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ESCONDIDO AREA AVOCADO ROOT ROT SOIL SURVEY

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In the Escondido area of San Diego County, over 250 acres of avocados have been damaged by the root rot fungus, Phytophthora cinnamomi. Avocados are grown in many different soils in this area, but a large percentage of the damage has been found on three or four soil series.

In general, the soils most commonly associated with avocado root rot damage are those that have slowly permeable subsoils. Similar surveys in other avocado districts such as Santa Barbara (1) and Fallbrook (2) show the close correlation of tree damage and excess soil water in certain soil series.

For many years it has been recognized in a number of avocado areas of the world that the occurrence and severity of avocado root rot are related to soil permeability. Tucker (3) in Puerto Rico in 1928 reported that the "avocado root disease" occurs frequently in heavy soils and in poorly-drained locations. In 1934, Home (4) noted that avocado trees in Cuba were dying from "decline" on soils judged to be of the Havana Clay and Pinar del Rio groups. These two soils had distinct subsoils and became waterlogged in times of excessive rain. No trouble was observed on the Matanzas clay type soils which were notable for free-drainage.

Wager (5) in California in 1942 reported that "dying-back" or "decline" of trees caused by Phytophthora cinnamomi can generally be expected under conditions of excess soil moisture due to impervious subsoil fairly near the surface. In 1952 Zentmyer and Richards (6) further indicated the connection between the accumulation of water in slowly-draining soils and the occurrence of avocado root rot.

In the fall of 1960, a cooperative field study was undertaken by personnel of the University of California, Agricultural Extension Service and the U. S. Department of Agriculture, Soil Conservation Service, to determine the relationship of avocado root rot distribution to the major soil series in the Escondido area. After a preliminary inspection of the district, two representative sample areas, each one-half mile wide and three and

one-half miles long, were selected for intensive study. These two strips totaled 2,320 acres and include the most important avocado-producing soils around Escondido.

Area A includes approximately 460 acres of avocado plantings southeast of Escondido. These plantings are mostly on soils of the Vista, Fallbrook and Las Posas series. There is also considerable acreage of lemons, oranges and grapefruit in this area. Many of the avocados are on land formerly planted to citrus. A portion of this area consists mostly of avocados which have been planted on land formerly in grain or pasture, which has recently been served with irrigation water. Some land on which avocados have been affected by root rot has been replanted to limes.

Area B includes approximately 300 acres of avocados between Escondido and San Marcos. These plantings are mostly on .soils of the Escondido series. There are relatively few citrus groves now in this area, although much of the avocado acreage is on land formerly planted to citrus.

The results from these two survey areas are shown on the graph and Table 1. These indicate that avocado plantings on Escondido very fine sandy loam have the highest incidence of root rot, with 45.6% of the acreage on the Escondido series damaged. The closely related Twin Oaks fine sandy loam soils also have a relatively high incidence, with 33.3% of the acreage planted on this series affected. The Las Posas series is also extensively affected, with 27.2% of the plantings on Las Posas loam, and 21.9% of those on Las Posas stony loam damaged by root rot.

While no root rot was found in the sample areas on Vista sandy loam soils, 30.1% of the plantings on Vista rocky sandy loam were recognized as root rot affected. This striking difference in the extent of tree injury on these two types within the Vista series possibly may be related to the less complete weathering of the underlying material or shallower depth of the rocky type. Cultural practices such as terracing, deep or continuous tillage and furrow irrigation also appear to aggravate the damage. (Figure 1.)

The Fallbrook series—the most extensively planted soils in the Escondido area—is affected by root rot on only 11.0% of the area planted on this series.

The Vista and Fallbrook series are typical Southern California soils, which are developed on deeply weathered granite rocks. The Vista .series has a granular sandy loam surface, with a very weakly-developed subsoil, and is underlain by decomposed granite at two to three feet. The Fallbrook soils are similar to those of the Vista series, but have more prominent, finer-textured, often reddish-colored subsoils. These soils as a rule are well-drained and .sufficiently permeable for satisfactory growth and development of avocado roots. These soils are, therefore, generally considered to be favorable soils for avocados in the Escondido area. The Ramona soils are very similar to those of the Fallbrook series, but are developed on old alluvial deposits rather than on weathered rock.

TABLE 1. ROOT ROT DISTRIBUTION AND AVOCADO ACREAGE IN SAMPLE AREAS

Soil Series and Type	Acreage Planted to Avocados				Acreage Damaged by Root Rot			
	Area A	Area B	Total	Percent of total Planted	Area A	Area B	To-tal	Percent of Planted
Arlington* Sandy Loam	19	0	19	2.5	2	0	2	10.5
Bonsall* Sandy Loam	9	0	9	1.2	2	0	2	22.2
Escondido Very Fine Sandy Loam	0	171	171	22.5	0	78	78	45.6
Fallbrook Sandy Loam	251	13	264	34.7	19	10	29	11.0
Las Posas Loam	23	21	44	5.8	7	5	12	27.2
Las Posas Stony Loam	13	19	32	4.2	4	3	7	21.9
Ramona Sandy Loam	16	0	16	2.1	0	0	0	0
Twin Oaks* Fine Sandy Loam	0	27	27	3.5	0	9	9	33.3
Vista Sandy Loam	63	0	63	8.3	0	0	0	0
Vista Rocky Sandy Loam	54	49	103	13.6	3	28	31	30.1
Miscellaneous, Rough Gullied Land	12	0	12	1.6	1	0	1	8.3
TOTAL	460	300	760	100	38	133	171	——

*Tentative soil series

The Arlington* soils are also developed on old granitic deposits, but are underlain at 4 to 8 feet by nearly impervious hardpan. Because of their unfavorable topographic position and limited internal drainage, these soils are not considered favorable for avocados.

The Bonsall* soils also resemble those of the Fallbrook series, but are underlain by nearly impervious day or sandy clay subsoils. Because of their poor internal drainage, these soils are also considered very unsatisfactory for avocados.

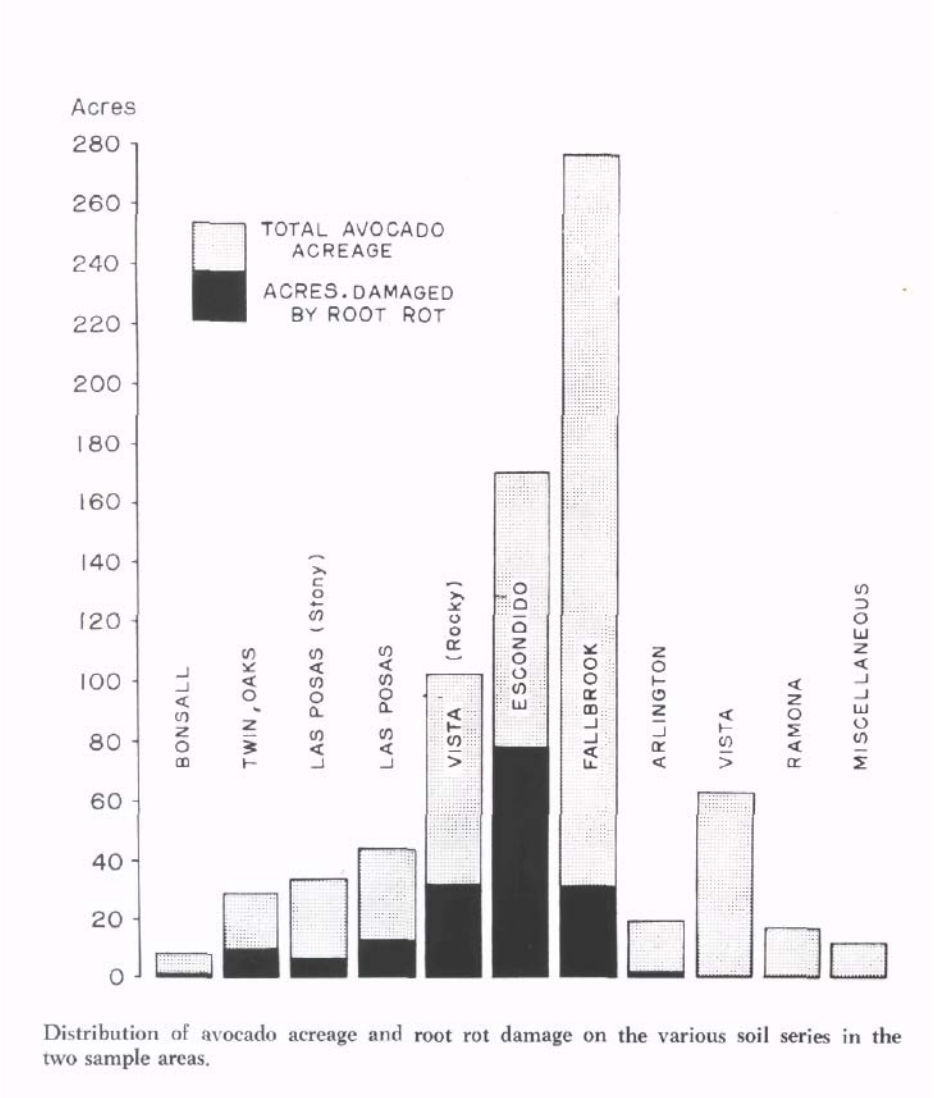
The Escondido soils are developed from hardened sandstone. They have a granular, very fine sandy loam surface soils, and relatively permeable subsoils, but are underlain by weathered rock at about 18 to 30 inches. Depth to this bedrock is often quite variable, and in many places this rock appears very dense and more or less impervious. These soils have, therefore, been regarded as doubtful for avocados, although extensive plantings have been made on soils of this series.

The Twin Oaks* soils closely resemble the Escondido soils, but are underlain by nearly impervious clay or clay loam subsoils over old alluvial deposits. They are considered very unsatisfactory for avocados.

The Las Posas soils closely resemble the soils of the Fallbrook series, but contain somewhat more clay, are more reddish in color, and are underlain by darker and finer-grained bedrock. Because of their slowly permeable subsoils, these soils are also regarded as doubtful for avocado plantings.

* Tentative soil series

Figure 1. Root rot damaged trees on left are planted on bench-terraced Vista rocky sandy loam. Furrow irrigation and constant tillage have spread the fungus throughout the grove. Healthy trees on right are on the same series, but are non-tilled and sprinkler irrigated.



Distribution of avocado acreage and root rot damage on the various soil series in the two sample areas.

In summary, to classify the major avocado soils in the Escondido area as to susceptibility to root rot damage, 1) Vista sandy loam and Fallbrook sandy loam are the least susceptible, 2) both the Las Posas loam and stony loam must be considered moderately susceptible, and 3) trees growing in soils such as the Escondido, Twin Oaks and Vista rocky sandy loam series show the most damage if the fungus is introduced under conditions of excess soil moisture.

This survey, together with studies in other avocado producing areas, should have practical value for future plantings and be helpful to growers that already have a diseased area. Knowing the soil around the infested area is important in determining the extent of the problem. Your local Farm Advisor and Soil Conservationist are available to help determine the best soils for avocado culture.

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