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VARIETY RESPONSE TO FOLIAR APPLICATIONS OF NITROGEN

T.S. Osborne, J.C. Banks, L.D. Bull, C.D. Jack, and J.T. Wallace
Oklahoma State University
Altus, OK

Abstract

High input costs and lower prices have forced cotton producers to scrutinize every aspect of production. Although fertility is a vital input to achieve maximum economic return, growers often attempt to reduce nitrogen rates in hopes of lowering these costs. In Oklahoma, nitrogen is typically applied preplant as urea or anhydrous ammonia on irrigated acres, while dryland acreage may go unfertilized or receive in-season applications of nitrogen. Often the plant's ability to utilize these forms of nitrogen in-season depends upon timeliness of rainfall or irrigation. Past research shows that peak nitrogen utilization by the cotton plant occurs from flowering through boll maturity, which often differs by variety. Picker-type varieties account for most of the irrigated acreage within Oklahoma, while the majority of dryland acres are planted to stripper varieties. Typically more determinant varieties (stripper-types) respond differently to environmental stresses than do less determinant (picker) varieties. The ability to manage nitrogen inputs more closely and on an as-needed basis could be advantageous for producers. Many times an adverse weather event early in the season will severely decrease or eliminate yield potential, which also reduces or eliminates the crop's need for nitrogen. Applying more nitrogen in-season may have the potential to reduce up-front expenses in an uncertain environment. Although substituting foliar applied sources of nitrogen for traditional applications historically has had little effect on cotton lint yields, their consideration as a means of adding supplemental nitrogen (when necessary) is gaining attention. One specific consideration is the reduction of traditional pre-season applications of nitrogen by 30% with the intention of supplementing the crop through foliar applications later in the season on an as-needed basis. Prior research in the area of petiole analysis by Livingston et al., 1996 shows that in-season nitrogen needs can be accurately monitored thus providing a means for prescribed supplemental applications during the peak usage period. The objectives of this research were as follows: (1) Diagnose in-season nitrogen needs through petiole analysis; (2) Apply prescribed rates of foliar nitrogen when petiole nitrate-N drops below a predetermined threshold; (3) Determine differences in fruiting pattern or yield between more or less determinant cotton varieties which received supplemental applications of foliar nitrogen; (4) Compare two supplemental foliar nitrogen regimes to a traditional fertility program.

This study was designed as a split-plot with 2 varieties as main plots and 4 fertility regimes as subplots with four replications. The cotton varieties DP 655 B/R (a less determinate picker variety) and PM 2280 B/R (a more determinate stripper variety) were planted in a Tillman Hollister clay loam soil on May 9, 2002. Each plot, consisting of 4 rows 120 feet in length, received one of the following four fertility treatments: (1) a traditional preplant nitrogen application based on soil-test recommendations (180 lbs 46-0-0 for 2 bale yield goal), followed by 0.2 lb/a of foliar boron at pinhead square; (2) 2/3 of the traditional preplant application followed by 0.2 lb/a of foliar boron at pinhead square and foliar applications of feed grade urea on an as-needed basis; (3) 2/3 of the traditional preplant nitrogen application followed by 1 qt/a of an experimental solution of 12-0-0-0.5 (HM 9826-A) at pinhead square plus 2 qt/a of 3-23-0, with 3% calcium (HM 9870) at mid-bloom followed by 1 gal/acre of an experimental solution of 25-0-0-0.5 (HM9309) on an as-needed basis; (4) 2/3 of the traditional preplant nitrogen application followed by 0.2 lb/a of foliar boron at pinhead square plus foliar water when any other as-needed treatment was applied.

All plots were maintained using standard irrigated cotton production practices throughout the season (insect control, tillage, weed control etc.) Five plants were mapped from each plot at the end of season to determine differences in fruiting patterns. The standard treatments at pinhead square were applied on June 26, 2002, while the mid-bloom treatment was applied on July 23, 2002. Beginning at the pinhead square cotton stage, petiole analysis was performed on each plot and continued on a weekly basis until cutout. Nitrate-N levels were recorded each week for each plot. When levels dropped below the arbitrary threshold (which cannot be disclosed for proprietary reasons) both as-needed treatments were applied. Foliar applications were made by a compressed air, high-clearance research plot sprayer at a volume of 10 gallons per acre, 22 PSI, with flat-fan 8002VS nozzles, traveling at 4 mph. Petiole analysis and yield data were subjected to factorial analysis of variance at the 5% level of significance.

Results of petiole analysis for Nitrate-N dictated the following applications: Treatment 2 - (Foliar N from feed grade urea @ 10 lbs ai/A) and Treatment 3 - (Foliar N from HM 9309 25-0-0-0.5 @ 1 Gal/A. The application dates for these two as-needed treatments were July 23, August 1, August 7, August 14, and August 22.

Statistical analysis revealed the interaction between variety and nitrogen treatments to be non-significant for all petiole sampling dates, fruit retention and yield. However, differences in petiole nitrate-N levels did exist between varieties on the sampling dates of June 25, July 2, July 9, and July 23 (Petiole Analysis Table.) Petiole nitrate-N was greater for DP 655 B/R compared to PM 2280 B/R on each of the four sampling dates previously mentioned. This suggests that the shorter season,

more determinate variety depleted more nitrogen from the soil than the longer-season, less determinate variety at those given dates. This difference is expected since the fruiting period of the more determinate variety is generally initiated earlier in comparison to the less determinate variety.

First position fruit retention was independently affected by variety and nitrogen treatment. Nitrogen treatment 1 showed greater first position fruit retention than treatment 4. No other fruiting differences existed between nitrogen treatments. First position boll retention was greater for DP 655 B/R compared to the more determinate PM 2280 B/R. Likewise, lint yields were greater for the less determinate variety (DP 655 B/R). Nitrogen regimes (treatments) had no effect on cotton lint yield, thus the data is not presented.

In conclusion, petiole nitrate-N levels were accurately monitored throughout the growing season and did provide a basis for the diagnosis of in-season nitrogen deficiencies. Overall fruit retention from plots which received reduced (2/3 of the soil test recommendation) applications of preplant nitrogen followed by a supplemental foliar program was equal to plots which received the traditional full (according to soil test recommendations) preplant application of nitrogen. This suggests that foliar applications do have the potential to maintain fruit retention when nitrogen deficiencies may exist. However, since lint yields were unaffected, the basis for the recommendation of foliar treatments may depend on factors other than yield. Further research may be justified in order to establish a nitrogen deficiency threshold where foliar applications may result in increased yields.

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