UREA WITHOUT THE LOSS

September 2011 - Hay & Forage Grower

Dennis Hancock, Extension Forage Agronomist
The University of Georgia

Our most effective nitrogen (N) fertilizer, ammonium nitrate, has become extremely had to find in most areas. Farmers are increasingly turning to urea and urea-based formulations to meet their N fertilizer needs. Unfortunately, there is a substantial risk of N loss when urea is used for forage production. New research is proving that farmers can substantially reduce these losses and make urea more effective.

Ammonium nitrate fertilizer provides N in a form that the plant can readily use. When it is applied, it splits into its chemical halves: ammonium and nitrate. No major intermediate steps are necessary. The roots quickly take up the nitrate. The ammonium latches onto the soil particles, is taken up by the roots, or ultimately is converted by soil bacteria into nitrate and absorbed up by the roots. As a result of this simplicity, there is little risk that any of it will escape as a gas.

Urea, on the other hand, has to be broken down to form ammonium. Because of the chemistry involved, a substantial amount of N from urea is often lost to the atmosphere as ammonia gas. These losses can be extremely large. Research at the University of Georgia has recorded ammonia losses as high as 48% of the applied N. A summary of other research shows that N losses are typically around 20% of the total N applied as urea.

With N fertilizer prices being as high as they currently are, these losses are a major economic drain on the farmer's profitability. It also makes for poor stewardship of our natural resources.

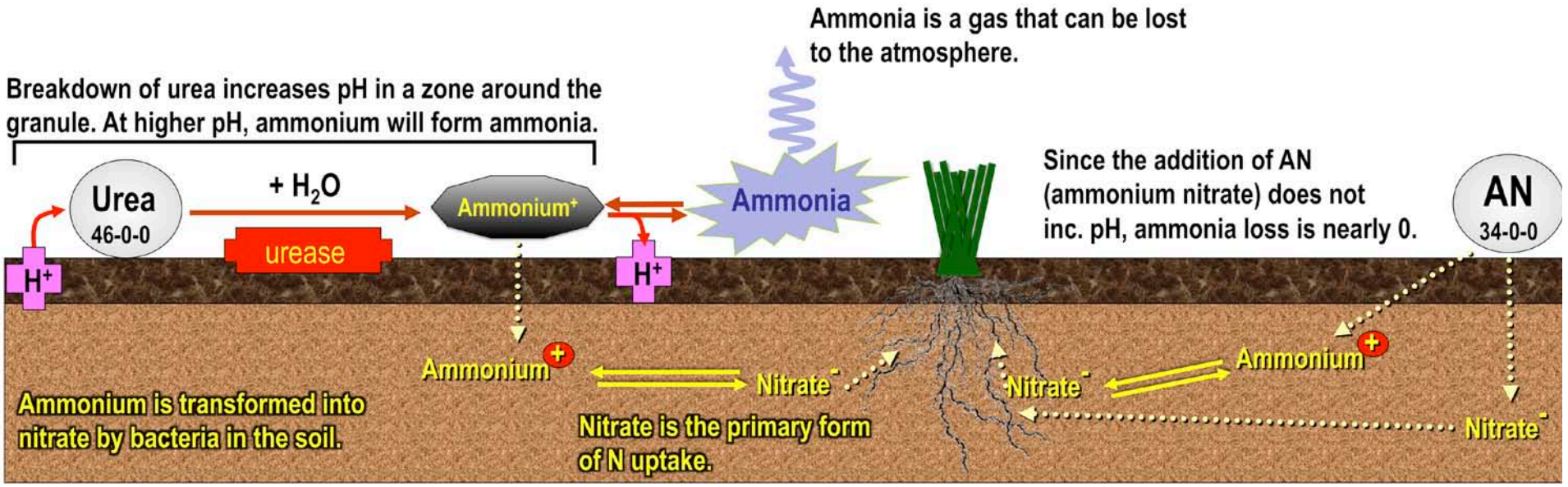
Recently, several so-called "enhanced-efficiency" products have been introduced to the market to curb these N losses. Some act by controlling the breakdown of urea to ammonium (specifically, the rate of urease activity). Others create a barrier, such as a polymer coating, that slowly allows the urea encapsulated inside to be moistened and to seep out.

A number of university researchers around the US have begun comparing these products to one another. We recently compared three of these products in a multi-year study at two locations in Georgia. The three products were: 1) Agrotain®, which is a urease inhibitor; 2) Nutrisphere-N®, which also is designed to control the urease; and 3) ESN® Smart Nitrogen, which is a polymer coated urea product. Our study was conducted on bermudagrass hayfields, which were harvested four times each year.

We measured ammonia volatilization loss in the field studies using an acid-trap. As expected, we saw very high levels of loss (an average of 17% of applied N) in areas where urea was applied. The majority of this volatilization was prevented by the Agrotain® and ESN® Smart Nitrogen. Nutrisphere-N® did not effectively reduce ammonia loss in our study.

The control of ammonia loss resulted in yields that were similar to the forage production in areas treated with ammonium nitrate. For example, the areas provided Agrotain®-treated urea produced an average of 11% more yield than areas provided conventional urea. This was similar to the performance of ammonium nitrate. In the initial studies, the ESN® Smart Nitrogen produced lower yields than urea. We found that this was because it was releasing N too slowly for our fast growing bermudagrass. In other experiments, we have found that yields can rival that of ammonium nitrate when conventional urea is blended with the ESN® Smart Nitrogen. In contrast, the forage yields were not different between areas treated with conventional urea or Nutrisphere-N®-treated urea.

Work with these "enhanced-efficiency" fertilizer treatments continues and the economics of these products are beginning to be closely examined. These results are promising and the current cost-structure appears to be beneficial. Most of these products add only 5 - 8% to the cost of urea (~$0.60 per lb of N in Georgia). Spending that much extra to prevent up to 20% of the N from escaping to the atmosphere can be cost-effective and cheaper than just adding more N to make up for the loss.



Graphic and data from Dr. Dennis Hancock, Asst. Professor and Extension Forage Agronomist at the University of Georgia.