Stem Pitting on Citrus Trees

disorder resulting from quick decline observed in California citrus orchards for the first time in 1952

W. P. Bitters

Stem pitting—a symptom of quick decline—was first observed in California citrus orchards in 1952.

The appearance of the disorder in the State was anticipated. Stem pitting and tristeza in South Africa and Brazil were shown to be interrelated—probably symptom expressions of the same virus complex. And it is generally accepted that quick decline in California and tristeza in South Africa and Brazil are caused by the same or a closely related virus.

The inroads of quick decline in California have been much slower than the progress of tristeza in Africa and South America. This may be due to the differences in virulence of the virus strain concerned, the inefficiency of the insect vector, the genetic composition of the commercial tree varieties grown, and differences in environmental conditions. Regardless of the rate of progress of the disease in California, the course of the diseases is closely paralleling the course it took in Brazil. This is particularly true of the rootstock trials. While in California only sweet orange tops on sour orange roots showed quick decline symptoms in old orchard trees, experimental trials indicated that many other combinations are susceptible.

Rootstock plantings for quick decline studies were made in 1945, 1946, 1948, 1950, 1951, and 1952. As of 1952, stem pitting had shown up only in one combination—in the 1945 planting. These particular trees were not artifically inoculated, but exposed to natural infection. The affected combination is Morton citrange stock budded to sweet orange tops. This same combination is showing some effect of the inoculation—but no stem pitting—in the 1948 plantings. Time may have been too short for stem-pitting development.

Trees in the 1945 planting show stem pitting only on the citrange stock. The pitting does not extend into the Valencia trunk. The pits have apparently coalesced to form grooves and ridges. The severe pitting extended only to the crown roots. Some pits were found on the crown roots, but not beyond that immediate area. Perhaps pitting will become more extensive on the roots as the trees become older.

Stem pitting is an anatomical abnormality which may occur on the twigs, branches or trunk of citrus seedlings and the stock of budded trees when the plants are infected with the quick decline virus. But stem pitting also may be caused by other factors.

The disorder prevents the cambium from functioning normally, at least in localized areas. Portions of the wood fail to develop normally, and numerous small pits or depressions form in the wood. In contrast, small masses of tissue develop in place of some of the normal bark elements so that corresponding to the sunken undeveloped areas in the wood are small elevated peglike growths on the inner surface of the bark. In advanced stages the pits tend to interjoint and the resultant grooves follow a twisted course parallel to the grain of the wood. The grooving may be more severe in some

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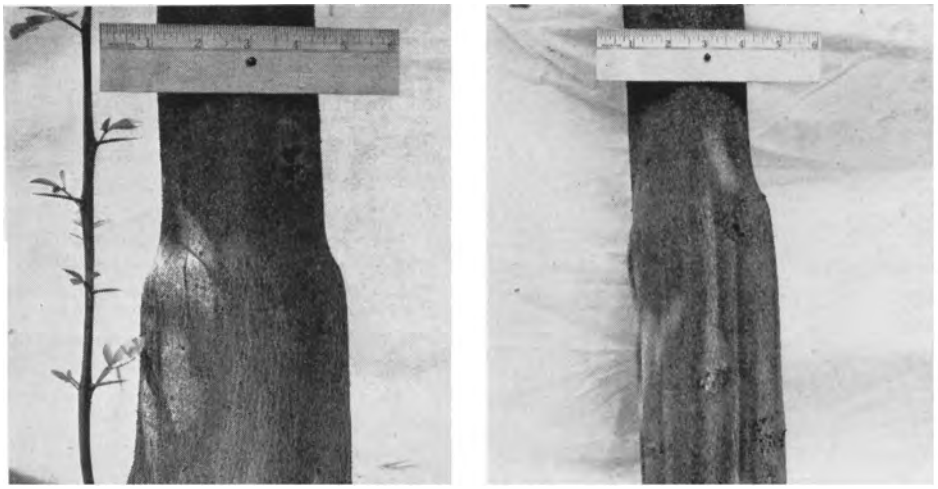
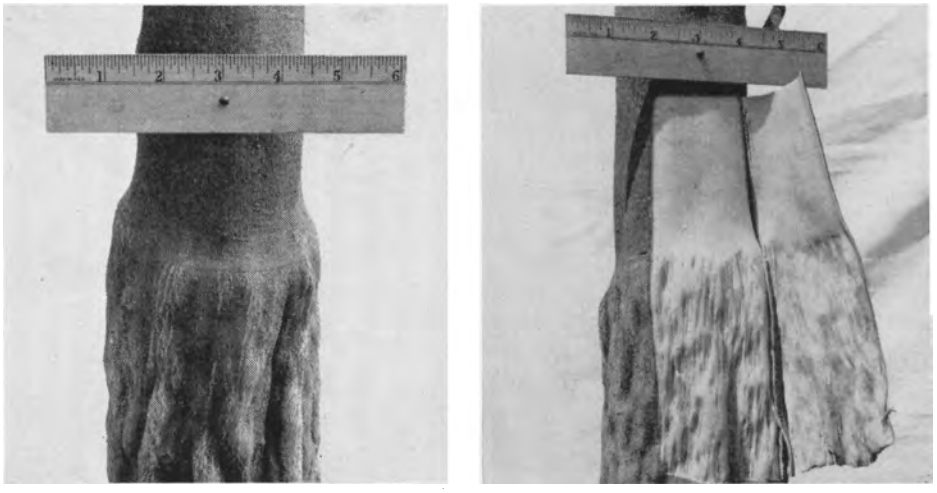


***Left.* Healthy Morton citrange stock showing the typical smooth, symetrical nature of the trunk. *Right.* Healthy Troyer citrange stock, showing typical light fluting, but no stem-pitting.**



***Left.* Morton citrange stock affected by stem pitting showing the resultant grooves and asymetrical nature of the trunk. *Right.* Morton citrange stock affected by stem pitting, which did not extend across the bud union. Note the pits and grooves in the wood and the corresponding peglike growth on the inner surface of the rolled back bark.**

DAIRY

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Of the families who had all their homogenized milk delivered almost one fourth in Oakland and about one sixth in Los Angeles used four quarts or less in the week studied. From 10% to 11% of the families used from over four to six quarts while from 19% to 22% used from over six to eight quarts. About 19% used from over eight to 12 quarts. About 18% used from over 12 quarts to 16 quarts and from 11% to 12% used over 16 quarts during the week.

From one half to more than three fourths of the half and half used was consumed by families who bought it at retail stores only and from 22% to 40% was used by families who had it all delivered. Only a small amount was used by families who bought from both sources. About three fourths of the cottage cheese and from 78% to 84% of the butter was used by families buying only at retail grocery stores and about 20% of the cottage cheese and from 13% to 18% of the butter was used by those families having it delivered.

As size of income increased the proportions of families who had all their homogenized milk delivered tended to increase and the proportion who had none delivered tended to decrease. This tendency was more pronounced in Oakland than in Los Angeles.

Over 75% of the families studied in Oakland and 58% of those in Los Angeles with incomes under $2,000 bought all their homogenized milk at retail grocery stores. Of those with incomes from $3,000 to $4,000—57% in Oakland and 49% in Los Angeles—bought their milk at this source. Of those with incomes of $6,000 or more, 49% of the Oakland families and 38% of the Los Angeles families bought all their homogenized milk at grocery stores.

Only 16% of the Oakland families and 38% of those in Los Angeles with incomes under $2,000 had all their homogenized milk delivered. Of those with incomes from $3,000 to $4,000, 28% in Oakland and 32% in Los Angeles had it all delivered. Of those with $6,000 or more, 40% in Oakland and 42% in Los Angeles bought their homogenized milk in this manner.

The proportions of families with two or three adults and no children under 16 years of age who bought all their homogenized milk at grocery stores were larger in both Oakland and Los Angeles than the proportions of the families with two adults and with one or more children under 16 years who bought all their homogenized milk at grocery stores.

Of the families with two adults only, from 63% to 73% bought all their homogenized milk at retail grocery stores. Of those with three adults only, from 48% to 60% obtained all this milk at this source. On the other hand only from 26% to 46% of the families with two adults and with from one to three children bought their homogenized milk at the grocery stores.

Conversely the proportions of the families with adults only who had all their milk delivered were smaller than the proportions of families with two adults and one or more children who had all their milk delivered. These practices were undoubtedly related to the quantities used by the families since the families with children on the average used larger quantities of homogenized milk than those with no children under 16 years.

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Average Quantities of Six Major Deliverable Dairy Products Secured per Household Purchasing at Different Sources.

Source	Homogenized milk		Plain whole milk		Vitamin milk		Half and half		Cottage cheese		Butter	
	Oak.	L.A.	Oak.	L.A.	Oak.	L.A.	Oak.	L.A.	Oak.	L.A.	Oak.	L.A.
Number of house-holds purchasing	318	331[1]	96	49	10	128	119	195[1]	252	347[2]	220	269[2]
	Qts.	Qts.	Qts.	Qts.	Qts.	Qts.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
All cources	9.57	10.19	8.15	8.78	8.20	10.56	2.03	2.29	1.19	1.37	1.03	1.04
All delivered	9.72	9.86	7.55	8.62	9.17	9.47	1.87	2.72	1.26	1.37	1.18	1.20
Some delivered and	12.39	13.95	10.09	10.82	...	14.20	...	3.70	2.32	2.56	...	...
1. Some at retail grocery store	12.59	14.68	10.09	5.42	...	13.04	...	4.88	2.32	2.56	...	...
2. Some at other sources	8.50	11.80	....	13.52	...	16.76	...	2.81	...	...	...	...
None delivered	8.90	9.26	8.67	7.95	6.75	10.77	2.09	1.98	1.14	1.35	1.01	1.01
1. All at retail grocery store	8.89	8.88	8.82	3.54	6.67	8.91	2.09	1.96	1.13	1.36	1.00	0.99
2. All or part at other sources	10.50	13.09	4.00	15.31	7.00	18.01	2.14	2.16	1.67	1.14	1.17	1.75

[1] 1 additional household bought this product from unreported sources.
[2] 2 additional households bought this product from unreported sources.

STEM PITTING

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areas than in others and may result in an asymmetrical shape of the stock.

Of 19 trees of Valencia on Morton citrange examined in the spring of 1952 in one orchard in the Azusa area, 16 showed stem pitting symptoms on the stock. The condition of these trees was not obvious prior to 1952 although the trees were frequently observed and trunk diameters measured annually.

The degree of stem pitting has advanced since it was first observed. The health and vigor of the top is expected to decrease as affected trees become older.

Examination of some young navel orange trees on Morton citrange stock in a nearby orchard also revealed the presence of stem pitting on a large percentage of the stocks. Seven-year-old trees of navels and Valencias on Morton citrange roots planted in 1945 at Riverside do not show any pitting symptoms. Twenty-four-year-old navel orange trees on Morton citrange at Riverside also appear healthy. Quick decline did not appear in Riverside County until 1949, and in 1952 is still confined to a few widely scattered trees. It is likely that the disorder is caused by the quick decline virus rather than by any incompatability or physiological factor. In the Azusa area, adjacent seven-year-old trees of Valencia oranges on Troyer citrange stock do not appear to be affected. Troyer citrange stock is typically more fluted than that of Morton.

These findings show that the grower is faced not only with typical quick-decline symptoms in his orchard but also with the stem pitting aspect. Not the scion alone nor the stock alone, but their combination determines the susceptibility of the host plant to the disease. Thus Valencia orange on Rough lemon root is tolerant to the virus but grapefruit on Rough lemon in South Africa and Brazil is severely affected by stem pitting.

The combinations on which stem pitting may occur in California are not yet known. Many combinations are now under trial to determine their susceptibility to quick decline. They are being observed closely for the effect of the presence of the virus and for the appearance of stem pitting. The grower should exercise extreme care in planting only known quick-decline tolerant combinations in order to avoid tree distress in later years.

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