# Rootstock Effect on Olive

## influence on tree growth is found to vary with the scion variety in tests conducted at Winters, Corning, and Lindsay

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**In experimental** olive plantings—using three scion varieties and 12 different rootstocks—the principal rootstock effect on the scion variety was in tree vigor. However, any rootstock influence noted in a given scion-rootstock combination did not necessarily hold true for another scion variety on the same rootstock.

In long-term studies initiated in 1949, own-rooted trees of two varieties—Mission and Manzanillo—were more vigorous and yielded more fruit than trees grafted on any of the rootstocks tested. In the Sevillano variety, this was not the case. Sevillano trees on some rootstocks were more vigorous than own-rooted trees, although considerable variation in tree vigor, with different seedling rootstocks, was noted. Various degrees of dwarfing or invigoration of the scion variety occurred.

Generally, no rootstock effect on fruit characteristics appeared, although trees on *Olea ferruginea* and *O. verrucosa* rootstocks produced fruit with a reduced length-width ratio and an increased percentage of shotberries.

The studies were undertaken to determine: *1*, possible differences in behavior that might exist between olive trees propagated on their own roots and those propagated by budding or grafting on seedling rootstocks, and *2*, differences in tree behavior which might appear, due to the influence of various individual seedling rootstocks.

An 8-acre experimental olive rootstock planting was established near Winters in 1949, with Mission, Manzanillo, and Sevillano as scion varieties. Rootstocks used were seedlings of the Redding Picholine, Mission, Frantojo, Chemlali, and Ascolano varieties as well as seedlings of the species *O. verrucosa*, *O. chrysophylla*, and *O. ferruginea*. Rooted cuttings of the Oblonga variety were also included as rootstocks. In addition, trees of each variety on their own roots—propagated by cuttings—were used.

Five replicate trees of each rootstock-scion combination were planted. The trees in the experimental orchard were set 35′ apart in a square planting in a deep, fertile Yolo silt loam soil. To facilitate harvesting, each row in the planting consisted of a single variety, but the varietal rows were rotated. Each type of rootstock was used once in each row, and placed at random. The various rootstock-scion combinations were thus distributed equally over the entire area planted.

The orchard has been maintained under clean cultivation and irrigated at about 4-week intervals during the summer. No fertilizers were applied, because leaf analyses showed that the nutrient levels in the trees were well within the normal range for olives.

To determine the comparative growth rate of the trees, trunk circumference measurements—12″ above soil level—were made of each tree on March 28, 1957. The circumference measurements were then converted to trunk cross-section area measurements, assuming the trunks to be circular.

In 1954, the sixth year after planting, the trees were bearing commercial crops. That year and each year thereafter, data obtained per tree included: yields, average fruit weight, average pit weight, flesh-pit ratio, length-width ratio of the fruit, percentage of shotberries—a condition in which the embryo aborts and the fruit fails to develop to normal size—and, as a measure of rate of fruit maturity, the percentage of fruit showing color development at harvest.

To determine if the rootstock used had any influence on the mineral nutrient level of the leaves of the scion variety, leaf analyses for all rootstock-scion combinations were made on samples taken February 28, 1955.

Two additional rootstock plantings—one at Corning and one at Lindsay—were established in January 1954 with Sevillano as the scion variety in both plantings. Ten replicate trees per rootstock were planted, but arranged so that each rootstock occurred only once in each row, and placed there at random. The Lindsay planting was on relatively fertile Exeter loam, stony phase, soil and required no supplementary fertilizer. The Corning planting was on Arbuckle gravelly loam, a much less fertile soil, and the trees were fertilized at intervals with nitrogen and potassium.

The smaller table on the next page shows the effect of the rootstock on tree growth after eight years for the three scion varieties in the Winters planting. Mission and Manzanillo trees on their own roots were generally much larger than grafted trees. All rootstocks used induced dwarfing, some to a greater degree than others. With Sevillano, on the other hand, trees on their own roots were intermediate in size. Several of the rootstocks used were invigorating, but others were dwarfing.

The larger table shows the effect of rootstock on tree size of the Sevillano scion variety in the Corning and Lindsay plantings after four years' growth. Sevillano on its own roots was, in both plantings, among the smallest trees. Most of the rootstocks used had an invigorating effect. The difference in tree growth between the two plantings must be accounted for by differences in soil characteristics, because the trees used in each planting were from the same lot of nursery stock and the climatic influences in each area are similar.

Mission and Manzanillo yields in the Winters plot were considerably greater for trees on their own roots—because of their greater size—than for trees grafted on other stocks. On the other hand, Sevillano trees on their own roots were not as big as many of the grafted trees but

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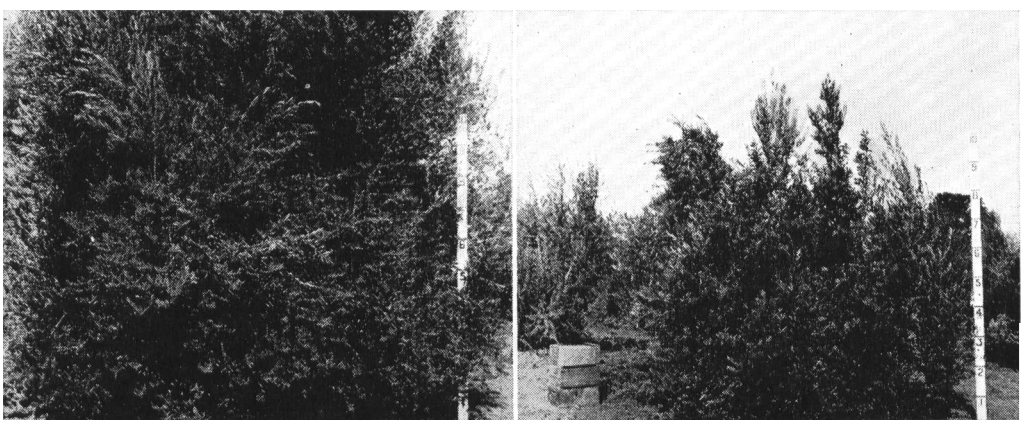
**An example of a dwarfing effect due to a seedling rootstock. *Left*—Own-rooted Mission tree. *Right*—Mission grafted on an Ascolano seedling rootstock. Both trees are nine years old. Measuring stick is 10′ tall.**



| | | | | | | |
|---|---|---|---|---|---|---|
| ..... 285 | 67 | 542 | 140 | 365 | 86 |
| cuttings ..... 376 | 50 | 251 | 85 | 202 | 31 |
| seedlings ..... 456 | 50 | 252 | 58 | ... | 20 |
| seedlings ..... 418 | 62 | 236 | 51 | 312 | 44 |
| seedhngs ..... 345 | 49 | 410 | 85 | 302 | 46 |
| seedlings ..... 369 | 51 | 374 | 72 | 243 | 40 |
| seedlings ..... 220 | 53 | 204 | 49 | 88 | 15 |
| seedlings ..... 184 | 30 | 184 | 44 | 112 | 36 |
| seedlings ..... 279 | 40 | 226 | 42 | 192 | 41 |
| seedlings ..... 341 | 21 | 260 | 49 | 266 | 31 |
| for significance at: | | | | | |
| -1% level .....269 | 34 | 168 | 41 | 149 | 39 |
| -5%level ..... 200 | 25 | 125 | 31 | 111 | 29 |

when used as rootstocks-proved to have a rather uniformly dwarfing influence on all three varieties, but much more so on Manzanillo than Mission or Sevillano. The clonal stock, Oblonga, had a pronounced dwarfing effect on Manzanillo and somewhat less on Mission, but an invigorating influence on Sevillano.

It is apparent that the behavior of each scion-rootstock combination must be tested individually. Any given influence of a rootstock on the vigor of one variety can not necessarily be expected to hold true for another scion variety.

In commercial olive production there are situations where either a dwarfing or an invigorating rootstock would be useful. In the Tulare County olive district especially, the trees are vigorous and tend to grow excessively tall, making picking difficult and slow, resulting in high harvesting costs. Under such conditions, a dwarfing stock would be of great benefit. Smaller trees, planted closely together, may give higher yields per acre and have much lower harvesting costs. On the other hand, in some areas it is often difficult to obtain adequate tree growth. In such cases, the use of invigorating rootstocks should prove to be very desirable.

Some individual seedlings used as rootstocks in the present study have shown dwarfing effects and some have had an invigorating influence. Cuttings taken from suckers arising from such selected seedling rootstocks have been rooted and grafted. Large-scale tests of such trees are now underway to determine if these stocks will have consistently dwarfing or invigorating effects so that they can be developed as clonal rootstocks for commercial use.

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## ASPARAGUS

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F-in addition to the rainfall-are given in the upper table on page 8. The intermediate irrigation treatment was considered to be about the amount of water growers would apply, while the wet plots probably received more water than is usually applied. The results as shown in the lower table and in the graph on page 8 indicated that both the intermediate and wet treatments had significantly higher yields than the dry plots. The difference in yield between the intermediate and wet plots was not significant at the 5% level but approached significance. The difference in mean weight per spear between the intermediate and wet plots was significant at the 5% level. However,