California Avocado Society 1960 Yearbook 44: 107-109

RESULTS WITH NEW METHOD OF TESTING FOR RESISTANCE TO PHYTOPHTHORA ROOT ROT OF AVOCADO

George A. Zentmyer and S. M. Mircetich
Plant Pathologist, Laboratory Technician II, respectively, University of California, Citrus Experiment Station, Riverside, California.

Early in 1959 the root rot resistance screening program at Riverside was shifted completely to the aerated nutrient solution test method. During the past year over 2,900 seedlings and cuttings have been tested by this method; this paper summarizes the results.

In this procedure, seed are germinated in flats containing steam-sterilized sand, then when three to four inches tall, are transplanted to tanks containing a complete nutrient solution (described by Bingham and Zentmyer, 1954) at a pH of 6.5 and a constant temperature of 24° C. Seedlings are grown in these tanks (Fig. 1) for seven to ten days until vigorous new root development has taken place in the aerated nutrient solution.

Fig. 1. Avocado cuttings and seedlings growing in temperature controlled tank containing nutrient solution, for root rot resistance tests.

When new roots are well developed, inoculum of **Phytophthora cinnamomi** is placed in the tanks. The fungus is grown on potato dextrose agar in petri dishes in the laboratory for seven to ten days, then the agar and mycelium is removed from the dish, placed in small cheesecloth bags and suspended in the nutrient solution in the test tanks. Eight bags containing the mycelium and agar from four petri dish cultures are

placed in each tank. The tanks contain 425 liters (approximately 140 gallons), and are 42 inches square.

Sporangia of the fungus are formed in great abundance on the inoculum placed in the tank and release thousands of swimming zoospores into the nutrient solution. These zoospores germinate on the avocado roots and cause numerous infections of the susceptible roots. At the above temperature and pH, brown lesions begin to appear on the white avocado roots in 48 hours. Infection progresses rapidly, and within seven to ten days 95 to 100 per cent of the roots of susceptible seedlings are dead.

Materials tested during the last year by this method include seed from the following areas: California, Florida, Texas, Hawaii, Puerto Rico, Mexico, Costa Rica, Colombia, and Venezuela. Many of the California seed were collected by R. M. Burns of the Agricultural Extension Service, Riverside, and W. A. Thorn of this Department, assisted by the Farm Advisors in most of the avocado producing counties. The great majority of the California collections were from Duke trees, following up the earlier indications of partial resistance in this variety (Zentmyer and Thorn, 1956). A large number of collections from Florida were provided by Dr. Murray Gaskins, Superintendent of the U. S. Department of Agriculture Plant Introduction Station at Miami, under a cooperative agreement with Dr. Gaskins and Mr. Harold Winters of the U. S. Department of Agriculture. A number of collections were sent from Puerto Rico by Mr. William Pennock, Horticulturist at the Rio Piedras Experiment Station, and other seed were collected by Mr. Pennock and the senior author of this paper during a trip to Puerto Rico in the fall of 1959. Seed were sent from Costa Rica by Dr. Luis Sequeira, plant pathologist with the United Fruit Company; from Colombia by Dr. David Thurston, plant pathologist with the Rockefeller Foundation; and from Hawaii by Dr. Richard Hamilton, horticulturist with the University of Hawaii. Mexican and Venezuelan seed were collected by the senior author.

In the standard screening test, final disease readings are taken ten days after the inoculum of the fungus is placed in the tanks. Seedlings are classified in two groups: 1) those with 90 to 100 per cent of their roots rotted, and 2) those with less than 90 per cent of their roots rotted. Seedlings in the first group are discarded, while those in the other group are transplanted into soil in clay pots or other containers for further propagation.

In this very severe test, the great majority of seedlings are in the first group at the end of the experiment, with 90 to 100 per cent of their roots rotted. Of the few in the second group, only a very limited number have an infection figure appreciably less than 90 per cent; most of them are in the 80 to 85 per cent group.

Results of tests—Of the 2,932 seedlings and cuttings tested, 91 per cent of these, or 2,655, were in the 90 to 100 per cent root infection class. The 9 per cent, or 277 plants, in the lower infection group (less than 90 per cent infection) included the following types: Duke seedlings of several types; Duke cuttings; two West Indian types from the Florida collections; several West Indian types from Puerto Rico; two Duke-like types from Mexico; **Persea caerulea** from Venezuela; **Alseodaphne** sp., a plant related to the avocado, from Asia, via Hawaii; and a few other miscellaneous collections. Of the 255 Topa Topa seedlings used for controls, none were in the class with less than 90 per

cent infection.

High resistance was evident in these tests in two collections: **Persea caerulea** and **Alseodaphne** sp. Both of these are non-graft compatible types. Promising results were obtained with several compatible types, however. Though the resistance of individual seedlings was not as high as that of the above two types, the following compatible varieties showed high percentages of seedlings or cuttings below the 90 per cent root infection class:

Type	Per cent of seedlings with root infection below 90 per cent
Mexican 19 seedling	100
Duke 6 cutting	100
Duke parent cutting	100
West Indian type seedling from Costa Rica	67
West Indian seedling from Guatemala	50
Mexican 6 seedling	40
West Indian seedling from Florida	33
West Indian seedling from Florida	(29)

Using this nutrient solution method, Duke cuttings were found to show higher resistance than Duke seedlings or Topa Topa seedlings. This resistance, however, was not as high as that of some of the small-fruited species of **Persea** such as **P. caerulea** and **P. skutchii.** Forty-one of 53 Duke cuttings tested had less than 90 per cent root rot by the end of the infection period (10 days), as compared with four out of 32 Duke seedlings and one out of 17 Topa Topa seedlings in the less than 90 per cent infection class.

Tests during the past year have been run with approximately 90 seedlings or cuttings per tank. A method of greatly increasing capacity of the tanks is now under test; if it develops as is indicated, approximately five times the number of seedlings can be tested in the same period. With this increased production and with interesting leads on resistant types appearing, significant progress should be made in the project of Phytophthora resistant avocado rootstocks in the next year.

LITERATURE CITED

1. Bingham, F. T., and G. A. Zentmyer. Relation of hydrogen-ion concentration of nutrient solution to Phytophthora root rot of avocado seedlings. Phytopathology 44:611-614. 1954.
2. Zentmyer, G. A., and W. A. Thorn. Resistance of the Duke variety of avocado to Phytophthora root rot. California Avocado Society Yearbook 40:169-173. 1956.