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EFFECT OF MOLYBDENUM ON AVOCADO TREES

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(Addition of molybdenum to the nutrient solution applied to cultures of seedlings and budded trees greatly stimulated tree growth)

The roots of avocado trees in addition to penetrating the soil mass, frequently show excellent growth of white rootlets at the soil surface beneath a variable depth of dry and decomposing avocado leaves (mulch). The purpose of the present study was to determine whether the availability of molybdenum to the roots might be a factor in the stimulation of growth in avocado trees.

Fig. 1. Beneficial effect of having molybdenum at all times in the nutrient solution applied to sand cultures of Fuerte (Carr) on Mexicola (Mex.) rootstock. Left to right: 0, 10 ppm—parts per million—molybdenum as sodium molybdate.

In the initial test, Fuerte (Carr) avocado trees on Mexicola (Mex.) rootstock were used in silica sand cultures 15 inches in diameter by 16 inches deep. The nutrient solution at all times contained, left to right in figure 1: 0, and 10 ppm—parts per million—molybdenum as sodium molybdate. In these and all other avocado tree cultures, distilled water and

chemically pure salts were used at all times. The results (fig. 1) indicated that molybdenum in the nutrient solution applied to the roots in silica sand cultures might stimulate the growth in avocado trees.

Additional tests with silica sand cultures were conducted in which Fuerte (Carr) avocado trees were budded on Harman (Mex.) rootstocks. The trees were planted bare-root in containers of silica sand and 14 inches in diameter by 17 inches in depth and were grown in the glasshouse. The nutrient solution contained at all times the following concentrations of molybdenum as sodium molybdate: from February, 1953, to February, 1954, 0, ,025, .05, .1, and.125 ppm; February, 1954, to June, 1954, 0, 3, 6, 12, and 15 ppm; and June, 1954, to October, 1954, 0, 18, 36, 54, and 90 ppm.

The nutrient solution was that of Hoagland's (A, B, C stock solutions) and containing .2 ppm—parts per million—boron as boric acid, manganese as sulfate, repurified iron as sulfate, 1 ppm zinc as sulfate, 3 ppm aluminum as citrate, .1 ppm copper as sulfate, and .05 ppm chromium as potassium chromate.

On October 1, 1954, the trees were photographed (fig. 2) at which time all of the cultures that received molybdenum had made better growth than the control tree the nutrient of which at no time contained added molybdenum. The trees were then cut back to a trunk extending about 18 inches above the bud union. The content of molybdenum in the applied nutrient solutions were continued from October, 1954, to June, 1955, at the following concentrations: 0, 18, 36, 54, and 90 ppm. In June, 1955, the new growth stimulation was in the same order as that obtained prior to the pruning.

Fig. 2. Improvement (as seen on October 1, 1954) of Fuerte (Carr) avocado trees on Harman (Mex.) rootstocks grown in silica sand cultures. To the nutrient solutions at all times were added molybdenum as sodium molybdate in the following concentrations (left to right): February, 1953, to February, 1954, 0, .025, .05, .1, and .125 ppm; February, 1954, to June, 1954, 0, 3, 6, 12, and 15 ppm; and June, 1954, to October, 1954, 0, 18, 36, 54, and 90 ppm.

The tests thus far have indicated that the growth of budded avocado trees in silica sand cultures is stimulated by the use of molybdenum. It appeared desirable to determine whether molybdenum can stimulate the growth of the Harman (Mex.) avocado seedlings that were used as the rootstocks in the preceding silica sand culture test (fig. 2). In this test with avocado seedlings in 3-gallon-capacity soil cultures, no laterals were permitted to grow and as in all of the avocado experiments, the cultures had excellent drainage. The nutrient solution was similar to that used in the cultures shown in figure 2, only the concentrations of molybdenum differed. The soil cultures treated with molybdenum received molybdenum in each application of nutrient.

Figure 3 shows the growth stimulation in Harman (Mex.) avocado seedlings in glasshouse soil cultures to which was applied a nutrient solution that at all times contained various concentrations of molybdenum as sodium molybdate.

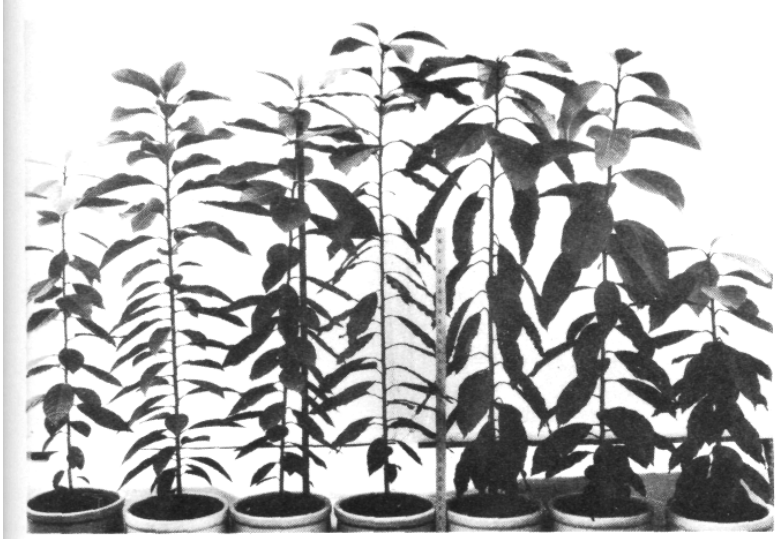

Fig. 3. Stimulation of growth of Harman (Mex.) avocado seedlings in 3-gallon-capacity glasshouse soil cultures that received a nutrient solution to which was added at all times various concentrations of molybdenum as sodium molybdate. Left to right: 0, .025, .05, .1, .5, 5, and 50 ppm molybdenum.

The data in table 1 gives the concentrations of molybdenum and the corresponding growth response. Continuous use of-50 ppm molybdenum in the nutrient solution reduced the trunk height and increased the total weight of the top and root. It is apparent from table 1 that the growth of Harman (Mex.) avocado seedlings was stimulated by the addition of molybdenum to the nutrient solution that was applied to the soil cultures.

Table 1. Growth of Harman (Mex.) avocado seedlings in 3-gallon-capacity soil cultures that received a nutrient to which was added at all times various concentrations of molybdenum as sodium molybdate. Cultures grown from December 13, 1954, to June 16, 1955.

Culture No.	Molybdenum concentration (ppm)	Final height of trees (inches)	Fresh weight of leaves (grams)	Fresh weight of trunk (grams)	Total fresh weight of tops (grams)	Dry weight of roots (grams)
1	0	38	51	45	96	16.2
2	.025	46	121	83	204	29.3
3	.050	46	100	67	167	25.2
4	.100	50	106	81	187	31.3
5	.500	48	142	108	250	21.3
6	5.000	47	127	92	219	23.3
7	25.000	45	99	75	174	20.6
8	50.000	29	78	36	114	22.7