

Micronutrients in Valencias

study made on the effects of nitrogen fertilization on the micronutrient concentrations in leaves of Valencia orange

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Deficiency of micronutrients in citrus trees is an important problem in central and southern California orchards.

Several reports indicate that continued heavy applications of nitrogen fertilizers may change the micronutrient nutrition of citrus trees. Therefore, a long-term experiment was started in 1950 to evaluate the effects of two levels each of nitrogen—among other fertilizers—on yield, fruit size and quality, tree growth, and chemical composition of leaves of Valencia orange trees. The experiment was conducted in northern San Diego County in an orchard which is on acid soil, nontilled, and sprinkler irrigated. Weeds under the trees were controlled with oil and other chemical herbicides.

Treatments

Nitrogen was supplied in one application per year. For evaluation of nitrogen effects on the micronutrient concentration in Valencia orange leaves, five treatments were selected: 1, no nitrogen; 2, two pounds of actual nitrogen per tree annually from 1950 to 1956 and 1.5 pounds nitrogen in 1957 from ammonium sulfate; 3, same amounts of nitrogen from calcium nitrate; 4, same amounts of nitrogen from ammonium nitrate; and 5, two pounds nitrogen per tree annually from steer manure. Each treatment was replicated five times in two-tree plots. The experimental orchard received an annual maintenance application of zinc and manganese in the late summer or the early fall except in 1957 when neither zinc nor manganese was applied.

Leaf samples for micronutrient chemical analysis were obtained in August 1956 and September 1957, prior to the zinc and manganese maintenance spray. Each sample consisted of 20 spring-cycle, fully developed Valencia orange leaves from nonfruiting shoots. The leaves from the two treatment trees in the plot were composited and included both leaf petioles and blades.

Results

Leaves from Valencia orange trees that received ammonium sulfate or ammonium nitrate contained more manganese than the leaves from the check trees or the leaves from trees that received calcium nitrate.

However, there was not any difference in the manganese concentration in the leaves between ammonium sulfate and ammonium nitrate treatments. Thus, fertilizer treatments containing ammoniacal nitrogen resulted in significantly more manganese in the leaves than the check or calcium nitrate treatments. All three sources of nitrogen resulted in a lower boron concentration in Valencia orange leaves than the check. There were no significant differences in the effects of the three sources of nitrogen. Zinc, copper, and iron concentrations were unaffected by nitrogen treatments in this experiment.

In the experimental nontilled orchard, application of two pounds of actual nitrogen per tree annually from steer manure resulted in less copper and manganese and more boron in the leaves than similar amounts of nitrogen applied an-

nually from ammonium nitrate. The zinc and iron concentrations were unaffected by nitrogen treatment, regardless of the source of nitrogen used. The boron in the steer manure may partly account for the increase of boron in the leaves of trees treated with steer manure. However, nitrogen in the leaves of the manure-treated trees was much lower than in the leaves of trees receiving ammonium nitrate. Thus the comparatively high nitrogen in the ammonium nitrate-treated trees may be associated with the higher manganese and lower boron concentrations in the leaves.

Complicated Effects

Soil applications of nitrogen fertilizers have complicated effects on the micronutrient concentration in Valencia orange leaves. Applying ammonium sulfate and ammonium nitrate to Valencia orange trees not only increases the nitrogen in the plant tissue, but also reduces directly or indirectly the boron and increases the manganese concentrations in the leaves. On the other hand, applying an equivalent amount of nitrogen as a manure mulch to Valencia orange trees is associated with a decrease in manganese and copper, and an increase in boron concentrations in the leaves.

It has been observed that heavy nitrogen applications to citrus trees over a period of years may induce zinc deficiency patterns in citrus leaves. The results of these studies suggest that when zinc maintenance spray applications are applied annually, nitrogen fertilizers do not have any deleterious effect on the zinc concentration in Valencia orange leaves.

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Effects of Nitrogen Fertilization on Micronutrient Concentrations in Valencia Orange Leaves^a

Source of Nitrogen ^b	Parts per million in dry leaves ^c				
	Zinc (Zn)	Copper (Cu)	Manganese (Mn)	Boron (B)	Iron (Fe)
Check	34.0	8.9 _b	31.1 _n	95.4 _n	83.2
Ammonium sulfate	33.2	8.1 _b	58.5 _n	76.0 _n	90.8
Calcium nitrate	32.3	7.9 _b	32.3 _n	77.0 _n	85.8
Ammonium nitrate	32.7	8.5 _b	53.0 _n	73.3 _n	90.2
Nitrogen from steer manure	29.3	6.1 _a	34.6 _n	89.9 _a	90.2
F value	N5	**	**	**	N5

^a N5 indicates that differences between means are not significant.

^{**} F value significant at the 1% level or higher.

^b Subscript letters a and b after values indicate statistical populations. Mean values are statistically different from each other if they do not have a common subscript letter in a column. Common subscript letters after values in a column indicate that the differences between means are not statistically significant.

^c Mean of two years, except for values for iron which represent 1956 data.