California Avocado Society 1986 Yearbook 70: 107-110

Observations on a Biological Root Rot Control Trial in the Fallbrook Area

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Biological root rot control was undertaken in the Protzman grove in the Winterwarm area of Fallbrook in 1970, when the property was owned by Russell Collins. Presence of the root rot fungus in the southeastern part of the grove had been established by the late Bill Thorne some time previously, and was confirmed by root samples collected by the writer.

A detailed soil and topographic map of the property was made on an aerial photo base on a scale of 200 feet per inch (1:2400). Soils were identified as Cieneba, Fallbrook, and Vista sandy loams, according to the legend for the San Diego Area soil survey (1). A weak silica-cemented hardpan was encountered in the weathered granitic rock underlying the Fallbrook soils at a depth of about 3 1/2 feet, and a perched water table occurred over this pan after irrigation in the vicinity of the root rot affected trees.

Naturally-occurring root rot suppression had been observed by the writer in calcareous Mocho clay loam soils in Orange County, in an area where trees had been killed on adjacent non-calcareous soils. A similar situation was observed by Burns, et al (3) on the Rockdale fine sand in Dade County, Florida, where the fungus was found to be present in a large number of groves.

At about this time, growers had been successfully developing biological control methods on the non-calcareous red clay soils in southeastern Queensland and at the Alstonville Experiment Station in New South Wales. Mulching with leguminous cover crops, dolomite, and poultry manure was widely practiced for root rot control under conditions that appeared extremely favorable for the disease. These methods were remarkably similar to those adopted by the late Arthur Anthony of Fallbrook, a pioneer avocado grower, on soils similar to those in the Protzman grove.

Collins mulched the Fallbrook sandy loam soils in the root rot-affected area with four bales of alfalfa straw and 320 pounds of ground dolomite per tree in the summer of 1970. This was approximately equal to five tons of straw and 4.3 tons of dolomite per acre. No apparent benefits were observed in the mulched area until the following year, when the spring flush of growth occurred. At that time, the mulched trees were distinctly more vigorous than those in the remainder of the grove, the soil to a depth of about 3 inches was more granular in structure, and the feeder roots in this soil were more numerous than in the unmulched soils. These differences in soil structure and rooting could be recognized for at least five years afterward.

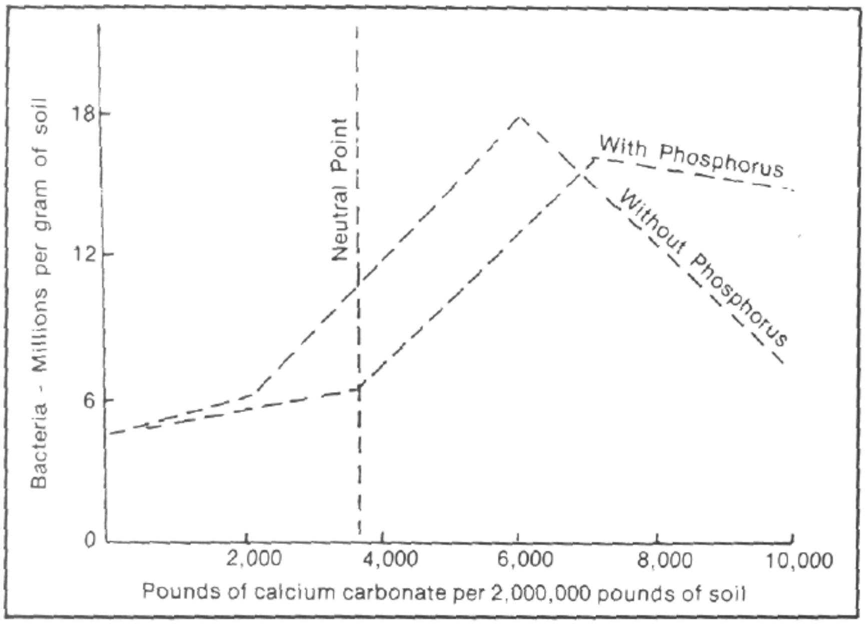
SAMPLES OF SURFACE SOIL taken from the Protzman grove about one year after mulching with alfalfa straw and dolomite (left) and unmulched soil (right).

No further spread of root rot appeared for several years. Root samples collected from affected trees in 1975 showed that the fungus was still present at that time.

Root rot in recent years, however, has spread throughout the Protzman grove, and killed most of the trees on the Fallbrook sandy loam soils. Only a few trees on the Vista sandy loam soils in the central part of the property are still in good condition. It would therefore appear that root rot was retarded for about ten years by mulching these soils in the affected area. This is consistent with the experience in the Anthony property, where root rot has since destroyed most of the trees on the Fallbrook sandy loam soils.

In the Protzman grove, drainage was impaired by the hardpan underlying the Fallbrook soils in the southeastern part of the property, and these undoubtedly were saturated for extended periods after heavy rains, especially during the winter of 1977-78, when more than 35 inches fell during the months of January, February, and March.

Broadbent, Baker, and their associates (2) concluded that root rot was suppressed in the red clay soils in Queensland by native soil bacteria, supported by the abundant soil organic matter accumulated under the tropical rain forest in which these soils developed. After this vegetation was removed, these soils gradually became non-suppressive as their organic matter content declined. They also found that these soils became non-suppressive with experimental sterilization with heat treatment of 100°C for 30 minutes, and by experimental waterlogging. Wager (4) similarly found that avocados became susceptible to the root rot fungus in California soils when these were saturated for two days or more, but remained unaffected in normally irrigated, well-drained soils.



Effect of lime on numbers of soil bacteria in an acid soil, with and without added phosphorus. From Selman A. Waksman, 1952, *Soil Microbiology*. John Wiley and Sons, New York.

Waksman (5) showed that numbers of soil bacteria could be increased more than threefold by liming acid soils up to 6,000 pounds of calcium carbonate per 2,000,000 pounds of soil, with or without added phosphorus. Such additions of calcium carbonate could be expected to increase the suppressiveness of non-calcareous California soils.

These observations indicate that biological root rot control is feasible with sustained additions of lime and organic matter, but is not likely to be successful in soils with impaired drainage.

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