

Effect of Soil- and Foliar-Applied Boron on the Yield of Cotton Under Two Nitrogen Regimes

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RESEARCH PROBLEM

Boron (B) is routinely applied in commercial cotton (*Gossypium hirsutum* L.) 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 of B 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 B at low and high soil-nitrogen levels. In a companion study the effect of B deficiency on the growth of the cotton plant was characterized (Oosterhuis and Zhao, 2001; Zhao and Oosterhuis, 2002).

BACKGROUND INFORMATION

Boron is an essential element required by cotton for optimal growth and development. Current production recommendations in Arkansas call for initial pre-plant soil applications of 1.0 lb to 2.0 lb B/acre or from two up 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 Maples 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.

RESEARCH DESCRIPTION

The field study has been conducted for the past three years at the Delta Branch Research Station at Clarkedale, AR, in the northeast part of the state. Nitrogen rates for the low and high N treatments were 50 and 100 lb N/acre, respectively, for the 2000 and 2001 seasons and 0 and 100 lb N/acre, respectively, for the 2002 season. The study was planted the first week in May each season utilizing cotton cultivar SG747. Each season, the studies were arranged in a split-plot design and replicated five times. Initial soil boron concentrations ranged from 0.9 to 1.9 lb B/acre as determined by Mehlich 3-extractable B at a 1:7 extraction ratio. Soil-applied B consisted of 1.0 lb B/acre applied at pinhead square and foliar-B applications consisted of three 0.2 lb B/acre applications 1, 2, and 4 weeks after first flower. 'Buffer Xtra Strength' (Helena Chemical Co., Memphis, TN) 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 affects on lint yields (Table 1). Nitrogen level also showed only small non-significant differences in terms of yield (Table 1). In 2002, the high N treatment out-yielded the low N treatment by 39 lb/acre lint compared to the low N treatment when averaged over B treatments (Table 1). 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 always be necessary as a routine procedure for obtaining high cotton yields. There were no positive responses to applied soil-B or foliar-B in either the high N or low N soil level. These results should be interpreted in relation to initial soil B status. There was no positive response to buffered foliar spray solutions of B.

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Table 1. Effect of soil and foliar B application on cotton yields at Clarkedale, AR.

Treatment	Lint yield			
	2000	2001	2002	3 yr. avg.
	----- (lb/acre) -----			
High N-control	1348	965	829	1047
High N-soil B	1462	921	834	1072
High N-foliar B	1302	911	835	1016
Low N-control	1296	998	809	1034
Low N-soil B	1352	961	775	1029
Low N-foliar B	1392	902	808	1034
LSD(0.05)	NS ²	NS	NS	NS

² NS = non-significant (P=0.05).