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VENTURA COUNTY AVOCADO ROOT ROT RESISTANCE PLOT

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An important phase of the research at the University of California, Riverside, on resistance to Phytophthora root rot of avocado is the establishment of field trials to test rootstocks that show some resistance to the disease in greenhouse tests. One of the largest of these is a test plot on the E. E. Converse property near Santa Paula, involving 127 trees, established in June 1959.

This is a progress report on this plot, which is now showing some interesting relationships between rootstocks and resistance to root rot, and tree growth and production.

Avocado trees on this ranch began looking poorly in the late 1940's and early 1950's. By 1955, trees on three to four acres had been killed by *Phytophthora cinnamomi,* the fungus that causes this disease. During 1956 the owner removed many of the dead and dying trees. During 1957 samples were collected from the cypress trees (another plant that may be attacked by the fungus) on the ridge above the dying avocados in an attempt to establish the source of the infection. All cypress samples were negative for the presence of *P. cinnamomi.*

In the spring of 1957, Mr. Fred Foote of the Limonira Ranch, near Santa Paula supervised the soil fumigation of the approximately one acre of this grove in preparation for replanting. The level terrace areas were treated by a tractor-operated applicator with Dicloropropane-Dicloropropene (D-D) at the rate of 900 pounds per acre. The sloping portions of each terrace were treated by hand operated Mack wed guns with the same material at two concentrations (300 and 150 gallons per acre). In November of 1957 further sampling was done to test the effectiveness of the soil fumigation. *P. cinnamomi* was recovered from five locations at depths of 24-36" and 36-48". The fumigant apparently eliminated the fungus at the 0 to 24" depths but was unable to kill effectively at the lower levels. The winter of 1957-58 was abnormally wet, with 30 inches of rain. This may have caused some spread of the fungus from a few areas where it was not killed by the fun-decant.

The soils in which avocados are grown are closely correlated with susceptibility to fungus development (1). Converse trial soils are primarily the Rincon series. Generally

these soils have fair-to-poor internal drainage, so if the fungus is introduced it can spread rapidly and be very damaging. Also with a generally fine texture, the penetration and distribution of fumigants is often restricted.

Figure 1. Tree with root rot symptoms, just prior to removal of trees from experimental area in 1956.

In 1958, the owner in cooperation with the University of California (the Agricultural Extension Service in Ventura County and the Citrus Research Center in Riverside) decided to establish a replant plot in this treated area to test the relative resistance of the Duke variety as a rootstock compared to that of the more commonly used Topa-Topa rootstock. The trees were planted in June 1959.

There had been previous indications in greenhouse tests (3) and in other field plots (4) that the Duke variety of avocado showed some resistance to root rot; the Converse plot was designed to compare these rootstocks under field conditions.

This planting includes 12 basic rootstock-scion combinations in a randomized planting throughout the area, with 10 replicates. Some additional trees were planted in a small plot outside of the main area. In the original planting the rootstocks were Topa-Topa seedlings, open pollinated Duke seedlings, self-pollinated Duke seedlings, as well as top-worked and non-topworked Duke cuttings; some of these were top-worked to either Fuerte or Hass. All top-worked trees came from Eggers Nursery in Fallbrook. In January of 1963 a propagator hired by the owner to top-work the seedlings to Hass inadvertently also topworked all the Fuerte trees resulting in sandwich grafts in the case of these trees. Most of the grafts were successful and at this time the trees are generally doing very well. Each tree is individually irrigated by a spitter type sprinkler located about three feet from the tree.

Soil samples were taken at 0-6 inch depths at all sites prior to planting; these were tested for the presence of the avocado root rot fungus, using the avocado fruit test method (2). The fungus was recovered from three of the 147 planting sites. In January 1963 additional soil and root samples were taken; *P. cinnamomi* was found at 20

additional locations at that time. In June 1965, all trees from which the fungus had not been recovered were sampled again. No additional locations for the fungus were found then. These same trees were sampled again in June 1966, and *P. cinnamomi* was found in six additional sites, making a total of 29 diseased trees to that time. Samples were taken again in July 1967 with the fungus found on 15 additional trees. Thus, a total of 44 trees are now infected with *P. cinnamomi.*

Figure 2. Young replants in fumigated area, spring 1964.

Figure 3. Replants in fumigated area, spring 1967; C. C. Delphey in foreground.

In the first few years after planting only two trees showed any evidence of root rot, and

most trees made excellent growth. With the gradual increase in occurrence of the avocado root rot fungus in this plot, additional trees are showing disease symptoms, though the total number is relatively low. Growth of the healthy trees and even of some of those infected with *P. cinnamomi* has been excellent. As the following table shows, many of the trees on Duke rootstock, which now are infected with *P. cinnamomi,* are not yet showing top symptoms, while all of the trees on Topa Topa rootstock which are infected with the fungus are showing some symptoms of root rot.

In the following; table major rootstocks are combined, and some of the trees on miscellaneous seedling rootstocks and combinations involving only a few trees are not included.

Scion/Rootstock Combination	No. of Trees	No. With *Phytopthora cinnamomi* 1966	1967	No. With Root Rot Symptoms 1967	Ave. Number Fruit per Tree 1966	1967
Hass on Topa Topa seedlings	24	10	15	10	29	37
Hass on Duke-open pollinated seedling (SB)*	15	2	3	1	63	52
Hass on Duke-open pollinated seedling (CRC)**	25	5	12	1	42	57
Hass on Duke-self pollinated seedling (H)***	25	8	10	1	28	43
Hass on Duke cuttings	7	3	3	1	13	59

*Seed from Duke tree at Santa Barbara Hospital, Goleta.
**Seed from Duke tree at Citrus Research Center, University of Calif., Riverside.
***Seed from Duke tree in Hemet.

Considering the total trees on any one rootstock, average production per tree is thus higher on the trees on Duke rootstock than those on Topa Topa rootstock. In general, growth on the two rootstocks is comparable.

To summarize this preliminary report of the Converse trial in Ventura County, indications are that trees grafted on Duke seedling or Duke cutting rootstocks are equal to or better in fruit production and growth to trees on Topa Topa rootstock. Trees on Duke rootstock are showing indication of greater resistance to *Phytophthora cinnamomi* than those on Topa Topa rootstock, although definite conclusions cannot be made at this early stage. Certainly, trees on Topa Topa rootstock are showing visible disease symptoms - earlier than comparable trees on Duke rootstocks. Several more years of observation will be necessary in order to draw more definite conclusions from this root rot resistance plot.

LITERATURE CITED

1. Burns, R. M., R. W. Kover, C. C. DeSphey, K. D. Gowans and G. A.Zentmyer. 1963. Ventura County Avocado soil and root rot survey. Calif. Avo Soc. Yrbk, 47: 65-72.
2. Zentmyer, G. A., A. O. Paulus and R, M. Burns. 1962. Avocado root rot, Calif. Agric. Experiment Station, Cire. 511.
3. Zentmyer, G. A., and W. A. Thorn. 1956. Resistance of the Duke variety of avocado to Phytophthora root rot. Calif. Avocado SocietyY earbook 40: 169-173.
4. Zentmyer, G. A., W. A. Thorn and R. M. Burns 1963. The Duke Avocado, Calif. Avocado Soc. Yrbk. 47: 28-36.

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