Forage News

MISSISSIPPI STATE UNIVERSITY EXTENSION SERVICE
Center for Forage Management and Environmental Stewardship

The Role of Urea Ammonium Nitrate (UAN) in Forage Systems

Rocky Lemus
Extension Forage Specialist

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Nitrogen is one of the major nutrients required by forage grasses for proper growth and development since it is not retained in the soil from year to year in a form that is readily accessible to plants. UAN solutions has been used in the row crop industry for quite sometimes and often forage producers inquire about their use in hay production systems. UAN like urea could have higher volatilization rates compared to ammonium nitrate. UAN is a liquid that under high humidity and summer temperature can lead to evapotranspiration and losses. Under cooler environments, UAN could be ideal for winter forage production such as annual ryegrass or small grains.

One of the advantages that UNA solutions offer is that they can be applied more uniformly that granular fertilizers. UAN solutions could also be mixed with herbicides, pesticides and other nutrients (solutions containing phosphorus and potassium). This approach gives forage producers the flexibility to reduce cost by applying several products simultaneously rather than having to make several trips across the field. This reduction in applications could also help reducing soil compaction. If calcium nitrate or solutions prepared with calcium nitrate are being used, it is recommended not to combine them with UAN solutions. The reaction of these two solutions can create a thick, milky, insoluble precipitate that could plug the lines and nozzles in the sprayer. It is important to read product labels to assess if UAN solution and the targeted product for mixing are compatible. One thing to keep in mind is that UAN solutions can be very corrosive. It is recommended to use UAN solutions that contain a corrosion inhibitor to help protecting the tank, lines and nozzles in the sprayer.

UAN solutions are made of two main components: urea [$CO(NH_2)_2$] and ammonium nitrate [NH_4NO_3]. The total percent nitrogen can range from 28 to 32%, with 28 and 32% N being the most popular N liquid fertilizers. Because UAN has a more diverse chemical composition than other N sources, it is important to understand the N uptake. The ammonium (NH4) fraction of the solution (~25% of the total N) can be directly taken by grasses, but those droplets reaching the soil can be rapidly oxidized by soil bacteria to form nitrate ($NO3^-$). The urea portion which is about 50% of the total nitrogen is usually hydrolyzed by soil enzymes to form $NH4^+$ and subsequently transformed to $NO3^-$. Since half of the total N is present as urea and can volatize under high temperatures, the use of urease inhibitor and N stabilizer have been used with UAN solutions to avoid loses, but little response has been observed in forage production systems. Avoid broadcast application of UAN solutions whenever possible in hot, dry days unless rain is imminent. N losses can be substantial when the air temperature is above 70 °F. Losses can be reduced if rain is expected within 2 to 3 days from the time of UAN application.

Table 1. Chemical and physical properties of UAN solutions.

Chemical Properties	UAN Grade (% total nitrogen) 28	30	32
	Composition (% weight)[1]		
Ammonium Nitrate	36-42	38-45	41-48
Urea	29-33	31-36	33-38
Water	35-25	31-19	26-14
Physical Properties			
Density, lb/gal at 60 °F	10.67	10.86	11.07
Salt Out Temperature, °F	0	16	32

[1]**Note**: Product composition may vary depending on the manufacturing origin.

UAN with 28% N is the most commonly used form in forage systems. The reason for that is because UAN may damage foliage if sprayed directly into the plants (especially during the summer), causing approximately 7-10 days delay in plant recovery after a cut of hay. The potential burn of UAN solutions have been observed at nitrogen rates above 50 pounds of N per acre. When N rates higher than that are needed, split applications are strongly recommended to avoid foliage

damage by the UAN solutions. Even at N rates lower than 50 lb/ac, some yellowing and burning of the leaf tips and foliage could be noted.

Calculating UAN fertilizer rates for forage production – Interest in liquid nitrogen is increasing in forage production. Price is competitive per pound of nitrogen and often somewhat lower than ammonium nitrate or urea. In order to calculate a fertilizer application rate, the following information is needed: (1) the N content of the material from the package label, (2) the target rate (usually not higher than 50-60 lbs N/ac per cut of hay), (3) the total area to which N will be applied, and (4) the density of the liquid fertilizer being used.

Example – A hay producer wants to apply 60 lbs of N per acre per cut of hay using a 32% solution. He has 50 acres of bermudagrass. How much he needs to apply for cut of hay? UAN solution content is given in lbs/gal. Soil test-based recommendations are often given in pounds per acre, so a producer will have to convert to gallons per acre to determine the application rate.

Calculation – 32% solution is 32-0-0, so there are 32 pounds of N per 100 pounds of material. Divide the desired amount of N by the percent N in the product: (60 lb N/0.32 = 188 pounds of material necessary to apply 60 lbs of N per acre).

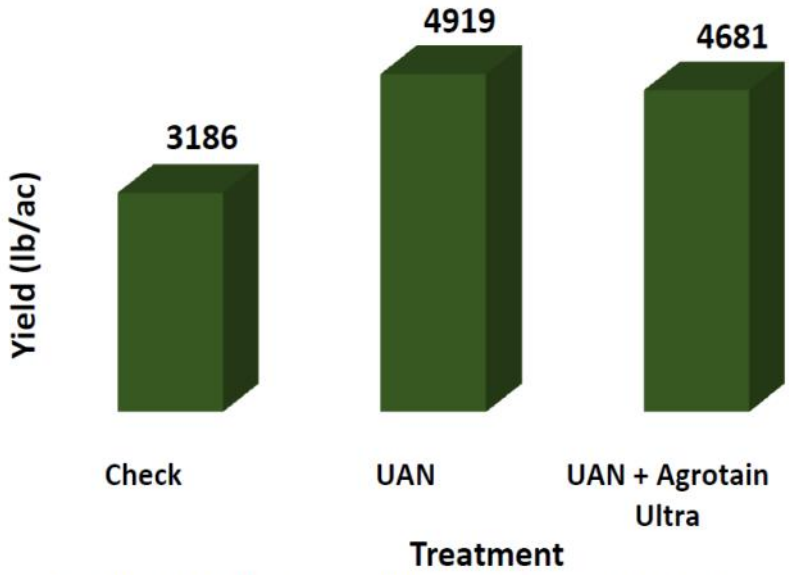

Figure 1. Effect of UAN alone and UAN with Agrotain Ultra in bermudagrass production. Preliminary data. Source: Lemus and White, 2014.

Then, divide the amount of product needed by the weight per gallon of the product. 32-0-0 typically weighs 11.07 pounds per gallon: (188 lbs material per acre/11.07 lbs per gallon = 16.98 gallons per acre, or roughly 17 gallons per acre). For 50 acres, 850 gallons of 32% UAN fertilizer will be needed.

It is important to keep in mind that all NH_4^+ and NH_3 based fertilizers have the potential to volatilize. Volatilization from liquid fertilizers is controlled by multiple and often interrelated factors such as soil properties and environmental conditions that make volatilization losses variable and difficult to predict under field conditions. In general, higher pH, temperature, organic matter, and moisture conditions increase the potential for volatilization. It is important to keep in mind that N applications to forage systems should be done when plants have sufficient foliage and are actively growing (not dormant) to increase N uptake and reduce losses.

For upcoming forage related events visit:
http://forages.pss.msstate.edu/events.html

January 11-14, 2015— American Forage & Grassland Council Annual Meeting, St. Louis, MO