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NITROGEN REQUIREMENTS FOR COTTON IN THE LOWER COASTAL PLAIN

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Abstract

Giving exact recommendations for nitrogen (N) on cotton over a range of soil types and moisture conditions is difficult since soils, rotations, and other management vary tremendously from farm to farm and year to year. However, managing N in cotton is important for profit as well as preventing nitrates from leaching below the root zone and into ground water. Timing and rates of N applied to cotton was studied for several years observing nitrate movement on both sandy and sandy clay loam soils with and without irrigation. Studies had N rates ranging from 0 to 180lbs./A and use of starter N as well as timing throughout the season. Results varied with soil type and time of application. Excessive N rates increased nitrate levels in the soil below the root zone. It was difficult to follow the nitrate surge on the sandy soil as the nitrate moved too quickly through the profile to follow, while nitrate in the sandy clay loam soil stayed in the root zone longer and could be monitored. A winter cover crop of wheat reduced the nitrate level in the soil profile by storing N in the plants for recycling in the summer crop. Monitoring soil nitrate N is helpful in evaluating potential ground water contamination and determining crop needs. Time of N application was very important for most efficient yield response. Fertilizer applied before planting may be leached below the root zone on sandy soils, while applying N after the 4th week of bloom may reduce yields due to excessive vegetative growth. If only one sidedress application of N is made, the optimum time is about 6 weeks after planting. When several N applications are made on sandy soils, they should be made about 3 weeks apart with the last one no later than 10 weeks after planting. Studies indicated that lower N rates should be used on unirrigated fields as compared to irrigated ones since dry weather may delay its utilization. No more than 140 lbs./A of N is needed for irrigated crops on sandy if proper splitting of applications is done. Irrigated cotton on sandy soils should have 20 lbs N./A as a starter followed by 20 lbs. N/A three weeks later, followed by 60 lbs. N/A 6 weeks after planting and 40 lbs. N/A at 9 weeks after planting. Irrigated cotton on sandy clay loam soil should have 30 lbs. N/A at planting followed by 90 lbs. N/A at 6 weeks after planting. Generally, the unirrigated fields do not need an application after the 6 week application.

Introduction

Proper nitrogen (N) management is critical to achieving high yields in cotton. Having the proper rate of N at the right time helps to insure that cotton has a good boll load and does not have an excessive amount too late in the season resulting in late maturity and poor defoliation (McConnell et al., 1993). Since N is so mobile in the soil and especially in sandy Coastal Plain soils, it is difficult to determine the N status available to the plant at any time. Gardner and Tucker (1967) were the first to identify a positive relationship between petiole nitrate-N and yield. Since that time, petiole tests for nitrate status of the plant has helped growers determine when and how much N may need to be applied to the crop. Florida had little cotton grown over the last 80 years until the early 90's when cotton moved back into the state as infrastructure was developed along the state lines with Alabama and Georgia. Cotton was a traditional crop in Florida and at one time one county in North Florida was the top producing county in the Southeast with a direct rail line to the coast for shipping. The soils in this area are called the "red lands" as they have high clay content and hold moisture well. These soils have a high production potential, but over the past 150 years have been bought by industrialists from the northeast for quail plantations. In recent years cotton moved from a small pocket in west Florida across the panhandle into sandier soils. As cotton moved east across the panhandle, organic matter, water holding capacity, and fertility decreased. This resulted in higher N recommendations and more split applications to help crops maintain adequate amounts of N for the peak uptake period. Cotton requires most of the N when bolls and seeds are developing (Hodges,1991, Radin et al., 1985). Our objectives in these studies has been to identify the proper timing of N application for good yields without risking leaching of nitrates through the system into the ground water during periods of high rainfall, and to keep from delaying maturity by applying N too late.

Discussion

Research projects were conducted during the last several years to determine rate and timing of N applications on cotton on sandy and sandy clay loam soils with and without irrigation. Weather conditions, rotations, tillage and several other factors varied over these studies. In about half of the projects, cotton was planted in rotation with other crops that had been intensively managed (corn or peanuts) on relatively heavy soils for the Coastal Plain. In years with severe hardlock, 3 out of the last 5 years, N applications actually reduced yields as a result of more severe hardlock in plots with moderate to high N rates. Where starter fertilizer was used at 20 lbs. N/A in the solution, little response was found on sandy clay loam soils if adequate sidedress N was applied 6 weeks after planting, while sandy soils always gave a yield response to starter N

regardless of the sidedress application rate, indicating that early N deficiency can result in yield decreases. In our studies with and without irrigation, one year had a drought period after sidedress applications of N with rainfall resuming in late summer and early fall. Unirrigated plots had excessive late season growth due to cotton taking up the N late in the season. Excessive late season growth delayed maturity and lowered yields.

In a study on N timing, using a total of 60 lbs. N/A applied to different plots starting at planting and making applications to different plots every 3weeks, highest yield was obtained from applying the 60 lbs. N at 6 weeks after planting. However, this was not different from applications made at planting and at 3 weeks. Applications made after the third week of bloom had yields not statistically different from the 0 N treatments. This suggests that much of the late season N that is applied does little or nothing for a yield increase and may be economically detrimental. Nitrogen management is critical to the success of a cotton crop and management is even more critical on the sandy infertile sites, and requires more management than the heavier more fertile soils.

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