Nitrogen Fertilizers, N-P-K Fertilizers

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Anhydrous ammonia (82 percent N) is a liquid under high pressure and must be injected at least six inches deep into a moist soil because it becomes a gas once it is released from the tank. In soil, ammonia reacts with water to form the ammonium (Nigh) ion, which is held on clay and organic matter. Anhydrous ammonia is generally the cheapest source of N; however, the method of application is less convenient and requires more power to apply than most other liquid or dry materials.

Nitrogen solutions (28 to 32 percent N) are a mixture of urea and ammonium nitrate in water. The solution has no ammonia vapor pressure and is generally sprayed or dribbled on the soil surface. The loss of N from surface application of 28 percent N solution is generally not considered to be of great concern in Michigan when it is applied early in the spring. Under certain conditions, however, N loss due to ammonia volatilization may be serious. If the conversion of urea to ammonia in the liquid fertilizer takes place on the surface, some ammonia can be lost by volatilization. The remainder of the ammonia may react with water on the surface to produce an alkaline condition, which also promotes volatile ammonia loss. The most favorable conditions for volatile N loss from surface-applied urea (solid or liquid) are alkaline soils, warm temperatures, intermediate relative humidity (50 to 90 percent) and sandy soils with low organic matter content and low cation exchange capacities.

One-half inch of rain will normally move surface applied N solutions deep enough into the soil to prevent ammonia volatilization. Nitrogen solutions should not be applied in the fall, because one-fourth of the N is in nitrate form and is subject to loss by leaching or denitrification.

Surface application of N solutions to heavy residues, which occur in no-till systems, has been shown to reduce its effectiveness when compared to N that is incorporated or knifed-in. Nitrogen can be temporarily tied up in residues and unavailable to the crop until the residues decompose.

Aqua ammonia (21 percent N) is a liquid under low pressure and must be incorporated into the soil to prevent the loss of free ammonia to the atmosphere. It is possible to lose all of the free ammonia if it is not incorporated. Aqua ammonia has advantages over anhydrous ammonia: placement need not be as deep, and high-pressure applicators are not required.

Urea (46 percent N) is the most widely used dry N fertilizer. Once applied to the soil, urea is converted to ammonia, which reacts with water to form ammonium within two to three days (faster under warm conditions). Some volatilization of ammonia can occur when urea is surface applied. Volatile ammonia loss from early spring topdressing of urea on wheat or pasture is seldom a problem. However, avoid topdressing of urea on pastures during summer months because of the potential for greater ammonia losses.

Ammonium nitrate (33 percent N) is decreasing in popularity because of storage problems associated with fire and explosive hazards. It is an excellent material for many purposes; however, one-half of the N is in nitrate form, which makes it immediately susceptible to potential leaching and denitrification losses after application.

Calcium ammonium nitrate is a mixture of ammonium nitrate and crushed limestone. Neither of these materials should be used for fall application. Ammonium sulfate (21percent N) availability has increased in recent years primarily because it is a byproduct of some industries. All of the N is in the ammonium form. It is a good material for high pH soils (pH>7.0) and can be used where sulfur deficiency is suspected. If applied to alkaline or calcium soils, it should also be incorporated to eliminate potential ammonia volatilization losses. It has the disadvantage of being the most acidifying form of N fertilizer which requires more limestone to neutralize the acidity formed by the N fertilizer. The cost of ammonium sulfate is usually greater than urea because of its lower analysis and higher transportation costs.

Calcium nitrate (16 percent N) contains all of its N in the nitrate form, which is highly susceptible to leaching and denitrification losses as soon as it is applied. It is used most extensively in the fruit and vegetable industry where a readily available source of nitrate N may be desirable. It is also used as a soluble source of calcium.

Potassium nitrate (13 percent N) is used as both a K source and a N source. All of the N is in the nitrate form and is subject to leaching and denitrification as soon as it is added to soil. It is used primarily in the fruit and vegetable industry as readily available sources of N and K.

Sodium nitrate (16 percent N) contains all of its N in the nitrate form and is similar to potassium nitrate and calcium nitrate in its reaction in soils. It is used primarily in the vegetable industry when a readily available source of nitrate N is desired.

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