

Title: Determination of Nitrogen Fertilizer Use Efficiency and Evaluation of Controlled-Release Nitrogen Fertilizer Products for Irrigated Corn.

Investigators: T.L. Roberts, Project Coordinator UAF, N.A. Slaton, UAF, and Jason Kelley, UACES.

Status: Reporting on year 2 of 3

Report:

Controlled-release fertilizers represent a significant portion of the fertilizer industry and are widely used in the Upper Midwest. To better understand the ability of these products to perform under Arkansas production practices, experiments have been established on one producer field and one experiment station. These studies were designed to compare the efficacy of ESN (Environmentally Smart Nitrogen) to standard urea over a series of rates and application times. Initial results indicate that products such as ESN can be applied in a single preplant application and produce yields similar to urea applied preplant or in split applications. Protection and extended availability of N fertilizer are benefits of controlled-release products and may provide added yield in extremely wet springs such as 2011. Data from 2012 indicates that ESN is a viable alternative to urea for preplant N and can provide adequate N to maximize corn yields in Arkansas on silt loam soils. The results from this individual study highlight the benefits of ESN and suggest that N applied preplant as ESN can be “protected” from significant rainfall and flooded or ponded water conditions. Corn yields from treatments that received ESN as the fertilizer source were consistently higher than urea when the same rate was applied and the ESN 150 lb N/A, non-flooded treatment resulted in the highest corn yield of all treatments. This data coupled with previous year’s results suggest that ESN is able to achieve higher yields than urea of an equivalent rate, regardless of when the urea is applied. Continued work on this project will allow researchers to develop guidelines for preplant N use of ESN to maximize N fertilizer efficiency and increase corn yields, while reducing the potential for N loss to the environment.

Year 2 of the ¹⁵N-labeled urea was established at the Southeast Research and Extension Center (SEREC) near Rohwer Arkansas. At physiological maturity whole plant samples were taken and separated into leaves, stalk, husk, cob and grain. Samples were dried and analyzed for ¹⁵N. Initial results indicate that N uptake efficiency and N use efficiency are not the same thing. Nitrogen uptake efficiency relates to how well the plant is able to capture the N fertilizer added to the soil, whereas N use efficiency relates to the ability of the corn plant to not only capture the N fertilizer, but turn that N into increased yield. Observations from year 2 support the previous year’s results that N use efficiency is strongly influenced by both time and rate of N fertilizer application. Preplant N fertilizer has the lowest uptake efficiency but is very important for corn establishment. Efficiency of sidedress N applications are directly tied to fertilizer rate and has the highest overall impact on corn grain yield. Preplant N fertilizer efficiency was directly related to sidedress N rate and can vary greatly in the N uptake efficiency as well as the impact on corn grain yield. Year 1 results suggest that properly managed preplant and sidedress N applications are sufficient to maximize corn yields with no benefit from preplant N applications. Year 2 corn yields were much higher than year 1, but the same trends in N uptake efficiency were seen indicating that under a wide range of N responses, the proper N rate and timing of N fertilizer application are essential to maximize producer inputs and profitability.