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Effects of chromium on citrus and avocado grown in nutrient solutions

A. R. C. Haas and Joseph N. Brusca

Exact tests show that extremely low concentrations of chromium benefit the growth of citrus and avocado trees.

Tests were carried out in three-gallon- capacity sand or soil cultures. Plant nutrients were supplied by stock Hoagland's solutions A, B and C. Distilled water and chemically pure mineral salts were used in all the tests, and the drainage was excellent.

A preliminary test was made in silica sand cultures planted to rooted cuttings of Prior Lisbon lemon. Potassium chromate was added to the nutrient solution at each application, to give chromium concentrations of 0, 0.1, 0.5, 1, 5, 10, 25, 50, and 100 ppm—parts per million—for the experiments.

Rooted Prior Lisbon Lemon cuttings in soil cultures. *Left*—0.075 ppm chromium; *right*—0.05 ppm chromium.

The growth obtained at 0.1 ppm chromium was distinctly better than with no chromium, and at 0.5 ppm the growth was somewhat better than with no chromium, though less favorable than at 0.1 ppm. At 1.0 ppm the growth was poorer than that of the control, and at higher concentrations the rooted cuttings failed to survive.

In a second test with Prior Lisbon lemon in the same kind of cultures, chromium concentrations were 0, 0.0125. 0.025, 0.05, 0.075, and 0.1 ppm in each application of nutrient solution. The cultures were planted on July 20 and harvested on February 25. The heights of the harvested plants were 18.5", 19.0", 27.8", 32.3", 24.0" and 33.0". Dry weights of the roots were 10.5, 10.5, 11.0, 11.5, 12.0, and 13.2 grams.

A third test was conducted to learn whether the use of chromium in each application of nutrient solution would benefit rooted Prior Lisbon lemon cuttings in soil cultures. Chromium concentrations were 0, 0.025, 0.05, 0.075, and 0.1 ppm. After growing from November 5 to March 16 the heights of the cuttings were 25.0", 35.5", 36.0", 28.5", and 26.5"; the fresh weights of the entire tops were 42.5, 63.0, 60.8, 54.7, and 42.2 grams; and the dry matter of the

roots weighed 4.0, 5.6, 5.8, 5.0, and 5.6 grams.

To test the effectiveness of chromium in stimulating the growth of orange trees, Koethen sweet orange seedlings were grown in soil cultures from August 9 to March 15. The nutrient solution contained 0, 0.0125, 0.05, 0.075, and 0.1 ppm of chromium. At the time of harvest the heights of the seedlings were 23.0", 30.3", 27.0", 30.8", and 25.5"; the fresh weights of the entire tops were 37.5, 46.0, 50.3, 40.8, and 40.0 grams; the dry weights of the roots were 7.5, 9.4, 11.8, 9.2, and 9.0 grams.

A similar experiment was conducted with Koethen sweet orange seedlings in silica sand instead of soil cultures. The most marked stimulation of growth occurred when the nutrient solution contained 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 (Mex.) avocado seedlings in soil cultures that received chromium in each application of nutrient solution. *Left to right*—0, 0.0125, 0.025, 0.05, 0.075, 0.30 ppm chromium.

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.

A. R. C. Haas is Plant Physiologist, Emeritus, university of California, Riverside.

Joseph N. Brusca is Laboratory Technician in Plant Biochemistry, University of California, Riverside.

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