EFFECT OF DELAYED NITROGEN AVAILABILITY ON COTTON YIELD IN VARYING SOILS ACROSS A RANGE OF IRRIGATION REGIMES

Timothy J. Grant
Brian G. Leib
Hubert J. Savoy
University of Tennessee-Knoxville
Knoxville, TN
D. Verbee
Donald Tyler
University of Tennessee
Jackson, TN
Amir Haghverdi
University of Tennessee-Knoxville
Knoxville, TN

Abstract

Water and nitrogen are the two greatest limiting factors for cotton production. Irrigated cotton acreage in West Tennessee has grown steadily for several years. With supplemental irrigation, questions arise about how nutrients, especially nitrogen, will behave with respect to availability or possible losses. These questions are confounded even more because of the range of potential soil types that can be encountered within a field. Studies in Jackson, TN have shown distinct and different responses to irrigation amounts and timing on different soil types. Soils varied largely in water holding capacity and ranged from deep silt loams to shallow silt loams over sand to soils that are quite sandy throughout. Lower water holding capacity soils often require more water earlier to achieve optimal yields, which could create environments susceptible to leaching of nitrogen. With this in mind, we investigated the effect of delayed nitrogen availability via the use of a polymer-coated urea fertilizer.

Our objective was to evaluate the effect of a timed-release nitrogen fertilizer on cotton yield and nitrogen uptake across a range of soils and irrigation regimes. Environmentally Smart Nitrogen (ESN) was used as a way to delay nitrogen release to the crop. ESN and ammonium nitrate were broadcast after emergence and were each examined over the previously established range of soils and over a range of irrigation regimes. Leaf samples were taken to monitor nitrogen uptake. Irrigation was applied using three sizes of drip tape, to simultaneously apply different rates, and three times a week adjusted for rainfall.

In two wet years, 2013 and 2014, deep soils did not respond to supplemental irrigation. Shallow soils, however, did see a yield increase with irrigation and also a yield downturn with the heaviest irrigation. In 2013, irrigation timing played a role in effectiveness of nitrogen sources. Earlier irrigation tended to benefit ammonium nitrate, and later irrigation cut-on resulted in similar yields between nitrogen sources. In 2014, higher overall water input was beneficial to ESN, but fertilizer effect was significant across all treatments and soils in favor of ammonium nitrate. Leaf sampling results supported the notion of higher available nitrogen from ammonium nitrate in general. ESN was generally competitive with ammonium nitrate but was slightly outperformed the majority of the time. Management questions arise about the use of ESN and whether it would be beneficial for it to be soil-incorporated and when it should be applied.