An Evaluation of an Alternative Commercial Fertilization Program for Cotton

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Abstract

Plant growth products manufactured by BioHumaNetics, Inc. (BHN) were evaluated at the Maricopa Agricultural Center for the third consecutive year in the same field. Treatments included: 1) no fertilizers added; 2) standard fertilization used on cotton at the farm; and 3) a treatment schedule prescribed by BHN. Yields in 1987 were significantly different; the BHN treatment produced the highest yield, and the unfertilized treatment produced the lowest yield. Yields from all three treatments were substantially lower than corresponding 1986 yields.

Introduction

BHN products are marketed on the basis that they provide a better nutritional environment for plant growth than most conventional approaches. The program uses frequent, relatively small applications of a wide range of nutrients, as determined by plant tissue analysis and growth stage of the plants. Both foliar and soil applications are prescribed. Most products are in a liquid form containing humic acids, and formulations often include micronutrients and nitrogen fixing bacteria. Because the manufacturers claim that program benefits are partially due to cumulative soil effects, we have maintained this trial in the same plots for the third consecutive year.

Methods and Materials

The three treatments (Table 1) were arranged in a randomized, complete block design with 8 replications. Each experimental unit was 8 rows wide (40" spacing) by 600 feet in length. DPL 61 seed was planted on 10 April. At this time, Thimet (15 lbs/A) was applied only to treatments 1 and 2. The BHN treatment received no Thimet. Seed for the BHN plots was treated with a non-insecticidal supplement. Seed for all three treatments was treated with the standard DPL seed treatment. Boll counts and height measurements were made at mid-season (6 August) and at the end of the season (16 October). Petiole samples were taken on 6 August for nutrient analysis. Boll samples were hand harvested from 1 meter by 1 row subplots at the end of the season. The 4 center rows of each plot were machine-picked on 23 October, and a second pick was made on 24 November. Soil samples were taken from each plot on 24 November and were analyzed for nitrate nitrogen (water extract) and for zinc and iron (DTPA extract).

Results and Discussion

Overall, yields were lower than 1986 results for all three treatments (Hofmann and Else, 1987). Lint yields in 1986 averaged 3.30, 3.90, and 3.84 bales/A for treatments 1, 2, and 3, respectively. Yields in 1987 averaged 2.64, 2.90, and 3.25 for the same three treatments.

Results in 1987 (Table 2) show that treatment 3, the BHN treatment, had a significantly higher first pick and total pick yield than the other two treatments, and had a significantly higher second pick yield than treatment 1 (unfertilized treatment). Treatment 2 (standard program) had a significantly higher second pick and total yield than treatment 1.

Nutrient deficiency symptoms were visually apparent in the treatment 1 plots by mid-June; this is reflected in the mid- season height measurements (Table 2). By the end of the season, treatment 3 plants were significantly taller than those of the other two treatments.

Analysis of soil samples taken at the end of the season did not reveal a clear picture of differences in available nutrients. There was a trend toward increased amounts of nitrate nitrogen in the two fertilized treatments, but it was not statistically significant. When considering only soil samples taken from the northern half of each plot, there was a significantly greater amount of zinc found in the treatment 3 samples (Table 2). This trend was not seen in samples taken from the southern half of each plot. Treatment 3 also had a significantly higher amount of iron in samples taken from the southern half of each plot, but this trend was not found for samples taken from the northern half of each plot.

Nitrate analysis of petioles sampled at mid-season indicated that there was significantly more nitrate nitrogen in the two fertilized treatments (Table 2). Values for all three treatments were relatively low, probably due to nitrate degradation which could have taken place between the time of sampling and analysis.

Table 1. Treatment schedule.

<u>Tmt</u> <u>1</u> Control: no fertilizers added

<u>Tmt</u> <u>2</u> Standard Maricopa Center fertilization program:

- 3/18- 46% urea at 130 lbs/A (46 lbs N/A), broadcast
- 6/9 - 21% ammonium sulfate at 352 lbs/A (62 lbs N/A), sidedress

<u>Tmt</u> <u>3</u> BioHumaNetics program (applied with ground rig, all liquid):

- 3/18- Soil application of "Lase" and "Huma-N" at 1.88 gal/A (3.75 lbs N/A)
- 5/26- Soil application of 30-0-0 "Huma-N" concentrate (urea and ammonium nitrate) at 16 gal/A (45.3 lbs N/A)
- 5/26- Foliar application of 6-12-4 at 1.7 qt/A (.25 lbs N/A)
- 6/9 - Soil application of 30-0-0 "Huma-N" concentrate at 16.3 gal/A (46 lbs N/A)
- 7/7 - Foliar application of a blend containing Ca, P, K, Mg, B, Mn, Fe, Zn, and Cu.
- 8/6 - Foliar application of a blend containing N (2 lbs/A), P, K, Ca, Fe, Zn, and Mn.
- 9/18- Foliar application of a blend containing N (1 lb/A), P, K, Ca, Mg, Mn, Fe, and Zn.

Table 2. Data Summary for the BHN Field Trial conducted at the Maricopa Agricultural Center in 1987.

	Tmt 1	Tmt 2	Tmt 3	Std. Error	Sig. of F
LINT YIELDS (bales/A):					
1st pick	2.37 A[1]	2.55 A	2.88 B	.127	.016
2nd pick	.27 A	.36 B	.37 B	.018	.000
Total pick	2.64 A	2.90 B	3.25 C	.126	.000
MID-SEASON RESULTS					
Number of bolls/m^2	65.2 A	65.2 A	64.7 A	4.53	.993
Plant height (cm)	71.6 A	81.4 B	80.9 B	3.23	.021
Petiole NO_3-N (ppm)	507 A	979 AB	1472 B	425	.124
Petiole Zinc (ppm)	22.8 A	20.2 A	20.8 A	1.20	.118
Petiole Iron (ppm)	469 A	443 A	455 A	18.9	.400
END-OF-SEASON RESULTS					
Number of bolls/m^2	77.5 A	87.8 A	93.7 A	8.78	.224
Seed cotton/boll (g)	4.85 A	4.80 A	5.04 A	.172	.436
Plant height (cm)	73.5 A	85.1 B	95.7 C	3.44	.000
Soil NO_3-N (ppm):					
North plot samples	3.30 A	4.14 A	4.15 A	.73	.440
South plot samples	2.65 A	3.09 A	2.76 A	.74	.645
Combined analysis	2.98 A	3.61 A	3.46 A	.80	.524
Soil Zinc (ppm):					
North plot samples	0.47 A	0.47 A	0.51 B	.015	.021
South plot samples	0.81 A	0.65 A	0.66 A	.146	.527
Combined analysis	0.64 A	0.56 A	0.59 A	.106	.622
Soil Iron (ppm):					
North plot samples	2.16 A	2.11 A	2.14 A	.088	.870
South plot samples	2.50 A	2.47 A	2.64 B	.035	.002
Combined analysis	2.33 A	2.29 A	2.39 A	.069	.175

[1]/Within each row, means followed by the same letter are not significantly different using the LSD method at the .05 significance level.

Given the inconsistencies of the results, one can only speculate the reason for the significant yield differences found in this experiment. It could be that, after three consecutive years of cotton production in the same field, nitrogen reserves in the soil were low, and nitrogen application scheduling was becoming more of a critical factor. The two fertilized treatments differed somewhat in this respect (Table 1).

It is not known if the treatment 3 foliar applications are having an effect on yield, or if the treatment 3 application of various non-nitrogenous nutrients is an important factor. Treatment 3 zinc levels were found to be higher than those of the other two treatments in one set of soil samples, and levels for all three treatments were below what is generally regarded as adequate (Cox and Kamprath, 1972). Additional soil analysis work is now in progress in order to verify these zinc levels. A closer investigation of both soil and plant characteristics will be necessary in determining the causes of observed yield differences.

REFERENCES

1) Hofmann, W.C. and P.T.Else. 1987. An evaluation of the BioHumaNetics[R] cotton growth program. Univ. of Az. College of Agric. Cotton Report Series P-69. p 79-81.

2) Cox F.R. and E.J.Kamprath. 1972. Micronutrient Soil Tests. p 289-317. In R.C. Dinauer (ed.) Micronutrients in Agriculture. Soil Sci. Soc. Amer.