

AVOCADO ROOT ROT DISEASE IN SANTA BARBARA COUNTY

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The Avocado Root Rot Disease is becoming an increasingly serious threat to the avocado industry of Santa Barbara County. Because of this threat it is well to take time out to review our knowledge to date, listing our practical recommendations, and to indicate that there are hopes for better control in the future.

Some of these comments have been covered many times before in other articles, but since we learn by repetition and constant re-evaluation, I have dared to assemble this article. Our present knowledge is largely based on the excellent research work done by Dr. G. A. Zentmyer, Jr., Plant Pathologist at the Citrus Experiment Station and many others on the University of California staff in cooperation with many growers and industry leaders. Through a number of cooperative test plots and two surveys conducted in Santa Barbara County, the following is the essence of our present knowledge.

Two conditions are necessary for the development of the Avocado Root Rot disease:

1. Presence of the cinnamon fungus-*Phytophthora cinnamomi*.
2. Excess moisture in the root zone.

If either of these conditions are lacking, little damage will result. If both conditions occur in an avocado grove, this disease will eventually destroy the trees.

SERIOUSNESS IN SANTA BARBARA COUNTY

Based on fungus cultures made in the past 2/2 years, Root Rot is known to occur in 30 different orchards comprising about 87 acres. Perhaps another 25 acres was lost in past years. It is estimated that nearly half of the present acreage is planted on soils on which this disease could occur. These losses can be estimated monetarily as:

Value of trees lost in past (25 acres at \$1000/A.)	\$ 25,000
Value of presently infected acreage (87 acres at \$1500/A.)	\$125,000
Value of trees on estimated threatened acreage (600 acres at \$1500/A.)	\$900,000
Value of crop loss annually in present infected orchards (1 field box/tree at \$5)	\$40,000

Because this disease is such a serious threat, we are doing all we can to acquaint growers with the problem. We are also set up to run fungus cultures in our county laboratory to more specifically determine the spread of the fungus as an aid to local

growers. The excellent cooperation of Robert P. Rich, Calavo field man, with these tests is greatly appreciated.

SOIL TYPES AND DISEASE OCCURRENCE

A very wide variety of soil types occur in Santa Barbara County. This gives us an opportunity to rate these many soil types in relation to the possibilities of the Root Rot disease occurrence. Using the results of more than 250 laboratory tests and the soil series as shown in "Soils of Southern Coastal Area, Santa Barbara County" 1950 by W. W. Weir, Division of Soils, University of California, the following groupings and evaluations are made:

I. *Deep Valley Soils*-made up mainly of these series:

Yolo	Mocho
Sorrento	Arguedo

These well drained, recent alluvial soils do not present any threat of Root Rot. A few diseased trees have developed on these soils, but in each case the trees were planted in septic leach fields or similar high moisture conditions.

II. *Lower Terrace Soils with Slightly Developed Profiles*—includes these series:

Carpinteria	Baywood	San Andreas
Elder	Botella	

A fairly safe group, but because of some profile development and restriction of water penetration, care is necessary to prevent disease occurrences.

III. *Upland Primary Soils*—only three series are used:

Sespe	Nacimiento	Zaca
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These are borderline soils for Root Rot, because they are usually heavy clays in texture, although they have good structure. Water can penetrate them slowly, so by careful irrigation and proper provision for rainfall runoff, these are satisfactory avocado soils. In some spots the high lime content will cause severe iron deficiency.

IV. *Terrace Soils with Impervious Clay Pans*

Milpitas	Montezuma	Clear Lake
Aliso	Ballard	Tierra
Clivenhain	Watsonville	

Because of their impervious clay pan subsoil varying from 8 inches to 3½ feet below the soil surface, these poorly drained soils are subject to Root Rot development if the fungus is present.

MEANS OF SPREADING FUNGUS

Although indications are that the fungus is not native to Southern California, it is now

rather widely distributed both in avocado groves and among the many ornamental plants which are also hosts. In any event, growers should take every precaution to prevent the introduction of *Phytophthora cinnamomi* into their groves, even on those soils which apparently do not readily develop this disease.

The major means of spread observed in Santa Barbara County are:

1. *Avocado Nursery Stock*. Unfortunately, apparently healthy nursery trees, both balled and tipgrafts, have been planted only to find that the fungus was present in the soil in the nursery; yet the nurseryman did not know of its presence. Only when the soil moisture became excessive did the trees wilt and die; usually this occurs in the first and second season in the field.
2. *Drainage Water*. The main means of spread in an orchard is from the introduced point downhill either by surface run-off water or subsurface drainage. In unusually wet spots the spread is quite rapid due to the swimming spores which *Phytophthora cinnamomi* forms.
3. *Other Host Plants*. Several orchard infections have been traced from other hosts planted above or adjoining the avocado trees. The most common alternate hosts are Cypress, Pines, Oaks, Camellia, and Heather.²
4. *Soil Movement*. Any means in which diseased soil can be moved is a means of spread; this includes cultivation equipment, shovels, or even on shoes where soil is wet and muddy.

METHODS FOR MINIMIZING LOSSES

While at the present time there is no cure for Avocado Root Rot, there are certain things growers can do to reduce the chances of infection and slow down the spread of the disease. These practices might be termed "learning to live with the disease" as we have with many other soil-borne fungus diseases.

CHOICE OF ORCHARD SITE

The most practical solution to Avocado Root Rot is to avoid planting on soils with poor subsoil drainage. A rating in this connection for Santa Barbara County has been presented above.

Regardless of soil type, growers should do everything possible to prevent the spread of *Phytophthora cinnamomi* into new orchard sites. Some of the more important practices are:

1. Tests for presence of fungus in nearby ornamentals or avocados.
2. Install drains to take care of surface run-off that might be a source of infection.
3. Never move tractors, cultivation equipment, truck and cars, or other means of spreading the fungus in soil from suspected Root Rot orchards into the new orchard site, particularly in wet weather.
4. Selection of disease-free nursery stock. Governmental certification against

Phytophthora cinnamomi appears impossible, so growers should deal with reliable nurserymen who are following accepted practices.

HANDLING KNOWN INFECTED ORCHARDS TO MINIMIZE SPREAD

Since this disease will usually spread gradually throughout an infected orchard if left unchecked, the following suggestions are made to minimize its seriousness:

1. Have the suspected trees tested to determine the extent of infection.
2. Do not irrigate the infected area and its borders. Usually the border includes at least one healthy tree outside. You can sacrifice these border trees because they will probably get the disease anyway.
3. Irrigate the rest of the orchard carefully, so that you do not build up excess water in the soil. The use of the alternate middle system is usually helpful. Irrigate only when soil examination shows that it is dry.
4. Cut off badly diseased trees, burn in place, and paint stumps with 2,4,5-T to kill roots. Allow grasses and weeds to grow to dry out this soil.
5. Do not move equipment from diseased area into clean area without carefully cleaning it.
6. Control gophers since it is believed they spread the diseased roots.
7. Control and drain-off surface water by construction of diversions and tile drains.

ALTERNATE CROPS

Once Avocado Root Rot has been confirmed in your orchard, plans should be made for an alternate crop. Experience in Santa Barbara County has shown that the best alternate crop is lemons. Other alternate crops that grow well, but which should be considered with caution because of their doubtful economic returns are: limes, macadamias, cherimoyas and carobs.

RESEARCH HOPES FOR CONTROL

Currently the research program of the University of California is emphasizing these promising developments:

1. Development of a rootstock resistant to *Phytophthora cinnamomi*.
2. Treatment of diseased trees in the orchard with soil fumigants.
3. Development of eradication measures to eliminate spot infections and allow replanting avocados.
4. Better methods of irrigation and drainage including perfection of devices for more accurate moisture determination.

Test plots on all these phases are underway in Santa Barbara County in cooperation

with Dr. G. A. Zentmyer, Department of Plant Pathology Citrus Experiment Station, Riverside.

We have come to the conclusion that Root Rot is a serious threat to avocado culture in Santa Barbara County, but not an insurmountable problem if growers will follow a good plan for minimizing losses. With a knowledge of how the disease occurs and spreads, growers can "learn to live with it."

LITERATURE CITED

1. *Report of special Sub-Committee of the Nursery Stock Certification Committee. California Avocado Society Yearbook. 1953—54: 72-75.*
2. *Thorn, W. A., and G. A. Zentmyer. Hosts of Phytophthora cinnamomi Rands, The Casual Organism of Avocado Root Rot. California Avocado Society Yearbook. 1952: 196-200.*