California Avocado Society 1953-54 Yearbook 38: 72-75

REPORT OF THE SPECIAL SUB-COMMITTEE OF THE NURSERY STOCK CERTIFICATION COMMITTEE

W. F Hiltabrand J. C. Johnston G. L. Stout C. C. Young G. A. Zentmyer

At the February 1953 meeting of the Avocado Research Committee, Chairman Chaffee Young appointed a Root Rot Certification Committee to study the problem of spread of *Phytophthora cinnamomi* by nursery stock and other means. At a meeting of the Certification Committee, called by Chairman Elwood Trask at Riverside on June 2, a subcommittee was appointed to prepare a report on present knowledge of spread of the fungus so that nurserymen and avocado growers would be informed on the subject. This is the report of the subcommittee.

Avocado root rot is a disease resulting from the attack of a soil fungus, *Phytophthora cinnamomi,* known commonly as the cinnamon fungus or the avocado root rot fungus. The disease is favored by excess soil moisture, as the fungus requires water for production of its spores and invasion of roots. The two factors required for development of the disease are the fungus and excess soil moisture. When one of these factors is absent, little damage results. In California, soil moisture conditions favorable for fungus activity commonly result from poor drainage.

SYMPTOMS OF THE DISEASE

Early symptoms of this disease include a lighter-green color than is normal for leaves, a tendency for leaves to wilt in the presence of an amply moist soil, and a lack of new growth. Many of the small feeder roots on affected trees are blackened, brittle, and dead. As the disease progresses, branches die back, many leaves fall, newly-formed leaves are generally small and yellowish green in color, and fruit does not reach normal size. Affected trees gradually decline in vigor and productivity over a period of several years.

Trees may be affected at any age, from nursery trees to large, old trees. Most of the trouble in the past has been with trees from twelve to fifteen years of age or older, but increasing numbers of young trees have been affected in recent years. According to unofficial estimates, from 2500 to 3500 acres of avocados have been affected by the root rot disease, resulting in a serious loss to the industry.

The cinnamon fungus is already widely distributed throughout avocado districts in southern California; it has been recovered from trees in San Diego, Orange, Los Angeles, Ventura, and Santa Barbara counties. Any quarantine measures therefore are out of the question. The main consideration at present is how best to prevent dissemination of this fungus into new land within the present avocado-producing counties, as well as into presently healthy groves.

Indications are that *Phytophthora cinnamomi* may not be a native inhabitant of southern California soils. It has not been recovered from any of the numerous samples taken from virgin soil areas in southern California. Originally described on cinnamon trees in Sumatra (hence the common name: cinnamon fungus) *P. cinnamomi* is primarily a tropical or subtropical fungus, and may have been introduced into southern California in the early days by means of importation of exotic plants of many kinds. If it is not a native soil inhabitant, all possible means should be taken to prevent its introduction into new areas that are going into avocado production.

OTHER PLANTS ATTACKED BY THE FUNGUS

Phytophthora cinnamomi has a number of other hosts in addition to the avocado. The other plants on which this fungus has been found in southern California are: camellia, heather, myrtle, and various types of coniferous nursery stock, including arbor vitae, Italian cypress, incense cedar, ornamental Lawson cypress, Monterey pine, and Canary Island pine. It attacks a number of other plants, including azalea, rhododendron, pineapple, cinchona, oak, chestnut, and papaya.

MEANS OF SPREAD OF THE FUNGUS

There are several means by which the cinnamon fungus may be spread to new areas. These are outlined below:

A. Soil—inasmuch as the causal fungus lives in soil, it can be moved about by movement of soil. Major means of spread are:

1) Nursery stock—An efficient means of transporting fungi of this type to new areas and to healthy groves by means of replants, is balled or potted nursery stock. In several instances within the past few years *Phytophthora cinnamomi* has been found in the roots of avocado nursery stock, both in balled trees and in trees grown in the tarpaper containers. Severely wilted trees are of course discarded in the nursery. Less obvi ously diseased trees and those with the fungus present in the soil but with no obvious symptoms undoubtedly are sold, as the nurserymen do not realize that the fungus may be present. The cinnamon fungus may be in the soil and cause no noticeable trouble if soil moisture is not excessive. The fungus has also been found on ornamental nursery stock in several southern California nurseries, so that it could be introduced into new land either on avocado nursery stock or on various other plants.

2) Water—The fungus may be spread downhill from an area of infection by means of surface drainage water, either by the movement of particles of soil containing the fungus, or by means of the swimming spores which *Phytophthora cinnamomi* forms.

3) Other means—There are possibilities of spread of the fungus by other means by which soil may be moved, as on cultivation equipment, shovels, or even on shoes when soil is wet and muddy.

B. Seed—another means by which the cinnamon fungus might be spread is by means of avocado seed. This could occur if the fruit from which the seed was taken were allowed to remain on ground which is infested with the fungus. The fungus will

grow into fruit that is lying on moist soil, and will invade the seed. Such seed, if severely rotted, would not germinate but would provide a means of transporting the fungus to the seed bed.

MEANS OF PREVENTING SPREAD

The following precautions are suggested in order to prevent the spread of *Phytophthora cinnamomi:*

1) Selection of nursery site—because of the danger of development of the cinnamon fungus, nurseries should not be planted on old avocado soil, on areas that tend to stay wet or are poorly drained, or on areas adjacent to groves with root rot. There is little possibility of building up the cinnamon fungus population in the soil if nurseries move every year to new soil. Growers should insist on healthy, vigorous nursery stock, grown under the above conditions, or grown in fumigated soil as noted below. Equal care should be used in selecting ornamental plants for planting on an avocado property.

2) Soil treatment—in the case of nursery trees grown in containers, soil fumigation will insure soil free of Phytophthora. Soil for use in the containers can be freed of any possible fungus infestation by fumigating with methyl bromide, under a plastic cover, following directions and precautions prescribed by the manufacturer. For elimination of *P. cinnamomi* a dosage of three pounds of methyl bromide per 100 cubic feet of soil, for 24 hours, is sufficient. Methyl bromide is a poisonous gas, and should be handled with great care; follow directions on the labels of the cans or cylinders containing the gas. A form of methyl bromide in which 2 percent chloropicrin is incorporated as a warning agent is known as MC-2. It is not possible to be equally certain of complete kill of soil fungi when fumigation treatments are applied in the field. Any fumigants known at present would be too expensive to be practical from the standpoint of ridding a nursery site of any possible infection.

The fungus may also be eliminated from nursery potting soil by thoroughly drying the soil to a low moisture content (1 percent moisture for a sandy loam, for example). This method takes longer than fumigation, and great care must be taken to see that the soil is turned sufficiently so that all of the soil reaches the desired moisture content.

If nursery potting soil is treated, suitable precautions should be taken to prevent subsequent contamination. These include keeping the containers from contact with soil which may be infested, by placing them above the ground on wooden platforms or on beds of sand and gravel; and prevention of any movement of non-treated soil into the containers.

3) Other factors—with respect to movement of the fungus by water, this could be reduced by installing drains to take care of surface run-off, though, as indicated above, nurseries should not be situated adjacent to groves with root rot. Nurserymen should also take particular care to lessen possibilities of movement of soil from diseased groves to their nurseries, by means of cultivation equipment.

4) Selection of seed—if fruit are collected in areas where root rot is present they should be picked from the tree, and not permitted to contact the soil.

A final, and exceedingly important, point to remember in connection with the problem of avocado root rot is that very little damage will be caused by the root rot fungus if avocados are planted on well-drained soil. Thus, future plantings should avoid soils which drain slowly and which are likely to cause trouble if *Phytophthora cinnamomi* is present.