

Small Oranges

size problem under extensive study to determine cause and control

L. D. Batchelor

Condensed report of address by L. D. Batchelor before Directors' Meeting of the California Fruit Growers' Exchange.

One of the first very bad years for small fruit sizes came to the orange industry rather suddenly in 1929 when it took 20% more oranges to fill a box than it took in 1928.

Data subsequently obtained for the Valencia harvest years of 1926 to 1932 inclusive, showed clearly a very high negative correlation between the average yearly production per acre and average size of the fruit.

This correlation was not perfect, but it was so large that the probability was very great that a year of heavy production also would be a year of small sizes.

Thinning Experiments

Thinning to increase the size of fruit has been a usual procedure in the production of most deciduous fruits such as apples, apricots, and peaches. Experiments were carried out in six orange orchards during 1930 to 1932.

It was clear that Valencia sizes could be increased by a removal of from 20% to 50% of the small oranges during the month of July. The more severe thinning increased the sizes of Valencias from about 264 to the box to only 232 oranges per box.

The navel orange increases were somewhat less. In two orchards where an average of 44% of the little oranges were removed the sizes per box improved only from 224 per box to 196.

With the price of labor, it was clear that a profit could not be obtained in these orchards by hand thinning. The reduction in the total crop, and the cost of thinning more than counterbalanced the increased value of the larger fruit.

Another complication became apparent the second year after thinning in that the trees thinned the most the first year set the largest number of fruit the second year, resulting in a large crop of small sizes.

Another experiment was begun in 1947. A removal of 40% of the crop on 30 trees increased the size of the remaining crop about 1½ packing house sizes—from 282 to 242 fruit per packed box.

Several chemicals have been tried the past two years in experiments in blossom

thinning. It is too early to draw any conclusions on this chemical flower thinning. The experiments will be continued for several years to determine the effects of repeated thinning on the trees in relation to carbohydrate production, and size of the fruit and volume of total crops.

It has seemed to many of the Experiment Station staff that the orchards which were the worst examples of small-size production also usually were subnormal in one or more of the general growth characteristics of vigorous, healthy orange trees.

Some of these characteristics which are usually most pronounced are: Small leaves, sparse foliage, too many dead twigs and small branches in tops and inside of the trees, and frequently a pronounced damage by such insecticides as oil sprays, or by insects such as aphids, red spider, and scale insects.

Weak growing orchards usually show a less than normal development of small, fibrous feeder roots. Many of the roots are dark brown and partly decayed and show very little growth.

All observations in two significant experiments were in agreement that a proportionately large number of leaves to fruit is conducive to large fruit. This was not a straight line relationship as oranges with 50 leaves per fruit on the tree were not five times as large as those with only 10 leaves per fruit.

This confirms, in some measure, general observations in small fruit problem orchards—that trees which periodically lose a portion of their foliage because of insect or insecticide damage, or have the foliage damaged, do not usually produce normal crops or normal sizes.

It has seemed generally apparent also in the various districts that the exceptional orchards which have produced fairly satisfactory size fruit have been in an especially healthy, vigorous condition with dense, dark green foliage and also reasonably free from insect or insecticide damage.

Insects and Insecticides

The major pests of citrus have become increasingly more difficult to control.

Orange orchards in general are supporting higher populations of scale insects and mites than formerly, and consequently are being treated with insecticides more frequently.

These conditions may have a bearing on the sizes of fruit produced. It seems safe to assume that any of the various factors which continually impair the metabolism of the citrus tree as a manufacturing unit would have an adverse effect on the normal fruiting characteristics of the tree.

Plant Growth Regulators

Among the materials which have been added to oil sprays to lessen their harmful effect has been 2,4-D, a so-called plant growth regulator.

Sprays composed of water and 2,4-D—as a means of preventing preharvest drop of both navel and Valencia oranges—have been used in experiments since the spring of 1946.

A profitable by-product of these experiments has been the determination of the effect of 2,4-D on fruit sizes.

It appears that the sprays in August and September, when oil sprays usually are applied, or water sprays as late as January, will not affect sizes. However, the water sprays applied just prior to, or during the bloom period—March 1 to March 15—to as late as July have made a notable increase in the size of the fruit. This effect usually is associated with a reduction in the number of fruit per tree. If too much 2,4-D is used—75 parts per million or more—the reduction in the number of fruits is excessive and there is still a greater increase in size but a lowering of external and internal characteristics of the fruit to the point of making them culls.

Two experiments carried out on trees sprayed in late February, 1947—with approximately 20 p.p.m. 2,4-D—showed a residual effect by decreasing the number of fruits; but, by notably increasing the size of navel oranges picked in the late spring of 1948, the net reduction in boxes per tree was only relatively small—0.3 box on 3-box trees.

Valencias sprayed—with 1½ light-medium oil plus eight p.p.m. 2,4-D—in June, 1946, showed increases in sizes when harvested in September, 1947.

Much additional work needs to be done on this encouraging approach to the size problem before general recommendations can be made.

Soil and plant analyses are being made to determine whether the trees are taking up the nutritional materials added.

Basic studies of citrus nutrition with bearing orange trees in water cultures are being conducted at Riverside.

It seems probable that if nutrition is

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PRUNING

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or towers in some districts. It seems practical to do some cutting back of limbs to allow passage of the equipment, as some growers are now doing, provided too much fruiting area does not have to be sacrificed.

In future plantings trees may well be spaced a little wider in one direction than the other to allow for mechanization. This also would help in hauling out fruit. The difficulty of operating the equipment in muddy soils may be partially answered by light weight and wide, mud-grip tires or multiple-drive wheels.

Good platform and tower equipment now being developed for pruning is also finding use in other orchard operations such as thinning, knocking and harvesting.

Rig has platform nine feet high, 7½ feet wide; slip-boards, 2" by 12", 12 feet long, iron reinforced.



Two-stage pruning platform for pears with slipboards on upper deck. Compressor is mounted on tractor.

In addition to certain savings, results show better timing of work for regularly employed crews, easier and more desirable employment for more highly skilled help, fewer troubles in labor training and management, and better control of quality work.

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at all involved in the small size problem as it occurs in the orchards some other factors also bear on it, especially micro-organisms, soil structure and other environmental factors.

Extensive experiments are being carried on in Riverside and Ventura counties studying the effect of soil fumigation on soil organisms, the growth of trees replanted on such soil, and a search is being made for soil fumigants which can be used in orchards without harmful effects on the trees.

The symptoms of poor feeder root systems under trees producing small size fruit have been observed rather generally.

The presence of nematodes on roots of both decadent and healthy trees has been generally observed wherever citrus is grown in various parts of the world. There also are usually several other micro-organisms closely associated with the nematodes.

Enlarged studies of this complex association during the past three years consider the possibility of relationship to slow decline of citrus trees which has gone hand-in-hand with small sizes. This study is important also to the problem of replanting land again to citrus.

Work is well underway studying the effect of rootstocks and varietal bud selections on fruit sizes.

A comprehensive plant breeding project also is underway to produce new varieties and to rejuvenate old varieties by means of nucellar seedlings.

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NEW PUBLICATIONS

A copy of the publications listed here may be obtained without charge from the local office of the Farm Advisor or by addressing a request to Publications Office, College of Agriculture, University of California, Berkeley 4, California.

THE PEACH TWIG BORER, by Stanley F. Bailey. Bulletin 708, September, 1948.

Written for the grower, pest-control operator and the entomologist, this bulletin describes the life history and cycle of this pest. A control program based upon the latest research information is outlined.

CONSTRUCTION OF FARM REFRIGERATORS AND FREEZERS, by James R. Tavernetti. Station Circular 386, September, 1948.

This circular suggests several designs to fit farm refrigeration needs. It discusses construction, materials, equipment and costs.

MAKING A COAT, by Ethelwyn Dodson and Frances Reis. Extension Circular 145, August, 1948.

Pictorial illustration of tailoring techniques and a step-by-step simplified work plan for construction of the garment are given in this booklet.

SUGAR-BEET

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sugar-beet nematode in California have not been successful. The reasons are not known but preliminary experiments have been started in an attempt to determine whether soil conditions, or the time of treatment in relation to the stage of the life cycle of the nematode present may account for the failure of chemicals to control the nematode in California.

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DONATIONS FOR AGRICULTURAL RESEARCH

Gifts to the University of California for research by the College of Agriculture accepted September, 1948

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