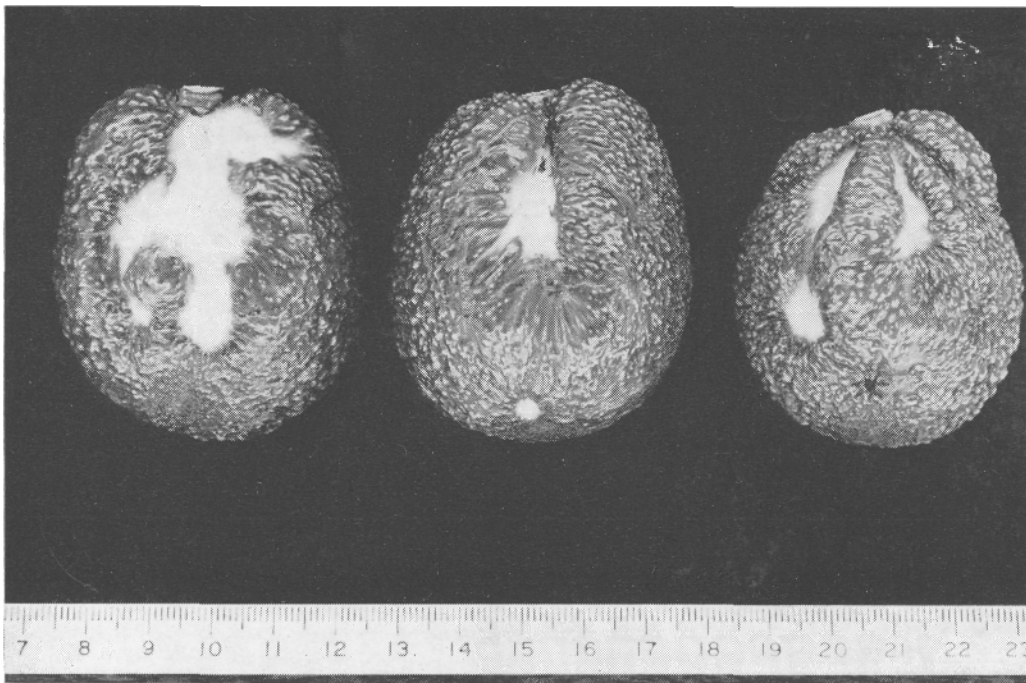


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RESISTANCE TO SUN BLOTCH VIRUS IN SEED SOURCE TREES OF DUKE AVOCADO

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Of 12 Duke avocado trees tested, 10 were found to be free of sun blotch virus infection. However, two trees without sun blotch symptoms were infected and apparently both are symptomless carriers. These transmit the virus through seeds to their seedling progeny and can cause infection of the scion tops that are worked on them when used as rootstocks. These studies demonstrate that it is necessary to test all Duke seed-source trees before using them as rootstock parents.



Sun blotch-affected Hass avocado fruit. Depressed areas are yellow in color.

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.

Except for occasional trees, planting of Duke trees has not continued because of the mediocre quality of the fruit, the somewhat erratic production, and the tendency of the

fruit to develop cracks when mature. However, there are trees of this variety scattered throughout the avocado-growing counties of California (many of these are in back-yard plantings) and some trees have produced good crops of fruit. The Duke variety has also been introduced into some of the newer avocado-growing areas where both summer and winter temperatures can be extreme. Nearly all avocado trees in the Hemet area are Duke, and production on a few trees has averaged 200 lbs per tree over a four-year period.

Mexican varieties

Although Duke is a Mexican type, it has never been used as extensively for a rootstock as other Mexican varieties such as Topa Topa and Ganter. The reason 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 stages than those of some other available rootstock varieties.

In recent years, studies at the University of California Citrus Research Center 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 in the Duke avocado for use as a rootstock. In the course of collecting seeds of Duke for root rot resistance studies, investigators found a number of trees were 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 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. Results presented here are from the first tests completed in the program to select suitable Duke trees for rootstock sources. The photo shows extreme sunblotch symptoms on Hass fruit. The sunken, yellow-colored areas on the surface and distortion of the fruit can make it unmarketable.

Inoculation

One method of determining whether an avocado tree without 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 19B-15-3 Citrus Research Center, which was known to be healthy. Seeds were planted individually in 1-gallon cans in virgin soil (Vista sandy loam) taken from non-cultivated 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, 1963, when the Hass indicator seedlings were 30 to 36 inches high, each was "inoculated" by inserting four shield buds, each from a different budstick of 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 were permitted to form a top.

Test plants

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 if the virus was present but had not yet caused symptoms. This is necessary because there is a delay in infection and production of symptoms of sun blotch in some plants. The first symptoms to appear on infected seedlings are small yellow spots on the green bark of the main stem. Later these spots along the stems enlarge, becoming yellow, colorless or sometimes pinkish streaks, which may be slightly sunken.

RESULTS OF TESTS FOR SUN BLOTCH IN DUKE TREES

Tree No.	Sun Blotch Symptoms	County Location	Reaction of Test Seedlings	
			No. Inoc.	No. Infected ^d
Duke 1	None	Ventura	10	0
Duke 2	None	San Bernardino	10	0
Duke 3	None	Butte	10	0
Duke 4	None	Tulare	10	0
Duke 5	None	Riverside	10	0
Duke 6	None	Riverside	10	0
Duke 7	None	Riverside	10	0
Duke 8	None	San Diego	10	0
Duke 9	None	San Diego	10	0
Duke 10	None	Santa Barbara	10	0
Duke 11	None	Sutter	10	10
Duke 12	None	Sutter	10	10
Duke 13 CK.	Positive*	Riverside	4	4
Duke 14 CK.	Symptomless Carrier†	Riverside	3	3
Topa 15 CK.	Symptomless Carrier†	Riverside	4	4

* Duke tree number 13 showed sun blotch symptoms.

† Duke tree 14 and Topa 15 were known to be symptomless carriers of sun blotch virus. Inoculations from these three known infected sources were made to serve as checks.

Evaluation

All test seedlings in this study were carefully examined for symptoms six times between September 1964 and October 1967. Infection results are summarized in the table. Duke test trees 1 to 10 proved to be sun blotch free since no infections were obtained from them. However, results obtained from Duke trees 11 and 12 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.

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 should be noted that 100 per cent of the Hass seedlings developed sun blotch after inoculation from the known infected trees used as controls in this experiment.

Infections

Infections from symptomless carrier trees have been reported to require a long time before symptoms appear on the test seedlings. This apparently results from the presence of a very low concentration of the virus in 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 per cent infection of seedlings inoculated from the two symptomless-carrier Duke trees numbers 11 and 12, symptoms did not appear on any test seedlings until two years or more after inoculation.

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