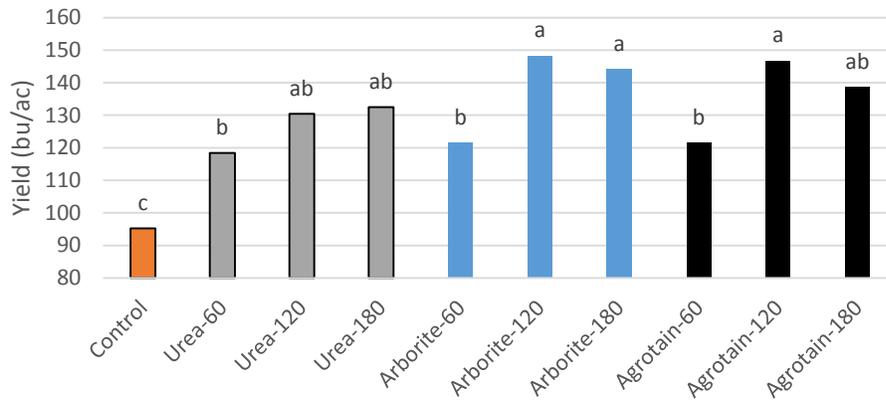
Materials and Methods

There are several products on the market for protecting urea from nitrogen losses. Two such products, Agrotain Ultra and Arborite Ag were used as a part of a trial at the CREC in 2016. Both of these products work by inhibiting the activity of the urease enzyme. Urea coated with these products was compared with uncoated urea at three nitrogen rates: 60, 120 and 180 lbs N/ac. There was also a control treatment where no nitrogen was applied. Right after planting 0.2 inches of water was applied. Nitrogen fertilizers were broadcast on the wet soil surface to enhance nitrogen loss. The trial was planted on May 17 and only received 0.22 inches of rain five days later. Between these two dates daily maximum temperatures were mostly in the high 70's. The pH of the top soil in the trial area was 8.1 and there was 26 lbs of nitrogen as nitrates in the top 24 inches.

Results and Discussion

Nitrogen enhanced yields compared to the check for all three products (Figure 1, Table 1). A yield increase between the 60 and 120 lb N rates was only significant for the Arborite- and the Agrotain-coated urea but not the plain urea even though there was an increase with nitrogen rates. The highest yield was achieved with the Arborite-coated urea at 120 lbs N (148 bu/ac), but was not significantly different from the Agrotain 120 lb N treatment (147 bu/ac). These yields were 18 and 17 bushels higher respectively, compared with plain urea at the same nitrogen level. Grain yield was higher where nitrogen extenders were applied at each nitrogen level. Applying nitrogen at the 180 lb level lowered yield compared to the 120 lb N level for the two nitrogen extenders and did not significantly raise it for plain urea. Fertilizer recovery was best at the 60 lbs N, Agrotain-coated urea treatment and worst for the 180 lbs N, urea treatment (Figure 2, Table 1). The rest of the treatments were not significantly different from each other. However, fertilizer recovery was better at every rate with nitrogen extenders.

Fig. 1. Corn yield response to N-rates applied as urea with or without nitrogen extenders

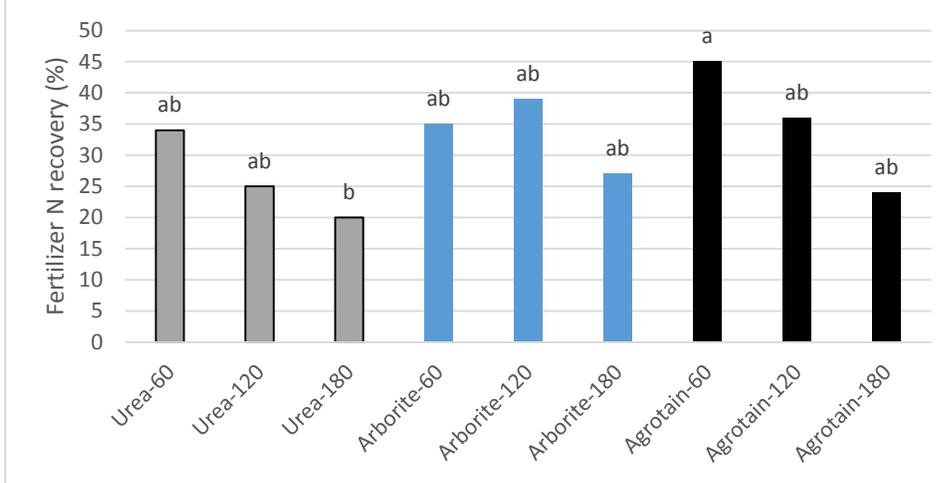


Means separated by different letters are significant at $P < 0.05$.

Table 1. Corn yield and nitrogen use efficiency response to nitrogen applied as a starter on wet surface with or without nitrogen extending products.

Trt	Trt name	Yield bu/ac	Protein %	Starch %	N removed by grain lb/ac	Fertilizer recovery %
1	Control	95	7.15	72.28	61	.
2	Urea-60	118	7.68	72.94	82	34
3	Urea-120	130	7.75	73.52	90	25
4	Urea-180	132	8.18	73.37	97	20
5	Arborite-60	122	7.51	73.06	82	35
6	Arborite-120	148	8.08	73.09	108	39
7	Arborite-180	144	8.45	72.83	109	27
8	Agrotain-60	122	8.07	73.15	88	45
9	Agrotain-120	147	7.94	73.06	104	36
10	Agrotain-180	139	8.47	73.17	105	24
C.V. (%)		11	4.35	1.09	11.62	45.36
LSD (0.05)		20	0.4978	NS	16	NS

Fig. 2. Fertilizer recovery of N applied with or without nitrogen extenders at three N rates



Means separated by different letters are significant at $P < 0.05$.

Sometimes when yield response to plain urea is compared to yield response to urea coated with nitrogen extenders, the advantage is not always apparent, but in this case the conditions of the wet surface of a high pH soil, coupled with a long period without rain and high temperature allowed these products to shine. A farmer might benefit the most from coating urea with Agrotain Ultra or Arborite Ag in a no-till management system on a late planted crop, or at a mid-season side-dressing application, where surface-applied broadcasted urea is at the mercy of the elements. Even though no one is likely to apply urea on a freshly irrigated surface, similar conditions can arise if a farmer applies on the surface anticipating heavy rain which ends up being nothing but a drizzle, just enough to wet the urea, but not enough to take it under ground. For this reason, one might consider applying these urease-inhibiting products as an insurance against potential nitrogen losses through volatilization.