Effects of Time of Symptom Expression of the Leaf-Crumple Virus on Yield and Quality of Fiber of Cotton

P. H. van Schaik, D. C. Erwin, and M. J. Garber

The leaf-crumple disease occurring in cotton-growing areas of southern California and Arizona was first described in 1954 (2). The incidence of the disease became more severe with increasing popularity of perennial (stub or ratoon) cotton between 1954 and 1959. Growing trends to mechanization, particularly in harvesting, and greater insect problems have reduced the popularity of stub cotton and thereby the incidence of the Leaf-crumple Virus disease in 1960 and 1961.

Laird and Dickson (5) showed that the virus was transmitted by the sweetpotato white fly (Bemisia tabaci (Genn.)). Additional information on resistance and susceptibility of certain varieties and species of Gossypium, and the existence of a mild and a severe strain of the virus were reported (3, 4) in 1961. Allen et al. (1), measured the effect of the virus on yield of individual plants within a variety test block at Yuma, Arizona, and showed that plants with symptoms yielded 20.6% less than healthy ones in first year cotton and 16.8% less in stub cotton. Normally occurring variability between plants was not taken into account. They showed an increase in incidence of disease with advance of the growing season but did not measure yield losses on individual plants infected at different times.

Since field evaluation of the effect of an insect-transmitted virus disease is difficult because of the natural spread into disease-free control plots, the effect of the virus was evaluated by recording the incidence of disease in the field at intervals throughout the growing season. Yield and quality determinations were then correlated with time of symptom expression. The results of a three-year study are reported here.

MATERIALS AND METHODS

In the 1958 experiment Acala 4-42 cotton plants grown in the greenhouse were inoculated by approach graft with the Leaf-crumple Virus (LCV). Check plants were grafted but not inoculated. On May 29, plants were transplanted to the field. The experiment included 4 replications (9 plants in each) of artificially inoculated plants and 4 replications of uninoculated. Symptoms on uninoculated plants were recorded twice in this experiment (Figure 2).

In May 1959 and 1960 plants inoculated with LCV were transplanted from the greenhouse to a field of cotton seedlings to provide a source of inoculum for natural insect transmission. Plants with LCV were placed 6 feet apart and in alternate rows. In 1960 the seedling plants were thinned to a 3-foot spacing in an attempt to decrease some of the individual-plant variation that occurred in the 1959 experiment. Yield data were taken only from the plants inoculated naturally. Since the rows of seedling plants were bordered on each side by rows of inoculated plants, each seedling plant was considered to have an equal opportunity to become infected naturally. In both experiments each plant was considered a replication randomly determined by insect inoculation and subsequent symptom expression. The treatments were the dates on which symptoms of LCV were recorded. Plants were tagged at intervals throughout the summer when symptoms were seen. At harvest time bolls from each plant were collected, counted, and weighed. Fiber quality was determined from subsamples from several replications of each treatment.

RESULTS

1958 experiment—Inoculation by grafting with LCV resulted in a yield of only 5.4 bolls per plant compared to 21.6 bolls per non-graft-inoculated plant (Figure 1). This difference was highly significant. Of 45 plants inoculated, 19 did not produce any bolls. Although average weight of seed cotton per boll was reduced from 4.6 to 3.6 grams by

Figure 1—Effect of the Leaf-crumple Virus on Acala 4-42 cotton plants in 1958 field plots. Top. Symptomless plant showing many open bolls; Bottom. Plant inoculated by grafting in May showing abnormal growth and very few bolls.