POTASSIUM FERTILIZER EFFECT ON TWOSPOTTED SPIDER MITE

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Abstract

Potassium fertility experiments were observed in 1993 to measure possible differences in twospotted spider mite (*Tetranychus urticae* Koch) infestation. Spider mite counts showed lower infestation levels in all deep placement potassium rates, compared to untreated plots which were potassium deficient. Cotton (*Gossypium hirsutum* L.) variety was DES 119. The highest rate of 720 lbs K_2O/A resulted in a significant reduction of 45% compared to no potassium treatment. Subsequent observations of twospotted spider mite infestations were made in 1995 and 1997 in a multiple year study of potassium fertilization effects on eight cotton varieties. Varieties in the test were Stoneville 132, Hartz 1215, SureGrow 125, Hartz 1330, Deltapine 50, SureGrow 501, Stoneville LA 887, and Deltapine 5415. The potassium fertilizer treatment by cotton variety interaction was not significant for 1995 data but was highly significant for 1997 data. Varieties on which twospotted spider mites were significantly lower in two or three potassium treatment rates than in the no potassium treatment were Deltapine 5415 and Hartz 1215 in 1995, and SureGrow 125, Hartz 1215, and Hartz 1330 in 1997. Potassium fertilization of cotton showed significant reduction of twospotted spider mites in cotton with a strong varietal influence. Spider mite infestation level was significantly lower in potassium treatments in some varieties while little or no effect was seen in other varieties. Varieties in the study observed in 1995 and 1997 represented a wide range of maturity characteristics from very early to late maturity. Potassium fertility effect on spider mites did not appear to be related to the maturity characteristic of the cotton varieties.

Introduction

A cotton aphid (*Aphis gossypii* Glover) control, potassium fertilizer, and cotton variety experiment was conducted in 1993 on Delta Branch Experiment Station, Stoneville, MS by Harris et al. (1993). Field design was a split-split-plot experiment with two aphid control main effect treatments, insecticide treated and untreated; potassium fertilizer subplot effect treatments, 180 lbs K_2O/A and no potassium fertilizer on a potassium deficient soil; and cotton variety sub-subplot treatments, DES 119 and Deltapine 51. Twospotted spider mite counts in the experiment showed no difference in the potassium fertilizer treatments but significantly fewer spider mites on DES 119 than on Deltapine 51. Concurrently, a potassium fertilizer experiment with higher rates of K_2O on DES 119 cotton variety was being conducted on the experiment station. This experiment showed symptoms of varying levels of spider mite damage, so counts of twospotted spider mites were made. Subsequent observations of twospotted spider mite infestations were made in 1995 and 1997 in an experiment in which curative rates of K_2O were applied for consecutive years to eight cotton varieties planted on a potassium deficient soil on Delta Branch Experiment Station.

Materials and Methods

1993

Potassium fertilizer treatments were applied to a potassium deficient soil on Delta Branch Experiment Station in the spring of 1993 and non-irrigated plots were planted to DES 119 cotton variety on Beulah and Bosket very fine sandy loam soil. The experimental design was a randomized complete block replicated 6 times. Potassium fertilizer treatments were expressed in lb K_2O/A. Muriate of potash (0-0-60) was the source of potassium. Potassium rates were 0, 120, 180, and 240 lb K_2O/A applied 6 to 15 inches deep in a 2-inch wide band in the drill.

Twospotted spider mite infestation observations on July 14 consisted of counting number of mites, both immatures and adults, within a 1 sq in template on the lower leaf surface centered on the main leaf vein nectary of 10 leaves per plot. Data are presented as mites per 10 sq in.

1995 and 1997

The test evaluated in 1995 and 1997 for potassium fertilizer and cotton variety effect on twospotted spider mite infestation had been initiated in 1990 on a potassium deficient Bosket very fine sandy loam and Souva silt loam soil (Tupper et al. 1996). The test was non-irrigated. Experimental design was a split-plot arrangement in randomized complete blocks replicated 5 times. Four rates of potassium (0, 120, 180, and 240 lb K_2O/A) were applied to the same plots in spring applications (50% surface broadcast and 50% deep banded) each year from 1990 to 1997. Each K_2O treatment had been annually applied 6 times when the 1995 spider mite observations were made and 8 times when the 1997 observations were made. Cotton varieties in the test ranged from very early to late maturing ranked in that order as follows: Stoneville 132 (St 132), Hartz 1215 (HZ 1215), SureGrow 125 (SG 125), Hartz 1330 (HZ 1330), Deltapine 50 (DP 50), SureGrow 501 (SG 501), Stoneville LA 887 (LA 887), and Deltapine 5415 (DP 5415).

Twospotted spider mite infestation observations on July 31, 1995 and July 24, 1997 were performed as described above for observations in 1993.

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Results and Discussion

1993

Results of 1993 observations are summarized in Table 1. Mean twospotted spider mites per 10 sq in ranged from a high of 53.8 in the no potassium treatment to a low of 29.8 in the high potassium rate of 720 lb K_20/A. The range of means suggest a negative relationship between curative rates of K_20/A applied to a potassium deficient soil and twospotted spider mite infestation level on leaves of DES 119 cotton variety.

1995 and 1997

Results of 1995 and 1997 observations are summarized in Tables 2 and 3.

Analysis of variance in 1995 data showed no significant potassium treatment and variety interaction ($p > .3$), no significant variety mean differences ($p > .4$). Potassium treatment means showed statistically significant differences ($p = .035$). When averaged over all varieties all three potassium rates resulted in significantly fewer spider mites per 10 sq in than the no potassium treatment (LSD $p = .05$). Varieties HZ 1215 and DP 5415 showed spider mite infestations significantly lower in all and two potassium rates, respectively, than in the no potassium treatment. Other varieties showing that trend were DP 50 and LA 887.

Analysis of variance of 1997 data showed significant potassium treatment and variety interaction ($p = .0009$). Varieties HZ 1215, SG 125, and HZ 1330 showed potassium treatment rates that were significantly lower than the no potassium treatment (LSD $p = .05$). Other varieties showing that trend were DP 50, LA 887, and DP 5415.

Conclusions

Potassium fertilizer can significantly reduce twospotted spider mite infestation when curative rates are applied to potassium deficient soils. There is a strong varietal influence on this effect. Spider mite infestation was significantly reduced in some varieties by potassium treatments compared to no potassium treatment, but little or no effect was shown in other varieties. There appeared to be no relationship between maturity characteristic of the cotton varieties and influence on the effect of potassium fertilization on spider mite infestation, even though the field experiment in which the 1995 and 1997 observations were made showed early maturing cotton varieties more sensitive to potassium deficiency than late maturing varieties (Tupper et al. 1996).

References

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Tupper, G. R., D. S. Calhoun, and M. W. Ebelhar. 1996. Sensitivity of early-maturing varieties to potassium deficiency. Proc. Beltwide Cotton Conferences. pp. 625-628.

Table 1. Mean twospotted spider mite infestation (July 14) on cotton leaves in deep placement potassium fertility experiment, Stoneville, MS, 1993.

Potassium treatment K_2O (lb/A)	Mites/10 sq. in.
720	29.8
480	36.7
360	38.8
240	32.5
180	41.2
0	53.8
LSD (P=0.05)	22.7

Cotton variety - DES 119

Table 2. Mean twospotted spider mite infestation (mites/10 sq. in. on July 31) in potassium fertility x cotton variety experiment, Stoneville, MS, 1995.

Cotton	Potassium Fertility (K_2O lb/acre)			
Variety	240	180	120	0
ST 132	7.4	5.4	5.6	8.2
HZ 1215	6.6*	2.6*	2.6*	20.0
SG 125	3.8	5.8	7.2	4.4
HZ 1330	3.2	5.2	4.6	1.6
DP 50	3.4	2.8	4.0	6.6
SG 501	6.2	2.6	2.6	7.6
LA 887	2.2	3.8	3.2	4.8
DP 5415	2.8*	3.8	3.0*	11.6
K_2O Fertility Mean	4.4*	4.0*	4.1*	8.1

Variety x K_2O interaction not significant ($p>.3$), LSD ($p=.05$) = 8.3
Variety mean differences not significant ($p>.4$)
K_2O treatment mean differences significant ($p=.035$), LSD ($p=.05$)=3.0
*Mean spider mite count significantly lower than in the no potassium treatment (LSD $p=.05$)

Table 3. Mean twospotted spider mite infestation (mites/10 sq. in. on July 24) in potassium fertility x cotton variety experiment, Stoneville, MS, 1997.

Cotton	Potassium Fertility (K_2O lb/acre)			
Variety	240	180	120	0
ST 132	17.4	15.4	57.0	21.4
HZ 1215	8.6*	36.8	20.0*	45.8
SG 125	17.0*	19.2*	16.6*	50.4
HZ 1330	26.8	20.8*	7.2*	45.2
DP 50	10.4	6.4	39.8	22.8
SG 501	4.8	30.4	20.8	10.8
LA 887	14.8	24.6	12.2	25.4
DP 5415	13.4	43.6	28.0	34.6

Variety x K_2O interaction significant ($p>..0009$), LSD ($p=.05$) = 23.8
*Mean spider mite count significantly lower than in the no potassium treatment (LSD $p=.05$)