California Avocado association 1940 Yearbook 25: 50-51

Avocado Tree Decline

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L. A. County Farm Bureau Monthly

The decline of avocado trees during the past three years has become a major problem of the avocado industry. There are, at present in the State of California, about 500 acres of avocados infected by decline, scattered throughout the avocado-growing districts of Los Angeles, Orange, and San Diego counties. Of this acreage about 100 to 150 acres occur in the La Habra Heights and the North Whittier Heights sections of Los Angeles County. This trouble first began to attract attention following the abnormal rainfall of the winter of 1936-37 and has become more and more prominent since that time with the ensuing winters of more than normal rainfall.

Since 1937 surveys by the Agricultural Extension Service in the study of this problem and its various phases have been made throughout the avocado districts. Results of these surveys in the separate counties finally culminated in an intense survey with the aid of the Citrus Experiment Station and the United States Department of Agriculture in which soil experts, irrigation experts, and plant pathologists took an intensive part. A meeting was held at Santa Ana recently at which all material collected in the surveys was correlated. Though by no means complete, the study indicates that excessive moisture is apparently the key factor in this problem. Avocado decline has become of industry-wide importance during the past three years, but the studies have indicated that there have been certain instances where a similar trouble has occurred in Los Angeles County in orchards located in low swales of the natural drainage areas.

Those areas which show the decline are usually on shallow soils underlain by soil structures highly impervious to water. The surface soils on these affected areas may be either heavy clays or looser soils of granitic origin such as those in the Vista areas. In some instances, holes twelve to eighteen inches deep have begun to collect water within fifteen minutes after digging, even though sufficient time had elapsed since the previous rain to have permitted all free water to penetrate to maximum depth in normal soils. Most of this decline occurs on hill lands. The water moves down the hill so slowly above the impervious layers that free water is found in the surface soils over unusually long periods of time. During these periods in which we have experienced more than normal rainfalls, an accumulation of excessive water in the root zones of these shallow soils, added to possibly by an injudicious use of irrigation water and the lack of good drainage, appears at this time to be the main factor in this trouble. The impervious substructures prohibit the drainage out of the root zone of these excessive amounts of surface waters. This analysis appears to be substantiated in these same orchards where, with the same shallow surface soils underlain by good drainage structures, the

trees are doing well. It is well known that the avocado tree, of all tree crops grown, is the most susceptible to unfavorable root conditions.

Studies are now in process in which the gases of the soil are being measured before and after rainfalls to determine the percentage of soil gas, especially of oxygen, in the soils where the decline is occurring. It is believed that the excessive amounts of water exclude the soil gases, and the roots become injured from the lack of oxygen. That avocado roots are oxygen-loving is well indicated by the feeder roots which are found running on the surface of the ground underneath heavy leaf mulches.

A new factor has been injected into the decline picture by plant pathologists. In each case where samples of roots from the decline trees have been studied in the laboratory, there has been isolated from them a fungus which apparently plays an important part in the decline. Dr. Wager of South Africa, working at the Citrus Experiment Station, was the pathologist who isolated the organism that has been given the imposing name of "Phytophthora cinnamomi." It appears that excessive moisture creates a root or soil condition which allows the fungus to develop in the tissue of the root, thus causing decline. This assumption seems to be verified in some experiments performed at the Citrus Experiment Station at Riverside.

Certain young avocado seedlings, grown in pots, had the soil around the roots infected with the fungus which had been isolated from declining trees. Others were left in normal soils. Some of both the inoculated and the fungus-free soils were emerged in water so that half an inch of free water stood on the surface of the pots. After a short period of time, the trees in the pots where the soil was infected with the fungus began to show typical decline conditions, but when the pots were removed and allowed to drain the trees regained their vigor and became normal again. When allowed to stand in water over longer periods of time, the trees in the inoculated soils, when removed and drained, failed to recover. Those trees in soils not infected with the fungus were able to stand saturated soil conditions for much longer periods of time than the trees in the infected soils.

Prom the present understanding of avocado decline, it appears that the best remedy is to prohibit accumulations of excessive soil moisture. The methods by which this may be accomplished have not been proven, but it has been suggested that the regulation of irrigation water so that just enough is applied to wet the surface soil down to the impervious layer and to prohibit the accumulation of excessive moisture above this tight substructure, should be an important step in controlling avocado decline.

Orchards should be allowed to go into the wet winter season on the dry side. Care should be taken in this instance, however, to prevent tree damage which might be caused by low soil moisture conditions and excessively hot weather during the fall, especially in those years when the first rains are late in arriving. Under certain conditions, tile drains or open ditches placed at the toe of the terraces and slightly intersecting the impervious substructures, may be helpful in intercepting the downhill flow of water above these tight under-layers. Heavy winter rainfalls should be removed from the terraces as rapidly as possible. It is well recognized that sloping lands on which many avocado orchards are located must have winter covercrops to prevent soil erosion. In those groves with shallow soils, it is imperative that growers go to great

extremes to prevent any loss at all of the little surface soil which they do have. Such crops, especially the deep rooted varieties, should be of benefit in removing the excessive moisture in the upper surfaces, but it must also be recognized that they will also slow down the flow of water draining from the surface, permitting easier penetration of rain.

Since no experimental work has been done on the control of avocado decline, no definite recommendations can here be given. It can be suggested, however, that all growers, whether or not they may have experienced avocado decline in the past, could look more carefully to their application of irrigation water. This can only be accomplished by an energetic use of the shovel or soil tool by each grower on his own place before, during, and after each irrigation, until he has become so familiar with his entire acreage that he knows just what the water requirement of each varying soil spot in his orchard may be.

Inasmuch as this trouble has only become prominent since our periods of abnormal winter rainfall and since there is generally a slightly improved condition during the summer months when the soil moisture has gotten down to normal, there is a possibility that during winters of normal rainfall this trouble may entirely disappear or may only be prevalent in those soils which are so shallow or in such heavy substructure as to be unsuitable for the growing of avocados under any circumstances,