

Growth of Citrus Seedlings

effect of 2,4-D available to roots of seedlings varies with concentration and seedling variety

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Little is known regarding the effect of 2,4-D—and especially of a range of 2,4-D concentration—on the growth of the tops or of the rootstock of citrus trees, although considerable information is available as to the effect of 2,4-D when applied to citrus fruit and its effect on the retention by the tree of oil-soaked citrus leaves.

In any application of 2,4-D to the top of the tree, varying amounts eventually reach the soil. It is possible that access to such deposits may be made by shallow roots.

Because seedlings are used as rootstocks, a study was undertaken of the effect of 2,4-D on seedlings—which did not have the seed attached—of a number of the varieties commonly used as rootstocks.

In the studies it was shown that the percentage germination of Koethen sweet orange seed and the very early seedling growth—while the seed was still attached—were greatly benefited when minute concentrations of 2,4-D were present during the germination process. Whether 2,4-D would be effective in stimulating seedling growth once the seed was no longer attached remains to be tested.

The trees of many citrus orchards have declined in vigor over the years for no known reason, and serious efforts are now being made to rejuvenate such orchard trees. If the growth of the roots—rootstock—could be stimulated, there is a possibility that the top of the tree might also be benefited.

The varieties used and the sources of the seeds obtained from fruits gathered for study were: Tangelo, R21, T52, 1ABC; rough lemon, R1, T52, 1ABC; grapefruit, R4, T39, 1ABC; sweet orange—Indian orchard—R11, T44, 1ABC; and Cleopatra mandarin, R13, T50, 1ABC. These seeds were planted in the propagation chamber on March 6, 1952. The Pomeroy trifoliolate orange seed, R34, T53, 1ABC, was planted on January 9, 1952, and that of the sour orange—Spanish—R16, T9-11, 1ABC, was planted on February 20, 1952.

On April 14, 1953, the seedlings of the above varieties and of Troyer citrange, R34, T5, 1ABC, were planted in the soil cultures.

A nutrient solution was prepared by

using one and one-half times the usual concentration of stock solutions *A*, *B*, and *C* ordinarily used in making Hoagland's Solution. The content of minor elements in the culture solution was in parts per million—ppm—boron, .2; manganese, .2; zinc, .2; iron, .2; alumi-

num, .3; copper, .25; and molybdenum, .05. This nutrient solution was applied at various times in similar quantity to each culture, and frequently distilled water alone was added to take care of transpiration losses.

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Noninjurious and possibly some beneficial effect of applications of 2,4-D to the soil of Cleopatra mandarin and rough lemon seedling cultures. Left to right, 0, .005, .010, .015, .020, and .025 ppm of 2,4-D in two liters of nutrient solution applied three times during the experimental period—April 14 to August 12, 1953. At various times, the nutrient containing no 2,4-D was applied. Note the increasing foliage density in the rough lemon cultures with increasing 2,4-D concentrations.

Cleopatra Mandarin



Rough Lemon



Sour Orange



Sweet Orange



Growth of sour orange and sweet orange seedlings from April 14 to August 12, 1953, in soil cultures that received numerous applications of nutrient and on three occasions received two liters of nutrient containing—left to right—0, .005, .010, .015, .020, and .025 ppm of 2,4-D. Note the slight increase in vertical growth at the .005 and .010 ppm 2,4-D concentrations and the more dense growth with little or no increase in height at the three highest concentrations.

The effect—left to right—of three applications of 2,4-D—0, .005, .010, .015, .020, and .025 ppm in two liters of nutrient solution added to soil cultures of Tangelo and of grapefruit seedlings during the period from April 14 to August 12, 1953. At other times nutrient containing no 2,4-D was applied. In the Tangelo cultures, the seedling growth became more dense as the vertical growth was retarded. Note the retardation of growth in the grapefruit cultures without an appreciable increase in foliage density.

Tangelo



Grapefruit



SEEDLINGS

Continued from preceding page

Three seedlings of a given variety were used in each of six soil cultures. The soil cultures of citrus seedlings were grown from April 14 to August 12 in 1953. During this period, on three occasions—the 20th day of April, of May, and of June—2,4-D was added to the two liters of applied nutrient solution in an amount to give the following 2,4-D concentrations—in ppm—in the nutrient of each set of the six cultures: 0, .005, .010, .015, .020, and .025. These concentrations were purposely made quite high in order to note any depressing as well as any stimulating effect of the 2,4-D.

On August 12, 1953, the growth made by the seedlings was photographed. Apparently, the three applications of 2,4-D to the soil had no injurious, and possibly some beneficial, effect on the growth of the Cleopatra mandarin seedlings, whereas in the rough lemon cultures, the increase in 2,4-D concentration was accompanied by an increased foliage density.

The growth made by the sour orange and sweet orange cultures which received a treatment similar to that of the cultures for the rough lemon and Cleopatra mandarin exceeded the vertical growth of the controls which had no 2,4-D. However, with more concentrated 2,4-D solutions, the growth was of approximately the same height as that of the controls but noticeably more dense.

Increasing concentrations of 2,4-D depressed the vertical growth of the Tangelo seedlings but compensated for it by a more dense vegetative growth. However, the growth of the grapefruit seedlings appeared increasingly depressed as the concentration of 2,4-D was increased and showed practically no increase in foliage density.

Seedlings of the Pomeroy trifoliolate orange and Troyer citrange varieties showed practically no benefit from 2,4-D applications to the soil.

The results obtained with the eight sets of soil cultures of citrus seedlings of varieties commonly used as rootstocks give some indication that certain varieties of seedlings appear to be indifferent to the application of the concentrations of 2,4-D—used in this study—to the soil. The seedlings of some varieties are stimulated to greater vertical growth at low concentrations of 2,4-D, whereas at increased 2,4-D concentrations the absence of increased height growth was accompanied by an increased foliage density.

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