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2, 4-D TREATMENT OF AVOCADO PLANTS

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SUMMARY

The maintenance of a continuous state of health in avocado trees is one of the objectives essential in their fruit production. Whether organic chemicals can contribute or assist in the role that inorganic fertilizers play in promoting healthy growth in avocado trees is the problem dealt with in this study.

The growth of rooted leafy-twig cuttings of the Zutano (Mex.) avocado variety was greatly stimulated by the addition on only three occasions of very low concentrations of 2,4-D to the nutrient solution applied to the soil of such glasshouse cultures.

The growth of large out-of-door soil cultures of Carr Fuerte avocado trees budded on Caliente (Mex.) avocado rootstocks was greatly stimulated by the addition (on only three occasions of .005, .010, or .015 parts per million) of the acid form of 2,4-D to the nutrient solution applied to the soil.

The concentration of plant growth regulators in soils appears to bear some relation to the fertility of the soil.

A beginning has been made in the direct reconstituting of desirable highly productive avocado trees by the cleft-grafting of a leafy twig cutting into a piece of avocado root. Low concentrations of 2,4-D and of nutrient solutions, the use of plaster sand-peat mixture, continuous water vapor in the propagation chamber, reduced light intensity, bottom heat, and a good drainage are some of the factors being tested.

One of the important problems in avocado tree culture is to maintain a healthy root and top growth at all times. A step in this direction was taken when studies involving organic chemicals were conducted with avocado seedlings to each of which a large seed is attached. The addition of low concentrations of 2,4-D to the nutrient solution added to such soil cultures greatly stimulated the growth of the tops and roots. In these tests, it was possible that the action of the 2,4-D plant growth regulator was chiefly on the plant food stored in the seed and not a direct action on the root itself.

Leafy-twig cuttings of the Zutano (Mex.) avocado variety were rooted in the propagation chambers and when hardened, a rooted cutting was planted on April 14, 1953, in each two-gallon-capacity earthenware jar that was filled with soil and was provided with suitable drainage. The cultures were grown in the glasshouse and were similarly treated as regards distilled water or nutrient applications. The composition of the nutrient solution was: Ca, 239; Mg, 81; K, 276; Na, 11; Cl, 15; NO_3, 1078; SO_4, 324; and PO_4 158; Zn, Mn, B, and Fe, each .2; Al, 3; Cu, .25; and Mg, .05 parts per million,

respectively. On the 20th day of April, May, and June, respectively, various concentrations of the acid form of 2,4-D: O, .005, .010, .015, and .020, respectively, were added to the nutrient solution that was applied to the soil of the various cultures (Nos. 1 to 5 inclusive). In this test, 2,4-D was not applied to the leaves and the possible effects on fruit to be produced later were not given consideration.

On November 16, 1953, the cultures appeared as seen in figure 1. Culture No. 1 never received any 2,4-D and served as a control. Although culture Nos. 2 and 3 received, on three occasions, .005 and .010 ppm, respectively, of 2,4-D in their nutrient solution, their growth was not unlike that of the control culture No. 1. The growth stimulation in culture No. 4 was very pronounced as was also the slightly less striking growth made by culture No. 5. Three soil applications of 2,4-D concentrations of .015 and .020 ppm, respectively, apparently was responsible for the unmistakable growth improvement.

The somewhat diminished stimulation in culture No. 5 than in No. 4 indicates the extreme caution that should be exercised in not raising unduly the very low concentrations of 2,4-D used. With such intense vigor as shown in culture No. 4, it will be of interest to test the susceptibility of such roots to root rot and other attacks. The increased leaf development should better facilitate the removal of excess soil moisture which is associated with certain types of root injury.

Fig. 1. *Growth of rooted leaf-twig avocado cuttings of the Zutano (Mex.) variety in well-drained cultures of sandy loam soil that received similar nutrient solutions except that on three occasions the nutrient solutions contained various concentrations of the acid form of 2,4-D (0, .005, .010, .015, and .020 ppm, respectively). Cultures were grown from April 14, 1953, until photographed on November 16, 1953.*

It is noteworthy that the addition of a plant growth regulator to the soil has proven beneficial to the growth of the plant, for it is known that the concentration of auxins in soils bears a relation to the fertility of the soil. The decomposition of the organic matter in the fallen avocado leaves possibly assists in the formation of auxins or growth substances.

The test with rooted-leafy-twig avocado cuttings in the glasshouse was followed by an experiment with budded trees in several sets, each of four out-of-door soil cultures, only one of which will be reported at this time. Caliente (Mex.) avocado seedlings were

grown in small containers of soil until of a size suitable for budding. The buds used were of the Carr Fuerte variety obtained in the C.E.S. orchard at Riverside. The budded trees were grown with similar nutrient supplies and under lath for nearly a year. On February 16, 1953, the roots of the young trees were washed free of most of the adhering soil and one of the trees was planted in each of four soil cultures that consisted of sandy loam soil in galvanized iron containers 18 inches in diameter and 25 inches deep and provided with drainage. The nutrient solution employed was similar to that used in the experiment for the rooted Zutano (Mex.) leafy-twig cuttings in soil cultures. On three occasions (February 23, April 6, and May 20, 1953, respectively) the nutrient solution (nine liters) contained the following concentrations of the acid form of 2,4-D (see fig. 2) : D, O; C, .005; B, .010; and A, .015 parts per million, respectively. Figure 2 shows the marked improvement in growth of the Fuerte avocado trees on Caliente (Mex.) rootstock when very small additions of 2,4-D were made to the nutrient applied to the soil. It would appear that the concentration of plant growth regulators in soils bears a relation to the fertility of the soil.

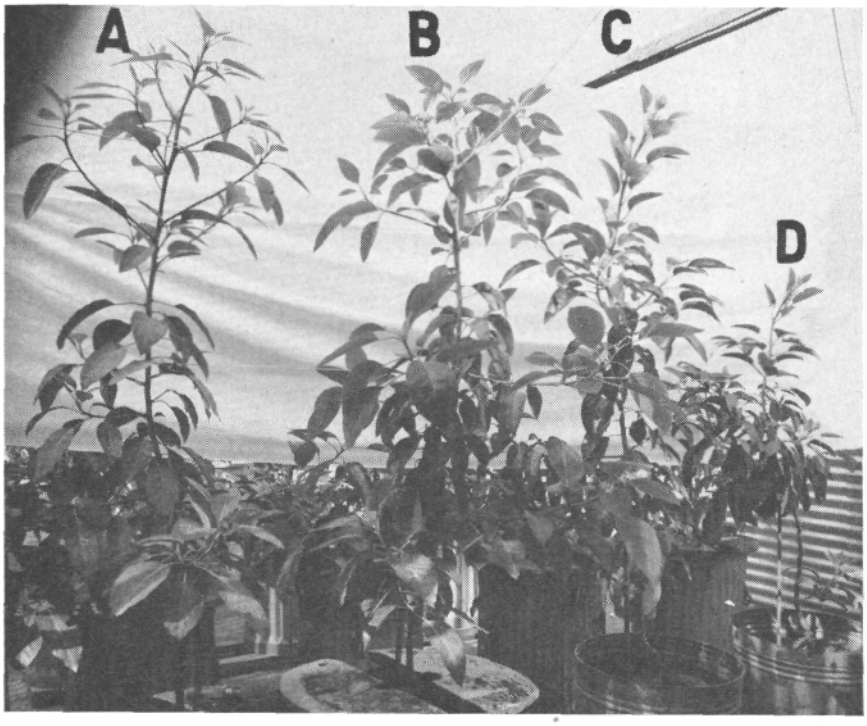

Fig. 2. *Improvement in the growth of Carr Fuerte avocado trees on Caliente (Mex.) rootstock when grown in large out-of-door soil cultures that received in the nine liters of nutrient solution applied to the soil on three occasions: D, 0; C, .005; B, .010; and A, .015 parts per million of 2,4-D, respectively. Trees planted in cultures February 16, 1953; photo November 16, 1953.*

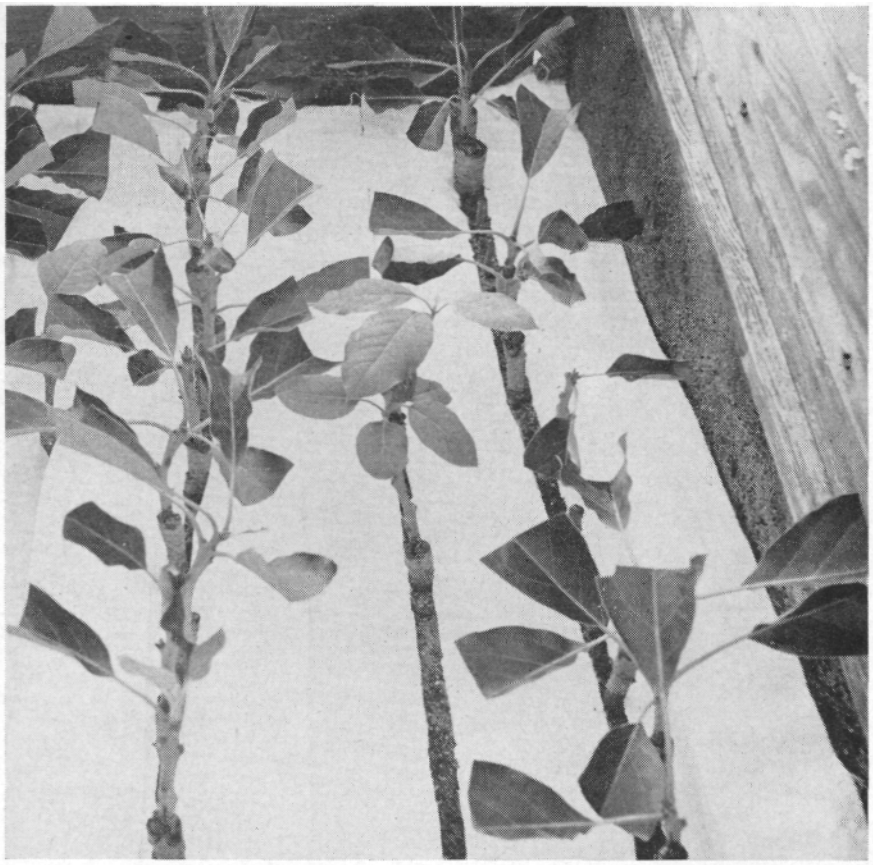

Fig. 3. *Shows efforts being made to reconstitute productive avocado trees. The propagation chamber has its cloth-covered-glass-frame removed to show the leafy-twig Fuerte avocado cuttings that are cleft-grafted into pieces of avocado root grown in a well-drianed half plaster sand-half peat mixture maintained at 65°F in the glasshouse with bottom heat. Collections of roots and leafy-twig cuttings are being made at monthly intervals. Nutrient solutions containing 2,4-D are sprinkled in low concentrations on the plants at intervals in order possibly to assist the cuttings in retaining their leaves and in stimulating plant growth and rooting. Water vapor in a continuous flow is now being maintained. White cloth was used to cover the soil for photographic purposes.*

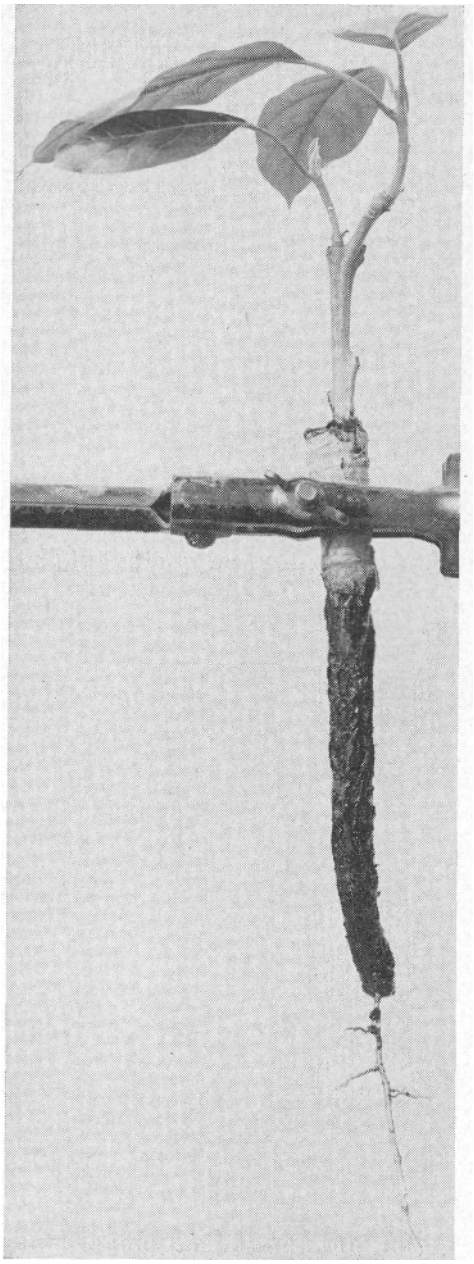

Fig. 4. *Progress of one of the grafted plants is shown in figure 3. The original leaves had just fallen prior to taking the photograph. This is the first plant of this kind from the propagation chambers and shows the presence of a root. 2,4-D and nutrient in low concentration, peat, and water vapor are being used in an effort to stimulate plant growth and to increase the retention of scion leaves.*

Low concentrations of 2,4-D are now being used in a preliminary way in grafting experiments in avocado plants. In avocado orchards, it has been shown by others that certain trees are responsible for the bulk of the fruit production and because of this, it is desirable that trees be grown that have the same root and top as these productive trees. For such tests, the propagation beds in the glasshouse consist of a mixture of half

plaster sand and half peat, maintained at 65 °F by bottom heat. The glass frames for enclosing the chambers were covered with thin cloth to reduce the light intensity.

In figure 3 are shown leafy-twig cuttings of Fuerte avocado trees wedge-grafted into pieces of avocado root. These grafted plants were occasionally sprinkled with a very dilute nutrient solution containing a low concentration of 2,4-D. Continuous vaporization of distilled water within the propagation chambers is also being tried in an effort aimed at further reducing the loss of scion leaves. Collections of roots are being made at various times in order to note whether their condition or state of physiological activity influences their grafting behavior. Others have reproduced avocado trees by means of tedious indirect methods and these tests are designed to explore other means. Varying success has thus far lent encouragement and in figure 4 is shown the first of these reconstituted avocado trees grown in this manner. The use of low concentrations of nutrient, saturation of the propagation chamber with water vapor, excellent drainage, and the acid and other properties of peat in the plaster sand-peat mixture, it is believed, should prove helpful, whereas the use of low concentrations of 2,4-D should assist in the retention of the leaves and in promoting growth.