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Nitrogen Fertilizer Sources and Properties

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Introduction

The most commonly available nitrogen fertilizer sources used in Virginia are urea, liquid urea-ammonium nitrate (UAN) solution, and ammonium sulfate. Ammonium nitrate is also available in some areas but its use is low relative to urea and UAN solution. Understanding the properties of these fertilizers enables managers to make better decisions as to the most effective way to use these fertilizers as well as to make economic comparisons.

Urea

Urea is a dry granular fertilizer containing 46% N, meaning that this fertilizer contains 46 lbs of N per 100 lbs of product. It is 100% water soluble and thus dissolves readily with rainfall. For surface applications of granular urea, approximately $\frac{1}{4}$ to $\frac{1}{2}$ inch of water is required to move the urea into the soil. Urea is transformed rapidly (complete in one week) in the soil to ammonium which plants can take up. However, if the transformation of urea to ammonium occurs on the soil surface, significant volatilization losses ($> 20\%$ of applied N) of ammonia can occur. See fact sheet number Five in this series for a more complete explanation of volatilization. Urea is the most widely used nitrogen fertilizer source in the world and it is becoming more widely used in Virginia as it has become more cost competitive in recent years. Cost per pound of N is calculated as price ton divided by 920 lbs N per ton. For example, if urea is priced at \$576 per ton, the price per pound of N would be $(\$576/920 \text{ lbs}) = \0.63 per pound of N.

Urea-Ammonium Nitrate (UAN) Solution

These liquid fertilizers are made by dissolving urea and ammonium nitrate fertilizers in water. These fertilizers are clear liquids and are made in concentrations of 32%, 30%, and 28% N by weight to avoid precipitation (salting out) of the fertilizer with cold temperatures. The lower concentration (28% N) solution is used in more northern climates while the 32% N material can be

handled in warmer climates. Thirty percent N is the most widely source in Virginia although significant amounts of 32% N are applied during side-dress applications for corn in summer months. Rates are calculated on a gallons per acre basis. For example, 30% N solution contains 3.26 lbs N/gallon, and thus an application rate of 100 lbs N/acre would require (100 lbs N/acre divided by 3.26 lbs N/gallon) an application of 30.7 gallons per acre. Cost per pound of N is calculated as price per ton divided by 600 lbs N/ton for 30% N solution. For 32% N solution the cost per ton would be divided by 640 lbs N per ton. For example, 30% N solution priced at \$375 per ton would be a cost of ($\$375 / 600 \text{ lbs N}$) \$0.63 per lb of N. Finally, fifty percent of the N in UAN solution is in the urea form, and the other half is ammonium nitrate. Urea is subject to volatilization losses (see FACT SHEET FIVE) while potential volatilization losses from the ammonium nitrate portion of this fertilizer are minimal.

Ammonium Sulfate

Ammonium sulfate is most widely available as a dry granular fertilizer with an analysis of 21-0-0-24S. The fertilizer is 100% water soluble. The nitrogen in this fertilizer is all in the ammonium form while the sulfur is in the sulfate form, and thus both elements are readily plant available. Ammonium sulfate is widely used as a sulfur source by blending with other fertilizers such as urea. Potential volatilization losses from surface applications of ammonium sulfate are minimal. Cost per pound of N in ammonium sulfate is calculated as cost per ton divided by 420 lbs N/ton, but such a calculation ignores the value of the sulfur. If ammonium sulfate is being used as a sulfur source, then the value of the N should be subtracted from the total N requirement for the crop.

Ammonium Nitrate

Ammonium nitrate is a dry granular fertilizer with an analysis of 33 to 34% N and is 100% water soluble. Both the ammonium and nitrate forms of N are taken up by plants. Potential volatilization losses from surface applications of ammonium nitrate are minimal. Cost per pound of N is calculated as price per ton divided by 680 lbs N/ton for a 34% N material. For example, ammonium nitrate at \$550 per ton would be ($\$550 \text{ divided by } 680 \text{ lbs N/ton}$) \$0.81 per pound of N. The use of ammonium nitrate in making illegal explosives has led to restrictions on handling and sale. The material can be safely handled as a fertilizer but such restrictions have led to this material being less readily available as a fertilizer.