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## Limiting N Loss In No-till Corn And Grain Sorghum Production

*Slow-release polymer-coated urea product are beginning to become available for agricultural use.*

**Summary:** In both the corn and grain sorghum experiments, the treated urea products yielded better than those untreated, and were similar to ammonium nitrate. There were no significant differences in yield of ESN, Agrotain, or Nutrisphere-N. In the corn experiment that included UAN (28%), yield of UAN treated with Agrotain Plus or Nutrisphere-N was greater than that of untreated UAN. If producers wish to broadcast urea-containing fertilizer on the soil surface in no-till production systems, there are several products available that are very effective in limiting N losses and increasing N-use efficiency.



No-till production systems are being used by an increasing number of producers in the central Great Plains because of several advantages, which include 1) reduction of soil erosion losses, 2) increased soil water-use efficiency, and 3) improved soil quality. However, the large amount of residue left on the soil can make nitrogen (N) management difficult. Nitrogen losses due to volatilization from broadcast urea-containing fertilizers in no-till production systems can be significant. Surface applications of urea-containing fertilizers are subject to volatilization losses. Depending on conditions, losses can be 10

to 20 percent of the applied N. Nitrogen immobilization also can be a problem when N fertilizers are surface-applied in high-residue production systems. Leaching can be a further problem on coarse-textured soils when N is applied in one preplant application.

However, on the brighter side, products that control urea solubility or affect urea hydrolysis and nitrification are available for agricultural use to help reduce volatilization, leaching, and denitrification losses. Slow solubility polymer coatings (ESN) allow urea to be released at a slower rate than uncoated urea. Recently,

a new product (Nutrisphere-N) that is a copolymer of maleic and itaconic acids has become available and has shown potential in reducing urea-N losses and improving yields. Agrotain is another commercially available urease inhibitor and has proven in numerous studies to be effective in reducing N losses to volatilization.

The objectives of the experiments in this discussion, one with irrigated corn and the other with dryland grain sorghum, were to 1) evaluate N efficiency from surface broadcast applications of urea-containing N, 2) try to reduce N loss, and 3) improve efficiency with the use of products designed

to limit N volatilization and loss.

### Treated vs. Untreated

Two studies were conducted, one with irrigated corn and the other with dryland grain sorghum. The irrigated corn study compared urea (46% N), UAN (28%), a controlled release polymer-coated urea (ESN), Agrotain, Agrotain Plus, Nutrisphere-N, and ammonium nitrate at three N rates (80, 160, and 240 lbs/A). A no-N check plot was also included. The dryland grain sorghum study consisted of untreated urea, ammonium nitrate, ESN, and urea treated with Agrotain or Nutrisphere-N. Nitrogen rates included were 40, 80, and 120 lbs/A as well as a no-N check. Both studies were conducted on Crete silt loam soils.

**Irrigated.** Grain yield of irrigated corn plots receiving untreated urea was lower than plots receiving urea treated with Agrotain, ESN or Nutrisphere-N at all levels of applied N (Table 1). Yields achieved with Agrotain, ESN and Nutrisphere were equal to those of ammonium nitrate. Yields achieved with UAN (28%) alone were also lower than those from UAN treated with Agrotain, Agrotain Plus, or Nutrisphere-N. When averaged over N rates, yields of all treated N products were greater than untreated urea or UAN (Table 2). There were no significant differences in yields of Agrotain, Agrotain Plus, ESN and Nutrisphere. The lower yields with urea and UAN indicated that volatilization or immobilization of N may have been a

Table 1. Effects of N source and rate on corn grain yield, earleaf N, and grain N, Scandia, KS (2-Year Average)				
N Source	N-Rate	Yield	Earleaf N	Grain N
	lb/acre	bu/acre	%	%
	0-N Check	152.2	1.72	1.13
Urea	80	152.0	2.30	1.22
	160	169.3	2.65	1.26
	240	183.1	2.68	1.30
ESN	80	171.6	2.89	1.28
	160	186.6	2.95	1.32
	240	196.9	3.05	1.40
Nutrisphere-N	80	165.8	2.89	1.29
	160	187.7	2.94	1.36
	240	196.9	3.06	1.41
Urea+Agrotain	80	171.6	2.91	1.30
	160	179.7	2.96	1.36
	240	196.6	3.04	1.38
UAN (28%)	80	156.6	2.45	1.24
	160	167.0	2.69	1.25
	240	180.8	2.74	1.27
UAN+Agrotain	80	170.5	2.88	1.30
	160	191.2	2.98	1.35
	240	195.8	3.03	1.39
UAN+Agrotain Plus+	80	168.2	2.90	1.31
	160	185.4	2.99	1.38
	240	195.8	3.08	1.42
UAN+Nutrisphere-N	80	170.5	2.87	1.30
	160	192.0	3.01	1.38
	240	195.8	3.04	1.41
Ammonium Nitrate	80	173.9	2.86	1.30
	160	187.8	2.96	1.35
	240	195.8	3.05	1.40
Average (not including check)		181.1	2.88	1.33

Table 2. Effects of N source (average over rate) on corn grain yield, earleaf-N and grain-N, Scandia, KS (2-year average)			
Treatment	Yield, bu/acre	Earleaf-N, %	Grain N, %
No N check	152.0	1.72	1.13
Urea	168.1	2.52	1.26
ESN	185.0	2.96	1.33
Nutrisphere-N	183.5	2.96	1.35
Urea+Agrotain	182.6	2.97	1.35
UAN	168.1	2.62	1.26
UAN+Agrotain	185.8	2.96	1.35
UAN+Agrotain Plus+	183.1	2.99	1.37
UAN+Nutrisphere-N	186.1	2.97	1.36
Ammonium Nitrate	185.8	2.96	1.35
LSD (0.05)	6.2	0.09	0.04
<b>CV%</b>	<b>6.8</b>	<b>4.5</b>	<b>4.9</b>

significant problem.

**Dryland.** The dryland grain sorghum study results were similar to the irrigated corn experiment. Yield of plots receiving untreated urea was significantly lower than plots receiving urea treated with Agrotain, Nutrisphere-N or ESN (Table 3). There were no differences in yield of the three products tested.

**Studies Affirmative**

Results of this study suggest that the efficiency of surface broadcast urea-containing fertilizers in no-till production systems can be improved by use of several products that are effective in reducing N volatilization losses.

<i>Table 3. Effects of N source and rate on grain sorghum yield, Belleville, KS (2-year average)</i>		
Treatment	N-Rate, lb/acre	Yield, bu/acre
Check		71
Urea	40	108
	80	122
	120	128
ESN	40	120
	80	130
	120	132
Urea+Agrotain	40	116
	80	129
	120	133
Urea+Nutrisphere-N	40	120
	80	133
	120	132
Ammonium Nitrate	40	118
	80	131
	120	133
N-Source Treatment Means		
Urea		119
ESN		127
Agrotain		126
Nutrisphere-N		128
Ammonium Nitrate		127
LSD (0.05)		5
CV%		6

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