

AN APPROACH TO THE EVALUATION OF AVOCADO ROOTSTOCK VARIABILITY

F. F. Halma and E. F. Frolich

*Professor of Subtropical Horticulture, and Laboratory Technician,
Subtropical Horticulture, University of California.*

SUMMARY

1. A method by which a limited number of cuttings can be obtained from very young avocado seedlings is described and also discussed in relation to its application to rootstock research.

2. A method, less limited in scope and already reported on by the junior author, is briefly discussed.

An unavoidable shortcoming of avocado rootstock research is the use of seedlings as rootstocks. Avocados do not reproduce true from seed, hence, in effect, every budded or grafted tree is on a different variety. Whatever these differences in seedling rootstocks may be, and to what extent they affect the scion variety, is difficult to determine. Soil variability and other orchard conditions which cannot be controlled complicate the problem. However, the use of cuttings would eliminate or minimize the genetic variability in root-stocks.

Investigation by Eggers and Halma (1) in 1937 showed that cuttings from mature Mexican trees could be rooted, but the percentage was generally low and variable. Guatemalan failed to root and Fuerte, a so-called hybrid, gave very poor results. However, cuttings from very young seedlings (if Mexican and Guatemalan rooted very well. Of course such cuttings are of questionable value as rootstocks because nothing is known of the parent seedling.

Nevertheless this finding was applied in the present investigation, the primary purpose of which was to find out how many cuttings can be obtained from individual seedlings, and secondly, to study growth variability and subsequent effect on the scion, provided a sufficient number of progeny of individual seedlings can be obtained.

The following experiment was set up in 1950. Twenty-five seeds of each of 4 Guatemalan varieties—Anaheim, Dickinson, Itzamna, and Nabal— and 4 Mexican varieties—Blake, Mexicola, Northrop, and Topa Topa— were planted in sand and placed in a glasshouse to hasten germination and to insure rapid growth. Five to 7 seedlings of each variety, selected at random, were used as mother plants (Fig. 1).

Table 1

Number of rooted cuttings per seedling and relative weight of seed
in grams

Variety	Parent #	Number of cuttings	Seed wt.	Variety	Parent #	Number of cuttings	Seed wt.
Anaheim	1	15	70	Topa Topa	1	9	30
	2	14			2	7	
	3	16			3	13	
	4	18			4	13	
	5	15			5	10	
	6	11			6	9	
	Aver.	14.8			Aver.	10.0	
Nabal	1	8	47	Mexicola	1	8	18
	2	10			2	10	
	3	11			3	11	
	4	7			4	8	
	5	10			5	9	
	Aver.	9.2			Aver.	9.3	
Dickinson	1	12	31	Northrop	1	11	24
	2	8			2	9	
	3	6			3	12	
	4	5			4	10	
	5	8			5	10	
	6	8			6	7	
Aver.	7.8	Aver.	8.6				
Itzamna	1	7	41	Blake	1	8	22
	2	10			2	11	
	3	8			3	12	
	4	7			4	8	
	5	2			5	2	
	Aver.	6.8			Aver.	7.7	



Fig. 1. *Seedlings were in this growth stage when first lot of cuttings were taken.* (Photograph by C. P. North)



Fig. 2. *Parent seedlings after two or three lots of cuttings had been taken.* (Photograph by C. P. North)

The first cuttings were taken when the seedlings were about 6 inches high. Only one cutting, about 3 inches long, was obtainable because there were then no laterals. The removal of the growing point resulted in the production of laterals which furnished the second lot of cuttings. This procedure was continued until it appeared that the mother plant was no longer able to regenerate new suitable material (Fig. 2). It should be mentioned here that some of the parent plants died as a result of this operation but that most of those that survived eventually developed into sturdy plants.

1

The cuttings, all succulent with leaves intact, were rooted in vermiculite in a covered propagating box located inside a glasshouse. High humidity was maintained to prevent wilting. Practically 100 % rooted within a few weeks. Fig. 3 shows a typical root system.



Fig. 3. *Rooted cutting.* (Photograph by C. P. North)

Two to 5 lots of cuttings were obtained from each seedling, and, as table 1 shows, the total number of rooted cuttings from seedlings of each variety varied. Also shown is the relative weight of seed for each variety to indicate that seed size was not related to the number of cuttings yielded during the five-month period. For example, Nabal and Mexicola yielded the same number of cuttings, although the seed of the former weighed about 47 grams and the latter only 18 grams.

The rooted cuttings were first planted in 3-inch pots and later transferred to larger paper pots and placed in a lathhouse. Figure 5 shows representative plants about 18 months after the cuttings were removed from the mother plants. Of interest is the fact that the growth rate was about the same for Guatemalan and Mexican varieties, although seedlings of the same Guatemalan varieties grow faster than Mexican, at least for the first year.

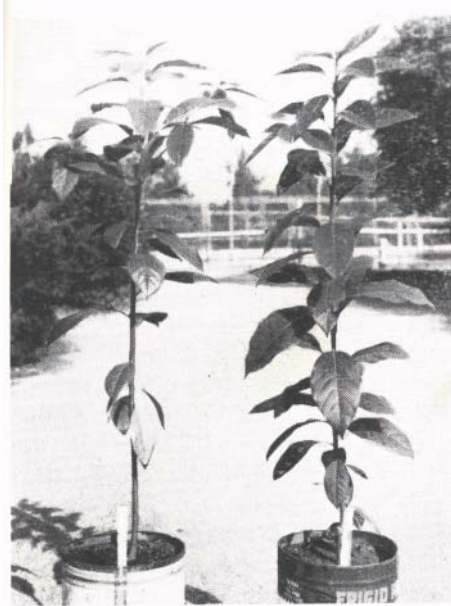


Fig. 4. *Left—Mexicola cutting about 18 months old. Right—parent seedling.*



Fig. 5. *Cuttings about 8 months old rooted by the method described by Frolich. Left—Anaheim; Right—Dickinson.*

Another observation of interest is that the response to rooting was most pronounced for the first two lots. The third and fourth lots did not root as rapidly as the first and second.

Most of the cuttings were planted in 2 plots during May and June 1952. The remaining ones were transferred to 3-gallon cans and kept in reserve. They were from 18 to 22 months old from the time of their removal from the propagating frame. One plot is located at the Citrus Experiment Station, Riverside, in cooperation with G. A. Zentmyer,

and one in the Santa Barbara County Hospital grounds, in cooperation with (Farm Advisor G. E. Goodall. It should be remarked here that the original plan of making a single planting in order to have a greater number of progeny under similar conditions did not materialize because a large enough area suitable for this purpose could not be found. The Riverside plot consisted of 59 Guatemalan and 60 Mexican cuttings averaging 3 for each of 40 parents. The Santa Barbara planting included 71 Guatemalan and 114 Mexican, averaging 4 for each of 36 parents. In addition 28 parent plants were planted.

The present plan is to allow the trees to develop undisturbed for at least two years, in order to obtain information concerning variability. The Riverside plot is then to be used for disease inoculation experiments and the Santa Barbara trees for top-working to a commercial variety.

In concluding the report on this investigation, it should be emphasized that this method of propagating rootstocks has no practical application. It merely furnishes genetically uniform material which is essential in obtaining information concerning the range of variability among seedlings used as rootstock. It may also be used in testing relative disease susceptibility and in procuring several progeny of hybrid seedlings as insurance against loss of the mother plant. If more glasshouse space were available, more parent seedlings could be used. It would then be possible to obtain more parents yielding at least ten or more rooted cuttings.

A method less limited in scope and offering greater possibilities in rootstock research than the one just reported on, should be mentioned. It has recently been developed and published by Frolich (2). Essentially it consists of obtaining rooted cuttings from stems, the bases of which have at no time been exposed to light, that is, roots will develop more readily in tissue in which chlorophyll formation is prevented. There are other necessary conditions that have to be met which are described in the report, hence need not be repeated here.

The principal advantage of this method lies in the fact that rooted cuttings can be obtained in any numbers from mature trees of standard varieties. Frolich mentions only three Guatemalan varieties, but since then cuttings of several additional varieties and several species of *Persea* have been rooted. The percentages in all cases have been very high, probably averaging 90 percent. However, it should be mentioned that the rooted cuttings require greater care after their removal from the parent plant than cuttings obtained from young seedlings. Figure 4 shows an 8-month-old cutting obtained by this method. Several of them have been planted in rootstock plots for comparison with budded trees on various stock varieties. With adequate glasshouse space a sufficient number of rooted cuttings could be obtained for use as rootstocks in test plots. This would eliminate or minimize variability due to the genetic factor in rootstock trials.

LITERATURE CITED

1. Eggers, E. R., and F. F. Halma. *Rooting avocado cuttings. Calif. Avocado Assn. Yearbook 1937: 121-125.*
2. Frolich, E. F. *Rooting Guatemalan avocado cuttings. Calif. Avocado Society Yearbook 1951: 136-138.*