

Propagation of the Fuerte Avocado by Means of Leafy-Twig Cuttings

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Recently Eggers and Halma (Calif. Avocado Association Yearbook 1936, pp. 63-66) have succeeded in rooting stem cuttings of two-year old Mexican nursery seedlings but were unable to root similar material of the Fuerte variety. They have made a forward step in the propagation of subtropical trees because the propagation of the avocado by means of stem cuttings has not been considered feasible.

The recent advances in propagation by the application of auxins or growth promoting substances to stem cuttings has caused many an investigator to suddenly become extremely enthusiastic about the possibilities in applying these chemical substances to avocado cuttings, especially those of the Fuerte variety. None, however, have as yet reported results.

In the present studies stem cuttings of the Fuerte variety were used in early December, 1936, and in February, 1937. They were obtained from trees grown very close to the glass house and no precautions were taken to cut or to keep the cut surfaces of the cuttings under water. The cuttings usually were taken from the mature tips of shoots and were 6 to 12 inches in length, each bearing 3 to 5 mature leaves.

COMPOSITION OF SOLUTION

The chemical substances, *a*-naphthaleneacetic acid, and indole-3-acetic acid were used in several concentrations (.25, .50 and 1 per cent) dissolved in lanolin which was rubbed with the fingers on various or all portions of the cuttings. Pronounced callus formation resulted at the cut surfaces. At the high strengths the cuttings showed injury while at the lowest strength no benefit was apparent. A solution of indole-3-acetic acid of .05 per cent strength was used in which to place cuttings for a varying number of hours. The chemical substance soon undergoes changes when in solution and especially in contact with plants. All treated cuttings, except those at the shortest exposure, soon showed injury. Again no benefit was observed, because equally good callus production was obtained with untreated control cuttings placed directly into the plaster sand in the propagation chamber. It is possible that a chemical substance obtained from avocado roots or a more specific chemical substance for avocado than the common growth-promoting substances may be of value in producing roots. It is usually assumed that growth-promoting substances assist in the rooting process particularly when rooting normally takes place to a small degree but that they are of little, if any, value when cuttings normally fail to root at all.

Figure 1 shows the marked callus formation at the cut surfaces and the absence of root

formation in control or chemically treated leafy-twig cuttings of the Fuerte variety. In the larger of the two cuttings a new cycle of growth was produced in the top but this additional top growth showed no apparent effect on the portion of the stem below the soil. Many cuttings like these were transferred to containers filled with pure silica sand, cutting sand, or soil in moist rooting chambers while others were left in the plaster sand of the propagation frame. A nutrient solution occasionally was sprinkled over the cuttings to assist in the processes of growth but none of the cuttings rooted, even though callus formation was abundant in all cuttings.

Roots of seedling avocados of the Mexicola variety were macerated with water in a mortar and leafy-twig cuttings were allowed to stand for various periods in different concentrations of the filtered water extract of the roots in order to absorb available root-forming substances. The cuttings were then placed with suitable control cuttings in the propagation chamber. Injury became evident near the cut portion of the twigs and no roots were formed. It is possible that root forming substance may not have been brought into solution or was soluble in excessive concentration, at any rate the juice extracted from the roots was toxic. The effect of dilution of this extract was not studied. It is known for certain plants that the juice of the plant may be toxic to the growth of the plant even though nontoxic within the tissues before being extracted.

Cuttings were also grown in which an upward cut was made at the basal end of the twig. In some cuttings the cut portions were bound together while in others they were kept apart. In every case there was a callus formed but no roots.

It was at this point that the writer tested out an idea gained from the former close association with Doctor F. F. Halma in the Department of Plant Physiology at the Citrus Experiment Station. Doctor Halma was propagating cuttings obtained from promising rootstocks for the purpose of identifying and growing such cuttings for studies on the rootstock problem.

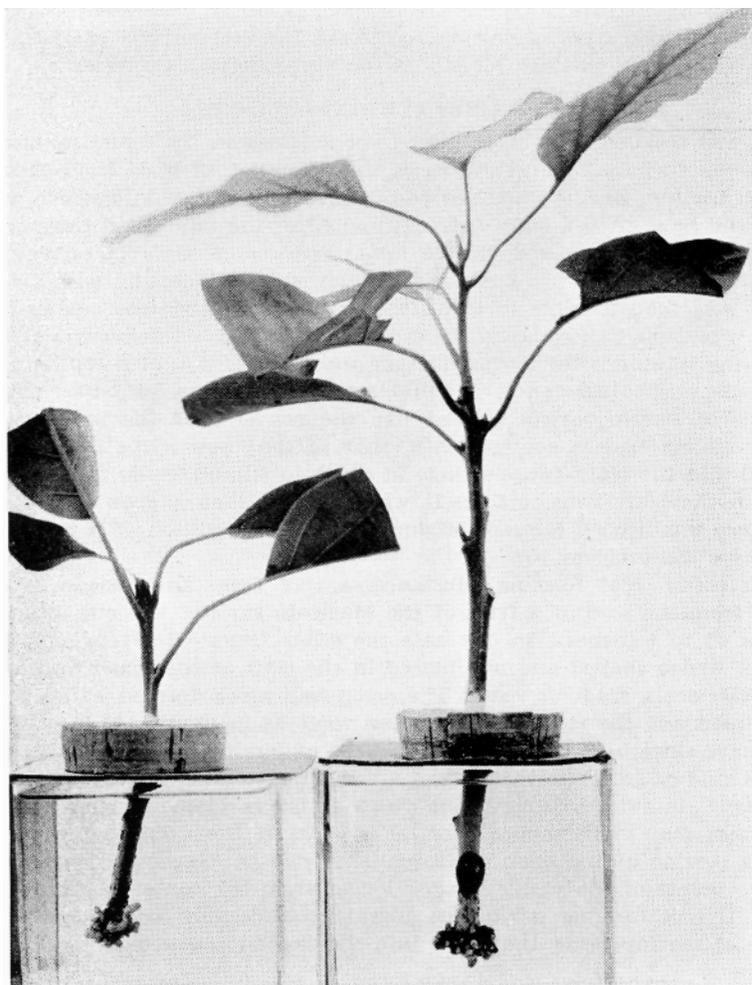


Fig. 1.—Chemically treated or control leafy-twig cuttings of the Fuerte variety of avocado showing the callus formation and absence of roots when grown in a propagation chamber at 28°-30°C. The cutting on the right produced a new cycle of top growth but no roots.

TOPS GRAFTED ONTO ROOTS

It was recalled that in planting root cuttings in the usual manner he was unable to induce in certain cases the formation of buds from which to develop the top. He then planned additional root cuttings into which at the upper end he grafted a leafy-twig cutting. After the union had taken place, adventitious buds occurred on the upper portion of the root cutting and then the grafted top was cut away, leaving the root cutting with its own top. It was then possible to identify the variety of the root cutting.

It is possible to assume in this case that what was needed was a growth-promoting substance for top production and the addition of a top helped to supply the needed substance. The problem of rooting the leafy-twig avocado cuttings of Fuerte variety seemed like the converse of the problem that Doctor Halma had to contend with, that is, that now a root ought to be grafted into the leafy-twig cuttings in order to stimulate the production of roots in the leafy-twig cutting. It was assumed that a growth-promoting substance was needed for root production and the addition of a root might help solve

the problem.

To obtain root forming substance, a root from an avocado seedling grown from the seed of a fruit of the Mexicola variety, was cut into short lengths (3 to 4 inches). In one case the scion (Fuerte leafy-twig cutting) was cut wedge shaped and was placed in the cleft at the upper end of the stock (Mexicola seedling root). The scion and stock formed callus and a good union and the stock produced new roots as in figure 2A. Most of the roots have since been cut away in the hope of forcing roots from the scion. In this kind of graft the root was of much larger diameter than that of the scion twig. In future studies scion twigs of larger diameter than those of the stocks may offer greater promise because of the overhanging or protruding portion of the scion. This condition can be exaggerated by making the two points of the wedge (scion) longer than the center portion of the wedge. If root forming substances migrate considerably, they then have a chance of moving below the union into the two blind overhanging edges of the wedge.

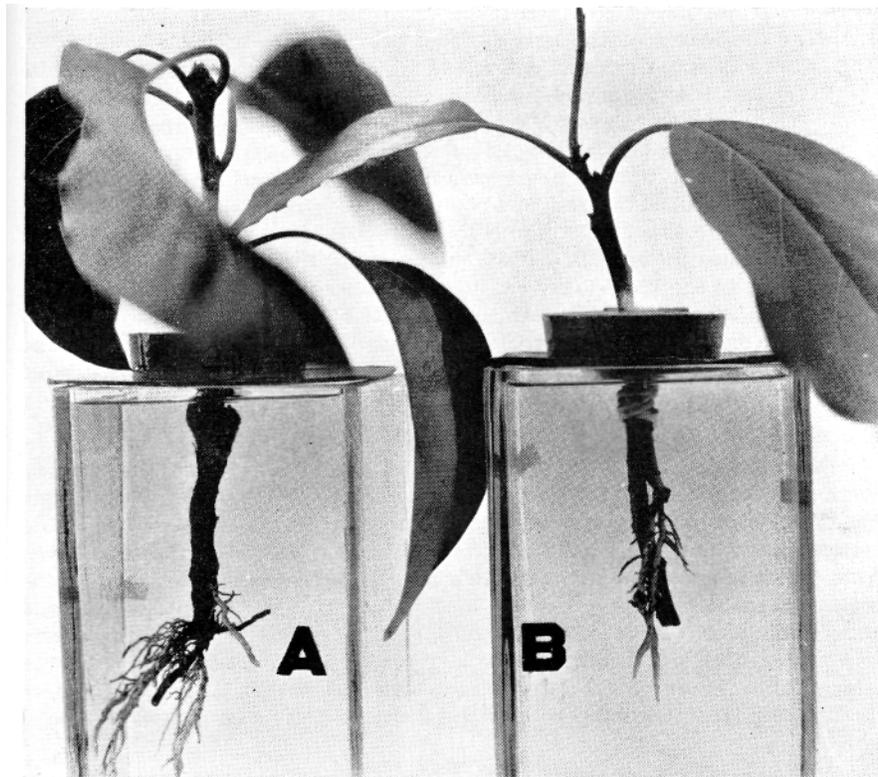


Fig. 2. Leafy-twig cuttings of Fuerte avocado: A, cleft-grafted on a piece of root of a young Mexicola seedling tree, with the root (stock) portion of larger diameter and without overhanging edges of the scion wedge. B, whip or tongue grafted to a similar root of small diameter, with the union poorly developed and with roots present at the protruding end of the scion. The stock was readily pulled away from the scion at this stage.

FUERTE TOP IS ROOTED

In figure 2B is shown the successful rooting of a leafy-twig cutting of the Fuerte variety after having made use of all the preliminary studies. In early December, 1936, a short piece of root of a young Mexicola seedling avocado tree as stock was whip or tongue

grafted and bound with raffia with a leafy-twig avocado of the Fuerte variety as scion. The one end of the cut scion protruded somewhat beyond and below the cut in the somewhat smaller diameter stock. The grafted plant was then placed in plaster sand in the propagation chamber so that the entire stock and the lower portion of the scion were below the surface of the sand. The light was at first reduced with cheesecloth. The humidity was kept high at all times.

In March, 1937, only a small portion of the stock remained alive and this at the junction with the scion. Roots were present on the projecting end of the scion. The stock was easily separated from the scion and the rooted scion was placed in an aerated culture solution in subdued light because the cutting was not hardened when taken from the propagation chamber. In a few days the leaves of the new cycle of growth were of considerable size, while the roots were thick and white, and about four inches or more in length. From this it is suggested that saddle grafts be made in which the base of the scion is split in the middle and is placed on a wedge-shaped stock and is bound as high as possible on the scion, thus leaving overhanging bases of the scion. Likewise approach grafts are suggested in which the stock and scion are both cut slant and are bound together near the top of the cut, thus leaving the lower end of the scion free. In this way as root-forming substances move up and then down in the scion, they have the opportunity of collecting in the blind lower end of the scion and when the concentration becomes sufficiently great, cause the formation of the roots. These results represent a beginning in the rooting of cuttings of the Fuerte variety and further studies may simplify a field which up to the present has offered much difficulty.

SUCCESS IN FEBRUARY

Considerable success has since been had in rooting untreated leafy-twig cuttings of the Fuerte variety. Large tip cuttings were used: approximately 3/8 inch in diameter at the base, 9 to 10 inches in length and bearing 6 to 8 leaves from which the tip halves were cut away. The cuttings were taken from the trees about the middle of February and were planted in sand in the rooting chamber to a depth of 3 to 4 inches and were kept in a humid atmosphere at 80° F. By May 1 of the same year, many of the cuttings were well rooted. Cuttings taken in February rooted better than those taken in late autumn. Many of the late autumn cuttings rooted but required more time in the rooting chamber than those cut in February.