

RELATIVE SUSCEPTIBILITY OF AVOCADO ROOTSTOCKS TO CHLOROSIS

2nd Report

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SUMMARY

1. Observations, additional to those reported previously, again show that the incidence of a type of chlorosis in young avocado trees on Guatemalan rootstocks is greater than in trees on Mexican varieties. Very limited information suggests that West Indian rootstocks may be as tolerant as Mexican.

2. The disorder is probably due mainly to an excess of calcium and, in a few cases, to salinity.

3. It is suggested that the genetic factor may account for variations in susceptibility among seedlings of a given variety.

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In a previous report (2) 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 rootstock plots, one located in Santa Barbara County and one in Orange County. In the former 70 percent and in the latter 78 percent of the trees on Guatemalan stocks became chlorotic about one year after planting, while only 1 percent of the trees on Mexican stocks in both plots showed the disorder. When the report was submitted in November 1951, 40 and 35 percent, respectively, of the chlorotic trees on Guatemalan stocks were either dead or seemingly beyond recovery. Since then the condition of the surviving chlorotic trees has fluctuated, and at present (November 1952) it is still uncertain as to what percentage will develop into normal trees.

This report presents additional evidence, obtained in two rootstock plots and one nursery, that Guatemalan varieties, as a group, are less tolerant to chlorosis than 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 6 Guatemalan varieties: Nabal, Challenge, Itzamna, Dickinson, Anaheim, Mayapan; 5 Mexican varieties: Topa Topa and 4 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 (2 years later) about half of the seedlings were grafted to MacArthur and half to Rincon. Up to the time of grafting no chlorosis was evident, but five months later 30 percent of the 46 Guatemalan showed the disorder in varying degrees; 13 percent of the Mexican were affected, while the West Indian trees were free of the disorder. Of interest was the fact that chlorosis occurred about two years after planting, whereas in all of the other affected plots it had appeared within a year. It is also noteworthy that with but three exceptions (all Guatemalan) all 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.

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, Duke, 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 percent of the trees on Guatemalan stock 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 at this time (November 1952) there were no recurrences or new cases. It will be noted that here as well as in the plot mentioned previously, the chlorosis situation differed from that in the plots reported last year, namely, 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 percent 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, Mayapan, 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. Grafting to the Dickinson variety was to be delayed until the following spring, but through misunderstanding most of the seedlings were grafted in September. Unfortunately a few days after grafting a desert wind killed 23 Guatemalan and 22 Mexican and 1 Lula. Many others suffered injuries in varying degrees.

About one month before grafting, observations showed 9 percent of the Guatemalan

more or less chlorotic. None of the Mexican or Lula was affected. The following spring (1952) 63 percent of the 85 remaining Guatemalan, 5 percent of the 92 Mexican, and 11 percent 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 percent, among Mexican 0 to 13 percent. 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. Figure 1 shows a chlorotic Guatemalan seedling adjacent to a normal Mexican seedling.



Fig. 1 *Two adjacent nursery seedlings.
Right, a chlorotic Guatemalan;
left, a normal Mexican.*

Another striking case of difference in chlorosis susceptibility was observed in an adjacent strip which the grower had planted to 108 each of Dickinson (Guatemalan) and Topa Topa (Mexican) seedlings. Figure 2 shows the difference between these two rows a few months after planting. Seventy-three percent of the Dickinson but only 5 percent of the Topa Topa were chlorotic. A large proportion of the Dickinson seedlings also showed severe leaf burn.



Fig. 2 *Topa Topa Row (right) practically free from chlorosis; Dickinson Row (left) 73 percent chlorotic.*

DISCUSSION

The observations made so far do not indicate a consistent trend as to degree of susceptibility of different varieties. This does not necessarily mean that differences do not exist. As pointed out before, 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. Moreover, the number of chlorotic trees on each of the stocks is too small to warrant a definite statement.

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, it should be kept in mind that 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.



Fig. 3 *Two adjacent Dickinson seedlings; one in foreground practically dead from chlorosis, one in back vigorous and not chlorotic.*

Most interesting is the variability in chlorosis within seedling progeny of the same variety. In all of the plots in which the disorder has occurred, normal and affected trees, about 20 feet apart and on the same rootstock variety, have been observed (Fig. 3). This can be due to soil variation, but a similar situation existed in the nursery where the plants were only about one foot apart. Obviously, soil variability alone does not explain this behavior. This raises the question of the genetic factor in seedlings. It is a well known fact that 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. In other words, each seedling is a different variety although some of the progeny may closely resemble the parent tree. It follows, then, that when we say that the rootstock is Nabal or Topa Topa, for example, we mean that they are seedlings of these varieties. 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 of asexually propagated progenies. Two methods of obtaining such material are available: one developed by Frolich (1), the other by Halma and Frolich (3).

LITERATURE CITED

1. Frolich, E. F. *Rooting Guatemalan avocado cuttings. Calif. Avocado Society Yearbook 1951: 136-138.*
2. Halma, F. F., and F. A. White. *Relative susceptibility of avocado rootstocks to*

chlorosis. Calif. Avocado Society Yearbook 1951: 153-156.

3. *Halma, F. F., and E. F. Frolich. An approach to the evaluation of avocado rootstock variability. Calif. Avocado Society Yearbook 1952.*