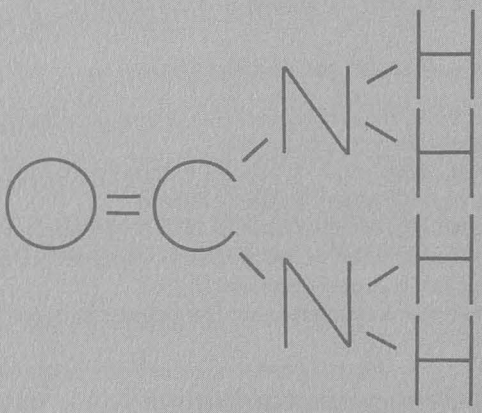
# FERTILIZER

# urea





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## Urea –

Urea, a white crystalline solid containing 45-46 percent nitrogen, is used widely in the agricultural industry as an animal feed additive and as a fertilizer. Here we discuss it only as a nitrogen fertilizer.

## Urea – Physical Forms

Commercially, fertilizer urea can be purchased as prills or as a granulated material.

In the past most urea was produced by dropping liquid urea from a "prilling tower" while drying the product. The prills formed a smaller and softer substance than other materials commonly used in fertilizer blends. Recently, considerable urea is granulated when manufactured. Granules are larger, harder, and more resistant to taking up moisture. In general, granulated urea has become a more suitable material for making fertilizer blends.

## Urea – Advantages as a Fertilizer

- Urea can be applied to a soil as a solid or a solution or to certain crops as a foliar spray.
- Urea, when properly applied, results in yield increases of crops equal to other forms of nitrogen.
- Urea usage involves little or no fire or explosion hazard.
- Urea's high analysis, 46 percent N, helps reduce handling, storage and transportation costs.
- Urea manufacture releases few pollutants to our environment.

## Urea – Incorporate For Best Use

Nitrogen from urea can be lost to the atmosphere if fertilizer urea remains on the soil surface for extended periods of time during warm dry weather.

The key to the most efficient use of urea is to incorporate it into the soil during a tillage operation. It may also be moved into the soil by irrigation water. As little as 0.1 inch of rainfall is sufficient to move urea into the soil to a depth where ammonia losses will not occur.

## Urea – Soil Application and Placement

If properly applied, urea and urea containing fertilizers are excellent sources of nitrogen for crop production.

After application to a soil, urea undergoes chemical changes and ammonium ($NH_4^+$) ions form. Soil moisture determines, to a large extent, how rapidly this conversion takes place.

Around each spot where a urea particle dissolves, a zone of high pH and a high concentration of ammonia occurs. This zone around the urea particle can be quite toxic for a few hours. Seed and seedling roots in contact with this zone can be killed by the free ammonia.

Fortunately this toxic zone becomes neutralized in most soils as the ammonia converts to ammonium. Usually it's just a few days before plants can effectively utilize the nitrogen.

Although urea imparts an alkaline reaction when first applied to the soil, the net effect is to produce an acid reaction.

Urea or urea-containing materials should, in general, be broadcast and immediately incorporated into the soil. Urea-based fertilizer applied in a band should be separated from the seed by at least two inches of soil. **Under no circumstances should urea or urea-based fertilizer be seed-placed with corn.**

With small grains, 10 lbs of nitrogen as urea can generally be applied with the grain drill at seeding time even under dry conditions. Under good moisture conditions, 20 lbs of nitrogen as urea can be applied with the grain drill at seeding time.

Recent research results at North Dakota State University indicate that under dry conditions, urea at the rate of 20 lbs nitrogen per acre applied with a grain drill, in a 6-inch spacing can reduce wheat stands more than 50 percent (table 1). Research at the University of Wisconsin indicates that seed placing urea with corn, even at low rates of nitrogen, is very toxic to the seed and reduces yields greatly (table 2). When urea was sideplaced as a 2" x 2" starter, however, little if any damage was noted (table 3).

Nitrogen needs for good crop production in Minnesota usually require an application of more than 20 lbs nitrogen per acre. Farmers can avoid damage from urea by broadcasting most of the urea nitrogen fertilizer ahead of seeding. Research with urea on corn at the University of Minnesota shows that broadcasting urea prior to seeding is just as effective and in some cases more effective than similar ammonium nitrate treatments (table 4).

## Urea — Spreading

Urea can be bulk spread either alone or blended with most other fertilizers. It is recommended that the spreading width should not exceed 50 feet when combined with other fertilizer materials.

Urea often has a lower density than other fertilizer with which it is blended. This lack of "weight" produces a shorter "distance of throw" when the fertilizer is applied with

spinner type equipment. In extreme cases the effect will result in unevenness in crop growth and "wavy" or "streaky" fields.

## Urea — Blending With Other Fertilizers

Urea and urea containing fertilizers can be blended quite readily with monoammonium phosphate (11-48-0) or diammonium phosphates (18-46-0).

Urea should not be blended with superphosphates unless applied shortly after mixing. Urea will react with superphosphate releasing water molecules, resulting in a damp material which is difficult to store and apply.

## Urea — Application on Growing Crops

Urea can be applied to sod crops, winter wheat, or other small grains. This application, however, should be made during cool seasons. During warm periods (60°F or above) urea in contact with vegetative material will tend to give off ammonia readily.

If urea must be applied on grass pastures, for example, in the middle of the summer, apply when there is a high probability of rainfall.

## Urea — Foliar Application

Urea can be applied to some crops as a foliar spray. This has been used with potatoes, wheat, sugar cane, vegetable crops, and soybeans.

Urea is highly water soluble. At normal atmospheric temperatures, approximately 1 lb of urea can be dissolved in 1 lb of water.

Table 1. **Seed placed ammonium nitrate (AN) and urea comparisons on seedling damage to spring wheat under limited moisture conditions in North Dakota, 1975**

| Treatments | | Seedlings per 40 ft. of Row | | |
|---|---|---|---|---|
| N | N | Location | | |
| (Lbs/A) | Source | Absaraka | Williston | Casselton |
| 0 | — | 600 | 270 | 760 |
| 20 | AN | 570 | 220 | 600 |
| 30 | AN | 590 | 240 | 690 |
| 40 | AN | 590 | 260 | 660 |
| 20 | Urea | 400 | 200 | 550 |
| 30 | Urea | 280 | 110 | 430 |
| 40 | Urea | 220 | 70 | 220 |

Source: Dahnke, North Dakota State University, 1975.

Research data indicate that urea should contain no more than 0.25 percent biuret for use in foliar sprays. The quantity of nitrogen applied at one time should not exceed 20 lbs of nitrogen per acre for many crops.

## Urea – Storage

Urea is neither combustible nor explosive. It can be stored safely with no quality loss under normal circumstances. Small or fast moving augers should not be used to move granular urea. Urea particles are generally soft and abrasion can break the granules. Belt conveyers should be used whenever possible.

Urea should not be stored with ammonium nitrate. These materials, when in contact, rapidly absorb water when the relative humidity is above 18 percent. Table 5 indicates the relative humidity at which urea and ammonium nitrate absorb moisture from the air.

## Urea – Slow Release

Urea fertilizer can be coated with certain materials such as sulfur to reduce the rate at which the nitrogen becomes available to plants.

Under certain conditions these slow release materials result in more efficient use by growing plants.

Urea in a slow release form is popular for use on golf courses, parks and other special lawn situations.

## Urea – Do's and Don'ts

- Store separately from ammonium nitrate.
- Do not use small fast-moving augers to move the urea.
- Do not exceed a spreading width of 50 feet when urea is applied.
- Do not place in direct contact with corn seed.
- Keep rates of nitrogen applied together with small grain in drill to 10 lbs on dry soils – 20 lbs when soil is moist.

Table 2. **Effect of urea and ammonium nitrate placed with seed on corn grain yield, Wisconsin, 1973**

| | Yield, Bu/A | |
|---|---|---|
| Lbs N/A* | Urea | Ammonium Nitrate |
| 0 | 137 | 137 |
| 5 | 60 | 142 |
| 10 | 36 | 143 |
| 20 | 33 | 92 |

* Sufficient N broadcast prior to planting.

Source: Liegel & Walsh Plainfield Sand, Hancock, Wisconsin.

- Apply urea on sod crops when atmospheric temperature is below 60°F.
- When urea is broadcast on soils of high pH (7.5 above), the material should be incorporated into the soil as soon as possible.

Table 3. **Effect of urea and ammonium nitrate side-placed on corn grain yield, Wisconsin, 1973**

| | Yield, Bu/A | |
|---|---|---|
| Lbs N/A* | Urea | Ammonium Nitrate |
| 0 | 142 | 142 |
| 25 | 145 | 145 |
| 50 | 146 | 146 |
| 100 | 150 | 141 |

* Sufficient N broadcast prior to planting.

Source: Liegel & Walsh Plainfield Sand, Hancock, Wisconsin.

Table 4. **Effect of source and placement of urea and ammonium nitrate (AN) on corn yields. Lamberton, Minnesota Experiment Station, 1960-74**

| Lbs N/A | Treatment | Source | Av. Yield, Bu/A |
|---|---|---|---|
| 0 | – – | | 66 |
| 40 | Plow down – fall | AN | 83 |
| 40 | Plow down – fall | Urea | 90 |
| 40 | Surface – fall | AN | 88 |
| 40 | Surface – fall | Urea | 91 |
| 80 | Plow down – fall | AN | 105 |
| 80 | Plow down – fall | Urea | 104 |
| 160 | Plow down – fall | AN | 110 |
| 160 | Plow down – fall | Urea | 111 |
| 40 | Topdress – spring | AN | 95 |
| 40 | Topdress – spring | Urea | 94 |
| 80 | Topdress – spring | AN | 108 |
| 80 | Topdress – spring | Urea | 110 |

Source: MacGrey and Nelson, University of Minnesota (1960-74).

Table 5. **Critical relative humidities (CRH) of urea, ammonium nitrate and a mixture of the two**

| Material | CRH % |
|---|---|
| Urea | 75.2 |
| Ammonium nitrate (A.N.) | 59.4 |
| Urea + ammonium nitrate | 18.1 |