Effective nitrogen (N) management in cotton (Gossypium hirsutum L.) production is essential to achieve proper growth and development. Soil-incorporated N fertilizer can undergo a series of chemical conversions along with numerous loss mechanisms (leaching, volatilization and denitrification) that can make N unavailable to the plant. Soil-applied N fertilizer has faced much scrutiny for its role in degradation of water quality. Methods to reduce the amount of soil-applied N, such as foliar fertilization, have been examined. From root and vegetative growth to reproductive development, N is vital in every phase of cotton development and plant demand is high. For over a century, foliar fertilization has been utilized as a source for correcting nutritional imbalances and supplementing soil-incorporated fertilizers to achieve proper plant development (Oosterhuis and Weir, 2010). However, foliar fertilization of cotton has only become popular within the last 20 years (Oosterhuis and Weir, 2010). The rationale and theory supporting the use of foliar-N fertilization is primarily based on the numerous loss mechanisms that soil-applied N fertilizers can endure and the high demand of N by cotton during the reproductive stage (Thompson et al., 1976). Boll development requires a substantial amount of N that is mainly provided by the leaves (Zhu and Oosterhuis, 1992) and any deficiencies in leaf N can result in decreased boll growth and overall yield (Bondada et al., 1997). Therefore, N applied to cotton via foliar fertilization is viewed as an option for correcting leaf N deficiencies (Craig, 2002). The objective of this study was to evaluate the effectiveness of foliar-N fertilization on the yield of field-grown cotton in conditions of limited soil-N availability.

PROCEDURES

The 2013 field experiment was conducted at the Lon Mann Cotton Research Station in Marianna, Ark., in a Memphis silt loam (fine-silty, mixed, active, thermic Typic Hapludalfs) soil. The experiment was a randomized complete block design consisting of three treatments and four replications. A total of 12 plots, each composed of 4 rows, 50-ft long by 3.17-ft wide, were used for the experiment that was planted with cotton cultivar Stoneville 4288 B2RF on 16 May 2013 at a seeding rate of approximately 3 seeds/ft. Furrow irrigation was performed as needed for ideal growth and adequate soil moisture throughout the growing season. Urea-ammonium nitrate (UAN 32) was applied to the soil in all treatment plots on 20 June 2013 at a rate of 45 lb N/acre. Foliar applications of urea (46-0-0) and Nitamin (30-0-0; Koch Agronomic Services, LLC, Wichita, Kan.), at rates equivalent to 6 lb N/acre, occurred approximately 1 week after first flower using a pressurized CO₂ backpack sprayer at 30 psi and 4-nozzle spray boom equipped with 8002VS spray tips calibrated to deliver 20 gal/acre. No stabilizers were used with either UAN 32 or foliar-applied urea. Seedcotton yield was determined with a mechanical picker.

Analysis of variance methods were used to determine significant differences between treatment means at the $P \leq 0.05$ and $P \leq 0.10$ levels using the “Fit Model” platform provided by JMP Pro 10.0 software (SAS Institute, Cary, N.C.).

RESULTS AND DISCUSSION

Seedcotton yield was different among the three treatments ($P = 0.0018$, Table 1). Interpretation of results at the 0.05 level of significance showed the foliar urea and Nitamin treatments were not significantly different, but had significantly greater yields than the no-foliar-N control. When the analysis was interpreted at the $P \leq 0.10$ level, all treatments were significantly different from each other with cotton fertilized with Nitamin having significantly greater yields than cotton fertilized with foliar urea.

PRACTICAL APPLICATION

This one experiment showed a positive yield response to foliar-applied N by cotton grown under field conditions of limited or low N fertility regardless of the foliar-N source. The 45 lb N/acre of soil-incorporated UAN was well below the N rates typically recommended for cotton production in Arkansas (90-100 lb N/acre). In this experiment, no N deficiencies were observed before foliar-N applications were made. However, if N deficiencies are observed in cotton plants at the growth stage of first flower, foliar applications of N can be advantageous due to the absorption and provision of foliar-applied N imparted by subtending leaves into the developing bolls. Additionally,
foliar urea is considered beneficial as a result of its rapid rate of absorption and relatively inexpensive cost (Oosterhuis and Weir, 2010). Repeated studies need to be performed to ascertain if Nitamin can consistently produce significantly greater seedcotton yields than foliar-applied urea. Since Nitamin is still a relatively new foliar-N fertilizer source, additional inquiries need to be made to determine if Nitamin’s slow-release technology and viscous nature can be as favorable in cotton production as a foliar-N fertilizer standard such as urea.

ACKNOWLEDGMENTS

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LITERATURE CITED


Table 1. Harvest yield means per treatment for the 2013 Marianna yield study.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (lb/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAN</td>
<td>2862</td>
</tr>
<tr>
<td>Foliar Urea + UAN</td>
<td>3080</td>
</tr>
<tr>
<td>Nitamin + UAN</td>
<td>3184</td>
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<tr>
<td>LSD _{0.05}</td>
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<tr>
<td>LSD _{0.10}</td>
<td>97</td>
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