Effect of Method and Time of Potassium Application on Cotton Lint Yield

By A.O. Abaye

Previous studies across the Cotton Belt demonstrated the importance of K fertilization on cotton yield and fiber quality. Three levels of preplant, split (preplant + first flower) soil-applied, and foliar-applied K were compared to untreated control on DPL-50. Foliar applications were made every two weeks and weekly starting from first flower. Potassium nitrate (KNO_3) was the K source for foliar treatments and potassium chloride (KCl) was utilized for soil treatments. Lint yield was measured for each treatment. Averaged over soil-applied treatments, K application increased lint yield. The increases averaged over the 3 years were 115 lb/A for preplant soil-applied K, and 138 lb/A for split soil-applied K. Weekly foliar K application increased lint yield over the untreated control. However, no increase in lint yield occurred when foliar application was made two weeks apart. Similar results had been reported for cotton grown in various environmental conditions.

Virginia research indicates the importance of plant available potassium (K) at the time of cotton boll filling. Lint yields were higher with split soil-applied and foliar K applications.

About 105,000 acres of cotton were grown in Virginia in 1997, compared with only 100 acres in 1988. Almost all of the cotton produced in the state is grown on coarse-textured soils that are subject to nutrient leaching. Potassium nutrition is important for every aspect of cotton yield and quality. Research conducted in Arkansas and California showed increased yield and quality of cotton in response to K fertilization. There is no information available in Virginia that show the effects of soil- and foliar-applied K on cotton yield and quality. The objectives of this experiment were: 1) To determine the effect of different levels of split vs. single applications of K on cotton lint yield, and 2) To evaluate the effect of varying levels of foliar- vs. soil-applied K on cotton yield.

TABLE 1. Soil analysis, 1993-1995.

Year	Soil depth, in.	pH	Nutrients, lb/A P	K	Ca	Mg
1993	0 to 6	6.1	52	198	912	66
	6 to 12	6.0	50	144	864	86
	12 to 18	6.0	10	190	720	138
1994	0 to 6	6.3	64	160	814	84
	6 to 12	6.4	46	156	744	78
	12 to 18	6.5	14	154	768	132
1995	0 to 6	5.9	78	74	672	50
	6 to 12	5.7	76	68	600	42
	12 to 18	5.7	14	68	312	28

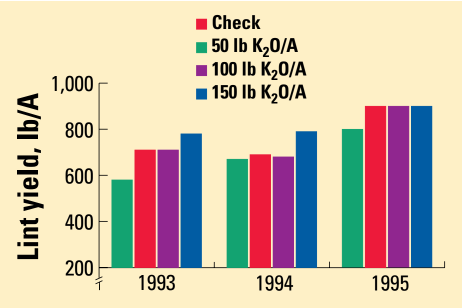

Figure 1. Influence of soil applied K on cotton lint yield. K_2O treatments: at planting = 50, 100, 150 lb/A applied once.
Treatment effect ($p<0.05$); year effect ($p<0.01$).

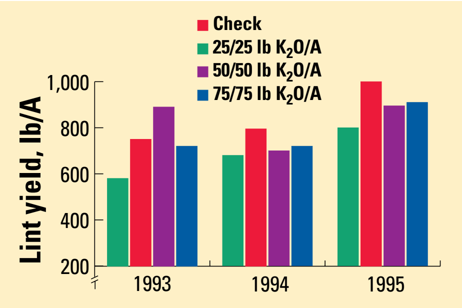

Figure 2. Influence of soil applied K on cotton lint yield. Treatments: split, at planting and first flower = 5/25, 50/50 and 75/75.
Treatment effect ($p<0.05$); year effect ($p<0.01$).

The experiment was conducted at the Tidewater Agricultural Research and Extension Center, Holland (Coastal Plain), Virginia, for 3 years. The soil was Nansemond (coarse-loamy, silicious, thermic, Aquic Hapludults). Four different levels of K_2O were applied prior to planting (0, 50, 100, and 150 lb/A). In addition, each of the three levels of soil-applied K were also applied in a split application with half at planting, the other half at first bloom. Additionally, K in the form of KNO_3 at 2, 4 and 6 lb/A was foliar-applied at each rate beginning at first bloom and at 3, 5, and 7 weeks after first bloom to cotton that received the soil test recommended rate of 50 lb K_2O/A. In 1995, a separate experiment was established with the foliar treatments being applied at 5 to 7 day intervals. Foliar applications were made using a carbon dioxide (CO_2) hand-driven sprayer at a rate of 10 gal/A. Nitrogen (N) in the form of foliar-urea was applied to plots that did not receive foliar KNO_3 (except the control plots) in order to avoid treatment differences due to N.

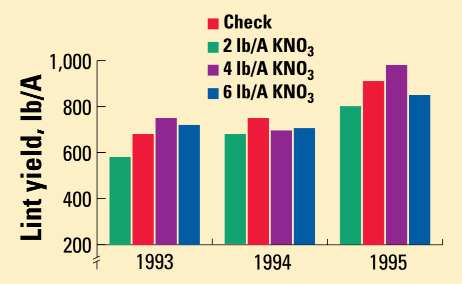

Figure 3. Influence of foliar applied KNO_3 on cotton lint yield. Treatments: foliar applied, in 2-3 weeks interval after first flower (each treatment split 3x)
Treatment effect ($p<0.05$); year effect ($p<0.01$).

Soil tests indicated K levels ranged from low to high for the 3 experimental years (**Table 1**). Adding K by any method increased lint yields (**Figures 1, 2** and **3**) compared with the untreated control 2 out of the 3 experimental years (1993 and 1995). Average lint yield increased from 579, 679 and 797 lb/A in the untreated control treatment to 727, 724 and 949 lb/A in the preplant soil applied treatments for 1993, 1994 and 1995, respectively. This yield increase was 148, 45, and 152 lb/A lint for 1993, 1994 and 1995, respectively (**Figure 1**). Similarly, lint yields were increased from 575, 679, 797, lb/A in the untreated control treatment to 786, 738, and 938 and in the split (preplant and pre-bloom) treatment for 1993, 1994 and 1995, respectively (**Figure 2**). The highest increase in yield was 211 lb/A for 1993 and 131 lb/A for 1995 for the split treatment. Foliar treatments applied in 2 to 3 week intervals in addition to soil applied K did not increase yields compared with the untreated control for 1993 and 1994. However, a slight increase in yield was observed in 1995 (**Figure 3**). Foliar KNO_3 applied at 5 to 7 day intervals resulted in significant yield increase over the untreated plots (**Figure 4**). This increase in yield was 175 lb/A. The higher lint yield for the split soil-applied and foliar KNO_3 treatments indicates the importance of plant available K at the time of boll filling.

Several researchers have shown increased yield of cotton in response to foliar K treatments. Oosterhuis (1976) reported a significant yield increase due to foliar fertilization by KNO_3. The lack of significant response to foliar treatment in our research could be due to the lower KNO_3 rate used compared to previous researchers who foliar-applied KNO_3 at a rate of 10 lb/A. BC

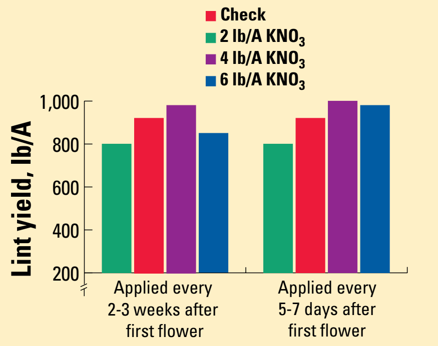

Figure 4. Foliar applied KNO_3 on cotton lint yield, 1995.
Treatment effect ($p<0.05$).

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Source: Agricultural Information Technologies, Inc., Iroquois, South Dakota.