Micronutrient Concentrations

effects of soil applications of phosphate, potash, dolomite on micronutrient concentrations in Valencia orange leaves

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That the micronutrient nutrition of citrus trees may be changed by continued heavy applications of commercial fertilizers has been indicated by several reports. However, there is very little available experimental evidence from field studies on the influence of soil applications of phosphate, potash, and dolomite fertilizers on the micronutrient concentration in Valencia orange leaves.

In 1950 differential fertilizer treatments were started to evaluate the effects of phosphate, potash, and dolomite—among other materials—on yield, fruit size and quality, tree growth, and chemical composition of leaves in Valencia orange.

The experimental orchard—on acid soil—was nontilled, sprinkler-irrigated, and weeds under the trees were controlled with oil and other chemical herbicides. Twelve treatments were selected. Each treatment was replicated five times with two-tree plots, making a total of 60 treatment plots. By grouping treatments factorially, dolomite was in effect replicated internally 20 times, and phosphate and potash, 30 times. One group of plots received no phosphate—P_0—and plots receiving a high amount of phosphate—P_1—were given 20 pounds of treble superphosphate per tree annually from 1950 to 1952. The low potash—K_0—plots were those receiving no potash, and plots receiving a high amount of potash—K_1—were given 20 pounds of sulfate of potash per tree annually from 1950 to 1952. The low dolomite—Dol_0—plots were those that received no dolomite; plots that received an intermediate amount of dolomite—Dol_1—were given 20 pounds of dolomite, and plots that received a high amount—Dol_2—were given 50 pounds per tree on September 1950, April 1951, August 1951, May 1952, and August 1952. All plots received two pounds of actual nitrogen per tree annually from 1950 to 1956, and only 1.5 pounds in 1957 from ammonium nitrate. Also, the experimental orchard received an annual maintenance application of zinc and manganese in late summer or early fall.

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.

Phosphate Effects

Leaves from trees treated with 20 pounds of treble superphosphate—46% phosphorus pentoxide—per tree per year in 1950, 1951, and 1952 contained in 1956 and 1957, appreciably lower copper, and higher manganese and iron concentrations than the leaves from trees that were not treated. Phosphate fertilization tended to reduce slightly the concentration of zinc found in the leaves, but not with sufficient consistency to attain statistical significance. This may be due to the maintenance sprays of zinc and manganese. Boron was unaffected by phosphate treatments in this particular experiment.

Potash Effects

Two levels of potash fertilizers were studied. Potash in a form of potassium sulfate—51% potassium oxide—was applied to Valencia orange trees in 1950, 1951, and 1952. Since that time no further potash fertilizer was applied. Leaves from trees treated with 20 pounds of potassium sulfate per tree per year in 1950, 1951, and 1952 contained significantly lower manganese and higher boron concentrations in 1956 and 1957 than leaves from untreated trees. Zinc, copper, and iron concentrations in the leaves were unaffected by potassium sulfate applications.

Dolomite Effects

Three levels of soil applications of dolomite were studied. Dolomite containing 60% calcium carbonate and 39% magnesium carbonate was applied in 1950, 1951, and 1952. Since that time no further dolomite was applied. Leaves from trees treated with an intermediate amount of dolomite contained lower concentrations of copper than those from untreated trees or trees treated with high level of dolomite. Dolomite soil applications tended to reduce the manganese concentration in the leaves, but not consistently. Zinc, boron, and iron concentrations in the leaves were not affected by dolomite soil applications.

Data collected indicate that soil applications of phosphate, potash, and dolomite have complicated effects on the micronutrient concentrations in Valencia orange leaves. Soil applications of phosphate, potash, and dolomite to Valencia orange trees not only influenced the macronutrient elements in the plant tissue, but also affected some of the micronutrient element concentrations in the leaves. Heavy applications of phosphate fertilizers reduced the copper and increased the manganese and iron concentrations in the leaves. Potash reduced manganese and increased boron, and intermediate amounts of dolomite reduced copper concentration in the leaves.

Influence of Soil Applications of Phosphate, Potash, and Dolomite on the Micronutrient Concentration in Valencia orange leaves[a]

Application rate[b]	Parts per million in dry leaves				
	Zinc	Copper	Manganese	Boron	Iron
P_0	31	7	45	73	89
P_1	30	5	59	73	93
F value	NS	**	**	NS	*
K_0	31	6	55	71	90
K_1	30	6	49	75	92
F value	NS	NS	*	**	NS
Dol_0	31	6.6_b	55	74	91
Dol_1	29	5.8_a	49	71	90
Dol_2	31	6.4_b	51	73	92
F value	NS	**	NS	NS	NS

[a] NS indicates that differences between means are not significant.

* F value significant at the 5% level.

** F value significant at the 1% level.

[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.

These studies suggest that trees in heavily fertilized Valencia orange orchards—particularly when chemical phosphorus or organic fertilizers containing large amounts of phosphorus are used over a period of years—should be examined carefully for symptoms of copper deficiency. Remedial nutritional sprays should be applied where necessary. Many workers in the field of plant nutrition have found that heavy applications of phosphate fertilizers to citrus trees, over a period of years, induce zinc

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Weed Control in Shasta Daisy

costly hand weeding of commercial flower crop reduced in successful field tests with neburon in Santa Barbara County

Jack L. Bivins and William A. Harvey

One of the more promising of the newer herbicides for weed control in commercial flower crops is neburon—1-n-butyl-3 (3,4-dichlorophenyl)-1-methylurea—a chemical low in water solubility and toxicity to man or animals.

To test the effect of neburon on Shasta daisy and to determine the extent of weed control during the growing period of the crop, an experiment was set up in an established field planting in Santa Barbara County.

The soil in the experimental plot is a Baywood loamy sand, moderately acid, developed from wind-modified sandy coastal-plain material.

The daisies were set in rows 24″ apart with the plants spaced 12″ in the row on April 23, 1957. The commercial neburon used in these experiments contained 18.5% of active ingredient and was applied as a suspension in water. On May 10, 1957, replicated plots, each 10′x4′, were treated with neburon at rates of 2, 4 and 6 pounds of active ingredient per acre. Applications were made with a two gallon sprayer at the rate of 200 gallons per acre with frequent shaking of the sprayer and contents to insure maintaining an adequate suspension. The entire plot surface was treated with no attempt to keep the the suspension off the foliage of the daisies. The field was irrigated 12 times from April 1957 to November 1957 with approximately 1.3″ of water applied each time. Rainfall from November 1957 to April 1958 was 23.08″.

Average Number of Weeds per Square Foot

Treatment	July 11 1957	Oct. 23 1957	March 14 1958
Neburon			
2 lbs./acre	1.3	3.0	22.7
4 lbs./acre	1.0	1.1	13.0
6 lbs./acre	0.2	0.05	2.3
Check	17.1	23.5	27.2

The plots were hand weeded three times and each time all weeds in a 12″ strip through each plot were counted. The first count was made July 11, 1957; the second on October 23, 1957; and the third on March 14, 1958. The weed species found in the check plots included annual bluegrass, bur clover, carpetweed, common chickweed, dandelion, filaree, lamb's-quarters, malva, mouse ear chickweed, pigweed, purslane, and wild mustard.

The control of weeds was excellent over a period of five months at all rates of neburon used in the test. At the end of 10 months there was no weed control at the low rate and the 4-pound-per-acre rate had lost much of its effectiveness. The 6-pound-per-acre rate gave excellent weed control for more than a year and at no time was there any visible damage to the daisies.

Neburon is an effective weed killer at low rates and easily applied. It may be sprayed on the foliage of the daisies without injury to the leaves. However, treatment of daisies should be delayed until the planted area has received sufficient water to settle the soil well around the roots.

Agitation within the spray tank is necessary to keep neburon in suspension. Also, sufficient irrigation—or rain—is necessary after spray application to wet the soil to a depth of several inches. Weed seed that germinate from depths of 1″ or more, are not killed. Hand weeding of those species is a precaution against the possibility of such weeds becoming established in epidemic proportions.

Neburon is particularly effective against shallow seeded weed species—such as purslane—which are particularly difficult to control by cultivation or hand weeding. In these tests, neburon at four pounds active ingredient per acre gave good control of all shallow seeded broad leaf weeds and grasses.

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Shasta daisy planting. Foreground treated with six pounds of neburon per acre. Untreated plot in background beginning at white stakes.

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deficiency patterns in citrus leaves. However, the present study suggests that phosphate fertilizers do not have any deleterious effect on the zinc concentration in Valencia orange leaves when zinc maintenance spray applications are applied annually to the trees.

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The above progress report is based on Research Project No. 1025.

Hartwell Bradford and Henry Greenfell of the Agua Tibia Ranch, and Ray Easton, Bradford Brothers, Inc., cooperated in the study reported in the above article.