ANHYDROUS AMMONIA

Anhydrous ammonia is really a compressed gas -- not a liquid -- and contains 80 to 82% nitrogen. It requires specialized high-pressure equipment and must be knifed into the soil to prevent losses of N as ammonia gas. It is a low cost source of N, but the low cost may be offset by the relatively high-cost equipment required. Anhydrous ammonia should be applied with care on the sandy soils of southern Delaware as losses of volatile N may occur. Careful attention to soil moisture content, injection depth, and proper closure of the injection slit is needed to insure that losses of N are minimized.

Table 2. Properties of Selected Liquid Fertilizers

Analysis	Density (lb/gal)	lb N/gal	Salting Out Temp. °F
28-0-0	10.67	2.99	1
30-0-0	10.86	3.26	15
32-0-0	11.05	3.54	29
10-34-0	11.78	1.18	10

ADDITIONAL INFORMATION

Additional information may be obtained from University of Delaware Cooperative Extension offices in Newark, Dover, and Georgetown.

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SOIL TEST NOTES

NOTE 5: Nitrogen Fertilizers

Nitrogen often represents the single greatest fertilizer cost in producing a crop. Many excellent sources of N, both dry and liquid, are available to growers today, but each material has unique properties that need to be evaluated in advance. Some materials may be more appropriate than others for certain situations. Moreover, some N sources may require careful management to be used efficiently and to avoid crop damage. This note briefly describes the properties, uses, and best management practices for the more common N-containing fertilizers currently available.

DRY FERTILIZERS

UREA

Prilled or granular urea is the highest analysis (46-0-0) nitrogen fertilizer available in dry form. It is also the least expensive. Urea is an important source of N in many areas, including Delaware. An excellent material, urea handles well and is useful both as a straight source of N and in blended fertilizers.

Despite its virtues, urea has some unique properties which require extra care for effective and efficient use. When spread on the surface of the soil, urea tends to give off ammonia gas to the air, resulting in substantial losses of N. It is estimated that as much as 10 to 30 percent of the N may be lost if urea is left unincorporated on the soil surface for as long as five days. Rainfall or irrigation immediately after spreading will dissolve the urea and move it into the soil, resulting in minimal losses of N. In addition, losses may be minimized by applying the urea in a narrow, concentrated band on the soil surface. This method of application is recommended when sidedressing crops such as corn.

Extra care is required when banding urea-containing fertilizers with the seed at planting. Ammonia gas given off by urea can be toxic to germinating seeds, resulting in stand reductions or even total crop failure. To avoid this, urea-containing fertilizers should *never* be banded closer than 2 inches below and 2 inches to the side of the seed.

Blended fertilizers are likely to contain urea and require the same care as straight urea. Use caution when purchasing blended fertilizers, and be sure to find out what source of N has been used in the blend.

Urea is only a moderately acid-forming fertilizer, requiring about 190 lb $CaCO_3$ to neutralize the acidity in 100 lb of N as urea.

AMMONIUM NITRATE

Granular ammonium nitrate (AN) (34-0-0) is used both as a straight N source and in mixed goods. An excellent material, AN is, however, somewhat more expensive than urea.

When spread on the surface of Delaware soils, ammonium nitrate does not lose appreciable amounts of N as ammonia gas. It has a relatively low equivalent acidity (Table 1). However, when banded, AN does cause some reduction in pH in the area of the fertilizer band. Seedling damage due to ammonia toxicity does not occur with AN.

AMMONIUM SULFATE

Granular ammonium sulfate (AS) (21-0-0-24) contains about 24% sulfur. Thus it is often used as a source of both nitrogen and sulfur. It is useful both as a straight material and in blended fertilizers.

Losses of N as ammonia gas from surface-applied AS do not occur under Delaware soil conditions. Ammonium sulfate is a highly acidic fertilizer (Table 1) and, when banded, will result in very low pH values in the area of the fertilizer band. Long-term broadcast applications of AS can significantly reduce soil pH. Where AS is being heavily used, growers should plan on periodic applications of limestone to maintain an optimal soil pH.

Table 1. Pounds of 95% Pure Calcitic Limestone Required to Neutralize the Acidity in 100 lb of N From Various Sources

Material	Analysis	lb $CaCO_3$ Required
Urea	46-0-0	190
Ammonium Nitrate	34-0-0	180
Ammonium Sulfate	21-0-0	560
MAP	11-48-0	620
DAP	18-46-0	400
UAN Solution	30-0-0	185
APP Solution	10-34-0	420
Anhyd. Ammonia	80-0-0	190

AMMONIUM PHOSPHATES (DAP and MAP)

Diammonium phosphate (DAP, 18-46-0) and monoammonium phosphate (MAP, 11-48-0) are both excellent sources of nitrogen and phosphorus, and are widely used in bulk blending and as banded fertilizers. Although they are similar materials, there are differences which are important to the grower.

DAP is a moderately acidic fertilizer (Table 1). But, when DAP is first applied, the area around the granule is alkaline (high pH), and ammonia gas is given off which can be toxic to plants. Thus, like urea, DAP should never be banded closer than 2 inches below and 2 inches to the side of the seed. As time passes, DAP will become acid, resulting in a low-pH band in the soil.

MAP is a highly acidic fertilizer (Table 1). Moreover, the area around a MAP granule is always acid. No ammonia gas is given off by MAP, so banding close to the seed poses little danger to the crop. MAP is not as popular as DAP due to its lower N content, and is not widely available in Delaware at this time. However, it is an excellent material, and deserves consideration from growers interested in a slightly lower N-content material.

LIQUID FERTILIZERS

NITROGEN SOLUTION (UAN)

Nitrogen solution is the single most important source of N in Delaware and accounts for about 60% of all the nitrogen sold in the state. It is available in a 30-0-0 grade in this area, although 28 and 32 percent solutions may be found elsewhere. This liquid material derives one-half its N from urea and the other half from ammonium nitrate. An extremely versatile material, UAN solution requires the same care as urea to be used effectively.

When UAN solution is sprayed on the soil surface, N may be lost as ammonia gas just as with urea. Incorporation, rainfall, or irrigation is needed to move the urea down into the soil and prevent losses. Losses are unlikely when UAN solution is applied through an irrigation system because the volume of water applied is sufficient to leach the urea down into the soil surface.

As with urea, N losses from UAN solution may be minimized when sidedressing or topdressing by dribbling the solution in a narrow, concentrated band. Research has also examined various knifing-in and injection systems for UAN solutions. These are also effective, but require more tractor draft than dribbling the solution along the surface.

Nitrogen solution is versatile -- it can be applied with the planter, as a spray, through an irrigation system, and in other ways. It can also be formulated to include secondary and micronutrients, and is compatible with many herbicides.

AMMONIUM POLYPHOSPHATE SOLUTION (APP)

This liquid material is sold primarily in a 10-34-0 grade under several trade names. Its effectiveness as a phosphorus source is comparable to that of triple superphosphate and the ammonium phosphates (MAP and DAP). In the soil, APP solution behaves much the same as MAP, i.e., it is always relatively acidic. The chief advantage to this material is it's liquid form and the resulting ease of handling. It is most commonly used as a planter fertilizer.