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Growth in Avocado Seedlings and the Continuity of the Nitrogen Supply

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The need of avocado trees for nitrogen is well recognized although the time of applying the nitrogen to the soil requires study. At present there is a lack of information regarding the importance of continuity in the nitrogen-nutrition of the vegetative growth.

When nitrogen is applied to the soil in an avocado orchard, considerable time may elapse before it is carried down to the roots. In other cases the nitrogen may be available only for a relatively short period before it is carried below the absorbing roots by excessive rainfall or irrigation water.

In order to be reasonably certain that avocado roots would have immediate and prolonged access to nitrogen when applied to soil, avocado seedlings were grown in containers without drainage and with a capacity of 4000 grams of air-dry soil. The soil used was a sieved and uniformly mixed Hanford loam and distilled water was used at all times. A single seed from a uniform lot obtained from Fuerte avocado fruits was planted (with the seed coats broken) in each container of soil. When the seeds had germinated and were a few inches high, twenty uniform cultures were chosen and four of these were used in each trial. In order that rain would not interfere and cause drowning or losses of nitrogen as a result of splashing from the cultures, the seedlings were grown in the glasshouse where conditions could be better controlled.

The cultures, consisting of the young avocado seedlings in soil, were treated beginning on December 28, 1944 and the plants were harvested on January 8, 1946. The control (check) group of cultures received no added nitrogen while each of the cultures in the other groups received 0.5474 grams of nitrogen (N) in the form of calcium nitrate solution during their period of growth. Considerable distilled water was added at the time of applying the nitrogen to the soil and no injury was observed.

During the period of the experiment (December 28, 1944 to January 8, 1946) the cultures in each group received their nitrogen supply (table 1) as follows: group No. 0, cultures received no added nitrogen (check); group No. 1, cultures received all of their nitrogen supply in one application; while in groups Nos, 4, 6, and 12, the cultures received their nitrogen supply divided into four, six, and 12 applications respectively at suitable intervals.

The relative position of each culture on the table in the glasshouse was changed at intervals in order to equalize the exposure to the light. Figure 1 indicates the growth of the avocado seedlings in some of the culture groups: (A) represents group No. 1, in which the cultures received a year's nitrogen supply in one application while (B) represents group No. 12 in which a year's nitrogen supply was added to each culture by

means of twelve applications at monthly intervals. The yardstick in the photograph was placed on the soil and indicates the greater growth of the seedlings when the added supply of nitrogen was the more continuous.

In table I are given, for the several groups of avocado cultures, the average values for the height of the seedlings, the number of leaves and leaf area per seedling, the fresh and dry weights of the leaves and trunk, and the approximate dry weight of the roots. The data indicate that better growth occurs as the number of applications, into which a year's supply of nitrogen is divided, are increased. It is possible that the smaller benefits to growth from the more infrequent but larger applications of nitrogen to the soil may be the result of higher osmotic concentrations about the roots. Fewer, but larger, applications of nitrogen may possibly stimulate growth at a level that cannot be maintained until the next application is made and a partially reversible injury results. An analogy between the nutrition of these plants and that of some animals[1] is of interest in that continuity in the growth appears to be of considerable importance.

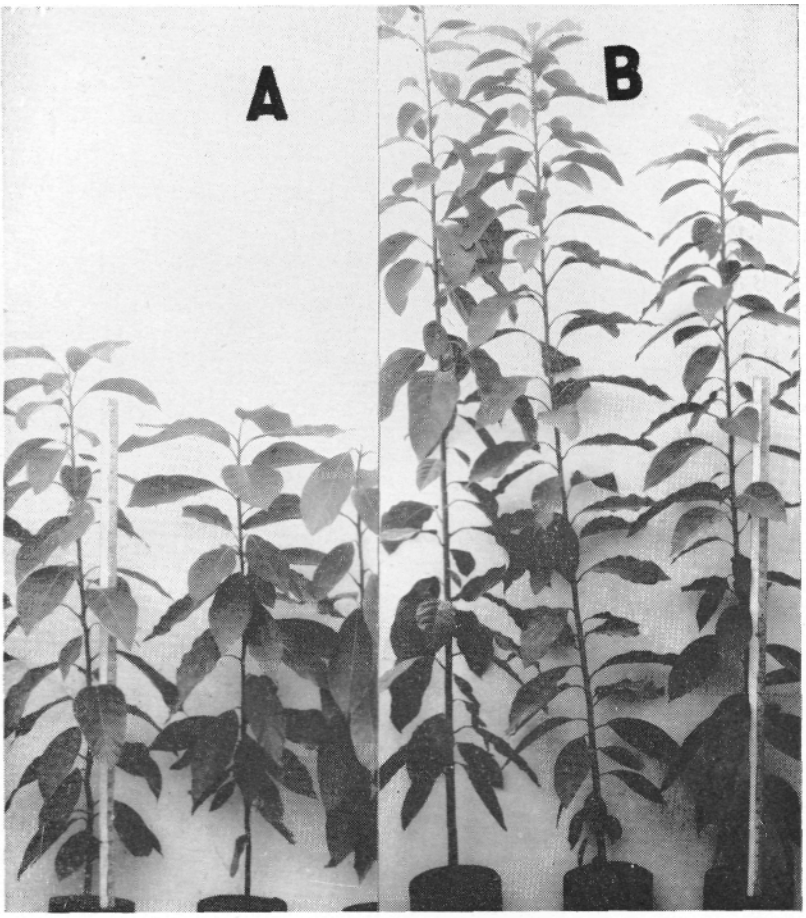

Fig. 1 Growth of avocado seedlings in soil cultures.

A. A year's supply of nitrogen applied to the soil at the start of the experiment and none added thereafter.

B. The same nitrogen supply as in (A) except that the supply was divided into twelve equal applications at suitable intervals. Length of ruler is 36 inches.

TABLE 1

Average growth of avocado seedlings in soil cultures as affected by the number of applications into which a year's supply of nitrogen (0.5475 grams of nitrogen (N)) was divided. Duration of experiment December 28, 1944 to January 8, 1946.

Culture group No.	Time of nitrogen applications	Final height of trunks (inches)	No. of leaves per seedling	Leaf area per plant (square inches)	Wt. of leaves per plant		Wt. of trunk per plant		Approximate dry weight of root per plant (grams)
					Fresh weight (grams)	Dry weight (grams)	Fresh weight (grams)	Dry weight (grams)	
0	Control (check) no added nitrogen	27.5	36	271.3	36.5	12.2	33.0	15.6	23.1
1	Dec. 28, 1944	37.2	39	422.0	57.4	20.3	54.4	23.1	25.0
4	Dec. 28, 1944 Mar. 28, 1945 June 28, 1945 Sept. 28, 1945	45.6	64	571.1	74.9	24.8	59.3	23.2	20.3
6	Dec. 28, 1944 Feb. 28, 1945 April 28, 1945 June 28, 1945 Aug. 28, 1945 Oct. 28, 1945	50.5	59	617.0	81.8	26.5	82.4	34.6	28.1
12	The 28th of each month from Dec. 28, 1944 to and including Nov. 28. 1945.	54.9	76	650.9	85.5	27.2	94.7	39.2	28.3

Summary

Avocado seedlings were grown in containers of soil for a period of about one year and each soil culture except in the controls (checks) was given what was considered to be a year's supply of nitrogen in the form of calcium nitrate solution. One group of cultures received this nitrogen supply all in one application; another group in four, another in six and another in twelve applications at suitable intervals. The object of the experiment was to observe the effects on the growth of avocado seedlings upon dividing a year's supply of nitrogen into a variable number of soil applications. In orchard practice such effects are often difficult to observe because of losses of nitrogen and other factors. The results appear to be somewhat analagous to those obtained with animals, namely, that continuity in growth is of considerable importance.

1. Guilbert, H. R., Hart, G. H., Wagnon, K. A., and Goss, H., The importance of continuous growth in beef cattle. Univ. of Calif. Agr. Exp. Sta. Bul. 688: 1-35, 1944.