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AVOCADO SEEDLING RESPONSE TO IRRIGATION AND FERTILIZATION ON SOIL FROM THE SOUTH COAST FIELD STATION

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Experimental evidence of the response of avocado trees to varying irrigation practices' has been reported in earlier volumes of the California Avocado Society Yearbook. Progress reports in 1958 and 1960 gave results from a one-acre planting of Hass avocado on the Citrus Research Center and Agricultural Experiment Station grounds at Riverside. The most conclusive result coming from this experiment is that growth rates and vigor of avocado trees are greatly reduced when irrigation water is withheld until soil water conditions reach the 10-bar level at a one-foot depth in the root zone. (Soil suction at 10 bars is measured using electrical resistance blocks which have been suitably calibrated to indicate the same index as measured with tensiometers hut for a larger range of values.)

During 1958, when a moderate amount of rain fell during the spring months, the soil water did not reach the level to require irrigation at 10 bars until late May. During that year, the trees under this dry treatment produced approximately 50 pounds of fruit per tree. During 1959 and I960, however, very little effective rainfall occurred even during the winter months. The trees were under the influence of the 10-bar irrigation treatment during most of the year. Only 8 pounds of fruit per tree were picked in 1959 and essentially none in 1960. The trees under this 10-bar treatment were so lacking in vigor and showed such excessive symptoms of sunburn and possible minor nutrient deficiencies (zinc primarily), that the treatment was changed to a 5-bar level.

These plots at the Riverside Campus, which were originally started with support from research funds of the California Avocado Society, have shown conclusively the response of avocado trees when soil water is limiting before each irrigation. The response to other irrigation treatments being carried out have not been conclusive. Trees being irrigated when soil suction reaches ^-bar, corresponding to a reading of 50 on a tensiometer, show somewhat better growth and fruit production than trees under a 1-bar treatment. The difference is not statistically significant. Because of the great differences occurring in avocado trees under any given treatment, it is difficult to measure small differences resulting from management practices.

South Coast Field Station Avocado Planting

A further study of the effects of irrigation and fertilizer practices on avocados is being undertaken on a seven-acre planting at the South Coast Field Station. This station near Tustin is a research facility provided by the University of California and is located in a climatic zone favorable for avocado production. Bacon trees on Ganter rootstock were grown for this planting. In an attempt to find a way to reduce the tree variability, half of the trees to be harvested for yield studies were grown on rooted cuttings from Ganter trees. E. F. Frolich supplied the information that cuttings from the Ganter variety could be rooted as readily as any variety. Cuttings were taken from large trees on the UCLA campus. P. W. Moore planned the handling of cuttings which were set in vermiculite under a rnist spray until rooting occurred, then transferred to one-gallon sized soil containers.

The usual nursery practice was used to grow the seedling rootstocks for guard row trees and for half of the yield trees. G. E. Goodall supplied the Ganter seed from the Santa Barbara County plots at Goleta. Dr. J. M. Wallace indexed the seed trees for sunblotch virus. M. K. Harjung tip-grafted the trees with budwood made available by H. T. Walker. All of the work of growing the trees was carried out on benches with steam-sterilized soil in order to avoid an introduction of avocado root diseases to the soil at the South Coast Field Station.

The young trees were set out in the field in June and August of 1958. The two planting dates were necessary. It required approximately one year longer to produce the trees grown on rooted cuttings compared to the seedling rootstock. As yet, no valid evaluation of a comparison of the two types of rootstocks can be made. General observations at planting time indicated that the trees on rooted cuttings had a wider range of size and vigor than a comparable group of trees on seedling rootstock. A rating of the trees made in November, 1960, is given in Table 1. The dead trees were more often the smaller ones at planting time. A more severe rouging of trees for planting or holding the trees for greater size before planting seems necessary for the trees on rooted cuttings.

Table 1. Growth rating made November, 1960 of Bacon avocado trees set out in June and August, 1958

Rootstock	Dead	Survival Questionable	Small, but growing	Adequate to large	Total
Seedling	5	11	211	453	680
Rooted Cutting	31	19	120	118	288

Response of Ganter Seedlings to Irrigation and Fe Fertilization

In advance of specifying the irrigation and fertilization treatment on the plots of the South Coast Field Station, a preliminary greenhouse trial was carried out using .soil from the plot area. Soil from between Rows 22 and 23 (Field 4) was transported to Riverside, passed through a '/2-inch screen, mixed, and placed in glazed ceramic pots. The soil containers were approximately 10 inches in diameter by 9 inches deep. A layer of sand deep enough to cover a drain hole in one .side at the bottom of each container

was provided.

Ganter seeds from the Santa Barbara County plots were planted directly in the .soil in September, 1959. Three seeds per pot were set and later thinned to a single seedling. A dial-type tensiometer was installed to indicate soil suction at an average depth of 6 inches near the center of each pot. A total of 24 plants were grown.

Differential irrigation treatments were started in February, 1960, when the plants were approximately one foot high. The treatments were carried out through June. Table 2 gives a description of the treatments, the average number of irrigations, and amounts of water to maintain the treatments.

Table 2. Irrigation treatments and average number of irrigations and amounts *of water to maintain the treatments from February 1 through June*

Treatment	Tensiom'tr. read. prior to irrig.	Avg. No of irrigations	Avg. amount water used in surface inches
Wet	15 centibars	35	27
Medium	40 centibars	22	23
Dry	80 centibars	15	21

Iron chlorosis is sometimes observed on plants grown in certain soils where irrigation management maintains soil water in excess. A possible interaction between irrigation treatment and iron nutrition was investigated by applying 3¼ grams of iron chelate (Chel 138 Fe, Geigy Co.) to four of the soil containers under each of the irrigation treatments. The treatment amounted to 25 ppm of Fe. The material was added to the soil on March 24, 1960. An evaluation of the leaf symptoms and the results of a chemical analysis of leaves picked on July 14, are given in Table 3. Also, the average growth records of the avocado seedlings in response to the various treatments are given in the last column of Table 3. A small decrease in vegetative growth is indicated as a result of allowing soil suction to reach 80 before each irrigation. While good correlation is shown between the observed leaf symptoms and the iron content of the leaves, the deficiency symptoms on plants receiving no iron chelate were not sufficiently severe to reflect in the growth of the plants. The wet irrigation treatment was not sufficiently extreme to result in the severe iron chlorosis sometimes observed under field conditions.

Table 3. Response of Ganter seedlings to irrigation and iron chelate treatments in terms of observed leaf symptoms, iron content of leaves, and seedling growth.

Irrigation Treatment	Iron Chelate	Leaf Ratings†	Iron content of leaves, ppm	Avg. Growth, inches
Wet	+	1.0	48	22.2
	—	2.2	24	23.7
Medium	+	1.0	53	24.3
	—	3.5	22	22.6
Dry	+	1.0	62	18.7
	—	2.8	29	15.6

† Leaf symptoms of tip burn and yellowing on an arbitrary scale of 1 to 4 with increasing severity.