Micronutrients in the Avocado

effects of nitrogen fertilization on the zinc, copper, iron, manganese and boron content of Fuerte avocado leaves

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Deficiency of micronutrients in avocado trees is often an important problem in southern California orchards.

However, there is little experimental evidence from field studies on avocado fertilization practices available and very little on the influence of soil applications of nitrogen fertilization on the micronutrient composition of avocado leaves. Several reports indicate that continued heavy applications of nitrogen fertilizers may change the micronutrient nutrition of citrus trees. Therefore an experiment was started in 1951, 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 avocado trees. The experiment was conducted in northern San Diego County in an orchard on Ramona stony sandy loam—a light-textured, well-drained, shallow, acid soil—having a cation exchange capacity of less than four me—milliequivalent—per 100 grams. The soil was nontilled; irrigation was by individual under-tree sprinklers; weeds under the trees were controlled with oil and other chemical herbicides.

Treatments

Nitrogen was applied in one application per year by a low-nitrogen treatment, a high-nitrogen treatment and nitrogen from manure mulch. Prior to 1955 the low-nitrogen treatments did not receive any nitrogen; in 1955 and in 1956, 0.5 pound of nitrogen was applied per tree from ammonium nitrate. The high-nitrogen treatments received two pounds of nitrogen per tree annually from ammonium nitrate, and the steer manure treatments received two pounds of actual nitrogen from manure mulch. Each treatment was replicated five times in single-tree plots.

Leaf samples for chemical analysis were taken in October, 1955, and in August, 1956, from the spring and summer flushes of growth. Each sample consisted of 20 fully developed leaves and included both blade and petiole.

Leaves from trees that received the high rate of nitrogen contained appreciably less concentrations of zinc, copper, and boron than leaves from trees that received the low rate of nitrogen. The same effect of nitrogen fertilizers on zinc, copper, and boron was found in two consecutive years. Although high-nitrogen treatments applied to the plots reduced markedly the copper and boron concentration in avocado leaves, recognizable copper and boron deficiency symptoms were not observed. High-nitrogen treatments increased the manganese concentration in avocado leaves in two consecutive years and iron in 1955 only.

Steer Manure

In this nontilled orchard application of two pounds of actual nitrogen annually from steer manure mulch resulted in more zinc, copper, and boron, and less manganese in the leaves than two pounds of actual nitrogen from ammonium nitrate, but there was no difference in iron content. The zinc, copper, and boron in the steer manure mulch may partly account for the increase of these elements in trees treated with steer manure mulch. However, nitrogen in the leaves of the manure-treated trees was much lower than that in the leaves of trees receiving ammonium nitrate. Thus the comparatively high nitrogen in the ammonium nitrate-treated trees may be associated with the lower zinc, copper, and boron content in the leaves. The root system of trees treated with steer manure was more extensively developed in the surface soil and in the mulch than the root system of the trees receiving ammonium nitrate.

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

Further Studies

Yield associated with this experiment will be described in the future. Similar information has been obtained in other experiments, in other orchards and with different avocado varieties.

These studies suggest that avocado trees in orchards that have been fertilized heavily with chemical nitrogen over a period of years should be examined carefully for symptoms of micronutrient deficiencies, particularly zinc, and remedial measures—wherever necessary—by the use of nutritional sprays should be taken promptly.

Effects of Nitrogen Fertilization on the Micronutrient Content of Fuerte Avocado Leaves[a]

Application rate	Parts per million in dry leaves									
	Zinc (Zn)		Copper (Cu)		Manganese (Mn)		Iron (Fe)		Boron (B)	
	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956
Low nitrogen from ammonium nitrate	34	23	4.1	7.3	538	394	48	59	38	44
High nitrogen from ammonium nitrate	31	20	3.7	6.2	653	496	52	61	27	32
F value	**	**	*	*	**	**	**	NS	**	**
High nitrogen from steer manure	41	25	5.8	8.4	366	303	51	62	41	41
High nitrogen from ammonium nitrate	32	22	4.0	7.8	570	413	52	60	31	34
F value	**	NS	**	NS	**	**	NS	NS	*	**

[a] NS indicates that the differences between means are not statistically significant.
* F value significant at the 5% level.
** F value significant at the 1% level or higher.

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