Effects of irrigation and nitrogen on

Micronutrient Concentrations

in Hass avocado leaves

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Availability of soil moisture affects the utilization of soil manganese and boron by avocado trees, and high nitrogen fertilization reduces the trees' utilization of copper.

For a long-term test, Hass avocado trees on a Mexican seedling rootstock were planted in June, 1952, on land cleared of native brush. During the first year water was applied in small basins around the trees, and thereafter a permanent irrigation system provided water near each tree by means of a sprinkler-type nozzle. During each of the first two years every tree received one-twelfth pound of nitrogen from calcium nitrate broadcast under the trees in two applications. Differential treatments were started in 1954, to evaluate the effects of three levels of irrigation and three levels of nitrogen fertilization on yield, fruit size and quality, tree growth, and chemical composition of leaves. Irrigation water was applied when soil suction—soil moisture tension—values reached 0.5, 1.0, and 10 bars—atmospheres of suction—at selected points in the root zone.

Annual Fertilizer Treatments
Pounds of nitrogen per tree

Years	Treatments		
	Zero Nitrogen	Low Nitrogen	High Nitrogen
1954	0	0.17	0.67
1955	0	0.25	1.00
1956	0	0.25	1.50
1957	0	0.25	1.50
1958	0	0.25	2.50
1959	0	0.75	3.00
Total	0	1.92	10.17

Each irrigation plot of 14 trees was divided into three subplots receiving differential nitrogen treatments. Six trees received a high level of nitrogen, based on leaf analysis, six received a low commercial level of nitrogen, and the remaining two were the check without added nitrogen. The total annual amounts of nitrogen were broadcast under the trees in three equal applications, in February, May, and August.

Because zinc deficiency symptoms were present on some trees, the whole experimental orchard was sprayed with zinc sulfate plus soda ash in June, 1956, and a soil application of one pound per tree of zinc chelate—17.7% zinc—was applied in 1958.

A sample of 20 fully developed leaves, with their petioles, was taken from one tree in each subplot in August, 1956, again in October, 1957, and in November, 1959.

Leaves from trees irrigated when soil suction reached one bar—the intermediate treatment—contained significantly higher concentrations of manganese than did leaves from trees receiving more frequent or less frequent irrigations. Apparently low soil moisture availability produced by infrequent irrigation and high soil moisture availability produced by frequent irrigation both resulted in lower manganese concentrations in avocado leaves than did an intermediate supply of soil moisture.

Leaves from trees that were not irrigated until soil suction reached 10 bars contained significantly smaller concentrations of boron than did leaves of trees receiving the frequent and the intermediate irrigation treatments. Thus it appears that avocado trees in areas where the concentrations of boron are low in the soil and water may develop boron-deficiency symptoms when subjected to an irrigation practice which allows very dry soil conditions between irrigations.

The zinc, copper, and iron concentrations in the leaves were not affected significantly by the differential irrigation treatments.

Leaves from trees treated with high nitrogen contained significantly smaller concentrations of copper than leaves from trees treated with low nitrogen or none. Zinc, manganese, boron, and iron concentrations in the leaves were not significantly affected by the differential nitrogen treatments applied. The spray and soil applications of zinc in 1956 and 1958 were possibly the reason that nitrogen fertilizers did not reduce the zinc concentration in the avocado leaves in 1957 and 1959. Analysis of zinc content was not made in 1956 because of zinc spray on the leaves.

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tained 0.075 ppm chromium in each application.

Rough lemon seedlings in soil cultures also showed considerable improvement in growth when low concentrations of chromium were applied in the nutrient solution.

Harman — Mexican — avocado seedlings were grown from December 13 to June 16 in soil cultures in the glasshouse. Chromium concentrations in the nutrient solution were 0, 0.0125, 0.025, 0.05, 0.075, and 0.30 ppm. The heights of the harvested plants were 34.5″, 55.3″, 56.0″, 59.8″, 51.8″, and 49.8″; fresh weights of the trunks were 57, 108, 102, 119, 88, and 97 grams and of the leaves 80, 115, 135, 112, 133, and 127 grams; dry weights of roots were 20.9, 21.7, 24.7, 19.3, 19.0, and 25.8 grams. The increased growth of the treated cultures over the controls indicates the stimulating effect of chromium on avocado seedlings of the Harman—Mex.—variety in soil cultures when each application of nutrient solution contained a low concentration of chromium.

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