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Nitrogen fertilizer sources for forage grasses in Florida

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Nitrogen (N) is an important agronomic input for bahiagrass production in Florida. Historically, ammonium nitrate has been a major N source used on pastures in the USA. However, because of rising costs of natural gas used in N fertilizer synthesis, fuel for fertilizer transport, and potential explosive properties, ammonium nitrate has become a scarcer N source for forage production. Alternatively, other N sources such as ammonium sulfate and urea have been more frequently used in forage production systems. Organic sources such as biosolids and animal manure also represent important sources of N that can be used in pastures.

Besides the differences in N concentration, different N sources may not be equally effective when applied to established pastures in Florida. A number of factors, including soil type, rate and method of application, forage management (haying versus grazing), and environmental conditions can impact the effectiveness of different fertilizer sources to provide N to pastures. Below are examples of N fertilizers typically used in forage production and their main characteristics.

Nitrogen Fertilizer Sources

1. **Ammonium nitrate**

   Ammonium nitrate (NH_4NO_3) typically contains between 33 to 34% N. Although ammonium nitrate is extremely soluble in water, under normal conditions of storage, ammonium nitrate is stable. When applied at adequate rates, ammonium nitrate does not produce as much acidity as other N fertilizer sources (i.e. ammonium sulfate). In addition, the salt index (a measure of the salt concentration that the fertilizer produces in the soil after its application) of ammonium nitrate is 2.99. This value indicates that the chances of ammonium nitrate to cause burning problems in the pastures are limited.

2. **Ammonium sulfate**

   Ammonium sulfate [$(NH_4)_2SO_4$], contains between 20 to 21% of N and approximately 24% of sulfur. When applied to the soil, ammonium sulfate can significantly increase soil acidity; therefore it is important to monitor soil pH after repeated applications of ammonium sulfate. One advantage of ammonium sulfate is that besides providing N, this fertilizer can also provide adequate amounts of sulfur, an essential nutrient for forage grasses. Ammonium sulfate has a salt index of 3.25, which may result in temporary forage damage due to burning when applied at extremely high rates. However, when applied at adequate rates, the potential of ammonium sulfate to injury forages is negligible.

3. **Urea**

   Urea is a white crystalline solid that contains 46% of N. Because of the high N concentration, urea has become a popular N source due to the lower cost associated with transport. Urea can be applied to pastures as a solid or a solution via foliar spray. When applied to pastures, urea undergoes a series of chemical reactions. Urea first reacts with water and is converted to ammonium bicarbonate (NH_4HCO_3). In soils that exhibit high pH (>6.5), ammonium bicarbonate can be further converted to ammonia gas (NH_3). Under these circumstances, significant amounts of N can be lost via ammonia volatilization. Compared to ammonium nitrate and ammonium sulfate, urea produces less acidity and typically does not affect soil pH significantly.

4. **Slow-release N fertilizers**

   Slow-release N fertilizers can be classified into two categories: (1) chemical compounds with inherently slow rates of dissolution, and (2) N fertilizers provided with a coating that acts as a moisture barrier. Sulfur-coated urea, ureaform, polymer-coated fertilizers are examples of slow-release N

fertilizers. Only a small fraction of the pastures in Florida receive slow-release fertilizers; however, increasing interest has been placed on fertilizer sources that can reduce potential environmental impacts of N fertilization. Although slow-release N fertilizers are believed to increase the synchrony of N release from the fertilizer and crop requirements, limited science-based data on how these N sources behave in grazed pastures in Florida is currently available.

5. **Organic sources**

Organic fertilizer sources such as animal manure and biosolids can satisfactorily provide N to forage grasses. When properly applied, these organic sources can be beneficial to agriculture with no negative impacts on the environment. One aspect that is important to consider is that the N present in organic sources is not readily available to plants. As the organic compounds mineralize, N and other essential nutrients become available. Therefore, time and rate of application are critical factors that can impact the effectiveness of organic sources in providing N to pastures. In addition, organic sources typically contain excessive phosphorus concentrations compared to the forage requirements. Therefore, supplying N to the plants via organic sources often results in excessive phosphorus application rates, which may exceed forage demand. Caution should be exercised when applying repeated applications of biosolids and/or manure to avoid soil P build up and possible contamination of water bodies. Another advantage of organic sources is that, because of the alkaline nature of some of these materials (i.e., lime-stabilized biosolids), they can increase soil pH and reduce costs associated with liming.

In this document we discussed the properties of the most commonly used N fertilizers in Florida. In addition to these N sources, other N fertilizers (i.e., potassium nitrate and calcium nitrate) not included here may also be available in some areas of the state. Decisions regarding the most appropriate N source should be based on cost, soil characteristics, and forage management.