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Alternative Fertilizer Nitrogen Sources for Tobacco Production

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Ammonium nitrate (AN) has been the dominate source of fertilizer nitrogen (N) for tobacco in recent years. It is relatively easy to transport, store and apply with equipment common on most tobacco farms. The mix of ammonical-N and nitrate-N helps to balance N availability through the growing season, and matches well with the N uptake pattern of tobacco. However, increasingly stringent regulations are being placed on the transport, storage, and sale of AN as a result of homeland security concerns. Some manufactures have stopped or limited production of AN, and some dealers are reluctant to stock large quantities. These factors suggest that AN may be in short supply for future growing seasons, and that the price for AN may rise relative to other sources. There are alternative sources of N that can be used for tobacco production, but it is critical to understand how they may differ from AN.

Dolomite-ammonium nitrate (DAN) is a mixture of dolomitic lime and AN that is relatively new to the fertilizer market (maybe referred to as calcium-ammonium nitrate in some areas). The advantage of this material is that it cannot be easily used to make explosive devices. Dolomite-ammonium nitrate can be stored, handled, and applied similar to AN. It is expected that the price per ton of DAN will also be similar to AN, however DAN is only 27% N as compared to 34% N for AN so more material per acre is needed to get the same amount of N (table 1). This means that the price per pound of N will likely be higher with DAN.

Ammonium sulfate (AS) is generally considered to be a specialty fertilizer for crops that prefer acid soil conditions. Ammonium sulfate is one of the oldest N fertilizers, but it has a low analysis at only 21% N. Its relatively high cost per pound of N and high lime requirement make it undesirable for widespread use in tobacco production.

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Anhydrous ammonia (AA) is commonly used on row crops like corn and grain sorghum and will likely have the lowest cost per pound of N compared to other N fertilizer sources. At 82% N it has the highest concentration of any N fertilizer; however, it requires specialized equipment and is typically transported and stored as a liquid under pressure. Special equipment is needed for injection into the soil as the resulting gas is quite volatile and dangerous. There are also security issues associated with AA due to its use in the illegal manufacturing of methamphetamines. The use of AA on tobacco will only be feasible if a grower already has the equipment. If used, AA should be injected at least 10 to 14 days prior to transplanting to avoid potential injury to young tobacco plants. In the soil surrounding the injection site, a zone of locally high pH may persist for several weeks after application resulting in a delay of nitrate formation (Table 1). AA should not be used to sidedress tobacco due to potential phyto-toxicity and potentially delayed N availability.

Urea has been used in the past by tobacco growers and historically has had a lower cost per pound of N than AN. Urea is 46% N compared to 34% for AN so less material is needed to get the same amount of N per acre (Table 1). Before the N in urea can be used by tobacco plants, it must first be converted to ammonium and then to nitrate. This conversion is readily carried out by enzymes and microorganisms that are common in the soil. However, some of the N in urea may be lost into the air during this conversion if the fertilizer is left exposed on the soil surface. To reduce losses, urea should be incorporated or watered into the soil shortly after application. This conversion to nitrate can also delay the plant uptake of N, so urea is not recommended as a source for sidedressing due to its tendency to linger as ammonium late into the season and interfere with ripening (Table 1).

Urea-ammonium nitrate (UAN) solutions contain a mixture of approximately 50% urea and 50% ammonium nitrate in a liquid form, and range in N concentration from 28% to 32%. UAN solutions may be a good alternative source for some tobacco growers, although the supply could be limited in some parts of the tobacco belt. Historically, the price of UAN solutions has tracked similar to urea so the solutions should have a lower cost per pound of N than AN. These solutions can be transported easily and applied through many types of spraying systems. Rate calculations can be made based on the weight of the solutions or by knowing the amount of N per gallon (Table 2). Often the solutions are used as a carrier for pre-plant pesticide applications, helping to reduce trips across the field. UAN solutions are quite corrosive to equipment, and since they contain urea, soil incorporation is strongly recommended. The availability of nitrate-N is intermediate between AN and urea because it is a mixture of these products. UAN solutions can be used for sidedress applications on tobacco, but they should be applied no later than 4 weeks after transplanting and at reduced rates to avoid problems with late season N uptake. Do not allow the solution to come in direct contact with the tobacco plants or severe leaf scorch may result.

Nitrate sources of N including potassium nitrate, calcium nitrate, sodium nitrate, and sodium-potassium nitrate (soda potash) are useful, but historically, these sources have been relatively expensive per pound of N and the supply has been erratic. Because of their low analysis, it takes a relatively large amount of material to get the same amount of N as from other sources (table 1). For example, it takes 3 lbs. of calcium nitrate to get the same amount of N as 1 lb. of urea. All of the N in these sources is readily available for plant uptake making them a good choice for sidedress applications (Table 1). Nitrate forms are also a good choice for soils with a low pH since they do not acidify the soil as the ammonium based fertilizers do. The relatively high price and low analysis of the nitrate sources make them undesirable for use as the sole source of N for tobacco production.

When choosing an alternative to AN, tobacco growers should first contact their local suppliers

to find out which materials will be readily available. Next, compare prices of the different materials on the basis of price per pound of actual N. Make sure that any needed equipment is available and in good repair. Special care is needed when switching materials to be sure that necessary changes are made to spreader settings. For example, spreading urea with a spreader set for AN can result in a significant over application of N, wasting money and potentially harming the quality of crop. Finally, growers should be aware of the source differences in N availability and effect on soil pH and follow a regular soil testing program to determine needs for lime or other nutrients.

Table 1. Selected sources of fertilizer nitrogen.

N source	Analysis	To supply 100 lbs. N	Weeks after application 0	3	6
	lbs./100lbs.	lbs./A	------ % of fertilizer N as NO_3-N -----		
Ammonium Nitrate	34-0-0	294	50	80	90
Dolomite Amm. Nitrate	27-0-0	370	50	80	90
Ammonium Sulfate	21-0-0	476	0	60	80
Anhydrous Ammonia	82-0-0	122	0	20	65
Urea	46-0-0	217	0	50	75
UAN Solution	28-0-0	357	25	60	80
UAN Solution	30-0-0	333	25	60	80
UAN Solution	32-0-0	313	25	60	80
Potassium Nitrate	13-0-44	769	100	100	100
Sodium Nitrate	16-0-0	625	100	100	100
Calcium Nitrate	15.5-0-0	645	100	100	100
Sodium-Potassium Nitrate	15-0-14	667	100	100	100

Table 2. Amount of nitrogen in UAN solutions.

UAN solution	Density	Nitrogen	To supply 100lbs. N
	lbs/gallon	lbs./gallon	gallons/A
28-0-0	10.7	3.00	33.3
30-0-0	10.9	3.27	30.5
32-0-0	11.1	3.55	28.2

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