Foliar Fertilizer Evaluation on Upland Cotton, 1997

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Abstract

A single field experiment was conducted in 1997 at the University of Arizona Yuma Valley Agricultural Center. The purpose of the experiment was to evaluate foliar applications of Macro Sorb (L form amino acids) and KeyPlex (chelated micronutrients and alpha keto amino acids) foliar fertilization materials on Upland cotton. Treatments consisted of various rates and times of application of the foliar materials based upon manufacturer recommendations. Results from this single experiment revealed no differences among treatments with respect to in-season plant measurements, tissue N concentrations, or lint yield.

Introduction

The management of a balanced fertilizer program is a very important component of any cotton (Gossypium spp.) production program in Arizona. Water, and N are normally the most limiting inputs to successful cotton production in most desert soils. Based upon all available evidence, there are 20 nutrients that are considered as essential for complete plant growth and development. Not *all* are required for *all* plants, but *all* have been found to be essential to *some*. It is important for cotton farmers to use fertilizers appropriately to provide a balanced nutritional base for the crop to maintain optimum yields and profits. However, understanding when, how much, and what form of a give nutrient is needed is not always clear. New fertilizer materials and formulations are constantly becoming available to the agricultural community. It is therefore important to provide some information relative to product performance with a given crop in an effort to develop guidelines for appropriate use. Accordingly, the objective of this study was to evaluate the effects of two foliar fertilization products at various rates and times of application on the growth, development, and lint yield of Upland (*G. hirsutum* L.) cotton.

Materials and Methods

A single field experiment was conducted in 1997 on a Holtville clay loam at the University of Arizona Yuma Valley Agricultural Center (YVAC). Upland cotton (var. DP 33b) was planted on 18 March 1997. The experimental structure was a factorial arrangement of treatments in a randomized complete block design with four replications. Plots were four, 38 inch rows wide and 30 feet in length. Treatments consisted of two materials: KeyPlex 350 (a Morse Enterprises Ltd. Product with chelated micronutrient mixture with alpha keto amino acids) and Macro-Sorb (manufactured by Nutramax containing L form amino acids). Macro-Sorb foliar is recommended for those occasions when plants have difficulty absorbing nutrients from the soil. Macro-Sorb has a guaranteed analysis of free amino acids - total (9.3%), natural amino acids - total (12.0%), organic matter - total (14.8%), B (0.019%), Mn (0.046%), and Zn (0.067%). KeyPlex 350 contains Mg (1.5%), Mn (0.75%), Zn (0.75%), Cu (0.006%), Fe (3.5%), B (0.16%), Mo (0.0006%), and S (4.0%). Treatments were made by foliar application using a hand held, CO_2 back-pack sprayer with a carrier rate of 40 gallons/acre. Timing of treatment applications were structured to coincide with early and peak bloom of the crop. Actual treatment rates and dates of applications are outlined in Table 1. All pest control and irrigation management practices were carried out in an optimum fashion. Nitrogen fertility was managed in a manner consistent with current UA recommendations (Silvertooth and Doerge, 1990; and Silvertooth and Norton, 1997)

Crop vigor is described by use of a height to node ratio (HNR), and fruit retention (FR) as a percentage of fruit retained on the first two positions of all fruiting branches, both as a function of heat units accumulated after planting (HUAP, 86/55 °F thresholds). Similarly, baselines and normal ranges have been described for other crop growth parameters such as the rate of node production, position of first fruiting branch, occurrence of first bloom, number of nodes above the top (first position) white flower (NAWF), rate of canopy closure, and progression to cut-out. Expected ranges with respect to each of these parameters has been developed specifically for cotton produced under Arizona conditions, therefore these baselines are very unique in this respect (Silvertooth et al., 1991).

Basic plant measurements were carried out within each plot on a regular 14 day interval for the entire season. These measurements included plant heights, number of mainstem nodes per plant, flower numbers per 95 $ft.^2$ area, and the number of nodes above the top white flower to the terminal (NAWF). Petioles were also sampled on a routine basis throughout the season and analyzed for NO_3^--N. Plant mapping was performed on each distinct treatment at 14 day intervals during the course of the season. Results from the plant mapping provide information concerning the percent total fruit retention (sum of positions one and two on each fruiting branch) for each treatment, a record of the general vegetative/reproductive balance maintained by the various treatments over time, and maturity progress.

Progression into cut-out was identified for all plots on 23 July (NAWF $\leq$ 5). The final irrigation was made on 31 July and all plots were harvested on 18 September. Lint yields were obtained for each treatment by harvesting the entire center two rows of each plot with a two row mechanical picker. Seedcotton subsamples were collected for ginning, from which lint turnout estimates were made. Results were analyzed statistically in accordance to procedures outlined by Steel and Torrie (1980) and the SAS Institute (SAS, 1988).

Results

Fruit retention (FR) and height to node ratio (HNR) results are presented in Figures 1 and 2. Lint yield results are shown in Table 2. Plants in this study experienced very strong FR levels relative to baselines (Figure 1) throughout the season. Plant vigor (HNR) levels declined very slightly in the latter part of the season. This was attributed to the strong boll load being supported by the plants and was a positive indication relative to the application and intended purpose of the foliar treatments used in this study.

Lint yields were relatively high among all treatments. A reasonably high level of variation was detected among treatments, as indicated by a coefficient of variation (CV) of about 24%. Based upon the analysis of variance, no significant differences were detected among treatments ($P \leq 0.05$) with an observed significance level (OSL) of 0.4998.

In conclusion, no measured benefits were realized by use of any of the treatments employed in this study. These results are based upon a single site-year of evaluation. Additional site-years of experimentation would be advantageous in the development of recommendations and guidelines for the use of materials such as these.

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Table 1. Foliar treatments used at the Yuma Valley Ag. Center, 1997.

	Date of Application	
Treatment	**13 June 1997**	**27 June 1997**
1	-	-
2	2 qt/acre Keyplex 350	-
3	-	2 qt/acre Keyplex 350
4	2 qt/acre Keyplex 350	2 qt/acre Keyplex 350
5	2 qt/acre Keyplex 350DP	-
6	-	2 qt/acre Keyplex 350DP
7	2 qt/acre Keyplex 350DP	2 qt/acre Keyplex 350DP
8	2 L/ha Macro-Sorb	-
9	4 L/ha Macro-Sorb	-
10	-	2 L/ha Macro-Sorb
11	-	4 L/ha Macro-Sorb
12	2 L/ha Macro-Sorb	2 L/ha Macro-Sorb

Table 2. Lint yields for each foliar treatment, Yuma Valley Ag. Center, 1997. Treatment numbers correspond to those found in Table 1.

Treatment	**Yield (lb. lint/acre)**
1	1975.9 a*
2	1442.7 a
3	1505.4 a
4	1536.8 a
5	1944.5 a
6	1536.8 a
7	1348.6 a
8	1693.6 a
9	1725.0 a
10	1787.7 a
11	1819.1 a
12	1348.6 a
§$LSD_{0.05}$	NS
†OSL	0.4998
‡C.V. (%)	23.29

* **Means followed by the same letter are not significantly different according to a Duncan's LSD test.**

§ **$LSD_{0.05}$=Least Significant Differences**

† **OSL=Observed Significance Level**

‡ **C.V.=Coefficient of Variation**

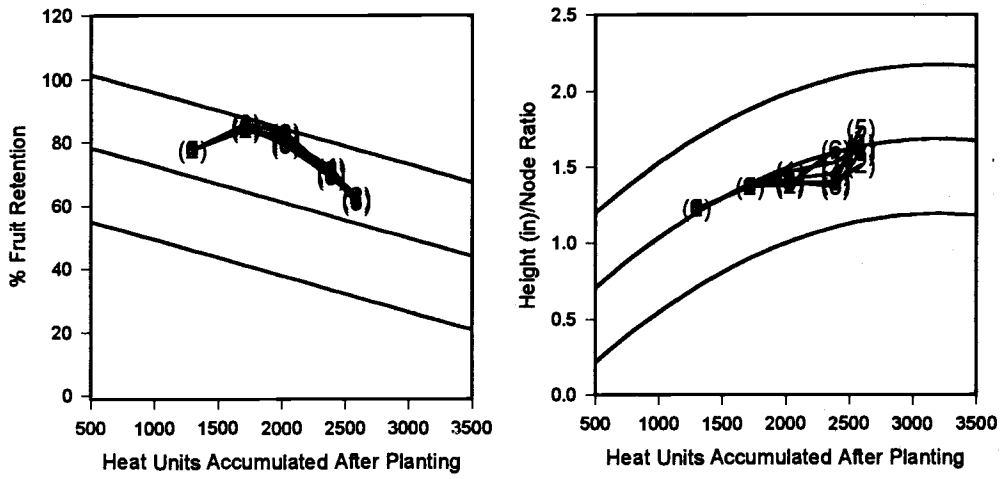

Figure 1. Fruit retention and height to node ratio levels, foliar spray study (treatments 1-6), Yuma Valley, 1997. Treatment numbers correspond to those found in Table 1.

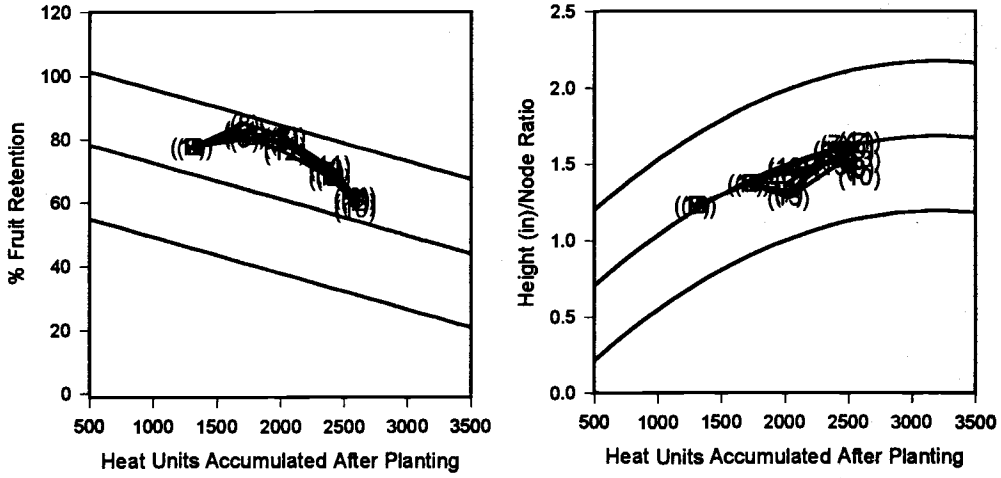

Figure 2. Fruit retention and height to node ratio levels, foliar spray study (treatments 7-12), Yuma Valley, 1997. Treatment numbers correspond to those found in Table 1.