

Research in Orchard Manage

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The following report was prepared by members of the staff of the Division of Orchard Management of the Citrus Experiment Station, under the chairmanship of E. R. Parker, Horticulturist in the Experiment Station.

The Division of Orchard Management at Riverside studies the performance of citrus, avocado, fig, and other subtropical fruit trees in the field.

It is interested in rootstock, variety and strain selection, the effects of soil management, fertilization, and other problems of management and environment. The laboratories of the Division facilitate the field studies.

Citrus Tree Improvement

Selections are being made of strains of the common lemon varieties which will be longer-lived and more productive of high quality fruit than many now in use. By selecting from the strains, especially from old and healthy individual trees, much progress is being made in avoiding early decline of lemon trees and in increasing yields.

Great differences in the health, vigor, and productiveness of the strains are now evident. Some of the selections are being widely used as sources of budwood for commercial orchards.

To improve the average yield, quality and size of Valencia oranges especially promising trees are being propagated and planted in experimental orchards. Vigorous, old trees which produce superior fruit and several nucellar strains which arose as chance seedlings were selected as parents.

Citrus rootstock trials supply useful information upon the effects of standard as well as many new stocks. After resistance to particular hazards is established, comparisons of trees on different stocks are being made over a long term of years to determine the effects on yields, quality and size of the fruit; size, longevity, disease-resistance, hardiness and other characteristics of the trees. Rootstocks are tested with all the commercial scion varieties of citrus, since some give better results with one variety than with another.

Nearly 200 rootstocks have been budded with sweet orange scions and are being tested to determine their susceptibility to quick decline. A smaller number of stocks budded to other species of citrus are also being tested. Present results indicate that orange trees on many rootstocks are susceptible. Some stocks which are tolerant to quick decline may be un-

satisfactory for other reasons. Although screening for the determination of susceptibility to quick decline should require only a few more years, it will be many years before other important effects of rootstocks can be determined in long-term trials.

In an investigation of replants in citrus orchards uncommonly vigorous trees, planted in old citrus soil, are tested. Vigorous strains of lemons and Valencia oranges have been budded upon several rootstocks, some of which have not been used previously. There is evidence that some of the trees will, at least partially, resist the handicap of being planted in old citrus soil. Vigorous strains of lemons and of oranges on Troyer citrange, Rangpur lime, Cleopatra mandarin and King mandarin are making better growth as replants than the same strains budded on sweet orange, Sampson tangelo, and some other rootstocks. The trees are still young, and additional time will be required before conclusions upon this and associated rootstock and scion effects are possible.

Several hundreds of citrus species and varieties are under observation to determine their commercial possibilities in California.

Field trials have been started in three locations to study the effects of heavy applications of fertilizers on collapse or on the prevention of collapse of lemon trees. Pruning trials have started to determine the effects of a controlled pruning program on collapse.

Investigations in intermediate and coastal areas are under way to determine the relations of tree type to lemon tree collapse and tree decline. Vigorous, densely foliated trees appear to be most resistant.

An extensive, long-term experiment with Washington navel oranges has been under way since 1927. It compares the effects of varying amounts of nitrogen, of several inorganic and organic sources, of cover crops and of various other sources of organic matter, of phosphate and potash fertilizers, and of gypsum, limestone and sulfur. Under study are their effects upon yield, size, and quality of the fruit, and their influence on trees and soil.

The cumulative effects of the addition or omission of certain fertilizers upon

the soil are being studied, partly in cooperation with other divisions. It is becoming apparent that the effects of fertilizer practices upon soil structure—as affecting water penetration, salt accumulation and perhaps other factors—is of increasing importance in maintaining tree health and good yields.

Fruit sizes have been increased in this experiment by the use of potash fertilizers. Manure applications have had a similar effect.

Fruit and leaves are being analyzed in an effort to interpret the effects of fertilizers upon yields and fruit characteristics. Information is being obtained which will aid in determining the fertilizer requirements in other orchards.

Co-operative fertilizer experiments are being conducted with farmers in several areas where special problems exist.

Three of these trials study the effects of phosphate and potash upon orange fruit size.

Another experiment investigates an orange orchard which produces a small crop of extremely large, coarse fruit of poor taste and shipping quality. An initial response to phosphate fertilizers—the first case of a response of orange trees in California to phosphate applications—has been obtained. At present 39 treatments are being tried in an effort to determine the factors which contribute to the poor tree condition and fruit quality and also to the effect of the phosphate fertilizers.

Field experiments are also under way to determine the effects of fertilization with lemon trees subject to early decline and collapse.

Spray application of fertilizers, especially nitrogen in the form of urea, to citrus trees has shown some promise. But spray applications of urea can not yet be recommended because of occasional leaf injury. Studies are under way to find the cause of the injury and ways of preventing it.

Preliminary trials indicate that small quantities of phosphorus and potassium are absorbed through the leaves. These suggestions are being tested more extensively to determine if there are yield, fruit size and quality effects.

Minor element fertilization of citrus trees are studied, including spray appli-

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cations of zinc, copper, and manganese. A new manganese source—manganese dioxide—appears promising for use in sprays. In large-scale trials it appears to be compatible with oil sprays.

Factors affecting orange fruit size—including nutrition of the trees, strain of variety, rootstocks, and the presence of aphids—are being investigated.

The quality of orange and lemon juice has been found to be affected by rootstocks.

Experiments show that the per cent of citric acid in the fruit is decreased slightly by phosphorus fertilizers and increased by potassium fertilizers. Ascorbic acid is reduced by nitrogen fertilizers.

The effects of fertilization upon water spot of navel oranges are being studied. Indications are that the severity of this trouble is slightly accentuated by heavy applications of nitrogen fertilizers.

Other Studies

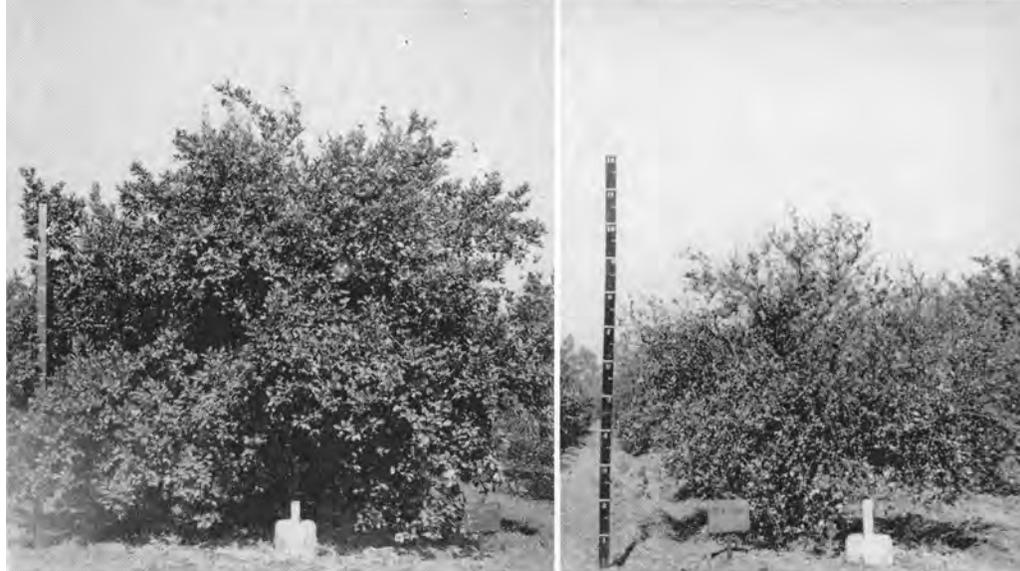
A collection of 120 fig varieties has made possible the identification of specimen trees fruiting in various parts of California and elsewhere and to judge their adaptability to local climatic conditions. A monograph is being prepared designed to give the history, the correct nomenclature, and detailed fruit description of all fig varieties.

Breeding for fig improvement is continuing. Back crosses to the Kadota or the Adriatic have given especially good results. A number of very promising seedlings are now fruiting at Fresno, Merced, and Riverside.

The following avocado varieties appear most promising in variety trials at the Citrus Experiment Station: Clifton, Duke, Emerald, Haas, Nowels, Ryan and Zutano.

Two preliminary trials on avocado fertilization have been established recently. One is in Ventura County in an area where nitrogen appears to be deficient. The other is in San Diego County, in an orchard which appears to be deficient in phosphorus.

Studies in dry-farmed fields and vineyards are resulting in reduction of erosion by winds due to the use of winter covercrops and sub-tillage during the spring months.



Eleven-year-old lemon trees propagated from two strains of the Lisbon variety. Selection of strains is important in obtaining satisfactory growth and long life.



Above: Comparative sizes of five-year-old Valencia orange tree replants on experimental rootstocks in old citrus orchard. Left, on Troyer citrange; right, on Sampson tangelo. Below: Nitrogen deficiency of orange trees. Left, fertilized; right, unfertilized tree. Methods of supplying nitrogen to citrus trees and their effects on yield, size and quality of fruit are being investigated.

