

California Agriculture. 1953. 7(7):3, 14.

Chlorosis in Avocado

Young trees on Guatemalan rootstocks appear less tolerant to disorder than trees on Mexican stocks

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The following article is the first of a two-part progress report on studies of the relative susceptibility of avocado rootstocks to chlorosis.

In two experimental avocado plantings—to test the relative merits of Mexican and Guatemalan, and to a very limited extent, West Indian, varieties as rootstocks—a type of chlorosis appeared about a year after planting. The disease is characterized by yellowing of the leaves and, in severe cases, by leaf burn, dieback and death.

Most noteworthy is the fact that, so far, the disorder in the experimental plots is practically confined to trees on Guatemalan rootstocks. However, chlorotic trees on Mexican stocks in commercial orchards and chlorotic Mexican seedlings in nurseries have been observed.

The cause of the disorder has not been determined. The term chlorosis simply means a diseased condition manifested as yellowing of the normally green parts of the plant. The loss of the green coloring matter—chlorophyll—in plants is often associated with micro-nutrient deficiencies such as iron, zinc, manganese and sulphur, but it may also result from any number of different causes; namely, excess phosphate and high alkalinity, all of which complicates the problem of diagnosis. Although some 45 rootstock plots have been established, the disease is widespread only in the two plots mentioned.

Since Mexican rootstocks are used almost exclusively in commercial propagation, information concerning the relative susceptibility of Mexican and Guatemalan rootstock varieties—to a nutritional disorder such as chlorosis—is necessarily limited to experimental plots in which both types of stocks are under similar soil and environmental conditions.

One of the two experimental plots—planted in Santa Barbara County in March, 1948—consisted of 119 MacArthur trees, but early replacements reduced the number to 116. The trees were grown in Santa Barbara County and the nursery also furnished trees for six additional plots, all planted in the county. The soil in all plots is fairly heavy but well drained.

The trees were budded on seven Guatemalan rootstock varieties—Anaheim, Dickinson, MacArthur, Itzamna, Sharpless, Cabnal, and Nabal—and four Mexican varieties—Ganter, Topa Topa, Duke, and Mexicola. Seventy were on Guatemalan and 46 on Mexican rootstocks. All Guatemalan seeds were of mixed origin, but seeds of the

Mexican varieties, except Ganter, came from single trees.

Chlorosis was first observed in August, 1949, about 16 months after planting. Seventy per cent—49 trees—of the trees on Guatemalan stocks showed the disorder in varying degrees. Only one tree on Mexican stock was affected but it soon recovered. As of September, 1951, about two years after the disease was first observed, 41%—20 trees—of the chlorotic trees were recovered or nearly so and 59%—29 trees—were dead or worthless. The loss, on the basis of the 70 trees on Guatemalan stock planted, amounted to 40%.



Adjacent Fuerte trees on the same rootstock variety. *Left: chlorotic; right: normal.*

On the assumption that the disease was iron chlorosis, attempts were made to control it by applications of ferrous sulfate and sulfur in the basins occupied by the affected trees. When no improvement resulted, the trees were sprayed with a solution of various micro-nutrients. This too failed to help.

To obtain further information concerning the relative tolerance of the two types of stocks, two balled trees, one on Mexican and one on Guatemalan stocks, were planted close to several affected trees in the fall of 1950. Unfortunately they made little or no growth because of the lack of sufficient soil moisture. Additional trees were planted in late spring of 1951.

Chlorotic trees are scattered over the entire plot, and in some cases affected and normal trees on the same rootstock are only about 20 feet apart. Incidentally, an adjacent young lemon orchard shows no symptoms of the disorder.

In the six other plots established with trees from the same nursery, a total of about 550

trees were planted, some 250 of them on Guatemalan stocks. Only three trees, all on Guatemalan and in one plot, have shown chlorosis. One of the plots which is free from the disease is less than a mile from the severely affected plot.

The situation in the second experimental plot is similar to that in the Santa Barbara County plot. It was planted in June, 1949, in Orange County, between rows of old orange trees. The avocados were interplanted with Valencia orange trees on sweet orange rootstock at the same time that the plot was established. Originally the planting consisted of 117 Fuerte trees, but early replacements with commercial trees reduced the number to 102 experimental trees. Fifty-five of them are on seven Guatemalan varieties—Anaheim, Dickinson, Itzamna, Nabal, Hass, Challenge, and Taft—and 45 on six Mexican varieties—Ganter, Topa Topa, Duke, Northrop, Mexicola, and Blake. Two trees are on Waldin, a West Indian variety from Florida. As in the first plot, all Guatemalan seeds were of mixed origin, but seeds of the Mexican, except Ganter, came from single trees. The trees were propagated in the Subtropical Horticulture Nursery at the University of California, Los Angeles. This nursery also furnished trees for three additional plots.

In June, 1950, one year after planting, 78%—43 trees—of the trees on Guatemalan stocks showed chlorosis in varying degrees. Only one tree on Mexican stock was affected, but it soon recovered. The two trees on West Indian stock remained normal. As of September, 1951, a little over a year after the disease appeared, 56%—24 trees—of the chlorotic trees were recovered or nearly so and 44%—19 trees—were either dead or worthless. The loss on the basis of the 55 trees on Guatemalan planted was 35%, as compared to a 40% loss in the other plot. As in the other plot, chlorotic trees are scattered throughout the area and in some cases affected and normal trees on the same rootstock variety are side by side.

Five commercial trees—presumably on Mexican stock—which were planted in place of severely chlorotic ones, so far have shown no symptoms of the disease. Also, of several hundred commercial Fuerte trees on Mexican stock—planted by the grower in 1948 and 1949 in the same orchard in which the experimental plot is located—only three show chlorosis. Neither the old nor the young orange trees are chlorotic.

Three additional plots were planted in 1949 with trees from the same nursery which furnished the Fuerte trees for the plot in Orange County. Two of them are located in Ventura County and one in Los Angeles County. Only three trees—all in one plot in Ventura County—of about 200 on Guatemalan stocks planted have shown chlorosis. None of a similar number on Mexican stock and three on West Indian are affected.

In the same orchard in which the three chlorotic Fuerte trees are located, 96 Hass and 54 Anaheim on Guatemalan as well as a similar number on Mexican and 11 on West Indian stocks were planted in 1950. A year later 5% of the Hass and 10% of the Anaheim on Guatemalan stocks showed chlorosis. However, practically all seem to be recovering. None of the trees on Mexican or West Indian are affected. Paradoxically, in the same orchard eight of about 40 Mexican seedlings planted by the grower showed the disorder a few months, then recovered.

The observations obtained during these studies, to the effect that Guatemalan stocks are far more susceptible to whatever soil condition causes chlorosis, are limited in

scope. Perhaps, as the root systems expand, trees now considered recovered may again become chlorotic or hitherto normal trees on both types of stocks may show the disease.

Whether the occurrence of chlorotic and normal trees in some cases only about 20' apart and on the same rootstock variety, is due to soil variation or genetic differences in the rootstock seedlings is an open question. All that can be said at present is that none of the 10 Guatemalan rootstock varieties used in the two severely affected rootstock plots is immune. The number of trees on these stocks varied from three to 18. This, and the fact that in one plot 14 trees on a certain variety showed 43% chlorosis and in the other, eight trees on the same variety showed 100%, stress the necessity for more extensive information for valid comparison.

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The above progress report is based on Research Project No. 1458.