SPIDER MITE *effects on yield and quality of four cotton varieties*

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Spider mite, Tetranychus urticae (Koch), populations in three cotton varieties in 1966, and four in 1967 were measured under controlled and uncontrolled conditions and data on plant injury, mite abundance and yields were compared for each variety. The variety Pima S-2 (Gossypium barbadense) was affected very little by mites. Auburn 56 (G. hirsutum) was severely damaged in the absence of pesticidal controls. Acala 4-42 and Acala SJ-1 (G. hirsutum varieties) suffered an intermediate amount of damage and yield depression from an uncontrolled infestation of mites. Fiber quality was affected only in the Auburn 56 variety.

SPIDER MITES of the genus *Tetranychus* are common pests of cotton in the San Joaquin Valley. Infestations occur in virtually every field. Although control with pesticides is often practiced, detailed information on the relationship of population levels to crop damage is lacking. In this study, data were obtained on the relation of the abundance of mites to crop damage in four varieties (as indicated by yield and fiber quality) to determine whether genetic resistance factors exist in commercial varieties of cotton.

The study was begun in 1966 using three distinctive genetic types of cotton, two varieties of the species *Gossypium hirsutum* and one variety of *G. barbadense*. The *G. hirsutum* varieties were Acala 4–42, the commercial cotton of the San Joaquin Valley in 1966, and Auburn 56, a commercial cotton of the southeastern United States. Pima S-2, an extra-long staple cotton grown in southwestern United States, was the *G. barbadense* variety. In 1967 Acala SJ-1, a *G. hirsutum* variety, was added to the experiment. This variety replaced Acala 4-42 as the commercial cotton of the San Joaquin Valley in 1967.

The tests were planted in a split-plot design with four replications. The varietal plots were 16 rows wide and 136 ft long. These main plots were split into two subplots of eight rows each. Mites were controlled by chemical sprays on one subplot, and on the other, mites were allowed to build up.

Spider mite infestations from natural sources were present soon after plant emergence during both years. These colonies were supplemented by the spreading of cotton seedlings infested with the two-spotted mite, *Tetranychus urticae* (Koch), throughout the field. Some colonies of the strawberry mite, *T. atlanticus* (McGregor), developed naturally. To assure predominance of the two-spotted mite, the field was dusted with sulfur early in June. This treatment controlled the strawberry mite, but had little effect on the two-spotted mite. The fields were sprayed four times with insecticidal compounds to destroy the natural enemies of the mites.

Infestations established

When spider mite infestations were well established, one-half of each varietal main plot (eight rows) was sprayed by ground equipment with a selective acaricide (either Kelthane or Chlorobenzilate). The adjacent eight rows remained untreated. Sprayed plots were retreated as frequently as necessary to prevent visible plant damage.

Spider mite population data were recorded once in 1966 and on three dates in 1967. Mite numbers were determined by washing them from representative leaves of each plot with a chlorox wash which dissolves the web.

The reproductive rate of the mites was investigated in two greenhouse experiments during the winter of 1966–67, as well as in field experiments during 1967. The reproductive potential of individual females was measured on each variety. Young, mature females that had been reared on Acala 4-42 seedlings were used. Each female was placed in an individual leaf cage and reproduction counts were made after several days. Twelve to 15 caged mites were used on each variety, in each experiment.

TABLE 1. COUNTS OF TWO-SPOTTED MITE ON LEAVES OF PLANTS IN SPRAYED AND UNSPRAYED PLOTS OF SELECTED VARIETIES OF COTTON

Variety	1966	1967		
	Aug. 29	Aug. 1	Aug. 22	Sept. 18
	Average no. mites per leaf			
Pima S-2				
Check	216	27	81	40
Sprayed*	25	4	6	34
Acala 4-42				
Check	447	44	106	186
Sprayed	11	26	38	118
Acala SJ-1				
Check	—	42	98	163
Sprayed	—	26	21	117
Auburn 56				
Check	405†	63	202	177†
Sprayed	77	25	15	70

* The sprayed plots were treated on July 18 and August 8 in 1966 and on July 25 and August 8 and 22 in 1967.

† Leaves were severely damaged by mites and the population was declining.

TABLE 2. AVERAGE REPRODUCTION PER FEMALE MITE IN TWO GREENHOUSE AND ONE FIELD EXPERIMENT—FEMALES CAGED ON LEAVES FOR INDICATED NUMBER OF DAYS IN EACH TEST

Variety	Greenhouse 1 (9 days)	Greenhouse 2 (11 days)	Field (12 days)
	Offspring per female*		
Pima S-2	60 a	44 a	104 a
Acala 4-42	113 b	66 c	105 a
Acala SJ-1		55 b	127 b
Auburn 56	118 b	77 c	103 a

* Means followed by the same letter are not significantly different at the 5% level of probability.

TABLE 3. LINT YIELD DEPRESSION DUE TO MITE INFESTATION IN UNSPRAYED PLOTS COMPARED TO SPRAYED PLOTS OF FOUR COTTON VARIETIES

Variety	Average yield depression in unsprayed plots*	
	1966*	1967*
	%	%
Pima S-2	1 a	2 a
Acala SJ-1		13 b
Acala 4-42	8 a	25 bc
Auburn 56	17 a	37 c

* Means followed by the same letter are not significantly different at the 5% level of probability.

Spider mites were evident throughout the experimental field by mid-May of each year. Applications of insecticides reduced the numbers of predators and stimulated the buildup of potentially destructive infestations. This was achieved by July 18 in 1966, and by July 25 in 1967, when general infestations were found throughout the field and when leaf damage was evident on most plants.

In the treated plots, satisfactory control was maintained until mid-September. After this date, population levels reached relatively high peaks in these plots. The

counts of mite numbers are presented in table 1.

Damage by the mites was evident on the leaves in the untreated plots from late July until harvest. The severity of damage was greater in some varieties than in others, as were the number of mites. Mite population levels were lower in the Pima S-2 variety during both years than in the other varieties. In contrast, the Auburn 56 variety showed the greatest abundance of mites on some dates. In late August 1966, and in September 1967, the untreated plots of this variety had been so severely damaged that leaves were no longer suitable as host material and the population was on a decline. Acala 4-42 and Acala SJ-1 were intermediate in spider mite abundance.

A major difference in the damage to leaves was seen between varieties. The Pima S-2 variety showed very little damage considering the numbers of mites present on leaves. Damage to Auburn 56 was very great even on leaves carrying small colonies, and by late August and September the plants were virtually desiccated by the attack. Acala 4-42 and Acala SJ-1 carried heavy populations with much less damage than Auburn 56.

Reproductive rate

The reproductive rate of female mites on each type of cotton is summarized in table 2 as the average number of offspring per female mite. The duration of the experiments depended upon temperature and colony buildup. In both greenhouse experiments the rate of reproduction on Pima S-2 was significantly lower than on the other varieties. In the second greenhouse experiment the rate of reproduction was significantly lower in Acala SJ-1 than in Acala 4-42 or Auburn 56. In the one field experiment the results were highly variable within each variety. In this case reproduction was significantly greater in Acala SJ-1 than in the other varieties. This field experiment is being repeated to determine the causes of the variability.

Lint yield depressions of the four varieties are shown in table 3. Yield of Pima S-2 was essentially unaffected by the spider mite infestation in both years. In 1966 the yields of Acala 4-42 and Auburn 56 were depressed by 8 and 17 per cent, respectively, in the unsprayed plots. In 1967 the yield depressions due to mites on Acala SJ-1, Acala 4-42, and Auburn 56 were 13, 25, and 37 per cent, respectively. In both years the greatest reductions were in the Auburn 56 variety which also appeared to be the most severely damaged.

High variability in lint yield occurred within the experiment in 1966, and no significant differences in yield depression were detected between varieties. In 1967 the yield depression of Pima S-2 was significantly less than that of the other varieties. That of Acala SJ-1 was significantly less than that of Auburn 56. The yield depression of Acala 4-42 was not significantly different from that of Auburn 56.

An analysis of fiber samples from all of the experimental plots did not indicate any differences in quality between the treated and untreated plots of each variety, except in 1967 when fiber fineness was affected in Auburn 56. In this case the micronaire value of the fiber from the untreated plots was less than that from the treated plots. This would indicate that mite damage resulted in the production of immature fiber in Auburn 56 in 1967.

The results of this study indicate that the *G. barbadense* variety, Pima S-2, carries a high level of resistance to spider mites and that the Acala 4-42 and Acala SJ-1 varieties of *G. hirsutum* carry an intermediate level of resistance. The resistance of the Acala varieties, as compared to Auburn 56, appears to be in their ability to support the same level of mite infestation without as great a reduction in yield.

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