Declining Yields in Oranges

appraisal of 220 mature orange orchards in five counties indicates possible causes of downward trend in production

Paul W. Moore and Edward Nauer

Average production of southern California oranges dropped from 370 to 265 field boxes per acre—for navels—and from 290 to 265 field boxes per acre—for Valencias—over a 12-year period. Many individual orchards in Los Angeles, San Bernardino, and Orange counties—the three areas most seriously affected—showed a production decline of as much as 100 to 250 field boxes per acre—for navels—and in the other counties and psorosis had not progressed as far. Orange County had 10.6% nonproducing trees and San Bernardino had 8.4%. In Tulare County, 6.0% of the trees had reached the nonproductive stage.

The principal cause of tree loss was found to be psorosis—scaly bark. About eight trees were killed by psorosis for every three trees killed by root rot and gophers. In Orange County, 10.0% of the trees showed bark symptoms of psorosis; in Los Angeles County, 8.1%; in Ventura County, 7.9% in San Bernardino County, 6.0%; and in Tulare County, 8.9%.

Of less importance were brown rot gummosis and root rot—Armillaria soils are generally heavier, more retentive of moisture, and more poorly drained than the soils of southern California, also suffered high loss—4.37%; known losses in gummosis alone amounted to 2%.

An accumulation of nonproductive diseased trees and nonbearing replacements explains part of the declining trend in production of southern California oranges. Learning how to grow better replants in old citrus soil is one of the problems of the California citrus industry. Figures collected in the San Gabriel Valley indicate that a replant Valencia tree—25-30 years old—will bear only 50% as much fruit as a tree of the same age in a virgin planting.

An analysis of the survey showed that in the four southern counties, about one out of every ten trees has become nonproductive because of disease—exclusive of tristeza. The average rate of tree loss —about 0.25% per year for the life of the orchards—could account for the loss of approximately 4,200 bearing trees per year to the California orange industry.

Los Angeles County—with 16.6% of its original tree spaces classified as unproductive—showed the greatest loss. Ventura County orchards had the least percentage—43%—of nonproductive trees, probably because the Valencia orchards in this county were younger than in the other counties and psorosis had not progressed as far. Orange County had 10.6% nonproducing trees and San Bernardino had 8.4%. In Tulare County, 6.0% of the trees had reached the nonproductive stage.

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Longtime production records, covering most of the productive life of a few orchards, suggest that root disorders begin to influence production about the time an orchard reaches maturity. During the first 20 to 25 years—when roots...
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The problem of diminishing yield for Valencias, therefore, is primarily one of decreasing size. For navel, diminishing production has been due first of all to small sizes, but also—in certain areas—dwindling numbers of fruit per acre have accentuated the downward trend.

Southern California navels fared worse than Valencias. Along with the decline in fruit sizes, numbers of fruit per acre diminished in nine districts, remained fairly constant in 11, and increased in only three. Yields, expressed as field boxes per acre, dwindled in 19 districts, remained steady in four, and increased in no district.

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muchs growth was obtained as in the controls. Many of the control plants were still living when survival counts were made but they were weak and produced little or no new tissue. Growth clearly revealed the difference in cold injury and indicated the increased forage production.

These freezing tests confirm observations made on the range. Whereas frost may kill back leaf tissue of fertilized plants, it results in nearly complete growth cessation in the unfertilized.

The photograph on page 5 illustrates the effect of nitrogen fertilizer on frost burn in six-weeks-old soft chess plants two days after being subjected to a single night when the temperature dropped to 30°F. The pot on the left had received four applications of supplemental nitrogen while the control on the right received none. The twisted, curled leaf tips—from the tip to 1" down the leaf—of the control are brown and dead. The plants with added nitrogen show no frost burn.

In the field, density of ground cover and height of growth are increased by nitrogen applications. This may provide an insulating effect against frost injury to the plant bases. However, in the small pots used in the freezing studies, such insulation is negligible.

Increased root development is likely a factor in the better tolerance of fertilized field plants to drought. However, such root development in the pots is restricted and would not seem capable of producing the improved growth and recovery from injury. The physiology of these responses will be investigated further.

It is probable that the improved frost tolerance observed in these experiments can be found only in areas of mild winters where night freezing alternates with day temperatures warm enough to promote growth. Such conditions in California apparently permit the stimulation of winter forage production by fertilization without increasing the hazard of frost damage.

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