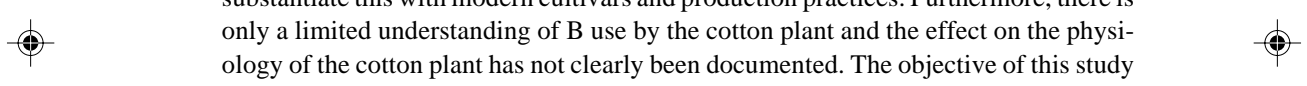




EVALUATION OF SOIL AND FOLIAR FERTILIZATION STUDIES WITH BORON IN ARKANSAS

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RESEARCH PROBLEM



Boron (B) is routinely applied in commercial cotton production as soil- and foliar-applications irrespective of soil B status. However, this recommendation was based largely on research conducted 30 years ago, and there has been no recent work to substantiate this with modern cultivars and production practices. Furthermore, there is only a limited understanding of B use by the cotton plant and the effect on the physiology of the cotton plant has not clearly been documented. The objective of this study was to evaluate yield response of soil- and foliar-applied boron at low and high soil-nitrogen levels. In a companion study the effect of boron deficiency on the growth of the cotton plant was characterized (Oosterhuis and Zhao, 2001).

BACKGROUND INFORMATION

Boron (B) is an essential element required by cotton for optimal growth and development. Current production recommendations in Arkansas call for initial preplant soil applications of 1.0 lb to 2.0 lb B/acre and two to six foliar applications of 0.1 lb to 0.2 lb B/acre. This is based largely on research conducted by Miley (1966), Baker et al. (1956), and Maple and Keogh (1963). Recently, reports of yield response to soil or foliar applications of B have been inconsistent. For example, Howard and Gwathmey (1998), Abaye et al. (1998), and Heitholt (1992) reported no yield response to B utilizing non-buffered spray solutions, whereas Howard and Gwathmey (1998) observed that buffering B spray solutions to pH 4.0 increased yields relative to buffering to pH 6.0.

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RESEARCH DESCRIPTION

The study has been conducted for three years at three locations across the state (northeast, central, and southeast Arkansas). The locations, cultivars used, planting dates, and initial soil-B level (SBL) are presented in Table 1.

Fayetteville and Rohwer locations were on University Experiment Stations and were conducted utilizing small plot studies. Nitrogen rates for the low- and high-N treatments were 50 and 100 units, respectively. County locations were conducted utilizing large plots/strips in producer fields. Treatments were replicated at all locations. Soil-applied B consisted of 1.0 lb B/acre and foliar-B applications consisted of three 0.2 lb B/acre applications 1, 2, and 4 weeks after first flower. 'Buffer Xtra Strength', manufactured by Helena Chemical, was used to buffer spray solution to a pH of 4.0 to 5.0.

RESULTS

In general, soil- or foliar-B treatments had only small non-significant effects on lint yields, and in only one out of ten field trials was a significant yield advantage recorded (Table 2). In general at Clarkedale and in Desha/Jefferson and St. Francis Counties, the B treatments had no significant effect on yield. In Rohwer, significant differences were observed in the irrigated study in 1999 with B increasing yields in the low N plots, but no significant differences were observed in the dryland study and the high N plots of the irrigated study. Buffered foliar applications did not significantly affect lint yield (data not shown, see Oosterhuis et al., 2001).

PRACTICAL APPLICATION

Results of this three-year study indicated that soil- or foliar-applied fertilizer B may not have been necessary for obtaining high cotton yields. There were no positive responses to applied soil-B or foliar-B in the high N soil level in any of the locations. There was only one situation where the low N treatments responded to applied B. No positive responses were observed to buffered spray solutions of B at either of the two locations. These results should be interpreted in relation to initial soil B status. This study indicates that the application of additional B as a routine procedure may not be necessary.

ACKNOWLEDGMENTS

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Table 1. The locations, cultivars used, planting dates (PD), and initial soil B level (SBL).

Location	1999			2000			2001		
	Cultivar	PD	SBL	Cultivar	PD	SBL	Cultivar	PD	SBL
Fayetteville	SG 125	June 4	0.5 lb	SG 747	May 12	0.5 lb	----	----	----
Desha Co.	ST BXN47	May 14	----	----	----	----	----	----	----
St. Francis Co.	PM 1560BG	May 11	----	PM 1218BG/RR	May 21	0.6 lb	----	----	----
Rohwer	ST 474	May 14	0.1 lb	----	----	----	----	----	----
Jefferson Co.	----	----	----	DP 451B/RR	May 9	1.6 lb	DP 451B/RR	May 11	3.2
Clarkedale	----	----	----	----	----	----	SG 747	May 8	1.9

Table 2. Effect of soil- and foliar-B application on cotton yields for test locations in Arkansas in 1999 and 2000.

Treatment	Fayetteville		Clarkedale	Desha Co. irrigated	Jefferson Co.		St. Francis Co.		Rohwer		Rohwer dryland	
	irrigated				irrigated ^z		irrigated		irrigated			
	1999	2000	2001	1999	2000	2001	1999	2000	1999	2000	1999	2000
	[lint yield (lb/acre)]											
High N-control	1173	1348	965	1187	1063	1003	986	— ^y	1432	— ^x	883	---
High N-soil B	1149	1462	921	1196	1041	909	955	1291	1466	---	942	---
High N-foliar B	1181	1302	911	1209	1041	953	944	1250	1420	---	945	---
Low N-control	1236	1296	998	---	---	---	---	---	721	---	896	---
Low N-soil B	1072	1352	961	---	---	---	---	---	1024	---	963	---
Low N-foliar B	1044	1392	902	---	---	---	---	---	1037	---	929	---
LSD(0.05)	NS ^w	NS	NS	NS	NS	NS	NS	NS	184	---	NS	---

^z Field oversprayed with 1 lb B/acre three weeks after the first flower.

^y Treatment not included.

^x Hail destroyed the study.

^w NS = Non significant (P= 0.05)