Dr. Bill Weir

Foliar Potassium Bumps Cotton Yields

California researcher reports consistent yield increases to foliar-applied potassium over a period of years in the San Joaquin Valley.

Summary: Tests run since 1992 have shown the benefits of foliar-applying potassium (K) on cotton plants in the San Joaquin Valley. Greatest increases in lint yield resulted from applications beginning two weeks after first bloom. Foliar K applications later in the season produced less response. The effect was similar regardless of the K source.

The application of foliar nitrogen (N) and potassium (K) to cotton at or near the early bloom stage of growth, when these nutrients are needed most, has gained in popularity in recent years. These, and other cultural changes, have resulted in annual yield increases of 32 pounds of lint/A/yr from 1983 through 1996.

Widespread K deficiencies have been documented throughout the San Joaquin Valley of California. It has been speculated that these K deficiencies are related to the introduction of high-yielding, early maturing, fast-fruiting cotton varieties.

These deficiencies cannot always be corrected by applying K to the soil. However, foliar applications of K may allow correction of these deficiencies more quickly and efficiently. They can allow deficiencies, as indicated by petiole analyses, to be corrected in time to prevent yield loss during the current season. Soil-applied K at this time would be too late, and effective only for the next crop season.

Potassium can be required at rates of 1.9 to 3.0 lbs/A/day during the boll fill period of a cotton crop. California studies have demonstrated that K uptake requirements can be difficult to maintain, especially on vermiculitic soils. The amount of fixed K in these soils is great due to high buffering capacities.

San Joaquin Valley cotton growers are very aware of the need to be efficient with fertilizer use and to prevent losses of nutrients to groundwater and the atmosphere. Innovative methods of fertilizer applications such as split sidedress, water run, and foliar are becoming common. The increasing interest in supplemental applications of N and K as foliar fertilization by cotton growers presents a unique challenge to researchers.

Meeting challenge

In 1992, field tests were conducted in Merced County, California, in which K was applied in foliar sprays at various times during the growing season. Positive responses were obtained. As a result, other field tests followed during subsequent years (1993-97). From two to five tests were conducted each year using various carriers of K and different times of application.

Plots were sprayed by a tractor sprayer set up for foliar work. It sprayed eight 30-inch rows at a time. Plots were

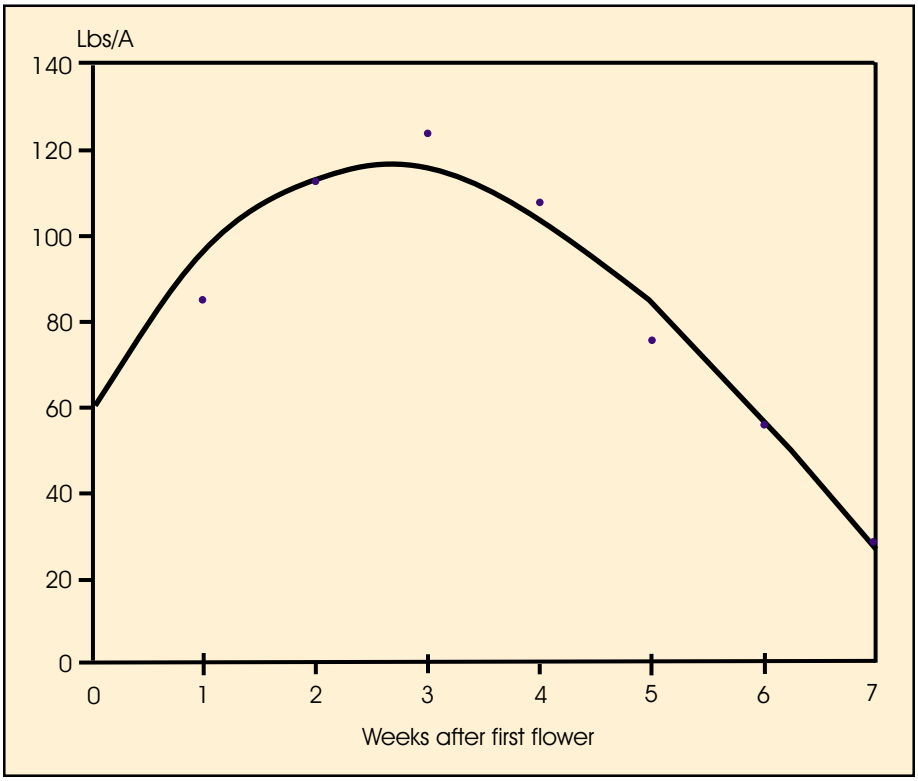

Figure 1. Typical response curve of K foliar materials applied to cotton after first bloom, Weir, University of California.

generally the length of the field (about a quarter mile), and were replicated four times. All tests were conducted using a completely randomized block statistical design.

In general, the times of K applications were:

- at bloom
- followed by weekly applications
- including multiple applications at bloom and one week later; at bloom and two weeks later, etc.

Amounts of K per application were generally 4.5 lbs/A of K_2O, regardless of material applied. Figure 1 shows a typical response curve to K foliar material applied to cotton after first bloom.

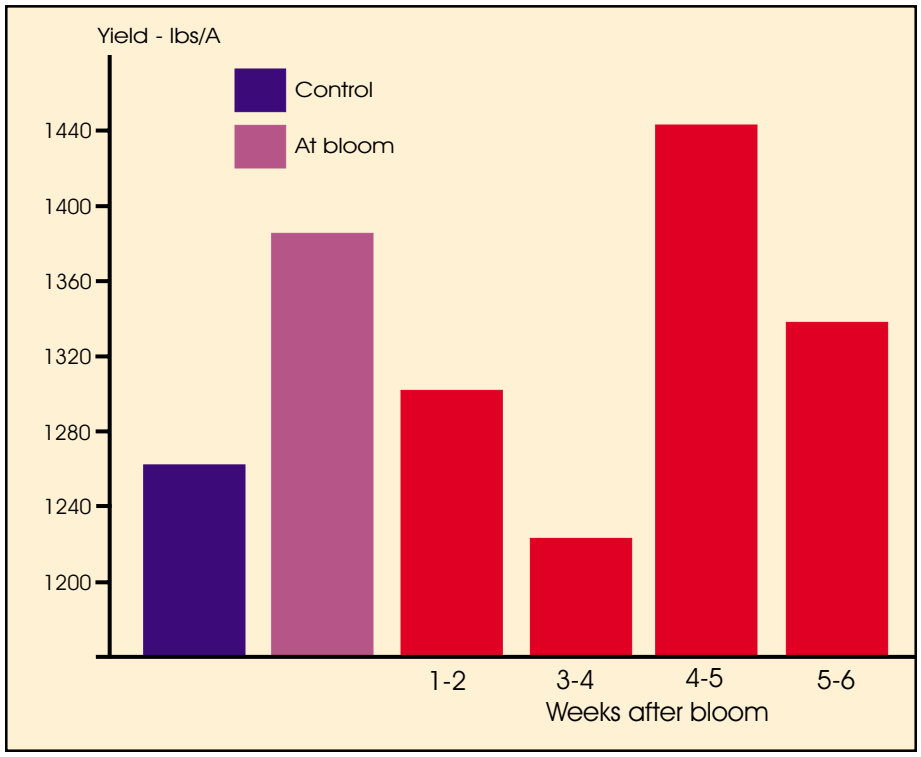

Figure 2. Effect of foliar KNO_3, on cotton yields, Weir, University of California, 1993.

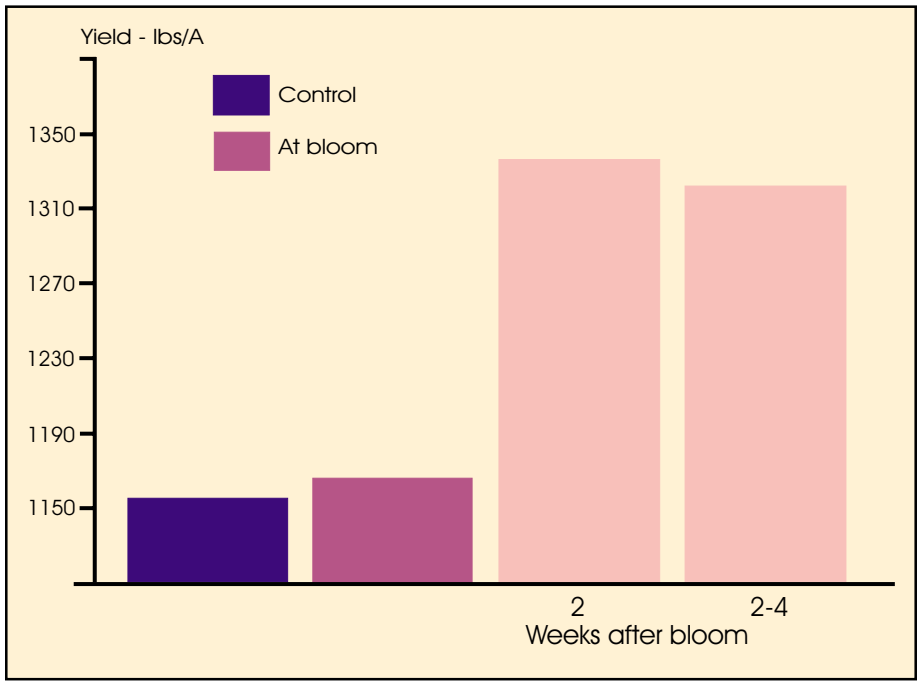

Figure 3. Effect of foliar K_2SO_4, on cotton yields, Weir, University of California, 1994.

Steady response

1992. There was a benefit to K applied at bloom, but the greatest increase in lint yield was at about two weeks after first bloom.

1993. Strikingly similar results were obtained again, using Acala Maxxa and Pima S-7 cottons. Greatest yield advantages were measured from plots that received foliar K from two to three weeks after first bloom.

Foliar applications later in the season responded less and the effect was similar whether the source of K was potassium nitrate KNO_3 (Figure 2) or potassium sulfate K_2SO_4 or SOP (Figure 3).

1994. Several forms of K were applied to cotton through foliar sprays. Potassium nitrate, potassium thiosulfate (KTS), and SOP were all applied at rates of 4.5 lbs/A of K_2O per application. Many treatments received more than one application. Responses to foliar K occurred in every case when compared to untreated controls. Findings were consistent with earlier results in that the greatest responses occurred with applications about two to three weeks after first bloom.

1995. Potassium sulfate, KTS, and potassium nitrate were applied as foliar sprays at bloom, followed by applications 2-4 weeks later. Potassium sulfate gave the greatest yield increases where 4.5 lbs/A of K_2O were applied at bloom and again two weeks later. The test results were similar to previous years. Greatest yield response occurred when potassium sulfate or potassium thiosulfate was applied about 2-4 weeks after first bloom.

1997. Fertilizer sources for foliar applications conducted in the San Joaquin Valley included:

- ESP K Sulfate
- Mora Leaf P&K
- Fulcrum
- KNO3
- KTS

ESP K Sulfate produced increased yields as rates were increased. No phytotoxicity or other problems were evidenced.

Mora Leaf P&K performed similarly. Yields increased on both Acala and Pima cottons, although there were no significant differences among the treatment means.

Fulcrum increased yields most when it was applied early in the season. Applications after squaring or flowering resulted in less lint than the untreated control. This is the only material that has given a positive response to early applications.

Potassium nitrate rates were increased over tests of previous years. High rates resulted in better yields than standard low rates.

KTS, tested as a supplemental foliar fertilizer for the past two years, yielded positive results. Slight phytotoxicity on plant leaves was noted when high rates of material were used. The crop quickly outgrew the symptoms.

Summary

Foliar K fertilization of cotton has proven to be an important management tool for high-yielding cotton varieties in the San Joaquin Valley. Late-season K deficiencies produced by high K demand of heavy boll loads from high-yielding varieties can cut yields and profits if not met with supplemental K. California research has shown that timing is critical in meeting these additional K needs. Success with K foliar fertilization suggests that other nutrient needs may also be addressed by foliar fertilization. Additional research is continuing in that area.

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