COMPARISON OF BORON FERTILIZERS FOR FOLIAR FEEDING COTTON

Glen Harris
University of Georgia
Tifton, GA

Abstract

A field study was conducted to compare the effectiveness of foliar feeding different boron fertilizer materials currently available to the Georgia cotton farmer. Five different boron fertilizers were foliar applied to field plots in 1999 and 2000. All treatments were appplied at recommeded rates and then plant tissue samples taken 10 days after application. Yields were also measured on all plots. In both years, a granular boric acid material was the most effective in raising the concentration of boron in the cotton leaf tissue. A granular sodium borate and liquid boric acid were both slightly less effective but were well above the untreated check. A sodium borate liquid, "organically complexed" and containing nitrogen was not different than the untreated check as far as raising leaf tissue boron. No yield response was measured for any treatment. This was due to more than sufficient boron concentrations in all treatment including the untreated check. Additionalk boron applied in either a preplant or sidedress fertilizer each year is thought to be the cause of this result.

Introduction

The standard UGA recommendation for boron on cotton is 0.5 lb B/a foliar applied during the peak bloom period. There are a number of boron fertilizer materials available to the Georgia cotton farmer including sodium borates and boric acid (both in solid and liquid forms). In addition, there are currently liquid formulations available that are combined with nitrogen. Some of these nitrogen-boron combinations claim to be chelated or "complexed". This supposedly makes them more efficient as far as crop uptake, therefore requiring less active ingredient per acre compare to their competitors. The objective of this research was to compare different boron fertilizer materials for their effectiveness for foliar feeding cotton.

Methods

This study was conducted in 1999 and repeated in 2000 at the "RDC Pivot" in Tifton, GA. The soil type is a Tifton loamy sand, the preceding crop each year was peanuts, and the site is irrigated with a center pivot. A different plot area (in different "quadrants of the pivot) was used each year. Conventional tillage was used in 1999 and conservation-tillage (strip-till) was used in 2000. All plots were fertilized according to soil test each year prior to planting. In 1999, a 5-10-15 blend containing no boron was use to supply recommended P and K and preplant N. In 2000, a 5-10-15 blend containing boron was used. In 1999, a 14-4-14 fertilizer was used to sidedress cotton prior to implementing the foliar boron treatments. In 2000, ammonium nitrate was used as a sidedress N source. DPL 458 cotton was planted the first week of May each year and managed using standard recommended practices.

In both 1999 and 2000, at approximately the third week of bloom, foliar B treatments were applied using a backpack CO_2 sprayer. Fertilizer materials evaluated included 1) solid sodium borate (Solubor DF), 2) liquid sodium boron with urea (N-Boron), 3) solid boric acid, and 4) liquid boric acid (Borosol). Both solid fertilizer materials contain 17.5 %B, the liquid boric acid 10 % and the liquid sodium borate contained 3.5 % B (and 3.3 % N from urea). All materials were applied at a 0.5 lb B/a rate except for the N-Boron which was applied at the recommended rate of 0.1 lb B/a. All treatments were applied with 20 gal/a water to plots measuring two rows wide by fifty feet long. Treatments were replicated four times in a randomized complete block design. An untreated check was also included. Ten days after the applying the foliar treatments, plant tissue samples were taken from the uppermost mature leaf blade. All tissue samples were washed with tap water and then dried and analyzed for boron concentration. All plots were also machine harvested in late September each year to evaluate treatment effects on cotton lint yield.

Results and Discussion

Significant differences in the ability of different foliar applied boron fertilizers to increase the concentration of boron in cotton leaf tissue was measured in both years of the study (Table 1). The solid boric acid material raised the leaf tissue boron concentration the highest each year, the solid sodium borate and liquid boric acid were the next most effective and the liquid sodium borate with nitrogen was not significantly different than the check.

There was no yield response to any of the foliar boron treatments compared to the untreated check in terms of cotton lint yield in either year (Table 2). This can be explained by noting that all treatments including the untreated check were above the sufficiency range for leaf tissue boron (20-60 ppm). This is further explained by the fact that in 1999, boron was contained in the sidedress nitrogen fertilizer material and in 2000 in the preplant fertilizer material.

Conclusions

Results of this study indicate that solid boric acid is slightly better in terms of raising the boron concentration in cotton leaf tissue than solid sodium borate or liquid boric acid. All three of these materials did raise the leaf tissue boron above the untreated check. On the otherhand, the "complexed" liquid sodium borate material containing nitrogen that was applied at a lower rate according to the recommendation on the label, did not raise cotton leaf tissue boron above the untreated check. This confirms the current recommendation that most boron materials can be evaluated on a "pound for pound" basis and farmer's decisions based on availability, handling and cost.

The lack of yield response to foliar boron in this test should not be interpreted as a lack of need for such treatments. In this study, boron was included in preplant or sidedress fertilizer materials in addition to the foliar treatments. In this case the foliar treatments were "cheap insurance" that the plant was supplied with adequate boron for good pollination and fruiting. Georgia cotton farmers should continue to apply foliar apply boron in addition to or in replace of preplant and sidedress boron applications.

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Table 1. Effect of foliar applied boron fertilizer treatments on cotton leaf tissue boron concentration (in ppm).

	1999	2000
Solid Boric Acid	128	44
Liquid Boric Acid	109	41
Solid Sodium Boroate	100	40
Liquid Sodium Borate with Nitrogen	72	35
Untreated Check	66	35
Statistical Significance	0.0001	0.0113
Coefficient of Variance (%)	9	9
Least Significant Difference (0.05)	15.7	5.5

Table 2. Effect of foliar applied boron fertilizer treatments on cotton lint yield (in lb/a).

	1999	2000
Solid Boric Acid	1190	1287
Liquid Boric Acid	1201	1184
Solid Sodium Boroate	1299	1191
Liquid Sodium Borate with Nitrogen	1157	1274
Untreated Check	1067	1307
Staistical Significance	NS	NS
Coefficient of Variance (%)	9	6