Sweet Root Orange Trees

symptomless hosts of the quick decline virus

H. S. Fawcett and J. M. Wallace

Infected sweet root orange trees can serve as carriers of the virus of quick decline even though they remain symptomless.

The results of studies present experimental evidence that orange trees on sweet orange roots can become infected with the virus of quick decline under field conditions and that the virus maintains itself in such trees.

Early in studies of quick decline it became clearly evident that sweet orange rootstock did not develop symptoms of quick decline. The question naturally arose as to whether or not trees of sweet orange on sweet root could harbor the virus even though they showed no symptoms of disease, and thus serve as reservoirs of the virus from which it could be spread to other trees.

Transmission Tests

Many tests are now in progress to determine experimentally if sweet orange seedlings and/or budded sweet orange on sweet root trees are actually capable of becoming infected and of maintaining the virus.

These tests involve transmissions into healthy trees of Valencia on sour root by means of buds taken from sweet seedlings and from budded sweet orange on sweet root that were inoculated previously from quick decline trees.

Earlier tests of this nature consisted of transmissions from healthy-appearing orchard trees of sweet orange on sweet root that were adjacent to, or in close proximity with plantings of sour root trees showing a high percentage of quick decline.

In July, 1946, buds were taken from two orchard trees of Valencia on sweet root and from one navel on sweet root, and placed in young Valencia on sour test trees growing in a relatively isolated experimental planting in the vicinity of Baldwin Park.

The three sweet root trees were symptomless, and were growing in close proximity to Valencia sour root trees severely affected with quick decline.

Buds from the sweet root trees were placed as inoculum into both the sweet top of some of the test trees and into the sour rootstock of others.

Inoculations into the rootstock were made in many experiments to determine if orange trees could be infected through the sour portion. The buds were used as inoculum and not for propagating a new top.

Controls, or checks, consisted of test trees in which no buds were placed and trees in which disease-free buds were placed in the sweet top of one group and in the sour rootstock of the second group.

Results

The results of these tests are summarized in the accompanying table.

A total of 127 check trees showed no quick decline in January, 1948. This is strong evidence that no tree in this experimental planting has developed quick decline symptoms as a result of natural infection.

On the other hand, nearly one half of the test trees, that had buds from the two Valencia and one navel tree placed in the sweet tops, are showing symptoms within 17 months after inoculation.

Results of Transmission Tests from Valencia and Naval Orange Trees on Sweet Orange Rootstocks

(Inoculations made July, 1946)

Source of inoculum	No. of test trees	Place of insertion of inoculum (buds) in test trees	Test trees showing symptoms Jan. 1948	
			Number	Per cent
Valencia No. 1*	24	Valencia top	9	37.5
Valencia No. 1	20	Sour orange stock	3	15.0
Valencia No. 2*	24	Valencia top	14	58.3
Valencia No. 2	21	Sour orange top	4	19.0
Navel No. 1*	19	Valencia top	9	47.4
Healthy Valencia† (Riverside)	24	Valencia top	0	0.0
Healthy Valencia (Riverside)	24	Sour orange stock	0	0.0
———‡	79	Not inoculated	0	0.0

* Healthy-appearing orchard trees growing near diseased trees in quick decline area.
† Disease-free outside quick decline area.
‡ Additional check trees in which no buds are placed.

Inoculations into the sour rootstock have so far resulted in less infection, or at least in slower symptom expression.

This may possibly be due to a delay in movement of the virus into the top when the inoculation is placed low in the trunk of the tree.

Some of the test trees began to show top symptoms within 11 months after inoculation. Premature flowering and fruiting, which seem to be the first obvious symptoms of quick decline, were observed on numerous trees within nine months after inoculation.

Some of these same trees, when first examined seven months after inoculation showed some degeneration of the bud-union tissues. At the same time, in the controls, the bud-union tissue was normal.

Many investigations are now in progress to determine if other combinations of citrus will develop symptoms of the disease when infected.

H. S. Fawcett is Professor Emeritus of Plant Pathology and Plant Pathologist in the Experiment Station, Riverside.

J. M. Wallace is Associate Plant Pathologist in the Experiment Station, Riverside.

RED MITE

Continued from page 12

According to unpublished data gathered by the Experiment Station, 50 times the concentration of this compound is required to kill the two-spotted spider mite, *Tetranychus bimaculatus,* as is necessary for the citrus red mite.

Experimental work is in progress to determine its effectiveness on the various plant-feeding mites.

Formulations of K-1875 which have been used in field tests have not given satisfactory control of the citrus bud mite *Acaria sheldoni* and the citrus rust mite *Phyllocoptruta oleivora.*

It appears to be relatively nontoxic to most beneficial predators and parasites and there has been no evidence of an increase of insects or other mites when this material has been applied to citrus trees.

The several favorable properties of K-1875 and the results obtained in experimental tests so far, suggest that this compound may be effective in aiding the citrus grower to control one of the major pests affecting citrus—the citrus red mite.

L. R. Jeppson is Assistant Entomologist in the Experiment Station, Riverside.

POTASH

Continued from page 3

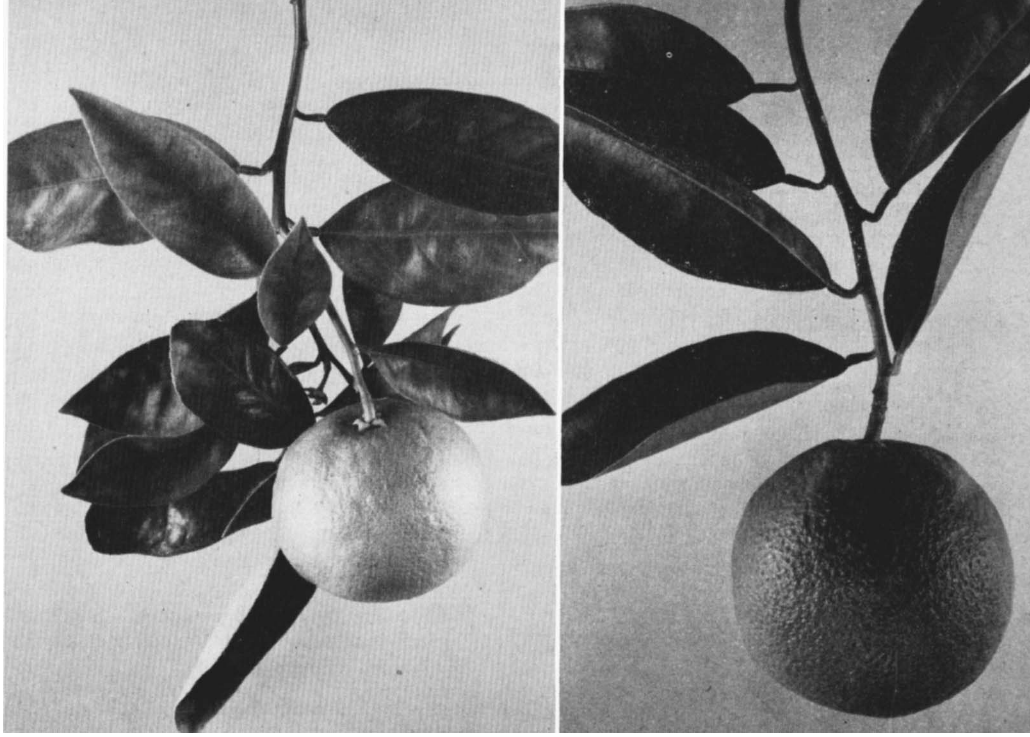
slightly deficient in potash showed from 0.26% to 0.35% potassium on a dry weight basis.

Leaves from trees markedly deficient in potassium and showing the type of puckering and malformations described previously had a potassium content ranging from 0.14% to 0.24%.

Leaves from trees showing injury from excessive potash showed potassium ranging from 2.15% to 3.63%. It would thus appear that values in between these extremes, that is from about 0.35% to 2% can be regarded as representing ample but not excessive supplies of this element.

Many hundreds of leaf samples have been analyzed from commercial orchards following this work and the great majority show potassium values ranging from 0.4% to 1.5%.

In no case have we obtained values greater than 2%, and in only a few instances have we found orchards where the level was below 0.4%.



Twig and fruit (left) from tree moderately deficient in potash contrasted with fruit (same age) from tree receiving ample potash. Note difference in both size, rind texture, and in characteristics of foliage.

Variable Supply

Each year the fruit from each tree was counted, weighed, graded as to rind texture and other external characteristics. Measurements were made on diameter, thickness of rind and percentage of juice characteristics.

Fruit from trees lacking in potash was small in size but otherwise of good quality.

The rinds tended to be smoother in general than fruit from trees receiving ample potash and the fruit from the trees injured from excessive potash had very coarse rinds.

The juice from the low-potash fruit was slightly lower in acid than the fruit from the amply supplied trees but was of good total solid content and acceptable flavor. The chief effect of lack of potash on fruit therefore was in the matter of size.

The decrease in average size of fruit was found to hold not only for the fruit from trees acutely deficient in potassium, but also for the fruit from the trees which were so slightly deficient in this element that no visible symptom of potash lack could be seen.

The results of leaf analysis and soil survey in these tests give no evidence of a potash lack in most California citrus soils. This suggests some other reason or reasons for small fruit sizes.

Some of the orchards sampled, where small sizes are an acute problem, have a much higher potash level in both leaves and soil than in other orchards where sizes are good.

In a number of orchards manures have been consistently used over a period of years. This practice has substantially increased the potash content of both the soil and citrus trees without apparently affecting fruit sizes.

It thus appears improbable that increasing the potash of a soil already sufficiently supplied will improve fruit sizes.

H. D. Chapman is Chairman of the Division of Soils and Plant Nutrition, Professor of Agricultural Chemistry, and Chemist in the Experiment Station, Riverside.

S. M. Brown is Associate Chemist in the Experiment Station, Riverside.

D. S. Rayner is Senior Laboratory Technician, Experiment Station, Riverside.

BLACK-END

Continued from page 10

fruits and from those that did not. These young trees are now growing in an experimental block at the University Farm at Davis. They have produced crops whose black-end performance is closely correlated with that of the original trees.

The disease has never been observed on Beurré Hardy even when this variety was on the same clonal stock as the Bartlett which had severe black-end.

Rootstock

All the foregoing point to the fact that the black-end condition is closely related to the rootstock of the individual tree.

A number of investigations have been conducted in the laboratory.

The distribution of lenticels from the stem to the calyx end has been studied. Certain morphological and histological features have been investigated. The pH and acidity of various sections of fruit with and without black-end have been determined as well as the seasonal pH changes of fruits on French and Japanese stocks. In the latter case the samples were divided into those from trees that did not produce black-end and those that did.

The buffer capacities of juice from black-end and normal fruit have been compared. The sugar content of mature pears from Japanese stocks with and without black-end and from French rooted trees has been determined. Certain ash constituents of leaves and fruit have been studied.

A block of selected Japanese clones on their own roots, whose black-end history is known, is now being grown at Davis for further basic study of this disorder.

It may be stated that this disorder, so far as the California pear industry is concerned, is now largely only of academic interest.

Pear Acreage Down

The severe losses suffered from fireblight in 1930, the prevalence of hardend, and economic conditions during the early thirties resulted in the removal of most pear orchards propagated on oriental rootstocks.

As of 1946 there were 37% fewer bearing pear trees in California than in 1933, leaving a comparatively small acreage where hard-end is a problem.

L. D. Davis is Professor of Pomology and Pomologist in the Experiment Station, Davis.