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VENTURA COUNTY AVOCADO SOIL AND ROOT ROT SURVEY

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In Ventura County there are approximately 2,900 acres of avocados. All the acreage is in the southern half of the county with the majority in the Santa Clara Valley—Oxnard Plain and the Las Posas Valley—Camarillo areas. Most of the avocados are growing in 17 different soil series, but over 25 soil series are involved. Fortunately, avocado root rot has damaged only 20 acres in 21 different locations.

Avocado root rot, caused by the fungus Phytophthora cinnamomi, is the most important avocado disease. In California there are approximately 26,000 acres of avocados—approximately 4,000 acres have been damaged by root rot.

For many years it has been known that the occurrence and severity of tree damage are related to soil drainage. Even before Wager (1) in 1942 found that P. cinnamomi was the cause of "dying-back" or "decline" of avocado trees in California, Tucker (2) in Puerto Rico in 1928 and Home (3) in 1934 reported avocado trees dying in poorly drained soils.

In 1955, Goodall (4), in a preliminary avocado root rot survey in Santa Barbara County, showed a close correlation between certain soil series and their susceptibility to fungus development—this was further substantiated by a comprehensive survey completed in 1962 (5).

Subsequent surveys in other avocado districts, including Fallbrook (6) and Escondido (7) have also shown that when the fungus is present avocado trees growing in soils with poor internal drainage are most susceptible to root rot damage.

This cooperative survey between the University of California and the Soil Conservation Service is part of a statewide program to evaluate and classify avocado soils for their root rot potential.

The studies in Ventura County were implemented in that much of Santa Rosa, Las Posas and Simi Valleys and the Oxnard Plain—Camarillo area are in Soil Conservation Districts and had been previously surveyed. Avocado groves outside the Districts, such

as those in Santa Clara Valley, Ojai and Rincon areas had to be individually surveyed.

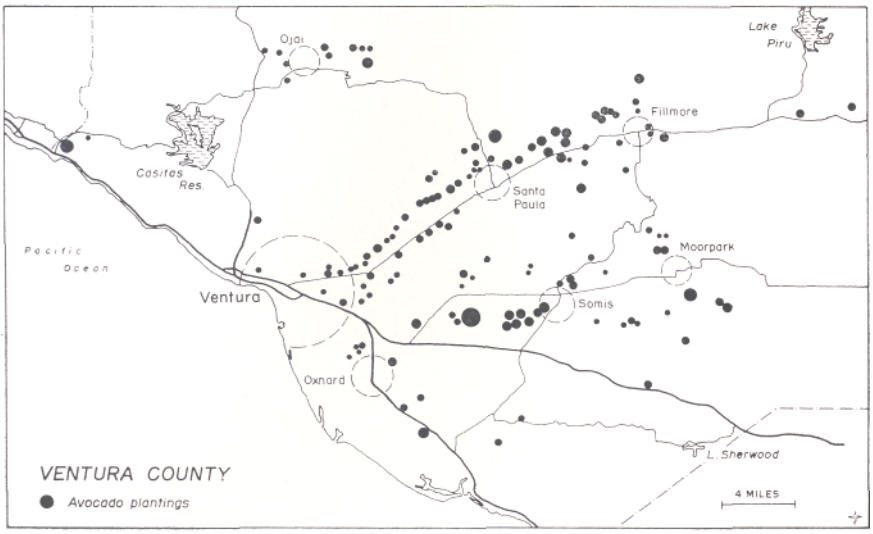

Figure 1. Map of western Ventura County showing the main avocado plantings.

As can be seen from Figure 1, there are avocado plantings scattered throughout the lower half of Ventura County, but most of the acreage is in the Santa Clara Valley, from Fillmore to the Ventura city limits and in the Santa Rosa Valley, from Moorpark to Oxnard.

There are eight avocado districts listed by the Ventura County Agricultural Commissioner (Table 1), but Camarillo, Ventura and Santa Paula are the largest districts.

Table 1 Avocado Acreage by District in Ventura County*

DISTRICT	TOTAL ACREAGE
Bardsdale	32.4
Camarillo	802.9
Fillmore	180.2
Moorpark	215.8
Ojai	96.0
Oxnard	219.3
Santa Paula	881.5
Ventura	455.5
Total	2888.4 acres

** Information supplied by Ventura County Agricultural Commissioner for 1962.*

SOIL TYPES

A soil type includes soils developed from the same parent material and having similar profile characteristics or texture—such as a poorly drained, grayish-brown, calcareous, sandy loam. Add to this the soil series name— usually for a geographical area—such as the city of *Camarillo*—and the soil type would then be Camarillo** sandy loam.

In the survey, avocados were found in 67 different soil types—starting with Metz** loamy sand over loams with 107 acres of avocados; including Yolo loam, 102.9 acres; Conejo clay, 51.2 acres; all the way to Riverwash with 6.8 acres and 4.5 acres of

Terrace breaks. The largest acreage on any one soil type was San Benito** clay loam with 251.5 acres, but there were ten soil types with less than one acre involved. The aerial photo in Figure 2 shows how this great variation in acreage is possible.

Figure 2. Aerial photo showing avocado groves outlined in solid white lines. Broken white lines outline various soils. The numbers and letters are abbreviations for soil series. The white circle is area damaged by P. Cinn. The soil here is a Rincon silty clay loam with restricted internal drainage.

For simplicity the many soil types have been combined in Table 2 into 25 soil series—in Table 3 the various textures have been combined. In both tables the number of acres damaged by root rot is included.

From Table 2 it can be seen that much of the avocado acreage in Ventura County is planted on alluvial soils such as Yolo, Sorrento and Mocho. These occur on gently sloping, recent alluvial fans and narrow flood plains.

Table 2 Avocado Acreage and Root Rot Incidence of the Principal Soil Series in Ventura County.

SOIL SERIES	TOTAL ACRES	DISEASED ACRES	PER CENT DISEASED
Metz**	59.45		
Yolo	360.6	1.0	.28
Sorrento	486.1	0.5	.10
Mocho	377.55	0.75	.10
Conejo	51.2	1.5	2.92
Vina	22.0		
Botella	20.0	3.25	16.25
Hueneme**	30.6		
Camarillo**	131.8	3.0	2.27
Zanja**	74.3		
Zamora	80.6		
Pleasanton	198.4		
Ojai	74.3	1.0	1.35
Rincon	118.8	4.5	3.78
Montezuma	58.0	2.5	4.31
Huerhuero	147.1		
San Benito**	303.4	0.05	.016
San Timoteo**	40.1		
Nacimiento	22.5	0.2	.88
Zaca	20.0		
Sweeney	21.2	1.5	7.08
Soper	154.8		
Sobrante	15.6	0.5	3.20
Salinas	6.5	0.5	7.70
Miscellaneous	50.5		
	2925.4*	20.75	

* *Greater acreage in survey than the Crop Report because avocados interplanted in citrus groves were tabulated on acre rather than tree basis.*

This is very fortunate from a root rot standpoint, since all three soils are deep, with good internal drainage, so avocado trees are seldom damaged on these soils. The predominant series, Sorrento, has a dark grayish-brown surface and a texture varying from silt loam to gravelly loam.

The main difference between the Yolo, Sorrento and Mocho series is the amount of lime in the subsoil. Yolo has a neutral reaction, Sorrento is moderately basic with lime in the subsoil while Mocho is calcareous throughout.

***Tentative soil series.*

Relatively large acreages are also found on the San Benito**, Pleasanton, Soper, Huerhuero, Camarillo** and Rincon series. Generally these soils have fair to poor internal drainage, so it is fortunate that relatively few root rot infections have occurred.

The San Benito series is characterized by dark grayish-brown surface and a texture of clay loam to clay. The subsoils are of similar color and texture, but are calcareous. They are developed on soft to moderately hard sandstone and shale.

Figure 3. Avocado planting on hillside is on Pleasanton stony loam. In foreground are holes for new avocado planting. Soils here are Yolo stony fine sandy loam—area previously in lemons.

Pleasanton soils include a rather wide range in color and soil characteristics. They are developed on old alluvium on terraces (Figure 3) and valley plains. Texture ranges from loam to stony sandy loam. Color is grayish-brown or brown in the surface horizon to light-brown or yellowish-brown below three to five feet. The subsoil is somewhat more compact and is clay loam to stony clay loam in texture. The soil reaction is neutral to slightly acid.

The first avocado root rot infestation in Ventura County was found in 1948 near the present Ventura College. The soil in this grove was Mocho fine sandy loam with very good internal drainage. Through the years a few trees died, but root rot was never a real problem. In early 1963 the trees were bulldozed out for apartments.

Since 1948 many hundreds of culture tests for P. cinnamomi have been made in avocado groves throughout the county. Root rot was isolated in only 21 locations and only approximately 20 acres has been damaged. Comparing Ventura County—second in avocado acreage in the state—with other counties such as San Diego, Santa Barbara and Los Angeles, this is a very low per cent damage. Santa Barbara County, as an example, has had approximately 16 percent of the total avocado acreage damaged by root rot.

Root rot can be spread in many ways, but diseased nursery stock has undoubtedly been mainly responsible for the wide distribution of the fungus throughout the other avocado-producing areas of southern California.

Of the soils where most of the root rot damage occurred (Table 2) the Botella, Montezuma, Ojai and Rincon soils are developed in older alluvium and have moderate to distinct profile development. The Camarillo and Conejo soils are developed on recent alluvial materials, but have poor internal drainage (high water table) and clay textures, respectively. The Sweeney soils are primary clay soils developed in place on hard volcanic rocks.

Table 3 Avocado Acreage and Root Rot Incidence by Texture in Ventura County.

TEXTURE	TOTAL ACRES	DISEASED ACRES	PER CENT DISEASED
Loamy sand	51.5		
Coarse sandy loam	14.75		
Sandy loam	232.7	0.2	.09
Fine sandy loam	458.95	1.0	.22
Very fine sandy loam	74.3	1.0	1.35
Loam	1394.8	4.05	.29
Silt loam	13.0		
Clay loam	325.2	2.05	.63
Silty clay loam	199.3	5.2	2.60
Clay	149.6	7.25	4.83
Undifferentiated	11.3		
	2925.4	20.75	

(Stones and gravels have been included with main texture groups)

Table 3 shows the soil textures having the largest percentage of damaged trees. The soils having coarser surface textures (sandy loam to loam) typically have finer textured subsoils ranging from clay loams through silty clay loams to clays, or high water tables, all of which tend to restrict the internal drainage of these soils.

ROOT ROT POTENTIAL RELATED TO SOIL SERIES

The following is based on the main avocado soil series found in Ventura County (Table 2).

SLIGHT HAZARD	MODERATE HAZARD		SEVERE HAZARD
Metz	Camarillo**	Salinas	Botella
Mocho	Conejo	San Benito**	Montezuma
Sorrento	Hueneme**	San Timoteo**	Rincon
Vina	Huerhuero	Sobrante	Sweeney
Yolo	Nacimiento	Soper	Zaca
	Ojai	Zamora	
	Pleasanton	Zanja**	

Figure 4. A root rot damaged avocado grove near Santa Paula. Four trees have been killed—note stump in foreground. Two more trees in background are dying. The soil here is a Yolo rock loam which normally has good internal drainage, but this corner was waterlogged by continuous pump overflow.

Figure 4 shows that even if avocado trees are planted in the best of well-drained soils, trees can be damaged if the fungus is present in waterlogged soils. Since this root rot area has been allowed to dry, the spread of the damage has been slowed appreciably. Under normal conditions— with this well-drained alluvial soil—excessive tree damage would not be expected. This survey has value, not only in choosing sites for future plantings, but also is helpful where root rot has already become established. Persons planning new groves should contact their local Farm Advisor and Soil Conservation Service office to help determine which soils are best suited for avocado culture and the least favorable for root rot development. For those who already have an infestation in their groves, a knowledge of the soils that are involved and the extent or boundaries of the various soil series will help in deciding the measures to be taken to either control or retard the spread of the fungus.

In summary, a large percentage of the approximately 2,900 acres of avocados in Ventura County have been planted on medium to coarse-textured soils with very good internal drainage. However, many avocados are growing well on relatively poorly-drained soils. One of the main reasons for only approximately 20 acres of root-rot damaged trees is that the fungus has not been spread very widely in the county.

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