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## Chlorosis in Avocado

***May be caused by nutrients in soil or genetic variations in the variety***

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*In the first article of a two-part progress report on the relative susceptibility of avocado rootstocks to chlorosis evidence was presented to the effect that young avocado trees on Guatemalan rootstocks are less tolerant to a type of chlorosis—yellowing of leaves—than trees on Mexican stocks. The evidence was based mainly on information obtained in two rootstocks plots, one located in Santa Barbara County and one in Orange County. In the former 70% and in the latter 78% of the trees on Guatemalan stocks became chlorotic about one year after planting, while only 1% of the trees on Mexican stocks in both plots showed the disorder. In November 1951, 40% of the chlorotic trees on Guatemalan stocks in the Santa Barbara County plot and 35% in the Orange County plot were either dead or seemingly beyond recovery. Since then the condition of the surviving chlorotic trees has fluctuated. In November 1952, it was uncertain as to what percentage would develop into normal trees.*

In two rootstock plots and in one nursery additional evidence was obtained that Guatemalan varieties—as a group—are less tolerant to chlorosis than are Mexican varieties. Very limited information indicates that West Indian may be classed with Mexican in this respect.

One of the plots, located in Santa Barbara County and planted in April, 1949, consisted of 113 seedlings, but losses reduced this to 93, of which 46 were Guatemalan, 38 Mexican, and 9 West Indian. There were six Guatemalan varieties—Nabal, Challenge, Itzamna, Dickinson, Anaheim, Mayopan—and five Mexican varieties—Topa Topa and four other unnamed seedlings not hitherto used. There was only one variety of West Indian—Waldin—the seed of which came from Florida.

In the spring of 1951—two years later—about half of the seedlings were grafted to MacArthur and half to Rincón. Up to the time of grafting no chlorosis was evident, but five months later 30% of the 46 Guatemalan showed the disorder in varying degrees; 13% of the Mexican were affected, while the West Indian trees were free of the disorder

In this plot chlorosis occurred about two years after planting, whereas in all of the other affected plots it had appeared within a year. Also all affected trees, with but three exceptions—all Guatemalan—showed improvement within a few months. By August 1951 they appeared to have fully recovered, that is, the trees had made vigorous growth which showed no chlorosis symptoms. The scion variety had no effect on the chlorosis development or recovery.

**Topa Topa Row—right—practically free from chlorosis, only 5% affected; Dickinson Row—left—73% chlorotic. A large proportion of the Dickinson seedlings also showed severe leaf burn. Trees shown a few months after planting.**



The other rootstock plot in which chlorosis occurred is located in Ventura County. It was planted in May 1951 to 126 Hass trees. Freeze damage the following winter reduced the number to 112. Of this latter number, 49 are on Guatemalan stocks, which include, in addition to the six varieties mentioned for the first plot, the following: Hass, Taft, Lyon, Ryan, MacArthur, a total of 11 varieties. Forty-eight trees are on Mexican—Topa Topa, Ganter, Dyke, Mexicola, Northrop, Blake, Gherkin. The last named has been used in only a few rootstock plots. Fifteen trees are on West Indian—Waldin and Lula. While the latter is listed as a Guatemalan-Mexican hybrid, it seems to resemble West Indian more closely. Both Waldin and Lula seeds came from Florida.

About one year after planting, 31% of the trees on Guatemalan stocks showed chlorosis in varying degrees. None of the Mexican or West Indian was affected. Two months later all but three trees appeared to have recovered, and in November 1952 there were no recurrences or new cases. Here as well as in the Santa Barbara County plot the chlorosis situation differed from that in the plots reported last year in that recovery was rapid and that no serious losses were suffered.

Additional information on chlorosis was obtained in a nursery in Ventura County. Apparently an unfavorable soil condition—high salinity—existed in this area because about 50% of Mexican seedlings planted by the grower either died or were rendered useless for grafting. The nursery occupied several strips of land between rows of four-year-old lemon trees which showed some chlorosis symptoms.

In May 1951, 340 seedlings were planted in one of the vacant strips. Two hundred and eight were Guatemalan of the following 11 varieties: Anaheim, Carlsbad, Challenge, Dickinson, Edranol, Hass, Itzamna, MacArthur, Mayopan, Nabal, Lyon. Six Mexican varieties included Blake, Duke, Ganter, Mexicola, Northrop, Topa Topa. Eighteen Lula seedlings represented the West Indian type. The seedlings were planted in regular order and each variety was replicated 18 to 20 times. A few days after the grafting of most of the seedlings to the Dickinson variety a desert wind killed 23 Guatemalan and 22 Mexican and one Lula. Many others suffered injuries in varying degrees.

About one month before grafting, observations showed 9% of the Guatemalan more or

less chlorotic. None of the Mexican or Lula was affected. The following spring—1952—63% of the 85 remaining Guatemalan, 5% of the 92 Mexican, and 11% of 17 Lula showed chlorosis in varying degrees. There were many borderline cases which were difficult to classify. The percentage among Guatemalan varieties ranged from 25% to 92%, among Mexican 0% to 13%. This included grafted as well as nongrafted seedlings or those on which the graft had failed. The incidence of the disorder was nearly equally distributed among grafts and seedlings.

A consistent trend as to degree of susceptibility of different varieties has not been indicated by observation made in these studies, but this does not necessarily mean that differences do not exist. The observations were limited to randomized rootstock test plots, and although some 50 such plots have been planted during the past nine years, chlorosis has occurred to any extent in only five.

Whether the cause of the disorder is the same in all cases observed is not certain. There is a close correlation between the calcium reserve of the soil in the plots and the incidence of a type of chlorosis referred to as lime-induced chlorosis. Soil survey maps indicate that soils in three of the plots are highly calcareous. The other chlorotic plot and the nursery are saline. Other plots, where the soils are low in calcium and total salinity, have been free from this disorder. However, yellowing and leaf burn may result from any number of different causes.

The fact that chlorosis has not been noted to any great extent in commercial orchards in the past, except when planted in obviously high lime soils, may be due to the almost exclusive use of Mexican rootstocks. Moreover, affected trees on this stock seem to recover within a short time, hence may not attract attention.

The variability in chlorosis within seedling progeny of the same variety is apparent. In all of the plots in which the disorder has occurred, normal and affected trees, about 20' apart and on the same rootstock variety, have been observed. This can be because of soil variation, but a similar situation existed in the nursery where the plants were only about one foot apart. Soil variability alone does not explain this behavior so it raises the question of the genetic factor in seedlings.

Seedlings of a given variety vary more or less in leaf, fruit characters and growth habit even if the seeds are obtained from a single tree; each seedling is a different variety although some of the progeny may closely resemble the parent tree. In view of this situation it is likely that genetic variation among seedlings of a given variety would account for differences in degree of susceptibility to chlorosis. To prove this assumption would require extensive tests.

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