TECHNICAL NOTES

UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE
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AGRONOMY TECHNICAL NOTE NO. 99

COMMON FERTILIZERS AND AMMONIUM NITRATE ALTERNATIVES

BACKGROUND

The manufacture of illegal drugs and the threat of terrorism are having an effect upon once common nitrogen sources. Anhydrous ammonia, once extensively used in row crops, is a component of the drug crystal methamphetamine. Ammonium nitrate, widely used in all types of fertility programs, has been used to make bombs. Fertilizer dealers are now reluctant to handle either of these products because of liability issues. This is especially important to our livestock and hay producers who have relied heavily on ammonium nitrate as their nitrogen source for fertilizing pastures and hay meadows.

COMMON FERTILIZER SOURCES AND THEIR COMPOSITION

Table 1 can be used as a quick reference guide to common fertilizers. These materials may be used alone or blended with other fertilizer materials to create a multi-nutrient fertilizer. Some of these materials blended together may serve as an alternative to ammonium nitrate.

PROPOSED AMMONIUM NITRATE ALTERNATIVE

A blend of urea and ammonium sulfate is being touted as an alternative to ammonium nitrate. A 50/50 mixture of urea (46-0-0) and ammonium sulfate (21-0-0-24) produces a blend with an analysis of 33.5 N-0-0-12 S.

In a 50/50 mix on a per ton basis there are 460 lbs nitrogen from urea and 210 lbs nitrogen from ammonium sulfate which gives the mix 670 lbs total nitrogen/ton. Sixty-nine percent of the nitrogen is from urea and 31 percent of the nitrogen is from ammonium sulfate.

POTENTIAL PROBLEMS

Using Urea/Ammonium Sulfate Blend

One lb of nitrogen from urea neutralizes 1.8 lbs of lime. One lb of nitrogen from ammonium sulfate neutralizes 5.25 lbs of lime. One hundred lbs of nitrogen from this mixture contains 69 lbs of nitrogen from urea and 31 lbs of nitrogen from ammonium sulfate. The urea neutralizes 124 lbs of lime (69 x 1.8 = 124 lbs) and the ammonium sulfate neutralizes 163 lbs of lime (31 x 5.25 = 163 lbs). One hundred lbs of nitrogen from urea/ammonium sulfate blend neutralizes 287 lbs of lime.

Hay producers using 300 lbs/ac of actual nitrogen from the urea/ammonium sulfate blend will be neutralizing 861 lbs of lime per acre per year. After 3 years (normal soil testing cycle) hay

Table 1. Common Fertilizers

Fertilizer Material	Nitrogen N	Phosphate P_2O_5	Potash K_2O	Other
----------lbs/100 lbs----------				
Anhydrous ammonia (gas)	82	0	0	
Urea	46	0	0	
Ammonium nitrate	34	0	0	
Ammonium sulfate	21	0	0	24 S
Sodium nitrate	16	0	0	
Calcium nitrate	15	0	0	21 Ca
Potassium nitrate	13	0	44	
Diammonium phosphate (DAP)	18	46	0	
Triple superphosphate (TSP)	0	46	0	
Muriate of potash	0	0	60	
Potassium sulfate	0	0	50	16 S
Potassium-magnesium sulfate (K-Mag)	0	0	21	23 S, 11 Mg
Gypsum	0	0	0	22 Ca, 12 S
Mixed fertilizers	8	8	8	
Mixed fertilizers	13	13	13	
Mixed fertilizers	17	17	17	

Note: All fertilizers analyses are based on 100 lb of material, solid, or liquid. For fluid fertilizers you must know the weight per gallon to figure out how many gallons are in 100 lb of the fertilizer product. Ex: 32% nitrogen solution weighs 11.06 lbs/gal, thus 9.04 gals = 100 lbs. Each gallon contains 3.54 lbs of nitrogen.

producers will have neutralized 2,583 lbs of lime. Liming frequency could change from 3-5 years to 2-2.5 years. Considering that lime is spread on the surface (no incorporation) in grazing and haying operations, the efficiency of lime to raise pH could be reduced. Producers may see an accelerated decline in pH with year to year applications of the urea/ammonium sulfate blend.

Using Urea Alone

Urea nitrogen applied to the soil surface converts rapidly to NH_3 or NH_4^+ with adequate moisture, proper temperature, and the presence of the enzyme, urease. The NH_3 can be lost to the atmosphere through volatilization contributing to atmospheric greenhouse gases. Urea loss can be avoided by incorporation, applying when temperatures are low or irrigating immediately following application to carry the urea into the soil.

In the Deep South, because of the potential for volatilization, use of urea is generally limited to cool season crops/forages or where it is incorporated soon after application. Warm season surface application has typically been avoided. However with terrorism and liability issues limiting the availability and driving up the cost of ammonium nitrate, urea may be the most logical nitrogen alternative at this point for fertilizing pastures and hay meadows.

According to agronomists with expertise in the use of urea, surface applications with minimal volatilization losses are possible with proper management. Since cool temperature and moisture are critical to limiting volatilization, urea can be used more efficiently if applied during the early morning hours before dew has evaporated. This works best when hay fields are allowed to develop some canopy following cutting so that the soil will be shaded and the urea granules will not be exposed directly to sun and wind. Dew will melt the granules and help carry the urea into the soil.

Another alternative for urea is coating the urea granules with synthetic polymers. The polymer used and thickness of the coating influences the number of days after application before nitrogen release occurs into the soil allowing more time for the granules to melt. Polymer coating adds a couple of cents/lb to the cost of urea.

Urea has the same acidifying potential as ammonium nitrate (1.8 lbs lime neutralized for 1 lb. nitrogen from urea). Urea used at 300 lbs. nitrogen/ac/yr (600 lbs 46-0-0) would neutralize 540 lbs lime/ac/yr. That would necessitate liming approximately every 4 years.

SUMMARY

NRCS cannot dictate which nitrogen source clients use. However, we should help them use nutrients in the most efficient and environmentally responsible manner possible. NRCS needs to make our clients aware of important issues so that they can make informed decisions.

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REFERENCES

1. Potash and Phosphate Institute. October 2003. Soil Fertility Manual, Chapter 3, pages 11-12.
2. Stevens, J. Cheston, Jr. June 2007. Personal Communication. LSU Agricultural Center, Dean Lee Research Station.