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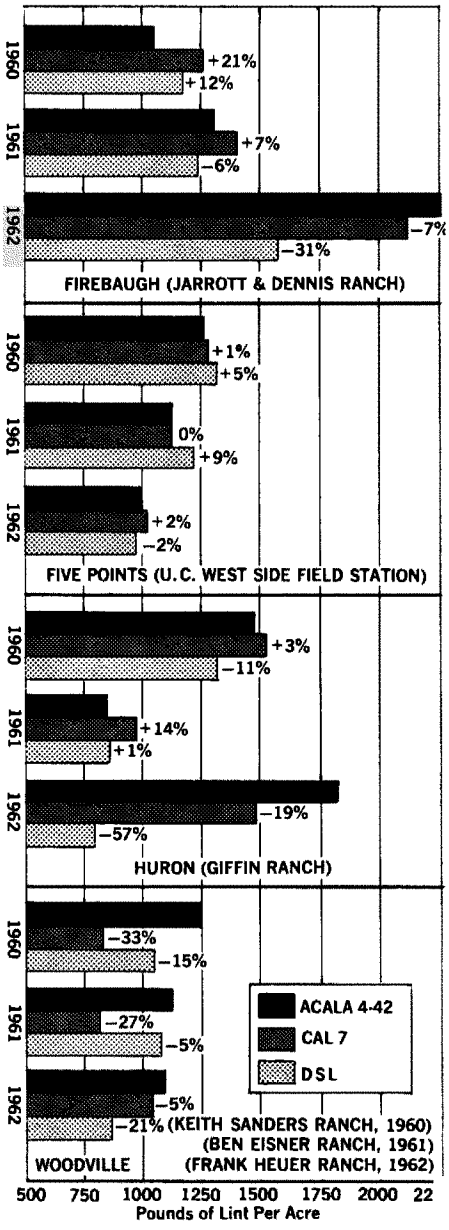
Wilt Tolerance *in Cotton Varieties*

Results of this three-year testing program in the San Joaquin Valley indicate that Verticillium wilt damage to cotton may vary from one area to another—but when wilt symptoms appear by mid-season, the wilt-tolerant Acala 4-42 variety will significantly outyield the two susceptible varieties, Cal 7 and Deltapine Smooth Leaf. When cotton is grown continuously on the same plots, more drastic declines in yield occur with wilt-susceptible varieties than for Acala 4-42.

VERTICILLIUM WILT (*Verticillium albo-atrum* R. & B.) is the most serious cotton disease in the San Joaquin Valley of California. This disease is also an important factor in certain cotton-producing areas of Arizona and New Mexico but is of only minor importance in the soils of rain-belt states. The most satisfactory means of minimizing wilt damage is by growing a variety that is resistant or highly tolerant of the wilt fungus. Complete resistance has not been developed in any variety, but Acala 4-42, the variety grown in the San Joaquin Valley, has shown a high degree of resistance since 1954. All other varieties tested are either susceptible to Verticillium wilt or display less tolerance than 4-42 when tested in the San Joaquin Valley.

Observations at the U. S. Cotton Research Station, Shafter, have indicated that wilt became increasingly severe when susceptible varieties were grown year after year on the same breeding nursery rows. The main purpose of this experiment was to determine the effect of Verticillium wilt on cotton yield at several San Joaquin Valley locations by growing wilt-tolerant and wilt-susceptible varieties continuously for three years.

Three varieties of cotton were chosen for this experiment: (1) Acala 4-42 (A4-42), the standard planting seed for the San Joaquin Valley One-Variety district; (2) Cal 7, an experimental strain, developed at Shafter for its early maturity and superior fiber quality (but not released because of its wilt susceptibility); and (3) Deltapine Smooth Leaf (DSL), a Mississippi variety which has yielded well in the Imperial Valley, but has lower fiber quality and is wilt susceptible.



Tests were located at Firebaugh, Five Points, Huron, and Woodville and a randomized complete block design was used at each site.

Firebaugh

Most soils in the Firebaugh area are wilt-infested, but the land chosen for this test had been in rice production the two previous years.

No wilt symptoms were displayed by either of the three varieties in 1960 at Firebaugh in the initial year of the experiment (see graph). Both Cal 7 and DSL gave higher yields than A4-42 under conditions that year. Wilt symptoms were noted by September, 1961, and the DSL yield fell below that of A4-42. Verticillium wilt was common in Cal 7 and DSL plots during 1962 and both these varieties gave lower lint yields than A4-42.

The much higher yield level in 1962 over the 1960 and 1961 seasons can be attributed basically to a change in the planting scheme. The 1960 and 1961 plantings were made in the normal solid-planted, 40-inch row beds. Then the grower switched to the "2-in, 2-out" scheme of planting in 1962, which resulted in each row of cotton having an adjacent unplanted row. This spacing allows the cotton plants to utilize extra sunlight, moisture, and nutrients—and has been found to increase yields by 50 to 100% as compared with normal solid-planted cotton.

Five Points

At Five Points, this experiment was located at the newly established University of California West Side Field Station. Solid plantings were made on the plots each of the three years. Lint yields obtained for the three varieties were practically the same. This was the only location at which the effects of Verticillium wilt were not apparent. It was late summer of the third year of the experiment before wilt symptoms were noted in Cal 7 and DSL plots. It is not known whether cropping to continuous cotton, internal wilt, or cultural management contributed to the gradual decline in yield at Five Points from 1960 to 1962, as shown in the graph.

Huron

The test area at Huron was relocated after the 1960 season. A low level of wilt

was apparent on both Cal 7 and DSL by mid-season of 1960. But Cal 7 gave a higher lint yield than A4-42 and the DSL yield was below that of A4-42. The 1961 planting was made on a field where an observational block of DSL was grown in 1960. Following the wilted cotton of 1960, it was easy to detect wilt symptoms in mid-summer throughout the Cal 7 and DSL plots, and minor symptoms were evident even in A4-42 plots. Yields from this location were considerably lower for all varieties in 1961 than in 1960. Nevertheless, the grower allowed the test to remain on the same plots in 1962.

However, the grower did switch the planting scheme from "solid" cotton to "2-in, 2-out." Significant yield differences were obtained among the varieties in 1962. A4-42 was outstanding for its wilt tolerance even though the low summer temperatures in 1962 were ideal for the wilt organism to operate. Heavy wilt damage was evident in the Cal 7 plots and lint yield was 19% lower than A4-42, as shown in the graph. DSL was severely damaged by Verticillium wilt. In fact, the wilt attacks occurred so early in the summer that the "2-in, 2-out" planting scheme offered no advantage. With both the direct wilt damage and the indirect loss of growth advantage due to the earliness of the wilt attack, the yield of DSL was 57% lower than that of A4-42.

Woodville

It was necessary to relocate the test plots at Woodville with a different grower each year since farm units are smaller and the growers cannot afford to absorb the loss from Verticillium wilt continuously.

Verticillium wilt was evident by mid-season on both Cal 7 and DSL in 1960 and 1961. The land used in 1962 gave less wilt damage. Data for the three years, as shown in the graph, shows higher yields were obtained from A4-42. The growth of both Cal 7 and DSL was visibly reduced on the 1960 and 1961 plots as a result of wilt attacks. The Woodville area plots showed a more drastic yield reduction for Cal 7 than at any of the three other areas.

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Tarweed

. . . a nuisance plant on California ranges

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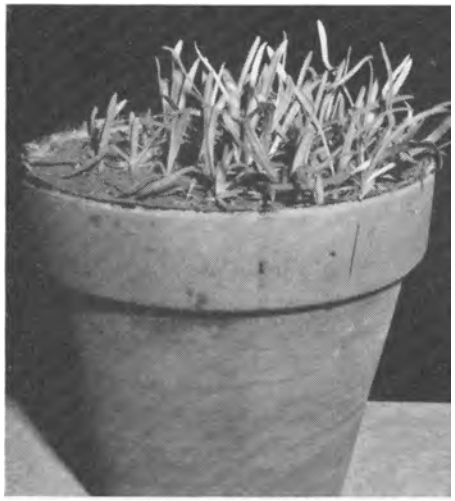

Tarweed seedling (Holocarpha virgata) as it appears in early annual range forage.

Tarweed is well adapted for survival as a nuisance plant on California ranges. While expensive control measures may not be justified, effective methods are needed for minimizing the use of soil moisture by tarweed seedlings in the spring. Clipping or heavy grazing and nitrogen fertilization offer possibilities for reduction in density of tarweed seedlings in favor of the more desirable forage species.

TARWEED, *Holocarpha virgata* (A. Gray, Keck), is a nuisance plant that grows on California foothill rangelands and is generally distributed in the Sierra foothills, Central Valley and inner coast ranges. At times it dominates some of the better forage-producing sites. This annual forb germinates in the fall, but has its greatest growth in the late spring and summer. The tarweed stand is persistent but may be dominant one year and of only minor proportions in a following year. Grazing use of tarweed has been observed during winter and early spring. Tarweed growth is most rapid in the late spring when the plants compete with desirable forage species for the diminishing soil moisture. Tarweed becomes most noticeable and particularly objectionable in the summer season when its bushy-stemmed, ill-scented growth forms dense patches among and above the dry annual forage species—obscuring and limiting use of desirable species as dry feed by livestock.

Some observations of tarweed seed production, germination, and hard seed percentage were made to help show how tarweed persists even though a seed crop might fail to mature. Clipping and fall application of nitrogen were studied as possible means of minimizing tarweed stands during the seedling stage.

Three tarweed-infested rangeland areas located in the Sierra Nevada foothills in Sacramento, Tuolumne, and Madera counties were chosen in the fall of 1956 as study sites. An additional study of nitrogen fertilization was initiated in the fall of 1958 and carried on through 1960 at the Shaubach Ranch, Madera County. Old tarweed plants from the previous growing season were used as a basis to choose specific sites for these studies.

Tarweed seeds were harvested by hand in the fall from mature plants growing on a foothill range area in Madera County. Seeds were germinated for 28 days with temperatures alternating from 5, 15, 20, and 20–30°C.

Treatments

A series of 10×20 ft. plots were clipped at three-week intervals through the spring months. A different set of plots was clipped at a height of 1½ inches with a scythette mower at each location each time. Tarweed density estimates were made on June 27, 1957. Soil moisture percentage was determined at 5 to 7-inch and 18 to 20-inch depths.

Fertilized plots, .2 acre in size, were established at each county location in 1957. Treatments consisted of 60, 120, and 180 pounds of nitrogen applied as 16-20-0 for comparison with an unfertilized check plot. A strip through each plot was harvested June 27, 1958, with a scythette mower. The percentage of tarweed was obtained by hand separation.

At the Shaubach Ranch the rates of nitrogen applied were 0, 40, 80, 120, and 160 pounds per acre using 16-20-0. Fertilizer treatments were replicated four times using 20×20-ft. plots. The total plot