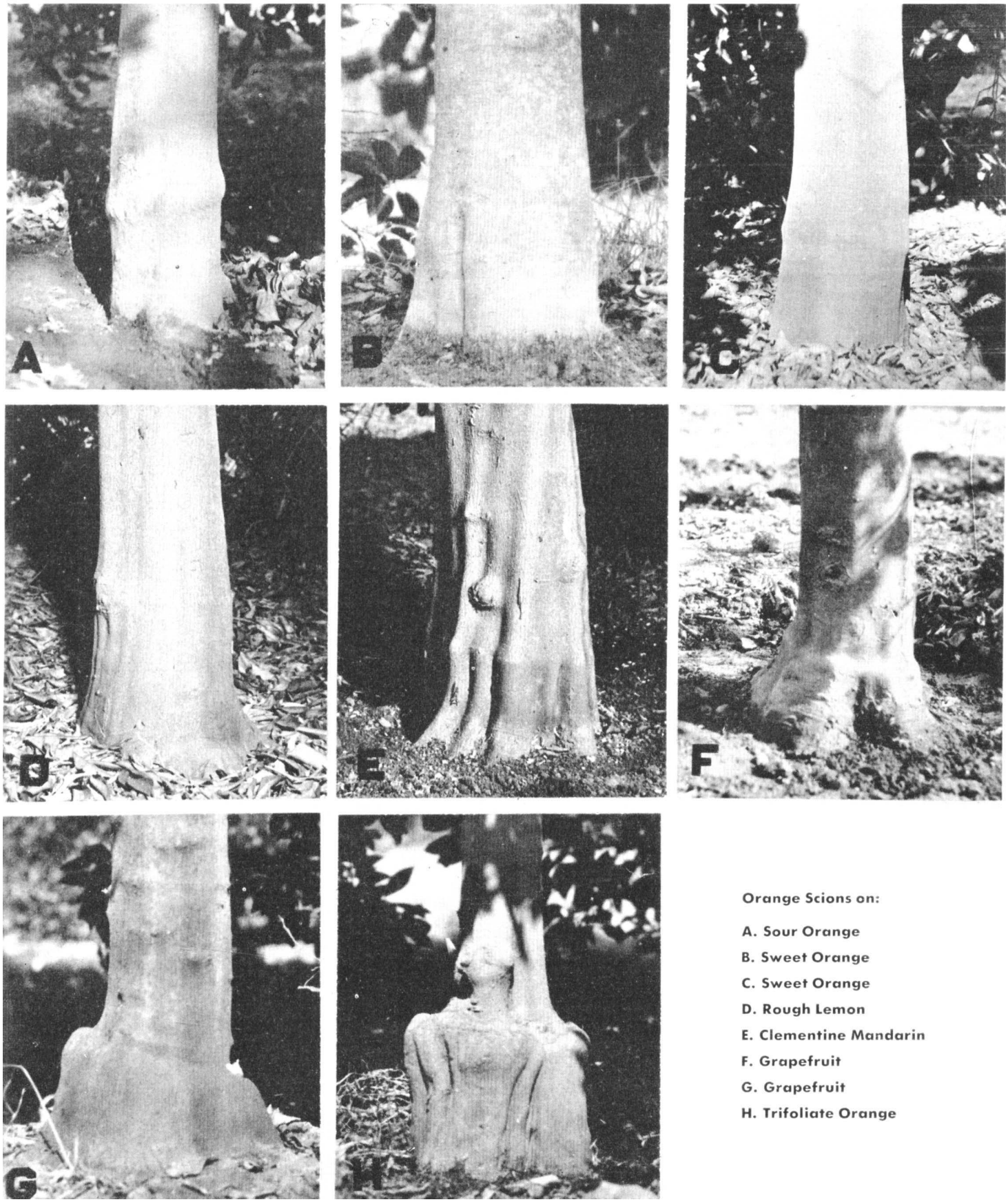


Orange Scions on:

A. Sour Orange
B. Sweet Orange
C. Sweet Orange
D. Rough Lemon
E. Clementine Mandarin
F. Grapefruit
G. Grapefruit
H. Trifoliate Orange

**Typical bud union characters of orange scions budded upon various rootstocks.**

# Rootstocks for Oranges

## identification by recognition of their foliage and bud union characteristics

W. P. Bitters

**Accurate rootstock** identification is difficult and sometimes nearly impossible by methods which are known today.

A chemical method of identifying rootstocks is generally reliable for distinguishing between sweet orange stock and sour orange stock but its reliability diminishes for other types of stock.

Variables in the age of the tree, thickness of the bark, the nearness of the sample to the bud union, the scion variety, the freedom or presence of disease, the presence of surface contaminants and other factors may affect the tests and render identification uncertain.

Studies of the bud union and of the foliage growing on suckers arising from below the bud union are valuable aids in determining a rootstock's identity. This information may often be used to supplement the chemical test; in other cases it enables the grower to infer for himself what the stock type in his orchard may be or to indicate if chemical tests are desirable.

### Leaf Characters of Rootstock Suckers

Suckers arising from the rootstock in an orchard frequently provide simple but exact identification of several stock types.

A normal young sucker type of growth is often abnormal in appearance because of its extreme vigor, and some confusion in the identity of the stock may be caused by this fact. Although the fruit grown upon it provides the most positive identification of a sucker, one seldom finds a stock sucker of sufficient size and age to bear fruit.

Care should be taken to examine a sufficient number of leaves, because leaf characters may differ slightly in different strains of the same species or on vigorous and slow-growing suckers.

### Sweet Orange Leaves

Sweet orange leaves are medium sized citrus leaves, pointed at the tip and rounded at the base.

The petiole—stalk attaching the leaf to the plant—is narrowly winged, but on vigorous shoots it is occasionally broad-winged. There is no overlap of the winged petiole with the leaf blade. The broad-winged leaves may easily be mistaken for those of sour orange. However, the length of the sweet orange petiole is only about one third as long as those of sour orange.

The odor of the leaves when they are crushed is not markedly aromatic.

### Sour Orange Leaves

Sour orange leaves are generally larger than those of sweet orange but are often more pointed at the tip and are slightly more wedge-shaped at the base.

The petioles are noticeably longer than those of sweet orange and are generally more broadly winged. They also do not overlap the base of the leaf. This helps to distinguish them from grapefruit leaves.

Sour orange leaves have a characteristic aromatic pungent odor when they are freshly crushed which is not as detectable in crushed sweet orange or grapefruit leaves.

### Grapefruit and Shaddock Leaves

Leaves of the grapefruit and shaddock are generally larger than those of sweet orange.

They are more oval shaped, blunter at the tip and rounder at the base than leaves of either sweet orange or sour orange.

The chief identifying character is the broad wings on the petiole which generally touch or overlap the leaf base.

### Mandarins

Mandarins have seldom been used as stocks in California.

Their leaves are smaller than the sweet orange or sour orange and much narrower and pointed. The size of the leaf varies considerably with the different mandarin varieties. There is only a trace of a wing on the short petiole.

### Rough Lemon

Leaves of rough lemon are usually lighter colored than leaves of sweet orange, sour orange and the grapefruit.

They are more oval shaped and more bluntly pointed than the other types.

They may be distinguished by the lack of any wing on the petiole.

The oil glands on the upper surface of the leaf are very conspicuous when the leaf is held up to bright light.

There is usually a characteristic lemon odor to the crushed leaves.

### Trifoliate Orange

The trifoliate orange is easily identified by its palmately, three-foliated—clover-like—type of leaf.

Of all the stock types, this feature is found only in the trifoliate orange and its hybrids—such as citranges and citremons. The trifoliate and its hybrids are exceptionally spiny. All the leaves of the trifoliate orange are shed in the fall.

### Bud Union Characteristics

If there is an absence of suckers arising from the stock or if stock identity cannot be distinguished because the foliage characters of the suckers cannot be differentiated, then an additional aid in determination of the rootstock may be gained by observing the type of bud union resulting from the stock-scion combination

This is especially true when the stocks are budded high and planted high in the orchard. Low bud unions may cause confusion because the roots start close to the soil surface and may thus affect the shape of the union.

Stock-scion combinations are characterized by three distinct types of bud unions: Those showing a smooth bud union, those showing an undergrowth of the stock, and those showing an overgrowth of the stock. These differences usually become more distinct as the trees mature.

### Smooth Unions

A sweet orange top on either sweet orange rootstock or rough lemon rootstock results in a typically smooth bud union with regular, smooth contours.

Growth of the stock and the scion are about equal, and frequently the union is so smooth it is difficult to locate it. In such cases the bark of the stock is smooth and of the same color as the bark of the scion.

There is no identifying odor to the rough lemon bark or to any of the rootstock barks. However, reactions vary

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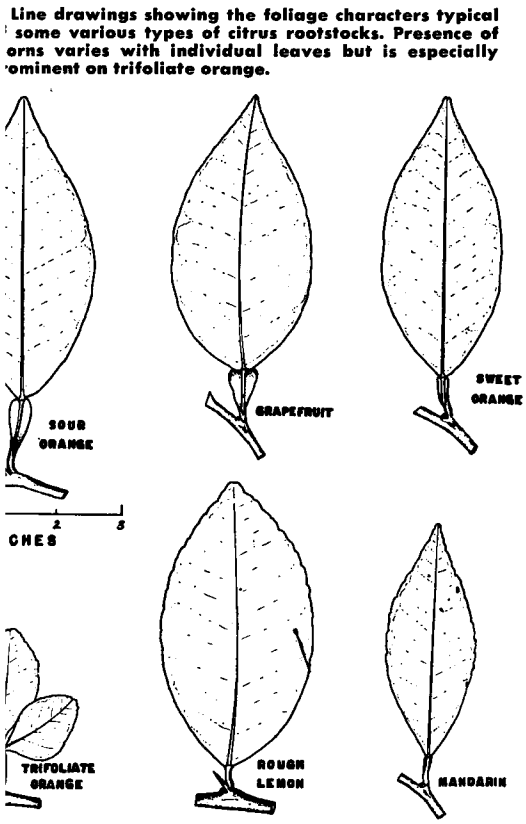
**Line drawings showing the foliage characters typical some various types of citrus rootstocks. Presence of orns varies with individual leaves but is especially ominent on trifoliate orange.**




## 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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