Effect of Nitrogen Efficiency Enhancers on Corn Growth and Yield at Multiple N-Rates

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Introduction

Nitrogen is an extremely mobile element that has high potential for non-target losses after application as a fertilizer. This is especially true in the porous, sandy soils that are prominent in the southeastern U.S.A. Several products known as Efficiency Enhancers (EE), which claim to reduce N losses through urease and nitrification inhibition, can be added to multiple formulations of N fertilizer.

Several of these products have been tested on multiple crops and in multiple locations with mixed results. However, there is little data regarding the effectiveness of EEs in light, sandy soils. Hot temperatures and high humidity, coupled with coarse textured soils make volatilization and leaching losses of N fertilizers a major concern. Since corn (*Zea mays* L.) requires large amounts of fertilizer and water to maximize grain production, and there is little water or nutrient holding capacity in sandy soils, EE products theoretically could improve nitrogen use efficiency and/or reduce fertilization rate recommendations in sub-tropical environments.

Objective

These experiments were designed to evaluate whether the addition of an EE to Urea Ammonium Nitrate (UAN – 32-0-0) would result in improved plant size or performance (yield, canopy/leaf color – chlorophyll content) compared to UAN alone at various N rates.

Materials and Methods

Dates: March 24, 2008 to September 9, 2008

Locations: 1) Attapulgus Research and Educ. Center - Attapulgus, GA
2) UGA Lang Farm - Tifton, GA

Experimental Design: Split Plot Design with treatments arranged in a Randomized Complete Block

Main Plot Effect: N fertilizer source
1) UAN alone
2) UAN + Agrotain Plus
3) UAN + Nutrisphere-N

Sub-Plot Effect: N rates (kg N ha^{-1})
0, 17, 30, 45, 58, 72, 85, 100, 113, 127, 140, 155, 168, (196 - at Tifton only)

Application: May 14 (Attapulgus); May 15 (Tifton)

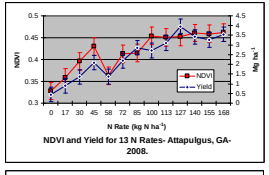
Replications: Attapulgus (5); Tifton (4)

Corn Variety: Dekalb 6971

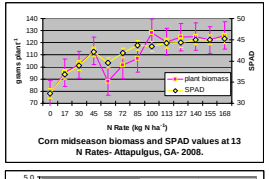
Canopy/Leaf Color Measurement:
GreenSeeker active light sensor (NDVI)
SPAD meter (SPAD) – Attapulgus only

Additional Data Collection:
mid-season plant biomass – Attapulgus only
yield

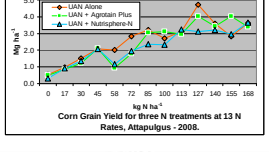
Results



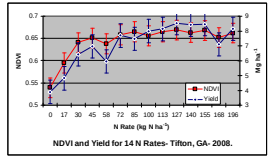
NDVI and Yield for 13 N Rates- Attapulgus, GA- 2008.



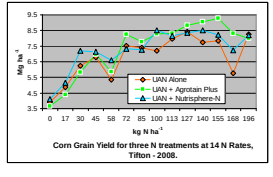
Corn midseason biomass and SPAD values at 13 N Rates- Attapulgus, GA- 2008.



Corn Grain Yield for three N treatments at 13 N Rates, Attapulgus - 2008.



NDVI and Yield for 14 N Rates- Tifton, GA- 2008.



Corn Grain Yield for three N treatments at 14 N Rates, Tifton - 2008.

Discussion and Conclusions

Each location was analyzed separately for each measured variable. There were no source x rate interactions, and main-plot effect was not significant for any measured variable. Only the sub-plot effect of N rate led to differences in plant and ear size, yield, and canopy/leaf color. Trends were similar at both locations, although yields were greater at the Tifton location due to irrigation problems and very dry conditions at Attapulgus for most of the season, and severe late season flooding and wind damage from Tropical Storm Fay (Aug. 23). There were no yield differences for rates above 127 kg N ha^{-1} at Attapulgus, nor for rates above 72 kg N ha^{-1} at Tifton. Midseason samples (plant weight, NDVI, and SPAD) were taken shortly after tasseling on June 17 (Attapulgus) and June 27 (Tifton – NDVI only). All measurements showed similar responses to N rate at both locations. An application malfunction was noted in the 58 kg N ha^{-1} treatment at time of sidedress in both locations, which was depicted in all results.

Based on these results, the addition of an EE to UAN did not result in improved plant performance. Environmental factors were not evaluated in this test, so it is possible that these products do result in reduced N losses and favorable subsequent environmental impacts. However, this data is an indication that rate plays a more significant role in achieving yield goals in sandy soils with sub-tropical climates.