Further tests with 2,4-D sprays are necessary before any recommendations for their commercial use to increase fruit size are justified.

It is not known if spraying costs will be repaid by the resulting size increase. The effect of repeated 2,4-D applications over a number of years is not known. Some citrus trees, however, which have been sprayed annually for three years show no injury. These plots are being continued.

On the basis of 17 experiments performed since May 1946, it appears that a single 2,4-D spray applied anytime from several weeks before flowering to three to four months afterwards can increase the fruit size of the coming year's crop. Spraying with 2,4-D during this period not only increased fruit size but lengthened the growing period—hence delayed maturity—and reduced the number of fruits. Although the number of fruits was reduced, box production was not necessarily lowered since, because of the size increase, fewer fruits were required to fill a box.

The effect of repeated 2,4-D applications have been sprayed annually for three years show no injury. These plots are being continued.

Application of 2,4-D as described herein is expected to shift the production peak about one packing size toward larger sizes. Since the diameter difference between packing size 288 and 252 is only one eighth of an inch, this increase will probably not be apparent unless a large number of fruits are measured or the packout statement obtained for fruit from treated and nontreated trees in the same grove.

The fruit size effect of 2,4-D is more pronounced on trees five to 10 years old than on older ones. The same treatment may be used on young or old trees. No advantages have been observed as a result of spraying trees less than five years of age with 2,4-D.

It is possible that resultant curling of young leaves on very small young trees would retard their growth. There is no apparent advantage, and a possible disadvantage, in 2,4-D spraying of recently top-worked trees which have just a few very vigorous growing shoots.

The concentration of 2,4-D to use in the spray is determined by the time of application after flowering. The following concentrations of 2,4-D are suggested for experimental use to increase fruit size of Navel and Valencia oranges and grapefruit:

Time of application

- Concentration of 2,4-D in spray
  - 4–8 weeks after flowering: 16 ppm (parts per million)
  - 8–12 weeks after flowering: 24 ppm
  - 12–16 weeks after flowering: 32 ppm
  - 14–16 weeks after flowering: 40 ppm

According to this schedule, if full bloom occurred during the first week of April, then the 16 ppm 2,4-D spray should be applied during May, or the 24 ppm during June, or the 32 ppm during the first half of July, or the 40 ppm the last half of July. Applications during this last period seem to be the least likely to induce significant size increases.

These sprays probably will not lower quality of either oranges or grapefruit. However, if higher, excessive concentrations of 2,4-D are applied, quality will probably be lowered to such an extent that the fruit are worthless culls although of extremely large size. The poor quality is owing to a thick, rough peel; enlarged oil glands in the rind; large rudimentary seeds; excessively large protruding navels in Navel oranges; a cylindrical fruit shape; and grapefruit and Valencia oranges with rudimentary navels.

In districts where an early market is sought, 2,4-D sprays for size increase would be undesirable because of the maturity delay. Also, certain quality factors improve with maturity. Thus, 2,4-D sprayed trees harvested at the very beginning of the season may have lower quality than nontreated fruit or than if harvested later.

The 2,4-D spray may be prepared for experimental use by diluting 2,4-D weed killer preparations. The liquid 2,4-D weed killing formulations, such as esters and amine salts, are preferred to the powder types since the liquid forms become rapidly and uniformly distributed throughout the spray mixture. Further data than now available may show ester forms of 2,4-D to be more efficient than the amine salts.

The amounts of several of the weed killing 2,4-D preparations to use for preparation of 2,4-D sprays to increase orange and grapefruit fruit size

### FORMULATION

<table>
<thead>
<tr>
<th>FORMULATION **</th>
<th>Amount of 2,4-D to add to 500 gallons of water</th>
<th>Amount of 2,4-D to add to 500 gallons</th>
<th>Amount of 2,4-D</th>
<th>Amount of 2,4-D</th>
<th>Amount of 2,4-D</th>
<th>Amount of 2,4-D</th>
<th>Amount of 2,4-D</th>
<th>Amount of 2,4-D</th>
<th>Amount of 2,4-D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dow Formula 40</td>
<td>Fl. oz.</td>
<td>16 ppm 4-8 weeks after flowering</td>
<td>24 ppm 8-12 weeks after flowering</td>
<td>32 ppm 12-14 weeks after flowering</td>
<td>40 ppm 14-16 weeks after flowering</td>
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</tr>
<tr>
<td>Thompson's Liquid Weedicide Concentrate</td>
<td>Fl. oz.</td>
<td>16 ppm 4-8 weeks after flowering</td>
<td>24 ppm 8-12 weeks after flowering</td>
<td>32 ppm 12-14 weeks after flowering</td>
<td>40 ppm 14-16 weeks after flowering</td>
<td></td>
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</tr>
<tr>
<td>Esteron 44</td>
<td>Cc. or ml.</td>
<td>16 ppm 4-8 weeks after flowering</td>
<td>24 ppm 8-12 weeks after flowering</td>
<td>32 ppm 12-14 weeks after flowering</td>
<td>40 ppm 14-16 weeks after flowering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weed-no-more 40</td>
<td>Fl. oz.</td>
<td>16 ppm 4-8 weeks after flowering</td>
<td>24 ppm 8-12 weeks after flowering</td>
<td>32 ppm 12-14 weeks after flowering</td>
<td>40 ppm 14-16 weeks after flowering</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

* To prepare smaller amounts use proportionately less material. For example, to prepare 100 gallons of spray use 1/5 the above amounts; to prepare 200 gallons, use 2/5 the above amounts, etc.

** These are furnished as a convenience to the grower. No recommendation of one preparation over another is intended or implied. Of necessity this list is incomplete. Other 2,4-D formulations beside those listed here would be equally satisfactory for the experimental use of 2,4-D to increase citrus fruit size.
PHOSPHATE
Continued from page 11
concentrations greater than 0.50 ppm deficiency is unlikely to occur—only two out of 30 soils gave a response.

In the light of field and greenhouse results, the following ranges of phosphate in water extract are suggested for tentatively defining the status of available phosphorus in a given soil.

Class I. Response likely, less than 0.30 parts per million of phosphorus.

Class 2. Response uncertain, from 0.30 to 0.50 parts per million of phosphorus.

Class 3. Response unlikely, greater than 0.50 parts per million of phosphorus. It must be emphasized that these ranges of phosphate are expressed on the solution basis.

An anticipated response to phosphate fertilization implies that only phosphorus is the limiting element and that there exists no toxic condition in the soil. In California, often nitrogen must be added to secure a phosphate response.

In the case of a phosphorus-deficient soil, response can be expected only when sufficient amounts of phosphate have been added. In the case of a soil containing minerals of the kaolinite type, fixation would be great. This would require considerably more phosphate for a response or a banding of the fertilizer in the immediate vicinity of the roots.

The ranges of phosphate suggested for interpretation of the chemical extraction apply only to the crops listed, mainly pastures, field crops and truck crops.

Field experiments suggest that these responses are especially pronounced for winter crops.

Frank T. Bingham is Senior Laboratory Technician, Division of Soils, in the Experiment Station, Berkeley.

The above progress report is based on Research Project No. 1157.

CITRUS
Continued from page 10
One of 30 soils gave a response. This would require considerable addition of calcium and possibly other nutrients, such as potassium and magnesium.

Class I. Response likely, less than 0.30 parts per million of phosphate.

Class 2. Response uncertain, from 0.30 to 0.50 parts per million of phosphate.

Class 3. Response unlikely, greater than 0.50 parts per million of phosphate.

The ranges of phosphate suggested for interpretation of the chemical extraction apply only to the crops listed, mainly pastures, field crops and truck crops.

Field experiments suggest that these responses are especially pronounced for winter crops.

The cooled fruit is removed from the trays to clean, wooden boxes for temporary storage before shipping.

Herman J. Phaff is Assistant Professor of Food Technology and Assistant Microbiologist in the Experiment Station, Berkeley.

Emil M. Mrak is Professor of Food Technology and Mycologist in the Experiment Station, Berkeley.

The above progress report is based on Research Project No. 1255.

CLINGS
Continued from page 9
is becoming moist is to compare the thermometer readings.

Because of the large trimming losses—pits and peel—the over-all drying ratio is less favorable than for other fruit. A good quality fruit dries about 9:1 and a higher ratio is found for orchard run lots.

To complete the reduction of moisture content to about 20%, the fruit is removed from the dehydrator and allowed to stand for several hours.

In foggy climates this plan can not be followed, for standing fruit might actually absorb additional moisture from the air. In such places, the temperature at the finishing end of the tunnel is reduced to about 150° F and the drying finally completed while the fruit is still in the tunnel.