FIELD EVALUATION OF NITROGEN MANAGEMENT PRODUCTS FOR ENHANCING COTTON PRODUCTION

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Abstract

Increases in fertilizer prices and increasing environmental concerns with respect to nutrient runoff from agricultural lands have prompted a continued interest in nutrient management. The primary nutrients of concern for most across the country are nitrogen (N) and phosphorus (P) since these two nutrients are most responsible for eutrophication in streams or other water bodies. Various means are available to reduce nutrient losses from agricultural fields with the most productive means through nutrient uptake by growing plants of commercial interest. This is best described by the Global "4R" Nutrient Stewardship Framework that helps define fertilizer Best Management Practices (BMP's). Fertilizer BMP's can be described simply as the application of the **R**ight source (or product) at the **R**ight rate, **R**ight time, and **R**ight place (Right Product@Right Rate, Right Time, Right Place™ is trademark registered by the fertilizer industry). The objectives of stakeholders and site-specific soil, climate, crop, management system and logistics all have a significant impact on fertilizer management and should always be considered when selecting fertilizer BMP's. Getting nutrients to plants as close to the time they are needed leads to the most efficient use of nutrients whether coming from organic or inorganic sources. The plants themselves do not distinguish between sources; however, some crops such as rice preferentially take up certain forms while others through a symbiotic relationship with bacteria get N from the atmosphere. Many products are being brought to the market place with claims of increased nutrient use efficiency, reduced nutrient loss, nutrient stabilizers, or various other mechanisms to reduce nutrient loss. In recent years products have been marketed to reduce ammonia volatilization, nitrification, denitrification or even some combinations that involve more than one mechanism. This research project was designed to evaluate some of these materials compared to traditional N sources, urea (46% N) and urea-ammonium nitrate (UAN) solution (32% N) under dryland and irrigated conditions and on different soil types.

The materials evaluated in this study included ESN® (Agrium Advanced Technolgies, Inc) Environmental Smart Nitrogen that is a urea granule within a micro-thin polymer coating. The coating allows water within the soil to move into the granule and dissolve the urea inside. The urea solution then moves out through the coating into the soil where it becomes available to the growing crop. A second material evaluated was Agrotain® (N-*(n-Butyl*) thiophosphoric triamide (NBPT) from Koch Agronomic Services. This product has been billed as the world's leading urease inhibitor and is meant to reduce ammonia volatilization when coated on urea granules. The other product that was included in the study was NutriSphere-N® (Specialty Fertilizer Products). The enhancer is said to operate by "killing the spectrum of soil bacteria and manages N fertilizer at the molecular level." This product is also coated onto granular urea or mixed with UAN solution to enhance nutrient uptake. These three products were compared to urea and UAN solution applied at 90, 120, and 150 lb N/acre. The products were mixed with the appropriate N source just prior to application. The all fertilizer sources were applied as a split application, except ESN which was applied 100% at planting. For the split applications, 60 lb N/acre was applied just after emergence with the remaining N applied as a sidedress application (to establish rates) at the pin-head square growth stage (PHS). All cultural practices were maintained uniformly through the season. The non-irrigated study was located at the Tribbett Satellite Farm (TSF) on a Dundee-Forestdale silty clay loam with some Dowling soil intermingled. The experimental design was a factorial arrangement of treatment in a randomized complete block (RCB) design with five replications and grown as a continuous cotton system. The study was initiated in 2010 and continued in 2011. The irrigated site was established in 2011 at the Delta Research and Extension Center (DREC) on a Dubbs silt loam. Treatments were arranged in an RCB design with four replications and followed corn in rotation. All granular treatments at each location were hand-applied pre-weighed samples applied after emergence. Each plot was harvested with a commercial spindle picker adapted for individual plot harvest. Grab-samples were taken at the time of harvest and ginned through a 10-saw microgin to determine the lint percent and subsequent lint yields. All data was then analyzed with the Statistical Analysis System (SAS Institute, Cary, NC) utilizing Analysis of Variance with mean separation by Waller-Duncan K-ration t-test and Fisher's Protected Least Significant Difference.

Previous research has shown a significant decrease in lint percent with increasing N rates so only lint yields will be included in the discussion. First, for the TSF location in 2010 (Agrotain not included in 2010), lint yields ranged from 1159 to 1274 lb lint/acre across all treatments with no significant difference between any of the treatments. There was no significant interaction between N sources and N rates so main effects were calculated. There was no significant difference between sources and no response to increasing N rates. The 2010 rainfall at this location was at least 20 inches below normal which would limit total lint even through yields averaged almost 1200 lb lint/acre. The 2011 growing season was also dry with above average temperatures and below average rainfall. With reduced soil moisture coming into 2011 followed by drought conditions, lint yields were only about 50% of the preceding year. Lint yields ranged from 523 to 663 lb lint/acre. As in 2010, there was no significant difference between treatments. Variability was again high in 2011 but no significant interaction between N source and rate. Two of the lower treatment yields occurred at the lowest N rate. There was no significant interaction and thus main effects showed no difference in N rate or N source again in 2011.

An irrigated study at the DREC was initiated in 2011 following corn in rotation. Yields from this study ranged from 1137 to 1365 lb lint/acre. Statistical analysis showed no significant response to any of the N source by N rate combinations. Irrigated yields at DREC were almost double or more the non-irrigated yields at the TSF location. The DREC was more variable and ended up with a higher coefficient of variation and larger LSD. There was no significant treatment interaction so main effects were calculated. There was no difference between sources (urea+Agrotain and ESN slightly lower but not significant) was observed. There was also no response to increasing N rates based on the analysis of variance. The lint yields with 120 lb N/acre was less than 2% greater than the lower N rate (90 lb N/acre)

Early research with the different N sources have not shown a significant yield increase as of yet. However, this research will be continued in future years. Average rainfall at both research sites was much below normal and conditions that lead to potential volatilization losses or nitrification/ denitrification losses have not been present. The potential for these products still remains as long as their cost is not prohibitive.