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NebGuide

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How to Apply Fertilizer to Wheat

Application time, forms of fertilizer and methods of application must be considered when applying fertilizer to wheat.

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- Methods of Application
- Anhydrous Ammonia
- Dry fertilizer
- Liquid Fertilizer
- Nitrogen (N)
- Phosphorus
- Kind of Fertilizers to Use

Several different methods can be used to apply fertilizers to wheat, depending on the form of fertilizer material. Producers must consider application time and method as well as the most economical forms of fertilizer and the most efficient methods of application.

Fertilizers are sold in three forms -- liquid, dry and gas. The effectiveness of the forms is essentially the same as long as the same amount of available nutrient is properly applied. The form of fertilizer may dictate the method of application.

Methods of Application

Liquid materials can be sprayed as a broadcast application, applied in the row with the seed, dribbled by gravity on the surface, or placed into the soil in bands. Dry materials are most often bulk spread with spinner type spreaders, but also can be applied by gravity flow either broadcast or in the row. Anhydrous ammonia, which is gas under atmospheric pressure, must be injected into the soil. Liquids with a vapor pressure such as aqua ammonia also must be injected into the soil to avoid large losses.

Anhydrous Ammonia

Anhydrous ammonia usually is applied to wheat during fallow or before seeding. Ordinary knife equipment commonly is used or special applicators sometimes are available. Wheat roots do not extend very far laterally, so ammonia must be applied at narrow spacings. Irregular growth often results when spacing is greater than 20 inches.

Most producers applying nitrogen (N) during tillage operations are using chisel plows, sweep plows or rod weeders. While limited research information is available on the value of these methods of application, many producers have used these methods with success. There are, however certain precautions. Ammonia losses can be great if the application is shallow, especially in very dry or very wet soils. Machine width, depth of operation, speed of travel, soil conditions, soil type and topography are a few factors that influence loss.

Sweeps usually are run deeper than rod weeders, so the probability of ammonia gas loss should be less with sweeps.

Dry Fertilizer

The success of any fertilization method depends greatly on how the equipment is operated and how it is maintained. This especially is true when dry fertilizer is applied with spinner-type bulk spreaders.

It is common for these types of spreaders to spread fertilizer unevenly, causing alternate green and yellow strips throughout a field. Too much fertilizer applied in the middle of the strip and too little applied at the edge of the spreading pattern can cause yield loss compared to a uniform spreading pattern.

Yield losses can be substantial when nutrient deficiencies are severe. When the proper distance is driven between passes and spinners are maintained properly, adequate distribution can be obtained with these spreaders. Be sure and check with the dealer or manufacturer of such equipment for proper use.

There are many different kinds of bulk spinner-type spreaders available. Manufacturer's spreading instructions should be followed closely. Don't assume you know the proper distance and speed to drive just because you previously used a bulk spreader.

In addition to the mechanical aspects of bulk spreading, proper sizing of fertilizer materials is important. Research has shown that uniform sizing of particles is more important than the weight of the particle in reducing separation of fertilizer materials. The so-called "chemically combined" fertilizers have not been shown to have better distribution value compared to properly sized and blended bulk material.

Liquid Fertilizer

One advantage of liquid fertilizers is the ease with which they can be uniformly distributed by spraying. While it usually is conceded that liquid fertilizers can be more uniformly applied than dry materials, even liquid application can vary widely. Plugged nozzles or missed areas due to wide driving are the most serious distribution problems in liquid application. Sprayers are calibrated for uniform boom height above the ground. Uneven surfaces or excess speed causing "boom bounce" will influence the uniformity of the application.

Nitrogen (N)

Amount to apply

The correct amount of nitrogen to apply can be determined more accurately if soil residual nitrate-N is determined to a depth of two or three feet. This nitrogen test determines the presence of available soil nitrogen that reduces or even eliminates the need for fertilizer nitrogen. A residual nitrate soil test can reduce lodging by allowing a more accurate amount of fertilizer nitrogen to be applied.

Time of Application

Nitrogen may be applied effectively to wheat during fallow, prior to seeding or as a spring topdressing. Research over an 18-year period from nearly 100 experiments showed that spring-applied nitrogen is more effective in increasing grain yield than fall-applied nitrogen 20 percent of the time. Fall-applied nitrogen was superior to spring-applied nitrogen only five percent of the time. In addition, fall nitrogen decreased grain yield in 15 percent of the experiments, compared to only five percent for spring nitrogen. Yield depression, while not a major factor, can become a consideration on whether to apply nitrogen or not during low precipitation years. Greater soil moisture use associated with increased fall and early spring vegetative growth may account for yield depressions. The use of residual nitrate soil tests can help reduce the probability of having excessive available nitrogen, which encourages lodging and yield reduction in addition to increased soil water use.

In fallow cropping systems, application early in fallow may be desirable. Early application increases the probability that rain will move the applied nitrogen deeper into the soil by planting time. This may eliminate or reduce excessive water use caused by growth stimulation sometimes observed from fall-applied nitrogen. However, recent research has failed to show any in creased effectiveness of nitrogen applied early in fallow. Preplant applications of ammonia prior to seeding frequently have performed best when compared to other nitrogen forms. Preplant nitrogen as ammonia should be applied far enough in advance of seeding to prevent drying of the seedbed.

While spring topdressing usually is the most efficient method of applying nitrogen in terms of both grain yield and protein content, topdressing generally means using the more expensive dry or liquid forms of nitrogen. The most economical method is to apply anhydrous ammonia in conjunction with normal tillage, eliminating the cost of application. Ammonia application with normal tillage generally is the most efficient in terms of nitrogen cost.

If nitrogen is applied during fallow or just prior to planting, it is imperative that wheat not be seeded too early. Early planting with high nitrogen availability may deplete soil water and increase the probability of yield depression.

A disadvantage of spring topdressing nitrogen on wheat is that precipitation is required to move the nitrogen into the root zone before it is available to the wheat plant. If it is very dry during the early spring season, nitrogen fertilizer on the soil surface may not be available to the wheat and some may be lost to the air through volatilization. One-half inch or more of rain is necessary to produce early greening and yield response to nitrogen. It is possible to apply anhydrous ammonia to wheat in the spring. However, rolling coulter application equipment or back-swept knives are desirable. Other types of equipment may severely damage wheat stands.

Phosphorus

Phosphorus can be applied directly with the seed at planting time, knifed into the soil, applied at time of tillage with equipment such as field cultivators or large sweeps with ammonia (dual applied band) or without NH3, or it can be broadcast prior to planting and incorporated. Generally, it must be incorporated to be effective.

Experiments indicate application with the seed or knifing in bands is substantially more effective than broadcast at the same fertilizer phosphorus rate. Research shows that the profitability of applied phosphorus often is double with seed application or knifed bands, compared to broadcast application. The superiority of band applications (seed or knifed bands) increases as available soil phosphorus

decreases. While broadcasting phosphorus for wheat grown on low phosphorus soils usually will result in increased wheat yields and profitable applications, seed or knifed band applications are so superior to broadcast in terms of profitability that when fertilizer phosphorus is required, it always should be seed applied or banded into the soil. This is especially important when the soil test for phosphorus (Bray & Kurtz No. 1) is less than five ppm.

A small amount of nitrogen may be placed with the seed. While nitrogen damages seedlings during germination, small amounts usually are beneficial because of increased phosphorus availability. Ten to 15 pounds of nitrogen per acre applied with the seed normally will not reduce the yield. However, if potassium, sulfur, zinc or other micronutrients also are applied with the seed, seedling damage may be serious when planting in dry soils and during years when little or no precipitation occurs after seeding.

Kind of Fertilizers to Use

The commonly available nitrogen fertilizers are ammonium nitrate (dry white prill containing 34 percent nitrogen), urea (dry white prill containing 45 percent nitrogen), urea-ammonia nitrate (ammonium nitrate and urea dissolved in water containing 28-32 percent nitrogen), and anhydrous ammonia (a gas under atmospheric pressure containing 82 percent nitrogen).

While the various nitrogen sources always do not perform the same under field conditions, it is difficult to predict future performance when temperature and precipitation are unknown. Research comparisons between nitrogen sources seldom indicate any great differences in performance between the common nitrogen sources. However, volatilization losses (gaseous losses of nitrogen) can be relatively large under certain conditions. Volatilization losses would be expected to be most severe under conditions of high evaporation, high soil pH, and where large amounts of residue are on the soil surface. Under these conditions, ammonium nitrate is the preferred nitrogen source to use as a topdressing. Potentially, urea and urea-ammonia nitrate can lose large amounts of nitrogen, so nitrogen fertilizers should be incorporated into the soil whenever possible. How ever, it usually is not feasible to incorporate topdressed nitrogen unless applied with some kind of knife (backswept knives). This application method may be desirable particularly on high pH soils in the western wheat areas. Fortunately, topdressing of wheat usually is done when air and soil temperatures are low and volatilization losses usually are minimal.

Cost of nitrogen fertilizers varies greatly between sources. Liquid urea-ammonium nitrate often is the most expensive, with the dry forms intermediate and anhydrous ammonia the most economical. Ammonia commonly costs 30 to 40 percent less for an equal amount of nitrogen, compared to the dry and liquid nitrogen forms.

Phosphorus fertilizers are usually liquid ammonium polyphosphate (10-34-0), dry mono- or di-ammonium phosphate (11-48-0, 16-48-0 or 18-46-0), superphosphate (0-20-0), and concentrated superphosphate (0-45-0).

Suspensions which include clay to help suspend the fertilizer particles in a liquid are combinations of the above phosphorus and nitrogen sources. The commonly available phosphorus fertilizers, either liquid or dry, are considered of equal value when applied at similar rates and methods of application.

For further information on growing and fertilizing wheat see the NebGuide: *G73-35, How To Plant Wheat.*

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