by Dr. Derrick M. Oosterhuis

Foliar Fertilization of K On Cotton Shows Potential

Results of three-year Beltwide study to correct K deficiencies in soil through foliar fertilization indicate need for more basic research.

Summary: *While firm conclusions cannot be drawn at this time, foliar application of* KNO_3 *appears to offer some potential for supplementing preplant soil applications of potassium fertilizer. However, results of a Beltwide study (1991-1993) have been variable and somewhat inconsistent. It is clear that additional research will be required to better understand the physiological aspects of plant K requirements and soil buffering capacity.*

Widespread outbreaks of potassium (K) deficiency across the Cotton Belt in recent years have focused attention on the possible use of foliar fertilization with K. However, the results that producers have experienced using foliar K have been somewhat inconsistent. Preliminary research in 1989 in Arkansas indicated that foliar applications of KNO_3 can increase yield and lint quality. More recently, a three-year Beltwide K study (1991-1993) was started to better understand the K deficiency syndrome and how to ameliorate it. The cooperative effort included researchers and sites in Arkansas (Dr. Oosterhuis and Mr. Janes), Missouri (Drs. Albers and Tracy), Alabama (Drs. Mullins and Burmiester), Arizona (Dr. Silvertooth), California (Dr. Weir and Mr. Roberts), Louisiana (Dr. Hutchinson), Georgia (Drs. Hodges and Carter), Mississippi (Dr. Ebelhar), North Carolina (Drs. Guthrie and Edmisten), Tennessee (Dr. Howard), Texas (Drs. Cothren and Hickey), and Virginia (Dr. Abaye). Although the results were variable, with significant yield differences about 40 per-cent of the time, improved understanding of the problem and its possible solutions has resulted.

It has been speculated that the outbreaks of K deficiencies in the Cotton Belt are related to the use of high-yielding, early-maturing, faster-fruiting cotton cultivars. These deficiencies cannot always be corrected through soil applications of K. Thus the search for an alternative, as already mentioned. Foliar-applied K may offer the opportunity of correcting these deficiencies more quickly and efficiently. Foliar applications have the advantage of allowing producers to add the necessary K when tissue analysis indicates a pending shortage, thereby arresting the deficiency and preventing yield loss. There have been numerous

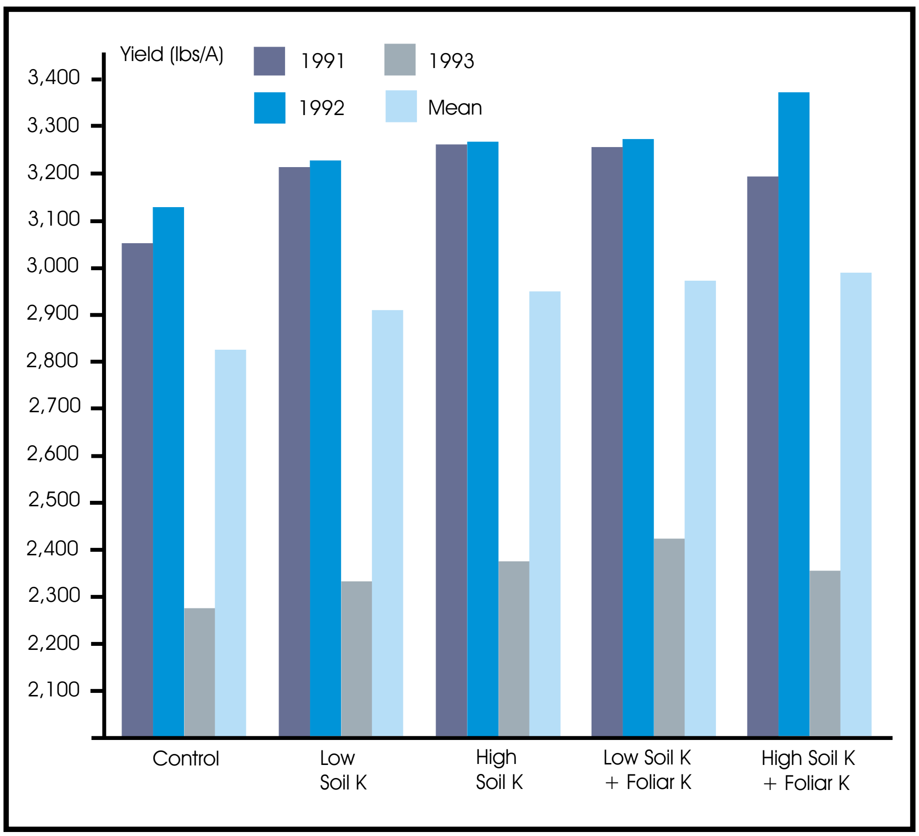

Figure 1. Mean of seed cotton yields averaged over sites for foliar potassium studies in 12 Cotton Belt states, 1991-1993.

reports on research involving soil-applied K, but only a few on the usefulness of foliar-applied K.

With the emphasis on lint quality, the effect of foliar K on lint quality may be of paramount importance. This article will cover a three-year study whose objective was to compare the effectiveness of foliar-applied KNO_3 with soil-applied KCl in alleviating K deficiency and improving cotton yield and fiber quality.

By the book

At all sites, the recommended practices for high-yield cotton production for that particular state were followed. Five treatments consisted of:

- no soil or foliar K
- low-soil-K as preplant KCl, according to preplant soil tests
- high-soil-K preplant (double the recommended level)
- low-soil-K-plus-foliar-K
- high-soil-K-plus-foliar-K

Foliar rate was 10 lbs/A of KNO3 applied four times at 10- to 14-day intervals after first flower. Whenever KNO3 was added to treatments 4 and 5, 1.38 lbs/A of N were added to the other treatments as foliar urea to negate the possible effect of the added nitrogen in the foliar KNO3 treatments.

Preplant soil test potassium levels in the upper six inches varied widely, from a low of 67 lbs/A in Georgia to a high of 829 lbs/A in College Station, Texas.

Mixed returns

1991. Yield results were variable and significant differences occurred in only three of the twelve locations: Alabama, California, and North Carolina.

The soil-added K treatments tended to increase yield (by an average of 150 lbs/A), compared to the untreated control at all except three locations: Georgia, Mississippi, and Texas (College Station). At these three locations, the untreated check gave the highest yield.

The high-soil-K treatment showed only a slight (non-significant) increase in yield of 45 lbs/A, compared to the low-soil-K treatment.

Low-soil-K-plus-foliar-K treatment tended to increase yield the most—by 200 lbs/A, compared to the untreated check and by 50 lbs/A compared to the low-soil-K treatment. Strangely, the high-soil- K-plus-foliar-K treatment decreased yield by 10 lbs/A, compared to the low-soil-K treatment, and by 60 lbs/A, compared to the low-soil-K-plus-foliar-K treatment.

1992. Significant differences occurred at six often locations: Alabama, Arkansas, Georgia, California, Tennessee, and Mississippi.

The low-soil-K and high-soil-K treatments increased yields by an average of 100 to 200 lbs lint/A, compared to the untreated control.

Foliar applications increased yields by an average of 230 and 332 lbs lint/A, compared to the untreated control, and by 44 and 69 lbs lint/A, compared to the low-soil-K and high soil-K treatments, respectively.

1993. Significant differences occurred in three of twelve locations.

The low-soil-K and high-soil-K treatments increased yields by an average of 40 and 99 lbs lint/A, compared to the untreated control.

Foliar-K applications increased yields by an average of 140 and 97 lbs lint/A for the low-soil-K-plus-foliar-K and high-soil-K-plus-foliar-K treatments, respectively, compared to the untreated control.

Foliar K applications increased yields by an average of 100 and 41 lbs lint/A, compared to the low-soil-K and high-soil-K treatments, respectively. Similar trends were observed for boll numbers and boll weight.

The treatment means, averaged across twelve locations, are presented for all three years in Figure 1.

Three additional treatments added in 1993 were:

1. foliar KNO_3 without any soil-applied K
2. sidedressed KNO_3, following a soil-applied KC1 preplant treatment
3. a plant growth regulator (PGR-IV), followed by foliar KNO_3.

The foliar treatment without initial soil-applied K was very disappointing. The sidedressed KNO_3 was not much better than the control. The mean yield for PGR-IV plus foliar KNO_3 over all locations gave the highest yield of all eight treatments. The possible reason is PGR-IV caused increased boll retention that the foliar KNO_3 was then able to feed.

More research needed

While firm conclusions cannot be drawn at this time, foliar application of KNO_3 appears to offer some potential for supplementing preplant soil applications of potassium fertilizer. The results have been variable and somewhat unpredictable. Significant yield differences, as stated earlier, have occurred about 40 percent of the time.

It is clear that additional research will be required to understand the physiology of plant K requirements and soil buffering capacity.

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