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Observations on the History and Status of the Avocado Tree Decline and Collapse Problem in California

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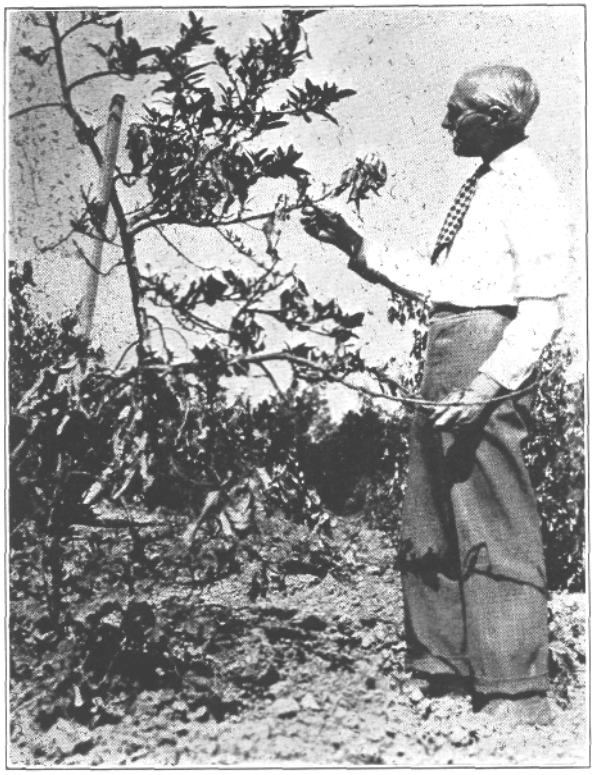

Professor Wm. T. Horne of the Citrus Experiment Station at Riverside examines an avocado tree in "decline" at Rancho Santa Fe in the summer of 1931.

Introductory Statement

The recent increase in prevalence of avocado tree decline and collapse, to the point where it is now widespread and extremely serious in certain districts, has caused many persons in the localities affected to fear or conclude that a new and mysterious disease has appeared which not only threatens the industry where it now exists but may also spread to areas not now affected. It is the purpose of this note to summarize the known facts concerning the history and nature of this problem as they have accumulated from the time it was first recognized and reported some twenty years ago. As will be seen, these facts are reassuring in certain respects; from other points of view, however, such is unfortunately not the case.

Symptoms of Decline and Collapse

The avocado tree, like all other fruit trees, is subject to various causes of decline in health and vigor, some of which if not corrected ultimately result in death. The decline and collapse referred to in this discussion, however, are concerned with a characteristic deterioration in health of trees originally normal in all respects, which is not the result of neglect in orchard management practices or of insect or fungus injury to the above-ground portion of the trees.

Two general types of decline are recognized—a relatively rapid impairment of health characterized by a progressive reduction in amount and vigor of foliage and new growth, and sudden collapse. The first symptoms of the former, which is universally referred to merely as decline, seem to consist of the death of the small feeder roots followed by a paling of the foliage color. There then ensues a more or less rapid reduction in the amount of foliage, each crop of leaves being smaller and paler than the last and each growth flush less in amount and vigor than that preceding. Usually within a matter of months affected trees lose most of their foliage, cease to grow, exhibit sunburn of the defoliated branches, and begin to die back from the tips. Death is usually progressive and gradual but sometimes occurs suddenly. Observational evidence indicates that where the trouble is early recognized corrective measures may result in improvement, often temporary but sometimes apparently permanent. In the great majority of cases, however, the trees have continued to decline in spite of efforts to restore them, and many growers contend that it is impossible to re-establish an avocado orchard on the site of one which has been pulled out because of decline.

Collapse, however, as the name indicates, is much more rapid in its action. Affected trees, apparently in the best of health, suddenly wilt and usually die within a matter of days or weeks, depending on the weather. The leaves die so quickly that they are not shed but remain on the tree. In the majority of cases affected trees are killed outright, but in some instances only the leaves are killed, or part of the tree dies and recovery subsequently occurs. It has been the experience of at least some of the growers that the replacement of collapsed trees has been entirely successful.

History of the Problem in California

What is considered to be avocado tree decline of the type above-described seems first to have been noted and reported by the writer at North Whittier Heights in 1920, while serving as Farm Advisor in Los Angeles County. It was observed on thin, poorly drained, hillside soils. Two years later, following the wet winter of 1921-22, Farm Advisor J. G. France in San Diego County reported it on a shallow soil underlain by hardpan, at National City. That it must have been more or less prevalent at that time is suggested by the references to soil or water injury to the avocado tree by Professor Wm. T. Horne in Circular 265 of the California Agricultural Experiment Station and to its sensitiveness to poor drainage by Farm Advisor Knowles A. Ryerson in Bulletin 365 of the same agency, both of which were published in 1923. Following are the pertinent quotations from these two publications:

"Soil or Water Injury. Certain sickly conditions apparently caused by excess moisture

due to hardpan or other soil defects. Trees apparently are sensitive to water-logging of soil and have poor recuperative power after such injury."

"The avocado is extremely sensitive to poor drainage and will not endure saturation for more than a few days."

From that time on, numerous members of the staff of the College of Agriculture—Farm Advisors, Extension Specialists, and Experiment Station workers—have reported the occurrence of avocado tree decline and collapse. The first extensive occurrence seems to have been that at Rancho Santa Fe following the two successive wet winters of 1925-26 and 1926-27, when hundreds of young trees died. In that year it was also reported in Santa Barbara County, at Carpinteria. In 1936 a general survey by Professor M. R. Huberty showed it to be more or less prevalent in certain localities in Santa Barbara, Los Angeles, Orange and San Diego Counties.

The Present Status of Our Knowledge as to Cause

From the first report of the occurrence of this trouble its relation to soil conditions has been noted. Almost without exception it has been observed to be associated with shallow or poorly drained soils. A causal relation was therefore early suspected, the nature of which was first stated by Professor Horne in the quotation above given. Moreover, without exception from the time first reported, decline has been observed to increase following wet winters, and notably so after two wet winters in succession. Thus it became especially serious in 1928, again ten years later, and more recently in 1941. The above-average rainfall of last year (1942-43) has materially increased its prevalence in certain localities. In this connection it may be of interest to note that during the twenty-three years since it was first reported there have been ten winters of above-average rainfall. The past decade, however, which has witnessed much the greater part of its development, has included six wet winters, of which four occurred in two pairs separated by the dry winter of 1938-39, and one, namely that of 1940-41, was characterized by nearly double the average rainfall. The essential nature of the trouble is therefore evident—excess moisture in shallow or poorly drained soils, the most common source of which is winter rainfall.

That more than simple root suffocation may be involved in decline, and possibly also in collapse, has been suspected for at least a decade. The first reference to this possibility seems to have been made by Professor Wm. T. Horne in Bulletin 585 of the California Agricultural Experiment Station, published in 1934, from which the following quotations are taken:

"The possibility remains that the trouble"—i.e., decline—"is due to a specific organism or group of organisms, which become active under certain conditions, or to deleterious substances formed under conditions of deficient oxygen supply."

"This trouble"—i.e., collapse—"appears mainly in heavy soils and follows heavy rains in the spring, although some cases have been reported brought about in the soil by exclusion of air, and not due to water directly."

These possibilities have received attention at the hands of several investigators in recent years with highly interesting but, thus far, inconsistent and inconclusive results.

Decline and Collapse Observed In Other States and Countries

That this trouble is by no means confined to California is certain from the testimony of Californians who have observed it elsewhere. Professor Wm. T. Horne reports having seen it in Cuba as long ago as 1904. The writer observed hundreds of young trees in Florida in 1927 drowned as the result of temporary submergence following the hurricane of 1926 and in 1928 saw declining avocado trees in Spanish Honduras. Professor H. S. Fawcett reports having observed it in Brazil in 1936 and that same year J. G. France found it fairly widespread at La Canada, Mexico, following a rainy season of approximately twice the normal.

Summary and Applications

Summing up the facts available, it is certain that avocado tree decline and collapse of the type now so widespread in certain localities in California do not comprise a new and mysterious disease which is likely to become general throughout the industry. On the other hand, it is clear that these troubles are associated with soil conditions and that excess moisture comprises the primary unfavorable factor under which they develop. Admittedly the control of this factor on shallow soils in years of above-average rainfall will pose problems which may well prove difficult, or in some cases impossible, of solution.