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TESTING DUKE AVOCADO SEED SOURCE TREES FOR SUNBLOTCH

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The Duke avocado has been grown primarily in California where it was considered of some value in the 1920's and 1930's as an early, green, good-sized Mexican fruit with fairly good cold hardiness and resistance to wind damage. In the Alta Loma region, Duke trees withstood temperatures of 21°F. during the 1937 freeze and bloomed the following spring while Fuerte trees in the same locations were severely damaged. Zentmyer, Thorn, and Burns (6) reported in detail on the origin, characteristics, distribution, and uses the Duke variety of avocado.

Other than occasional trees, planting of Duke trees has not continued because of the mediocre fruit quality, somewhat erratic production and the tendency for the fruit to develop cracks when mature. However, there are trees of this variety throughout the avocado-growing counties of California, but many of these are scattered, back-yard plantings. Some trees have produced good crops of fruit. Also, the Duke variety has been introduced into some of the newer avocado-growing areas where both summer and winter temperatures may be extreme. For example, avocado trees in the Hemet area are nearly all Duke and production on a few trees averaged 200 pounds per tree over a four-year period.

Although the Duke is a Mexican type, it has never been used as extensively for a rootstock as other Mexican varieties such as Topa Topa and Canter. The reason for this is that nurserymen observed that Duke seeds germinate slower and the seedlings, particularly those from selfed seeds, develop slower and less uniformly in the early stage than some other available rootstock varieties.

In recent years, studies at the University of California Citrus Research Center (3. 4, 5. 6, 7) have shown that a fairly high proportion of Duke seedlings have some resistance or tolerance to *Phytophthora cinnamomi,* the avocado root rot fungus. This has created a new interest is the Duke avocado for use as a rootstock. In the course of collecting seeds of Duke for root rot resistance studies, a number of trees were found to be infected with the virus of sun-blotch disease. Those which displayed obvious symptoms of sun blotch could be avoided, but there remained the possibility that some Duke trees might be symptomless carriers of sun blotch virus. Since it has been shown (1, 2) that seedlings grown from symptomless carrier avocado trees are infected with sun blotch virus through seed transmission and should not be used as rootstocks, it became necessary to insure that no symptomless carrier Duke trees be used as rootstock seed sources. This paper presents results of the first tests that have been completed in the program of selecting suitable Duke trees for root-stock sources.

Methods of Testing for Sunblotch

One method of determining if an avocado tree which shows no sun blotch symptoms is healthy or is a symptomless carrier of sun blotch virus, is to inoculate from it to known healthy avocado seedlings.

In these studies, the seedlings used for indicators were derived from Hass tree Citrus Research Center 19B-15-3 which was known to be healthy. Seeds were planted individually in 1-gallon cans in virgin soil (Vista sandy loam) taken from noncultivated land of the University of California campus at Riverside. Seeds were planted in May 1962 and the containers and plants were maintained in a lathhouse throughout the experiment.

In May and June of 1963 when the Hass indicator seedlings were 30-36 inches in height, each was "inoculated" by inserting four shield buds, each from a different budstick from a given Duke tree. A total of 10 Hass seedlings were inoculated from each of 12 Duke trees under test, using from 16 to 20 budsticks taken at random from, each tree being tested. To speed up movement of the virus (if present) from the buds into the seedlings, the test plants were topped just above the upper inoculation bud and new shoots permitted to form a top.

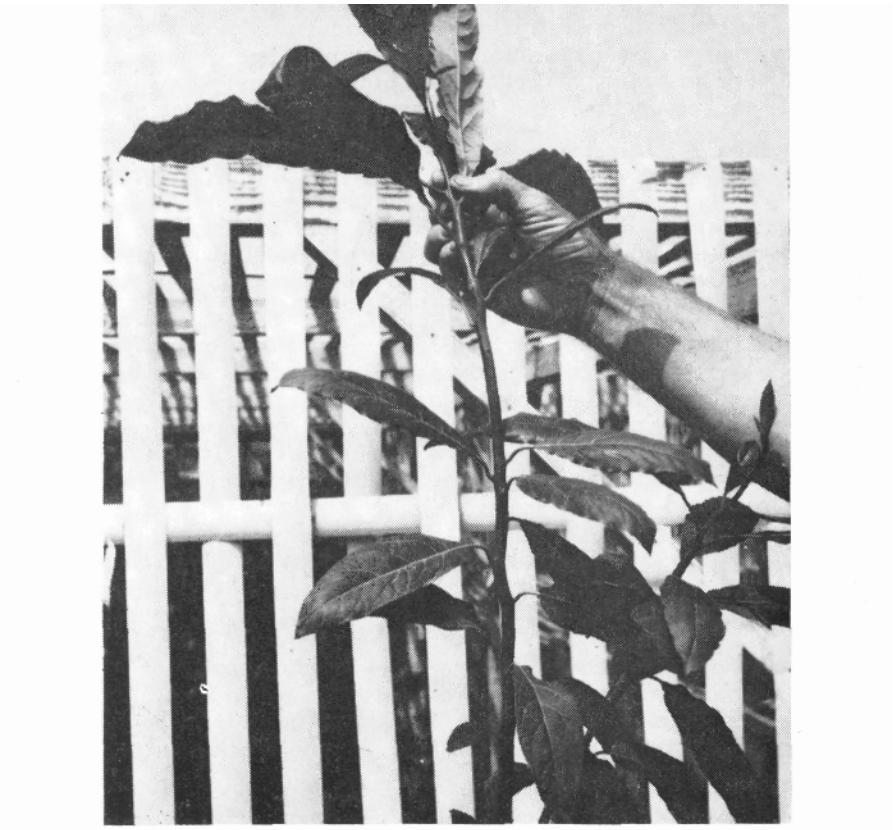

Figure 1. Hass test seedling showing symptoms of sun-blotch virus. On the main stem near the area of the hand can be seen the characteristic sunken bark streaks.

All test plants were transferred to three-gallon cans in April 1965. All seedlings which

had not developed symptoms by that time were again topped to encourage infection and development of symptoms in case the virus was present but had not yet caused symptoms. This is necessary because in some plants there is a delay in infection and production of symptoms of sun blotch. On infected seedlings, the first symptoms to appear are small yellow spots on the green bark of the main stem. Later these spots enlarge and yellow, colorless or sometimes pinkish streaks, which may be slightly sunken, develop along the stems as shown in Figure 1.

Results

All test seedlings in this study were carefully examined for symptoms six times between September 1964 and October 1967. Infection results are summarized in Table 1.

Duke trees 1 to 10 proved to be sun-blotch free since no infections were obtained from them. However, the results obtained with Duke trees 11 and 12 clearly showed that both were infected; all 10 test seedlings inoculated from each, developed sun-blotch symptoms. Inasmuch as no symptoms were found on these two Duke trees the chances are good that they are the symptomless carrier types which would produce diseased seedling progenies unsuitable for use as rootstocks. At least it is certain that they are infected.

In Table 1, Duke trees 13 and 14 were known to be infected with sun-blotch virus; tree 13 showed symptoms while tree 14 was a previously-identified symptomless carrier. Tree 15 was a symptomless-carrier Topa Topa. It will be noted that 100 percent of the Hass seedlings developed sun blotch after inoculation from the known infected tree which were used as controls in this experiment,

It has been reported by Wallace and Drake (2) that infections from symptomless carrier trees require a long time for symptoms to appear on the test seedlings. This apparently results from the presence of a very low concentration of virus in the infected, symptomless trees. Two of the four trees inoculated from Riverside Duke 13 which showed sun blotch symptoms, developed symptoms within 10 months after inoculation. Although there was 100 percent infection of seedlings inoculated from the two symptomless carrier Duke trees number 11 and 12, symptoms did not appear on any test seedlings until two years or more following inoculation.

Summary and Conclusions

Of the 12 Duke avocado trees tested, 10 trees were found to be free of sun-blotch virus infection. However, two trees which showed no sun-blotch symptoms were infected and apparently both are the symptomless-carrier types which transmit the virus through seeds to their seedling progeny. These infected seedlings never show symptoms, but if used as rootstocks they bring about infection of the scion tops that are worked on them.

These studies demonstrate that there are some symptomless carriers of sun-blotch virus among existing Duke trees. It is therefore necessary to test all Duke seed-source trees before using them as root-stock parents.

TABLE 1. RESULTS OF TESTS FOR SUNBLOTCH IN DUKE TREES

Tree No.	*Sun-blotch Symptoms*	*County Location*	*Reaction of Test Seedlings No. Inoc.*	*No. Infected*
Duke 1	None	Ventura	10	0
" 2	"	San Bernardino	10	0
" 3	"	Butte	10	0
" 4	"	Tulare	10	0
" 5	"	Riverside	10	0
" 6	"	"	10	0
" 7	"	"	10	0
" 8	"	San Diego	10	0
" 9	"	"	10	0
" 10	"	Santa Barbara	10	0
" 11	"	Sutter	10	10
" 12	"	"	10	10
" 13 C.K.	Positive[1]	Riverside	4	4
" 14 C.K.	Symptomless Carrier[2]	"	3	3
Topa 15 C.K.	Symptomless Carrier[2]	"	4	4

[1]Duke tree number 13 showed sunblotch symptoms
[2]Duke tree 14 and Topa 15 were known to be symptomless carriers of sun-blotch virus. Inoculations from these three know infected sources were made to serve as checks.

Acknowledgements

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