ALABAMA

Cotton Response to Sulfur on a Coastal Plain Soil

By G.L. Mullins

Since the early 1960s, the Southeast has experienced a reduction in the use of S-containing phosphorus (P) fertilizers, reductions in industrial emissions of atmospheric S, the use of higher yielding varieties, and the adoption of improved production practices, all of which could increase the need for fertilizer S.

The acreage of cotton in the Coastal Plain region of the Southeast has increased in recent years. Soils of the southern Coastal Plain are typically sandy and have low levels of extractable sulfate-S (SO_4-S). Many of these soils have low S adsorption capacities which result in limited residual effects of applied S due to leaching. It is on these deep, sandy soils that a response to S fertilization would be expected.

Cotton yield responses to sulfur (S) have been documented on some Coastal Plain soils, but most of the research was conducted in the 1950s and early 1960s. Alabama is no exception. The current recommendation in Alabama is that all crops receive 10 lb of S/A per year.

In the spring of 1993, a non-irrigated field test was initiated on a Lucy loamy sand at the Wiregrass Substation in Headland, Alabama. The purpose of the study was to evaluate the response of cotton to S. Treatments included rate, source, and timing of S fertilizer applications. Sulfur was preplant broadcast as ammonium sulfate [$(NH_4)_2SO_4$, 24 percent S and 21 percent nitrogen (N)], elemental S (90 percent S), potassium sulfate (K_2SO_4, 19 percent S and 50 percent K_2O), potassium-magnesium sulfate [K_2SO_4•$2MgSO_4$, 22 percent S, 22 percent K_2O, and 11 percent magnesium (Mg)], and potassium thiosulfate ($K_2S_2O_3$, 2.1 lb S/gal. and 3.0 lb K_2O gal.).

Each source was applied at rates of 0, 10, 20, and 40 lb S/A. Timing of S application was evaluated by applying $(NH_4)_2SO_4$ at rates of 10, 20, and 40 lb S/A at first square. In 1995 (last year of the study), additional treatments were added to evaluate cotton response to Mg. The first treatment received 20 lb Mg/A as Mg chloride hexahydrate ($MgCl_2$•$6H_2O$, 11 per-

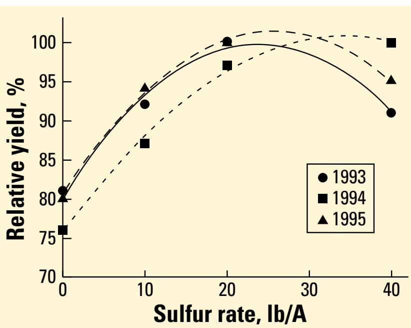

Figure 1. Cotton lint yields as affected by the rate of S on a Lucy loamy sand in Alabama.

TABLE 1. Effect of the source of S fertilizer on cotton lint yields on a Coastal Plain soil in Alabama.

Sulfur source	1993[1]	1994	1995
		lb lint/A	
Ammonium sulfate	277	768	754
Elemental sulfur	294	629	758
K-Mg sulfate	291	786	802
Potassium sulfate	282	629	712
Potassium thiosulfate	296	691	740
$LSD_{(0.10)}$	NS[2]	124	NS

[1]Low yields in 1993 resulted from low rainfall.
[2]NS = non-significant.

cent Mg) without S, and the second treatment received 20 lb Mg/A and 20 lb S/A, the S being applied as $(NH_4)_2SO_4$. All treatments received uniform annual applications of 90 lb N/A and 140 lb K_2O/A.

The Lucy soil had low organic matter and a low level of extractable SO_4-S, which averaged 4 lb/A in the surface 18 inches. Under rain-fed conditions, a positive yield response to S rate was obtained during all three years of the test (**Figure 1**). Lint yields peaked at a rate of ≃20 lb S/A, which is twice the current recommended rate of 10 lb/A for cotton production on this soil. Applying S at a rate of 20 lb/A increased lint yields by an average of 21 percent as compared to the no S check treatment.

In this test, five sources of S were compared: $(NH_4)_2SO_4$, elemental S, K_2SO_4, $K_2S_2O_3$, and K_2SO_4•$2MgSO_4$ (**Table 1**). Lint yields were not affected by the source of S during the first and third years. However, during the second year (which was extremely wet), $(NH_4)_2SO_4$ and K_2SO_4•$2MgSO_4$ produced slightly higher yields as compared to the other sources.

Preplant versus first square applications of S as $(NH_4)_2SO_4$ did not affect lint yields during the first and third years of the study (**Table 2**). In the second year, applying S preplant gave higher yields as compared to first square applications. The response due to timing of S application during the second year was attributed to heavy rainfall soon after the first square application.

In 1995, additional treatments were added to evaluate the effects of Mg on lint yields, primarily due to the favorable performance of K_2SO_4•$2MgSO_4$ in 1994. The Lucy soil had 87 lb/A Mehlich I extractable Mg, which would

TABLE 2. Cotton lint yields (means averaged across rates) as affected by applying S as $(NH_4)_2SO_4$ at preplant or at first square.

Time of application	1993	1994	1995
		lb lint/A	
Pre-plant	294	768	753
First square	296	587	720
$LSD_{(0.10)}$	NS[1]	129	NS

[1]NS = non-significant.

Sulfur-deficient cotton leaves.

correspond to a "high" rating according to the Auburn University Soil Testing Laboratory. Results from a single season suggest that S response and Mg response were additive on the Lucy soil. The response of cotton to Mg and S when applied alone and together needs further investigation.

Summary

Results of this three-year field test on a sandy Coastal Plain soil with low levels of organic matter and extractable SO_4-S in the surface 18 inches showed that cotton may require annual applications of 20 lb S/A to achieve high yields. These results also suggest that for lint production, differences among available commercial S fertilizer sources should be minimal. Sulfur should be applied to cotton preplant. However, in this test delaying application to first square was acceptable in two out of three years. BC

Note: *Article adapted from Mullins, G.L. 1998. Cotton response to the rate and source of sulfur on a sandy coastal plain soil. J. Prod. Agric. 11:214-218.*

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