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Cooperative Extension South Dakota State University

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# UREA FERTILIZER



Cooperative Extension Service  
South Dakota State University  
U.S. Department of Agriculture

# UREA FERTILIZER

Robert P. Schoper, Paul Carson,  
and Ron Gelderman\*

Urea fertilizer has replaced ammonium nitrate in recent years as the most popular dry nitrogen fertilizer material in South Dakota. Because of its lower production costs, low explosion hazard, and high analysis, urea will continue its rise in popularity.

Urea is manufactured by combining anhydrous ammonia with carbon dioxide. The high analysis urea product contains 45 to 46% nitrogen. It can then be combined with ammonium nitrate to form a 28 to 32% nitrogen solution, converted to a dry nitrogen fertilizer, or combined in either liquid or dry form with other nutrients.

## Soil application and placement

Incorporation of urea is recommended whenever possible.

When urea is covered with soil or carried into the soil by water (0.1 inch of rainfall is sufficient), nitrogen released from the urea will attach to soil surfaces or organic matter.

When incorporation is difficult or impossible, restricting surface applications to periods when the soil surface is cool will minimize nitrogen loss.

Soil conditions such as warm temperatures, high pH, and accumulations of plant residues will increase potential nitrogen loss from surface applied urea.

Monitor spreading widths closely when applying urea blended with other fertilizers. Urea is lighter in weight per unit volume than most fertilizers. This results in a narrower pattern of urea distribution when applied with spinner type equipment. In extreme cases uneven crop growth will result.

Many small grain producers apply most of their fertilizer with a grain drill attachment. This is the preferred method for phosphorus on small grains and is an acceptable way to apply some nitrogen and potassium.

However, excessive rates of nitrogen and potassium applied with the seed can seriously reduce stands, seedling vigor, and yields.

Stands of spring wheat can be seriously reduced by seed placement of urea, especially under dry conditions (Table 1). Even with average or above average soil moisture, high application rates of urea placed with the seed can result in yield reductions (Table 2).

Urea fertilizers should not be seed placed with corn.

Research at the University of Wisconsin indicates that seed plac-

Table 1. Effect of fertilizer carrier and rate on stands of spring wheat.\*

Nitrogen Rate (placed with seed) lb/A	Stand Reduction	
	Urea	Ammonium Nitrate
		%
0	0	0
20	26	8
40	45	7
60	67	12

\*Data by Paul Carson. Average of three locations, 1976.

Table 2. Effect of drill applied urea on the yield of spring wheat.\*

Nitrogen Rate + (placed with seed) lb/A	Yield bu/A	Yield Reduction %
0	35	—
10	34	3
20	34	3
30	33	6
40	30	14
50	30	14
60	28	20

\*Data by Paul Carson. Average of seven locations, 1977-78.

+ All plots received a total of 80 lb/A of nitrogen.

ing urea with corn (even at low rates of nitrogen) is potentially very toxic to the seed (Table 3). When urea was side placed as a 2x2-inch starter, little if any damage was noted (Table 4).

Table 3. Effect of urea and ammonium nitrate placed with seed on corn grain yield, Wisconsin.\*

Nitrogen Rate (placed with seed) lb/A	Grain Yield bu/A	
	Urea	Ammonium Nitrate
0	137	137
5	60	142
10	36	143
20	33	92

\*Data by Liegel and Walsh, University of Wisconsin.

Table 4. Effect of urea and ammonium nitrate side placed on corn grain yield, Wisconsin.\*

Nitrogen Rate + (2x2 inch) lb/A	Grain Yield bu/A	
	Urea	Ammonium Nitrate
0	142	142
25	145	145
50	146	146
100	150	141

\*Data by Liegel and Walsh, University of Wisconsin.

+ Sufficient N broadcast prior to planting.

## Field performance

Urea has been compared with other nitrogen materials on most crops under varied conditions.

With few exceptions, urea has performed equally well when properly handled. For example, a 19-year study at Lamberton, MN, showed urea to be an excellent nitrogen fertilizer in that area (Table 5).

South Dakota research shows that similar results can be expected from the use of urea on forage crops. The data in Table 6 are from 13 experiments conducted by SDSU scien-

\*Schoper: Extension agronomist, Carson: professor of plant science, Gelderman: manager, Soils Laboratory.

Table 5. Influence of nitrogen rate and source on corn yield at Lamberton, MN, 1960-1978.\*

Nitrogen Rate lb/A	Grain Yield bu/A	
	Urea	Ammonium Nitrate
0	65	65
40	96	88
80	107	109
160	113	112

\*Data by G.L. Malzer, University of Minnesota.

Table 6. Yield comparisons of urea and ammonium nitrate on grass.\*

Nitrogen Rate	Forage Yield	
	Urea	Ammonium Nitrate
0	1881	1881
60-70	3188	3508
120-140	3992	4265

\*Data by Ed Williamson, SDSU.

tists where urea was compared to ammonium nitrate. The overall average indicates that urea is equal to ammonium nitrate in performance.

However, at three of the experimental sites, urea produced lower yields than ammonium nitrate. This is probably due to loss of nitrogen from surface applied urea.

Such losses can be minimized by applying urea in the late fall or early spring when soil temperatures are cool and there is a greater chance of rain.

#### Mixing or storing urea

Do not mix or store ammonium nitrate or urea forms of nitrogen fertilizer in the same container or bin.

Troublesome fertilizer buildups can also take place in elevator legs or augers used to transfer both urea and ammonium nitrate. Mixing these two fertilizer materials results in moisture absorption and pellet breakdown.

Problems with "caking" can occur when urea is blended with triple-superphosphate (0-44-0) unless applied shortly after blending. No problem arises, however, when urea and ammonium phosphates such as 18-46-0 are mixed.

#### Application guidelines

##### Broadcasting

1. Incorporate urea or urea containing fertilizers into the soil whenever possible.

2. If surface applied urea cannot be incorporated, make applications

in the late fall or early spring when soil temperatures are cool and there is a higher probability of precipitation.

#### In planting equipment

1. For wheat, barley and oats: Combined totals of actual urea nitrogen plus potassium ( $K_2O$ ) should not exceed 10-12 lb under dry soil conditions or 20 lb under moist conditions when placed with the seed in 6- to 7-inch spacing. Corresponding reductions should be made as wider row spacing is used.

2. For corn and sorghum: Seed placement of urea should be avoided. If starter fertilizer is applied in a band at least 2 inches to the side and 2 inches below the seed, a total of 30 lb of nitrogen (N) + phosphorus ( $P_2O_5$ ) + potassium ( $K_2O$ ) may be applied.

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