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FOLIAR SPRAYS

correct manganese deficiencies on desert grapefruit

Manganese and zinc deficiency symptoms on grapefruit leaves can be corrected by foliar spraying with these nutrients, but spring applications in desert areas will not prevent symptoms from reappearing on the new flush of leaves in the fall. Both spring and fall applications are recommended in desert areas, after the new flush of leaves has expanded to at least two-thirds normal size.

MANGANESE DEFICIENCY symptoms appear often in a relatively mild form on a new flush of citrus leaves. In most cases these mild deficiency symptoms disappear within a month or two without any special treatment. More persistent cases of manganese deficiency do not disappear as leaves age, and require corrective treatment.

As early as 1930, soil and spray applications of various manganese compounds were made to citrus trees in desert areas without detectable results. Until recently, applications of manganese compounds have not been generally used to correct manganese deficiency of citrus growing in desert areas of southern California. In coastal areas of southern California, foliar applications of commercial grades of manganese compounds to citrus trees have been used for many years and are an effective and practical method of correcting manganese deficiency symptoms.

This report summarizes an experiment initiated in 1959 to study the effects of foliar applications of manganese sulfate and manganese chelate to grapefruit trees growing in the Coachella Valley of southern California.

Manganese-deficient Red Blush nucellar grapefruit trees, part on sweet orange rootstock and the remainder on Rough lemon, were selected for this experimental work at a bearing orchard in the Coachella Valley. Symptoms of manganese deficiency on the grapefruit leaves were somewhat like those of zinc deficiency. The midrib and main veins of leaves were green with a green band of varying width on either side. The areas between main veins were lighter green in color while those with zinc deficiency were a yellowish green. A randomized block design was used consisting of four trees per plot, replicated four times. Two trees within each plot were on sweet orange rootstock and the other two on Rough lemon. The two treatments included: manganese chelate (12% Mn) applied as a foliage spray using one pound per 100 gallons of water; and manganese sulfate (28% Mn) applied as a foliage spray using three pounds per 100 gallons of water. The foliar applications were made twice a year, during April and November of 1959, 1960, and 1961.

Since manganese and zinc deficiencies are commonly associated and, quite often, cannot be easily distinguished, the entire area was sprayed with 3 lbs. of zinc sulfate (36% Zn) and 1.5 lbs. soda ash per 100 gallons of water in April and November of 1959 and again in 1960. These foliar applications of zinc completely eliminated zinc deficiency symptoms.

Leaf samples of the spring flush were collected for chemical analysis of micronutrients and nitrogen prior to the April applications in 1960 and 1961. Each sample consisted of a composite of 50 leaves from nonfruiting terminals—25 leaves from each of the two in each subplot.

Results

No significant differences in nutrient concentrations in the leaves existed prior to the application of the treatments. Spring-flush leaves from trees treated twice with manganese sulfate, in 1959 and again in 1960, contained significantly higher manganese concentrations than leaves from control and manganese chelate-treated trees, but values for other micronutrients showed no significant differences.

Thirty days after foliar applications of manganese sulfate, manganese deficient leaves were free of symptoms. Leaves on unsprayed control trees showed typical manganese deficiency symptoms including light green areas between the main veins and dark green areas along the veins. Six months after the treatments of manganese and zinc were applied, a new flush of leaves showed mild, but distinct, manganese and zinc deficiency symptoms. These observations indicate that Mn and Zn did not move freely within the plant from sprayed leaves into the new flush of leaves. The late summer and early fall flushes responded rapidly in both 1959 and 1960 seasons to the second application of manganese and zinc sulfates by becoming dark green and shiny.

Rootstock effects

Rootstocks influenced the concentrations of micronutrients and nitrogen in the leaves of the grapefruit scion. Leaves from grapefruit trees on Rough lemon rootstock contained significantly higher manganese, iron, and nitrogen, and lower copper concentrations than leaves from trees on sweet orange rootstock.

Manganese and zinc deficiency symptoms are somewhat similar in appearance, commonly occur under the same conditions, and have been mistaken for each other. If manganese deficiency is severe, the symptoms displayed may become so prominent as to mask zinc deficiency. Conversely, if zinc deficiency symptoms are dominant, manganese deficiency symptoms may be almost completely masked. Therefore, it is possible that manganese deficiency symptoms on grapefruit leaves were confused by previous workers with zinc deficiency symptoms or vice versa, and that the results of foliar applications of manganese and zinc in the past were misinterpreted in desert citrus producing areas.

The main factors to consider in use of manganese and zinc as micronutrient sprays are the metal content of these elements, solubility, and purity. Suitable standard concentrations for spray use, based on the metal content, are as follows: one pound of metallic manganese, and/or one pound of metallic zinc per 100 gallons of water. If manganese and zinc sulfates are used as a source of manganese and zinc, it is recommended that soda ash (Na_2CO_3) be used in quantities equal to one-half the weight of manganese and zinc sulfates. Soda ash is recommended instead of lime because it is a more satisfactory spraying material and leaves less of the objectionable deposit on leaves and fruits.

Foliar applications of manganese and zinc are effective at any time of year. In order to secure maximum effects, however, applications should be made after a major flush of leaves has expanded to at least two-thirds normal size. After the major spring or bloom flush of leaves is fully expanded, the addition of 7½ pounds of urea to the same spray mixture will give better results. The urea should have less than 0.25 per cent biuret.

In desert areas, citrus trees ordinarily produce a flush of leaves at the end of late summer or early fall. This late flush generally shows manganese and zinc deficiency symptoms even if the major spring flush was sprayed with these nutrients. This indicates that manganese and zinc supplied to the major flush in early spring does not move freely from the old into the new leaves under such conditions. To correct these late deficiency symptoms, fall applications of manganese and zinc are also recommended. Urea should be omitted from fall sprays on orange trees because it may adversely affect fruit quality.

Earlier recommendations suggested that foliar sprays of manganese and zinc should be applied prior to the spring flush of growth. The results obtained recently from many experimental plots on citrus show that, from the standpoint of tree physiology, most effective use of manganese and zinc is obtained when sprays are applied to the young foliage. Leaves of that flush will be adequately supplied with manganese and zinc nutrients during the growing season and as long as these leaves remain on the tree. There is very slight translocation of these nutrients from old sprayed leaves into the new spring flush of leaves, however; and the new flush of leaves may show manganese and zinc deficiency symptoms even if the old flush was adequately supplied with the nutrients. Therefore, manganese and zinc foliar sprays should be applied after a major flush of leaves has expanded to at least two-thirds normal size. Citrus trees showing severe manganese or zinc deficiency symptoms should be sprayed at any time during the year and then repeated annually after a major flush of leaves has expanded to at least two-thirds normal size. In desert areas, however, spring and fall foliar applications of manganese and zinc are recommended.

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LEGUME TEST PLOTS

This test is one of many set out by Extension Service staff members to find more productive varieties of legumes to improve forage quality and increase total production of California rangelands. This particular plot is 92 x 44 feet and divided into 4 x 4 foot squares with alternate squares seeded. It is located at the Archie S. Porter ranch, between Kelsey and Georgetown, in El Dorado County, and is under the supervision of Farm Advisor D. Barry Leeson. Success of the various annual legumes being tested will depend on their ability to reproduce themselves in future years. The statewide project is being conducted by Farm Advisors and interested ranchers in many counties with coordination and guidance by W. A. Williams of the Department of Agronomy and Victor P. Osterli and James E. Street, Extension Range Improvement Specialists, University of California, Davis.