Rootstocks With Dwarfing Effect

investigations indicate some citrus rootstocks exert dwarfing effect on scions budded to them

W. P. Bitters

Several of 60-odd rootstocks used in an extensive citrus rootstock trial of the Citrus Experiment Station at Riverside exerted a dwarfing effect on scions budded onto them.

Dwarfed types of citrus trees might be a desirable type for people having limited space in which to grow trees and limited tree care facilities.

Citrus rootstocks which have a dwarfing effect on the scion are used in commercial plantings in the citrus areas of China, Japan, and Palestine.

Trifoliate Orange Citranges

Different top varieties may be dwarfed to varying degrees when budded upon the same source of rootstock. Included in the rootstocks tested which showed dwarfing tendencies in the Riverside investigation were the trifoliate orange citranges—trifoliate orange crossed with sweet orange —Severinia, Cuban Shaddock, Palestine sweet lime, and Eureka lemon cuttings.

Grapefruit tops on trifoliate orange roots at 20 years of age are 28% as large as comparable trees on sweet root. The trees are healthy. From 1942–47 they produced 58% as much fruit as the trees on sweet root. Navel oranges on trifoliate are 54% the size of trees on sweet root at 20 years of age and are producing 94% as much fruit. The Valencia trees on trifoliate orange averaged 58% as large as trees on sweet root and for the first 10-year period have yielded 94% as much fruit. For the last six-year period, 1942–47, the production was equal to that on sweet root.

Eureka lemons on trifoliate orange all developed exocortis on the trifoliate roots.

The trifoliate orange is a very satisfactory root for the mandarin group of oranges. Eight-year-old Satsuma trees on trifoliate root were 43% as large as trees on sweet root but produced 79% as much fruit. The Kumquat also does well on trifoliate. The trees are healthy and fruitful. The trifoliate orange is slow growing.

Budded combinations in the orchard have been precocious and have produced well in proportion to the size of the trees. The fruit is early to mature and is of high quality. The trees have been disease-resistant, and have shown a greater hardiness than some other rootstocks. If the factor of exocortis can be avoided it is a rootstock well worthy of consideration.

The Savage citrange has definite merit for dwarfing grapefruit trees, but is not recommended for other combinations except with mandarin tops. Grapefruit tops on this root after 19 years of age are 58% as large as trees on sweet root the same age, and average about 76% as much fruit. The fruit is of excellent quality. In the case of the Satsuma oranges, the trees on Savage citrange at eight years of age were 55% as large as trees the same age on sweet root, but were yielding 84% as much fruit. This rootstock is resistant to gummosis and the combinations are more hardy than similar tops on conventional stocks.

The Morton citrange, while it has not effected extreme dwarfing on tops budded to it, results in a very heavy producing tree yielding excellent quality fruit. Washington Navels budded upon it produced 63% more fruit during the first 10-year period than trees the same age on sweet root, although the trees on Morton were only 72% as large. From 1942–47 the combination produced 24% more fruit than trees on sweet root. The Satsuma oranges budded on Morton citrange were 91% as large as trees on sweet root, but have produced 40% more fruit. As a rootstock it is worthy of consideration for home plantings. Its biggest drawback is the difficulty of obtaining seeds for rootstock purposes. Fruit size of Washington Navels on this root tend to be small but not too small to be undesirable for home usage.

The Troyer citrange has only recently been included in rootstock trials. Preliminary observations on this rootstock indicate that it is very promising and possesses sufficient merit to warrant further plantings with it.

Other citranges included in the various trials, the Rusk, the Coleman, the Cunningham, and others, while they had a dwarfing effect on the top, resulted in combinations which were unhealthy in appearance and unproductive. They should probably not be used as rootstocks under California conditions.

Severinia buxifolia markedly dwarfed the various scions budded onto it. At 17 years of age, grapefruit trees on this stock are nine feet tall, whereas comparable trees on sweet root are 14 feet high. These trees are uniform and healthy. They annually produced about three boxes of average quality fruit, or about 45% as much as check trees on sweet root for the first 10 years. Results with Valencia oranges are more variable than with Marsh grapefruit, but such trees are now around 12 feet in height, as compared to trees on sweet root, which are 16 feet high. In the first 10 years they produced 52% as much fruit as the checks. Washington Navels on this stock after 17 years are nine feet in height, compared to 14 feet high on sweet root. They have fairly open tops, are chlorotic, and annually yield only about one box of fruit, or 27% as much as trees on sweet root. Eureka lemons budded on this root produced 33% as much fruit as trees on sweet root during the first 10 years. In practice probably only grapefruit should be budded on this stock.

Palestine Sweet Lime

Trees on the Palestine sweet lime are very markedly dwarfed. Washington Navels on this combination 18 years old are 9½ feet tall and 37% as large as trees on sweet root which are one year older. They annually yield about 3½ boxes of fruit. Eighteen-year-old Valencia trees are 58% as large as check trees one year older. They are about 11 feet tall and annually produce about four boxes of fruit. The grapefruit trees are about 10 feet high at 18 years of age and produce an annual yield of four boxes of fruit. Eureka lemons on Palestine sweet lime are 55% the size of trees on sweet root and produce about 50% as much fruit. This stock has a tendency to heavy production in early years and that is one of the reasons its use is preferred in some countries. Trees budded on this combination

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***Left:* Effect of dwarfing rootstocks upon tree size of oranges and grapefruit. 1. Grapefruit on trifoliate orange—21 years. 2. Grapefruit on Severinia buxifolia—17 years. 3. Grapefruit on Savage citrange—21 years. 4. Navel on trifoliate orange—21 years. 5. Navel on Palestine sweet lime—18 years. 6. Navel on Cuban shaddock—16 years. 7. Valencia on Severinia buxifolia—17 years. 8. Valencia on Palestine sweet lime—18 years. 9. Valencia on Eureka lemon cuttings—18 years. The measuring standard is a 12-foot rod calibrated in feet.**

DROP

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teresting to speculate on even how much more effective 2,4,5-T in the amine form might be.

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DWARFING

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are very sensitive to cold and at Riverside have shown more damage from cold than any of the other combinations. Fruit produced on this stock is very low in acid and has a tendency to be somewhat insipid. The stock itself is very susceptible to gummosis. It is questionable if this stock has sufficient merit to warrant its usage in California.

The Cuban Shaddock produces substandard sized trees. Marsh grapefruit trees on this stock after 14 years of age are 70% as large as trees 17 years old on sweet root. They produced as much fruit in the first 10 years as the trees on sweet root, but in the last six years have yielded only 71% as much. Washington Navel orange trees on this stock at 14 years of age are 45% as large as 17-year-old trees on sweet root. Production for the first 10 years is about the same as on sweet root, but in the last six years has dropped to 80% of the check trees. Eureka lemons on this stock in 1947 were 48% as large as trees on sweet root which were three years older. They produced 66% as much fruit for the first 10-year period as trees on sweet root. Unfortunately, there were no trees on sweet root of the same age for comparison, but obviously the difference in size and production of the two combinations cannot be entirely accounted for by the three years difference in their ages. Trees on this stock tend to have a heavy early production, but this is not maintained in later years. This rootstock appears to be fairly susceptible to footrot. In general, its effect on the top is to produce poorer fruit quality and a tendency toward greater damage from low temperatures than when conventional rootstocks are used.

Eureka lemon cuttings budded to Valencia oranges were also part of the orange rootstock trials. After 18 years these trees approximate 8½ feet in height as compared to comparable trees on sweet root which are 16 feet in height. They have produced 60% as much fruit in the first 10 years, but only 42% as much in the last six. Fruit quality is below average and the combination is easily damaged by low temperatures. In addition to being susceptible to gummosis this rootstock is susceptible to shellbark. It may also be another source of psorosis if the parent lemon trees were carrying the disease. As a rootstock it has little to recommend it other than the dwarfing tendency.

Most citrus growers in California prefer those combinations which produce large or standard sized orchard trees. While in general tree size and fruitfulness are associated, they are not always correlated. Long-lived, healthy, and productive dwarfed combinations may have a definite place in plantings made by the home grower and perhaps the orchardist.

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OLIVE

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ceding the 1949 crop only and bore 124 pounds per tree as compared with 28 pounds for the check trees. All the 1949 girdling in this orchard was done on February 15.

There was a reduction in fruit size of the heavier crop on the girdled trees, but this was offset easily by the greatly increased yields.

Using the yield records and size grades, and computing on an acre basis from the 15 girdled trees in this test orchard the increase in gross return in 1949 over nongirdled trees would amount to approximately $620 per acre at 50 trees per acre.

Girdling of olive trees is not recommended at present for use as a genreal practice but it may be worthwhile to try—in an experimental manner—on a limited number of trees in orchards which have a habit of blooming heavily but failing to set good crops.

Under such conditions the following suggestions are made:

1. The primary scaffold branches should be girdled about the middle of February, with one or two branches on each tree left ungirdled to supply the roots with carbohydrates until the girdling cuts heal over.

2. Girdling cuts are made most easily with a grape-girdling knife in areas with smooth bark. The soft bark should be removed down to the hard inner wood in a strip, not to exceed one fourth inch in width, completely around the branch.

3. The cuts should be covered immediately with either hot grafting wax or with an asphalt emulsion grafting compound. In orchards infected with Olive Knot provision should be made to prevent infection starting in the cuts. Also the girdling knives should be dipped after each cut in a disinfectant to prevent spread of the disease.

4. To determine accurately whether the girdling has been beneficial it is desirable to obtain yield records during harvest from the girdled trees and from adjacent trees of comparable size.

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INJECTIONS

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tity of dilute acid soluble phosphorus and potassium in this soil is very low and correlates well with the low phosphorus and potassium content of the leaves.

Lemon orchards with the leaf spotting referred to here have been noted in parts of Santa Barbara, Ventura, Tulare, and San Diego counties. More recent analyses show that the leaves obtained from these same areas are also very low in phosphorus.

Apropos of leaf analysis as a diagnostic tool, it can be stated that so far, responses to tree injection of phosphorus and potassium have been obtained only where exceedingly low levels of these elements were found in the leaves. Previous tree injection work using mono-calcium phosphate and di-potassium phosphate in Ventura, Orange, and Riverside counties failed to produce response in trees having phosphorus and potassium levels considered adequate by current standards.

This is the first time in California that citrus trees in the field—with leaves of a known low phosphorus and potassium content—have responded to phosphate and potassium treatment.

This response of citrus to phosphorus in southern California is of interest in the light of previous failures of many field trials with citrus to show responses from these elements.

It remains for future work to determine whether the response of lemons to phosphorus and potassium injections reported in this article can be duplicated by soil treatments.

It seems certain, based on the extensive leaf analysis surveys and soil studies of phosphate and potash in citrus groves made previously, that many groves are amply supplied with these constituents.

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