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Influence of Potash, Nitrogen and Genotype on Cotton Lint Yield and Quality

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The development of mid- to late-season K deficiency in cotton has become commonplace throughout U.S. cotton producing regions. This study was conducted at Stoneville, Mississippi, on a fine sandy loam. The objectives were to determine if genotypic lint yield and fiber quality varied in response to different levels of K fertilization, and if the lint yield response to N fertilization was different at varying soil K levels. Eight cotton genotypes were studied (DES 119, DPL 5415, HS 26, MD-51-NE, Pee Dee 3, Stoneville 453, Stoneville 825, and Stoneville LA887. The N rates were: (1) a preplant application of 100 lb N/A, and (2) 100 lb N/A applied preplant plus a sidedress application of 34 lb N/A at layby. Potassium at 120 lb K_2O/A was surface applied and compared to a no K control. Soil K levels, 0 to 6 inches, were 211 lb K/A for the zero K_2O rate and 288 lb K/A for the 120 lb K_2O/A treatment.

A USDA-ARS study evaluated the effects of potassium (K), nitrogen (N) and genotypes on cotton lint yields and fiber qualities. Potassium deficiency reduced lint yield, boll mass, lint percentage, seed mass, and some fiber quality traits. Varying the N rate did not affect these traits. Adapted genotypes did not exhibit a differential response to K.

Results

Potassium deficiency associated with the zero K_2O treatment reduced lint yield 9 percent, boll mass 7 percent, lint percentage 2 percent, and seed mass 4 percent (**Table 1**). Lint yield reduction, caused by the K deficiency, was attributed to coinciding reductions in the yield components: boll mass, lint percentage, and seed mass. Many fiber quality properties were altered by K deficiency, including fiber traits associated with fiber secondary wall thickening (micronaire and fiber maturity). Averaged across genotypes, K deficiency reduced fiber elongation by 3 percent, 50 percent span length by 1 percent, uniformity ratio by 1 percent, micronaire by 10 percent, fiber maturity by 5 percent, and fiber perimeter by 1 percent (**Table 2**).

Fiber strength in this study was not significantly affected by K fertilization, although others have reported strength reductions caused by K deficiency. It may be that K has only an indirect effect on

TABLE 1. Effects of K on cotton yield and yield components (two-year average across N rates).

K_2O rate, lb/A	Lint yield, lb/A	Boll mass, g/boll	Lint, %	Seed mass, mg/seed
0	1,061	4.1	38.6	90
120	1,169	4.4	39.3	94
LSD 0.05	31	0.1	0.3	2
Difference	9%	7%	2%	4%

TABLE 2. Effects of K on cotton fiber quality measurements (two-year average).

K_2O rate, lb/A	Strength,[1] kN m/kg	Elongation, %	Span 2.5%	Length 50%	MIC	Maturity, %	Perimeter, um	Uniformity ratio
			.... cm	....				
0	207	7.97	2.82	1.35	3.7	74.1	49.1	48.0
120	203	8.25	2.82	1.37	4.1	78.3	49.4	48.7
LSD 0.05	NS	0.25	NS	0.01	0.1	1.6	0.1	0.4
Difference	0%	3%	0%	1%	10%	5%	1%	1%

[1]Strength was determined by stelometer and not by HVI. To convert to g/tex, divide the value by 10 and then multiply by 1.02.

fiber strength. This indirect effect may have more to do with the early termination of reproductive growth caused by K deficiency and with the environmental conditions during this shortened window of reproductive growth than with the actual K level.

The 100 lb N/A rate was determined to be sufficient for the growing conditions of this study. Neither lint yield nor any of the components of yield were altered by the sidedress application of an additional 34 lb/A of N, as shown in **Table 3**. However, there was a tendency for the high N treatment to have a negative impact on lint yield and lint percentage when coupled with the zero K_2O treatment. Varying N rates did not affect any of the fiber traits.

Genotypes varied only slightly in their response to K fertilization. Adapted, normally high-yielding genotypes outyielded unadapted or poor yielding ones, regardless of the K level or maturity.

Summary

To assure that K does not limit cotton lint yields, growers should monitor K needs with soil testing and apply recommended K fertilizer rates to keep soil K levels adequate. This practice should produce profitable cotton yields with acceptable fiber qualities. BC

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TABLE 3. Effects of N and K fertilization on cotton yield and yield components (two-year average).

N rate, lb/A	K_2O rate, lb/A	Lint yield, lb/A	Boll mass, g/boll	Lint, %	Seed mass, mg/seed
100	0	1,082	4.16	38.9	90
	120	1,165	4.32	39.2	93
134	0	1,047	4.10	38.4	89
	120	1,178	4.40	39.4	95
LSD 0.05[1]		38	NS	0.3	NS
	LSD 0.10[2]	30	NS	0.4	NS

[1]LSD within N values are for comparison of K rates within a given N rate level.
[2]LSD within K values are for comparison of N rates within a given K rate level.