2,4-D Treated Avocado Plants

plant growth regulator improved the vegetative growth in greenhouse tests with sand cultures

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In avocado tree culture, one of the important problems 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 was attached.

Low concentrations of 2,4-D in the nutrient solution added to the soil cultures greatly stimulated the growth of the tops and the 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—Mexican—avocado variety were rooted in the propagation chambers and when hardened, a rooted cutting was planted on April 14, 1953, in each of five two-gallon-capacity earthenware jars filled with soil and provided with suitable drainage.

The five cultures were grown in the glasshouse and were similarly treated as regards distilled water or nutrient applications. The composition of the nutrient solution in parts per million—ppm—was calcium, 239; magnesium, 81; potassium, 276; sodium, 11; chlorine, 15; nitrate, 1,078; sulfate, 324; phosphate, 158; zinc, 0.2; manganese, 0.2; boron, 0.2; iron, 0.2; aluminum, 3; copper, 0.25; and molybdenum, .05. On the 20th day of April, of May, and of June, various concentrations of the acid form of 2,4-D—0, .005, .010, .015, and .020—were added to the nutrient solution that was applied to the soil of the various cultures. 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 shown in the illustration at the bottom of this page. Culture No. *1* never received any 2,4-D and served as a control. On three occasions culture No. *2* received .005 ppm of 2,4-D and No. *3*, .010 ppm of 2,4-D in their nutrient solution, but 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—.015 ppm to No. *4* and .020 ppm to No. *5*—apparently were responsible for the unmistakable growth improvement.

The somewhat more 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.

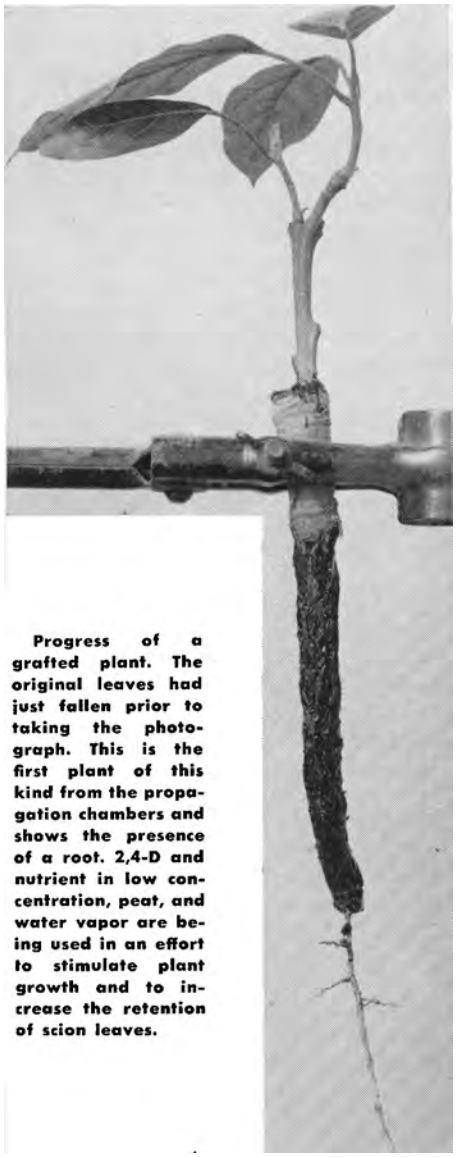
With such intense vigor as shown in culture No. *4*, it may be informative to test the susceptibility of such roots to root rot and other attacks. The increased leaf development should better facilitate the removal of excess soil moisture which is associated with certain types of root injury.

The addition of a plant growth regulator to the soil has proven beneficial to the growth of a plant, because the concentration of auxins—growth substances—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.

Outdoor Tests

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. In one set, Caliente—Mexican—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 and the budded trees

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.



Progress of a grafted plant. 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.

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-drained half plaster sand-half peat mixture maintained at 65° F in the glasshouse with bottom heat.

were grown—with similar nutrient supplies—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. One of the trees was planted in each of four soil cultures that consisted of sandy loam soil in galvanized iron containers—18″ in diameter, 25″ deep and provided with drainage.

The nutrient solution employed was similar to that used in the experiment for the rooted Zutano leafy-twig cuttings in soil cultures. On three occasions—February 23, April 6, and May 20, 1953, the nutrient solution of nine liters for each culture—except *A*, which served as the check—contained concentrations of the acid form of 2,4-D. On those dates .005 ppm of 2,4-D was added to *B*; .010 ppm to *C* and .015 ppm to *D*.

The picture at the lower right on this page shows the marked improvement in growth of the Fuerte avocado trees on Caliente 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.

Grafting Experiments

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 other research workers that certain trees are responsible for the bulk of the fruit production. Therefore, it is desirable that all the trees in an orchard have the same root and top growth as the productive trees. For tests toward that objective, the experimental 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.

The upper right picture on this page shows 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 con-

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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: *A*, 0; *B*, .005; *C*, .010; and *D*, .015 parts per million of 2,4-D, respectively. Trees planted in cultures February 16, 1953; photographed November 16, 1953.

Cherry Fruit Sawfly

DDT or lindane in pre-bloom spray controls pest on cherries, plums

R. M. Bohart

New methods of control—with DDT or lindane—have reduced the threat of crop loss in cherries and plums from the cherry fruit sawfly—*Hoplocampa cookei* (Clarke).

Damage to green fruit by this inconspicuous wasp has been a yearly occurrence in certain areas of central and northern California. Occasionally the pest has assumed epidemic proportions and during the worst years growers have had most of the fruit of some varieties destroyed and have not attempted to harvest the remainder.

The responsible insect has been frequently confused by ranchers with the cherry fruitfly because of the similarity in common names. However, the true fruitfly is not a pest of commercial orchards in California. The cherry fruit sawfly is more closely related to another cherry pest—the pear and cherry slug—but does its damage to the fruit rather than to the leaves.

The seasonal cycle of the insect is tied in closely with that of the host fruit trees. Adult sawflies emerge from cells in the ground in late February or early March, timing their appearance to coincide with the early, popcorn stage of the Chapman variety of cherry.

The female sawfly is mostly black, rather stout, and about one-half the size of the common housefly. The male is somewhat smaller and largely light reddish brown. On sunny days both sexes can be observed in open flowers or buzzing about the topmost branches of cherries and plums. During cold or cloudy weather the wasps cling to the trunk or hide in the grass beneath the tree. After mating, the female wasp inserts her eggs into the calyx tissue of the popcorn flower. No eggs are laid after the sepals turn down and the flower opens. This fact has an important bearing on control and for greatest efficiency sprays should be applied during the popcorn stage before the sawflies have laid their eggs.

Characteristic entrance and exit holes of a cherry fruit sawfly larva which has progressively attacked the three cherries of a fruit cluster. The seed has just begun to harden in the largest cherry and the mature sawfly larva is about to emerge.

The egg hatches in four to five days and the newly emerged larva bores into the young fruit which it quickly hollows out. A few days later it molts and crawls forth to seek another fruit. After making a small characteristic entrance hole it bores to the center and destroys the soft developing seed. Generally, a single larva will attack three fruits over a period of about three weeks, all before the seeds harden. The full-grown larva leaves the green fruit and drops to the ground. Here it quickly works its way a few inches below the surface and forms a papery cocoon. The species is single-brooded and the larva rests quietly in its cocoon during summer, fall, and winter, until early February at which time it pupates and transforms to an adult.

The egg-laying female lives for several weeks and will move from tree to tree and variety to variety in order to find flowers of the right maturity. Thus an early infestation of Chapman trees in an orchard of mixed cherry varieties indicates that Black Tartarian, Napoleon, Bing, and other varieties will be infested in turn as they come into flower.

Recorded distribution of the cherry sawfly includes orchards in Contra Costa, Napa, Solano, Yolo, Nevada, and El Dorado counties but injury has been most frequent and serious in Solano County.

The most characteristic symptom of cherry fruit sawfly presence is the small, rounded entrance hole in the green fruit. When such a fruit is cut open, the whitish, C-shaped larva can usually be found near the center. If only the ripe or nearly ripe fruit is examined, the larva will not be found and most of all of the previously infested green fruit will have dropped from the tree. In orchards with a history of sawfly damage, the farmer may be able to spot the adults in flowers. Also, he may observe them buzzing about the upper branches of trees just coming into bloom.

Control is best accomplished by using a DDT spray—two pounds of 50% wettable to 100 gallons—applied when most of the flower buds are in the pre-bloom stage. The branches, trunk, and ground area near the trunk should be wet with the spray. Two to five gallons per tree may be necessary. Lindane may be substituted with nearly as good results. When spraying is delayed until after petal fall, some control will be obtained but a certain proportion of the fruit will already be damaged.

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centration 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 to note whether their condition or state of physiological activity influences their grafting behavior. Other workers 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.

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 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.

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