Grapefruit

effects of 2,4-D sprays on preharvest drop, yield and quality

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Studies on grapefruit in field experiments indicate that the application of 2,4-D may reduce preharvest fruit drop from 52% to 78%.

The first experiments were established on June 3, 1946, in a randomized block design with six replications, each plot consisting of a single grapefruit tree. The trees in the different blocks were on different rootstocks.

The trees were sprayed between 6:00 and 10:00 a.m., June 3, 1946. Test trees were sprayed with water solutions of 5, 25, 75 or 225 parts per million—p.p.m.—2.4-D. A drenching spray was applied at 300 pounds pressure per square inch, using ordinary orchard spray guns with No. 8 disc in the nozzles.

At the time of spraying, the trees bore nearly mature fruit as well as young fruit between 1½ and 2½ inches in diameter that would mature the following year—about July 1947.

Each of the 2,4-D sprays reduced the drop of mature fruit in the 1946 harvest, and the amount of reduction was directly related to the concentration of 2,4-D in the spray.

From the time of spraying—June 3—until harvest—August 26—a period of 12 weeks, the fruit drop from the non-sprayed trees amounted to 15.6% of the crop. In comparison, trees sprayed with 5 p.p.m. or 25 p.p.m. 2,4-D dropped 7.3% and 5.5%, respectively. This was a reduction of 53% in fruit drop of trees sprayed with 5 p.p.m. 2,4-D, and of 65% in that of trees sprayed with 25 p.p.m. 2,4-D.

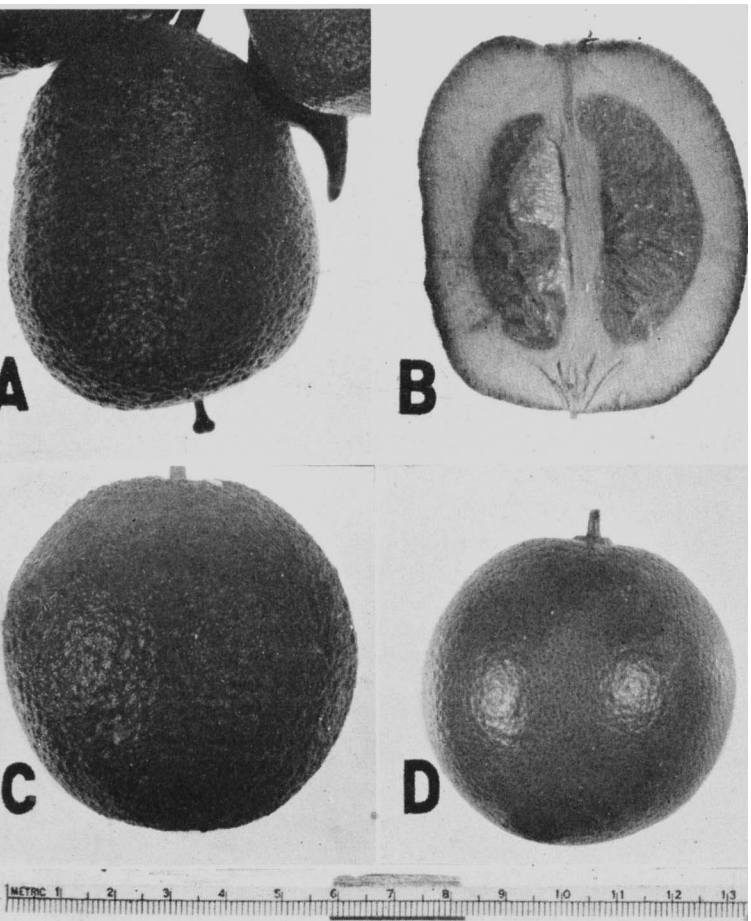
Excessive Concentrations

Still greater reductions were obtained with sprays containing 75 and 225 p.p.m. 2,4-D, but certain undesirable effects of these high concentrations appeared to render them impractical for commercial use.

Besides causing abnormal sizes of fruit, the 225 parts per million spray induced some fruits to become cylindrical in shape; other fruits developed navels and grew thick, coarse rinds having excessively large oil glands, while still other fruits developed dry, hard juice vesicles.

Laboratory tests were made on the juice of samples of fruit picked at intervals of two weeks during the period from June 17 to August 12, 1946.

No reduction in total soluble solids and no increase in total acidity were observed as a result of treatment with 2,4-D. The ratio was not reduced. There was also no significant change in pH of the juice. These data do not indicate any undesirable effects of the five and 25 p.p.m. sprays on fruit quality.



Abnormal fruit induced by water spray containing 225 parts per million 2,4-D applied to grapefruit trees, June 3, 1946. *A*, Cylindrical fruit; *B*, Longitudinal section of same fruit, showing navel structure. *C*, Fruit showing rough peel and enlarged oil glands. *D*, Normal, non-sprayed—control—fruit.

In the one block that was not harvested in August, fruit-drop counts were continued at intervals of about two weeks until January 6, 1947. This was 19 weeks after the period of commercial harvest and 31 weeks after the date of treatment.

Because of lack of replication of treatments, the observations made subsequent to August 26 are more variable than those made earlier. They indicate, however, that the 2,4-D sprays were effective in reducing fruit drop for a total period of at least 26 weeks, and that during this time the effects were positively correlated with the concentrations of the spray.

Soon thereafter the effects of the more dilute concentrations of 2,4-D—five and 25 p.p.m.—appeared to wear off, and the trees treated with these sprays dropped their fruit rapidly during the next few weeks. The rate of fruit drop from trees sprayed with 75 and 225 p.p.m. 2,4-D was only slightly accelerated in the final period.

Deformed Leaves

The sprays containing 2,4-D concentrations of 25 p.p.m. or more caused a curling and buckling of young, expanding leaves. The degree of deformation was in proportion to the concentration of 2,4-D. Deformations caused by 75 and 225 p.p.m. 2,4-D tended to persist as the leaves grew; those caused by 25 p.p.m. 2,4-D frequently were temporary.

Mature leaves showed different responses to excessive concentrations of 2,4-D. Those sprayed with 225 p.p.m. 2,4-D developed irregular chlorotic areas which persisted for several months and then gradually disappeared.

Fruit Sizes

Average fruit size, as indicated by the number of fruits per field box, was not significantly changed as a result of the treatments. Actually, however, some fruits from trees sprayed with 225 p.p.m. 2,4-D were greatly increased in size; others were very small. This effect was less apparent in fruit from trees sprayed with 75 p.p.m. 2,4-D and was not evident in that from the five and 25 p.p.m. treatments.

Fruit Quality

At the time the trees in this experiment were sprayed—June 3, 1946—a second crop of fruit had set but the June drop had not been completed.

Observations made on the quality of this fruit—harvested July 9, 1947—indicate effects of 2,4-D on the second crop to be very similar to those on the first crop.

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ROOTSTOCKS

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somewhat, and frequently there is a slight undergrowth of the sweet or rough lemon stock. Generally, this undergrowth is not as pronounced as with sour orange stock.

Sweet orange trees budded upon mandarin stocks also are characterized by fairly smooth unions. However, the mandarin trunk is usually distinguished by vertical ridges or fluting. The mandarin bark itself is smooth and somewhat slate-colored. These two characters readily distinguish it from sweet orange or rough lemon stock.

The Sampson tangelo, while not commonly used as a rootstock for oranges, results in a union which is similar to that resulting when sweet orange is used and it cannot be distinguished from one by visual inspection.

Sweet orange on sour orange stock is usually characterized by an undergrowth of the sour orange stock. Although the undergrowth is frequently very distinct, the union may occasionally be fairly smooth. This variation possibly may be associated with different strains of sour orange. There are no visible distinguishing features of the bark.

There is an overgrowth of the stock associated with trees budded on trifoliate orange, hybrids of the trifoliate orange, grapefruit or shaddock.

The shaddock is not widely used as a stock and the reactions of trees budded on shaddock and grapefruit are similar. They will be considered here as the grapefruit type.

Trifoliate orange stock generally shows more overgrowth than any other stock.

The overgrowth is so extensive it forms a shoulder or shelf several inches wider than the scion. The outer margins of the shoulder may occasionally be higher than the inner margin adjoining the scion.

The bark of the stock is not smooth but is roughened and presents a webbed appearance. This aids in distinguishing it from the grapefruit type which has smooth bark.

The chief difference between stocks of grapefruit and trifoliate orange is that the trunk of trifoliate orange is markedly ridged or fluted. The grapefruit stock is smooth and round.

Grapefruit stock is characterized by two types of unions. One of these displays the wide bench overgrowth similar to trifoliate orange. The bark is smooth and the stock is not ridged or fluted.

The second grapefruit stock type varies in that the overgrowth of the stock is not as conspicuous.

Both types are characterized by a flaring or bulging near the soil line which gives an enlarged bole effect. This enlarged base serves to differentiate this type from sweet orange or rough lemon stock.

Frequently the grapefruit bark is lighter than the orange scion.

The grower cannot be too cautious in his efforts to ascertain the stock or stocks on which his orchard is planted.

Occasionally only an examination of the bud unions may be needed to provide identification. The character of the foliage on root suckers may also be indicative in some cases.

Frequently information on the nature of the bud unions and of the stock suckers may be correlated to provide more positive information.

In many cases it will be necessary to carry out the chemical tests and to supplement them with such observations as have been made in the orchard.

There will be instances when all the facts available are insufficient for positive identification.

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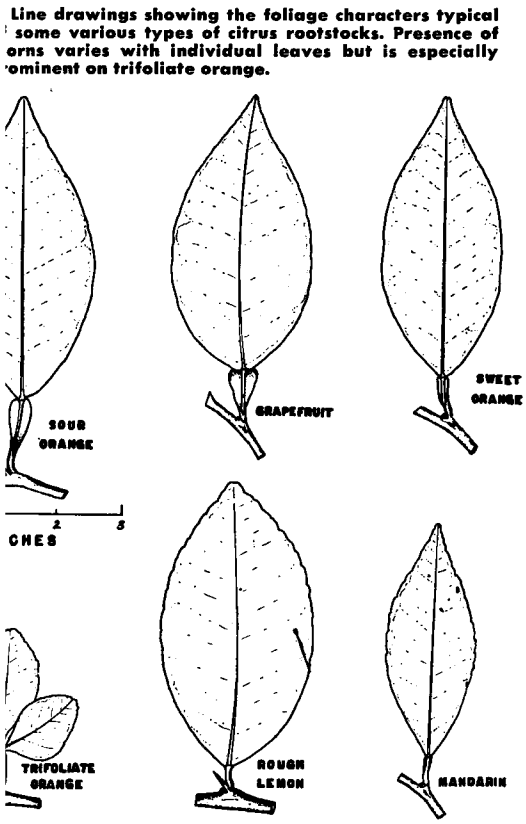
Line drawings showing the foliage characters typical some various types of citrus rootstocks. Presence of orns varies with individual leaves but is especially ominent on trifoliate orange.



GRAPEFRUIT

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A composite sampling consisting of eight fruits of uniform size was taken from each of the six trees per treatment for measurement of fruit quality.

These differences were noted in the fruits with increase in concentration of 2,4-D in the spray treatment: an increase in the ratio of length to width, an increase in the number of rudimentary seeds, a decrease in the number of normal-appearing seeds, a decrease in rind thickness, an increase in soluble solids and pH of the juice, an increase in percentage of rag—tissue not passing through the vibrating screen of an electric juice extractor—and an increase in the specific gravity of the whole fruit.

Samples of abnormally large fruits and of cylindrically shaped fruits from the trees sprayed with 225 p.p.m. 2,4-D also were examined for fruit quality. These fruits generally showed even more extreme effects of high concentrations of 2,4-D in the spray than the normal size fruit.

Additional Experiments

A total of 32 field plots containing 61 comparisons of fruit drop from 2,4-D sprayed and nonsprayed trees were established in 1947 in the counties of Orange, Riverside, San Bernardino, Los Angeles, Ventura and Tulare. Spray applications were made between February 17 and August 7.

The average decrease in drop was 30 fruit per tree or a decrease of 44% of the drop occurring on nonsprayed trees.

The 2,4-D applications were effective in reducing fruit drop in all of the wide range of localities tested.

The 1947 experiments were in agreement with those of 1946 in indicating that in water sprays about eight p.p.m. of 2,4-D is the most desirable concentration to use in the usual spray rig.

The data indicate that 2,4-D may be applied in conjunction with other spray chemicals.

Sprays containing 2,4-D did not seem to impair the keeping quality of grapefruit and may actually increase storageability by reducing the percentage of black buttons on the fruit.

Conclusion

Applications in 1946 and 1947 of water sprays containing eight p.p.m. of 2,4-D effectively reduced the preharvest drop of mature grapefruit when applied at dates ranging from April 15 to just prior to harvest.

Additionally, the 1946 experiments indicated that sprays which were applied before the June drop was completed increased production by apparently reducing the drop of mature fruit which occurs at that time. It is not definitely known whether such a reduction of June drop will be generally beneficial or harmful.

Possible cumulative effects of 2,4-D applications which may be made at any season have not yet been established. A longer period of testing is necessary to determine these effects.

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