

# Quick Decline Studies

## top-root relationships of citrus investigated in experiments to salvage susceptible orchard trees

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*The first of two articles on quick decline as influenced by top-root relationships*

**Existing top-root** relationships of susceptible orchard trees were altered in three ways to determine tolerance of budded citrus trees to quick decline. Alterations included topworking, which substitutes a tolerant top; inarching, which supplies a tolerant rootstock; and bridgegrafting, which provides a tolerant intermediate stock between top and root.

### Topworking

Twenty-eight trees of Valencia sweet orange on sour orange root showing varying degrees of quick decline were entirely or partly topworked by means of cleft grafts to Eureka lemons in the Glendora area.

Eighteen similar trees were partly or entirely topworked to Marsh seedless grapefruit in the Covina area.

The grafts were inserted in the primary scaffold or in the secondary limbs of the trees. Subsequently any new sweet orange growth from below the grafts was removed.

The trees which were completely topworked to lemons made normal growth. The general appearance of the new tops is healthy and their vigor satisfactory. At the end of five years many of these trees were producing four to six boxes of fruit per year.

The trees which were only partially topworked to lemons did not make a satisfactory recovery. The presence of the diseased sweet orange top on a part of the tree greatly inhibited the growth of the lemon scions on the other part. In several instances partially topworked trees collapsed and died. In one partially topworked tree the entire top was completely wilted. When the sweet orange limbs were removed normal new growth developed on the lemon scions within a few weeks. The presence of one sweet orange limb on the tree was sufficient to affect the vigor and condition of the entire top. The practice of leaving nurse limbs on the trees during the development of the new lemon top is detrimental when such trees are affected with quick decline.

The practice of topworking susceptible trees to lemons is feasible but limited by economic aspects, the fact that many orange-growing areas are not adapted to lemon growing, and other objections in specific cases.

Poor results were obtained with Valencia orange trees which were completely or partly topworked to grapefruit. The topworked trees failed to establish any strong shoots and the tops became compact and bushy. The grapefruit foliage was not normal, the trees flowered out of season, and the fruit set was abnormal.

The quality of the grapefruits was very poor. These are typical symptoms of quick decline.

These results were substantiated by tests with replant trees which were topworked within one year after planting. The trees were inoculated with buds from diseased trees. Lemon/sour/sweet trees remained healthy as did lemon/sweet/sour and lemon/sweet/bittersweet. However, trees of grapefruit/sweet/sour, and grapefruit/sweet/bittersweet consistently developed symptoms of quick decline.

In commercial orchards in the quick decline area grapefruit trees on sour orange roots have not developed symptoms after being exposed to natural infection for five to 10 years. Test trees, however, that were topworked to grapefruit developed very severe symptoms of quick decline. It must be concluded that grapefruit trees on sour orange roots are susceptible to quick decline. Recent rootstock trials also confirm this fact.

### Inarching

Inarching experiments were undertaken in the Azusa-Covina quick decline area. A total of 255 Valencia trees on sour orange root of different ages in varying stages of quick decline were inarched

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**Left: An affected Valencia on sour orange completely topworked to Eureka lemon. Right: An affected Valencia on sour orange partly topworked to Eureka lemon. Note the poor growth of the lemon scion next to the measuring stick.**



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with either sweet orange or Rough lemon seedlings. Generally four inarches were inserted per tree. Some four- and five-year-old trees received only two inarches per tree.

Sweet orange or Rough lemon inarches were inserted into the trunk above the bud union of trees in various stages of quick decline, or just before the advent of symptoms. This did not prevent the progress of the disease during the next two years and many of the trees were removed. The trees were not pruned at the time of inarching. Two years later, most of the remaining trees were pruned severely. The pruned trees improved considerably more than the unpruned ones. The improvement was slow, however, and none of the trees made a vigorous recovery. In general, the tops of the inarched trees were no larger after five years than the tops of young trees on tolerant roots planted in the same orchard at the time the older trees were inarched.

### Tree Responses

The tree response was greatest when the inarches grew well. Rough lemon inarches made more rapid growth than sweet orange inarches and had more beneficial effects on the trees. Unfortunately, Rough lemon as a rootstock has an adverse effect upon yields on trees of advanced ages, and orange trees on this root produce fruit of very poor quality. Various procedures were tried to increase the growth of the inarches, including girdling of the old trees near the place where the

inarches were inserted. Various girdling practices were used and all of them increased inarch growth and response of the old trees.

In one orchard the trunks of several small affected sweet orange trees on sour orange roots were completely severed slightly below the bud union. The trees had been inarched with sweet or Rough lemon seedlings two years previously. The original roots were separated from the inarched trees by cutting out a piece of the trunk. The trees were artificially supported since the small inarches would not hold them. The growth of the inarches on such trees was greater than that of inarches on control trees, but not greater than on some of the girdled trees. Some of these trees have been severed from the sour orange root for three years and are supported by three strong inarches. The tops of the trees are not larger than the tops of tolerant replants set in the same orchard at the time of the inarching. Such amputation of the old root system can be done only in small trees. It does not appear to be practicable.

The severity of the symptoms of quick decline at the time of inarching affected the growth of the inarches. The inarches on normal-appearing trees made the poorest growth. Poor inarch growth was also made when the trees were in advanced stages of quick decline.

The effects of inarching healthy trees some years before they are infected with quick decline are as yet unknown. The results obtained in these experiments suggest that some girdling in the area of the inarch insertion would be advisable. If the inarches are developed to a relatively large size before the trees are in-

fectured with quick decline the old trees may be salvaged. Affected trees should be pruned at or soon after inarching. Better seedlings may be found for inarching than the sweet orange and Rough lemon seedlings used in the present experiment. Limited inarching experiments are now under way outside the quick decline area involving several species of citrus and citrus relatives and employing the techniques developed in the current studies.

At present, it appears that replanting of tolerant combinations is a more practical solution to the problem than inarching.

### Bridgegrafting

Bridgegrafting over the bud union with grafts from a tolerant intermediate seedling was attempted on a small scale. Rough lemon bridgegrafts were placed in 70 trees. Six to eight bridges were used in each tree. Most of the trees were in the early stages of quick decline at the time the bridgegrafting was done. A high percentage of the grafts died. On trees in which all or most of the bridges survived the results were not satisfactory, and the progress of the disease was not checked. The results confirmed the lack of beneficial effects resulting from the use of tolerant interstocks between scions of sweet orange and susceptible root systems.

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**Left: Valencia on sour orange inarched in 1945. Right: A tolerant replant planted the same year.**

