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Avocado Root Rot - Two-Phase Series of Experiments to Determine Control Methods

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Avocado root rot occurs primarily on soils that tend to stay wet for varying periods, and is a disease with which the soil-inhabiting cinnamon fungus—**Phytophthora cinnamomi**—is usually associated.

Root rot is a more definite and descriptive term than decline, the name which has been generally used. Trees may decline from causes other than those described here.

Field and laboratory work indicate that in typical avocado root rot two factors are involved.

One is the root-rotting organism, the cinnamon fungus. The other is high water content of the soil, or conversely, low oxygen content which could result either from excessive rainfall or from over-irrigation.

The cinnamon fungus is favored by moist soil. It has a record of attacking roots of a number of plants in addition to avocado.

Research in the Division of Pathology has been aimed primarily at determining whether or not any definite pathogen or infectious agent is connected with this disease.

Soil Fumigation

The two main types of experiments are replanting areas where avocado trees have been removed because of the disease, and treating sick trees to see if they can be made to recover.

In the replanting phase it was found that soil from around diseased trees in the field which was taken to the greenhouse and sterilized, produced a markedly better growth of seedlings than non-treated soil produced.

This work led to some extensive field trials on replanting. On 13 different properties treatments have been applied in locations where 230 avocado trees subsequently have been replanted. Also included in the experiment are 117 untreated control spots where trees have been replanted.

Treatments were applied with weed guns and tractor applicators. Emulsifiable forms of fumigants were applied in basins, also.

Much of the field work has been done with ethylene dibromide and dichloropropane-dichloropropene preparations, some with chloropicrin and with miscellaneous materials.

Most of these plots have not been established long enough to determine the effect of

the treatments, but in the few cases where the replants have been in six months or longer, the fumigation has definitely aided growth.

Of 30 trees replanted last March in treated areas, 28 now are making good growth. Of 43 trees planted last March in untreated adjacent areas, only 13 are making good growth. All of these trees were replanted in spots where avocado trees previously had declined. These experiments constitute a small beginning—this is a report on 30 out of 230 treated trees and it is only six months after planting—but the results are encouraging and warrant further research.

Diseased Trees Studied

In the other phase of the work—that of various experiments on sick trees about 250 trees are involved in nine different groves.

Materials applied have been of two types:

1. Fungicides or materials that are hoped to be directly toxic to soil fungi such as the cinnamon fungus.

2. Materials which in themselves would not be harmful to the cinnamon fungus but which would stimulate growth of other harmless fungi and bacteria which in turn might counteract the cinnamon fungus. Such materials include manure, alfalfa meal, soil sulfur, cottonseed meal, and soybean meal.

In one greenhouse experiment and in a field experiment, this type of treatment has shown some promise and this investigation is being continued.

Fungicidal or toxic chemicals applied to the root zone of trees in the field include ethylene dibromide, dichloropropane-dichloropropene, copper sulfate and organic fungicides. Some work has been done on the effect of variable watering on root rot.

At a ranch in Carpinteria three rows of trees in various stages of disease receive variable watering. In this group the trees that are declining fastest are those receiving twice as much water as normal by watering twice as long as the normal interval at one time.

Other work on root rot includes investigation of barrier zones which might halt the spread of the cinnamon fungus.

Two barrier zones have been established on one ranch. On a hill above the upper margin of the disease area a zone has been injected with soil fumigants at four-month intervals. Trees have been examined for presence or absence of cinnamon fungus prior to and some months after treating.

Varieties

Another phase of the study is focused on the susceptibility of various avocado varieties to the cinnamon fungus and to another similar fungus which causes cankers—discolored, bleeding areas—on the trunks of the trees. This has been investigated both from the aspect of resistance of roots to waterlogging and to the cinnamon fungus.

The Guatemalan varieties tested—Kashlan, Nabal, Itzamna—are more susceptible to injury by cinnamon fungus and waterlogging than are the Mexican varieties—Mexicola, Ganter, Puebla, Harmon, and Topa-Topa.

Since the spread of cinnamon fungus by nursery stock has been substantiated, affected nursery trees should of course be avoided if possible. It is doubtful that this is the main method of spreading the fungus, however. Evidence indicates also that it already may be fairly widely distributed in soil.

Evidence Obtained

On the basis of the investigations, it seems fairly clear that both wet soil and the root-rotting fungus are involved in the avocado root rot disease. Any measures to remedy either situation should help to control the disease. To improve the wet soil conditions may mean drainage, preventing accumulations of winter rainfall, and careful irrigation with particular attention to spots that may stay wet.

No definite recommendations to reduce the concentration of cinnamon fungus can be made at present. There are many questions to be answered.

It seems clear that build-up of the cinnamon fungus in soil around diseased trees is the main reason why these areas cannot be replanted successfully.

Initial fumigation work indicates that it is possible to reduce the concentration of the cinnamon fungus—at least for a short time—to permit good growth of trees under greenhouse conditions, and in a few cases under field conditions.

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