Importance of nutrients for citrus trees

Let's talk about molybdenum (Mo) and nickel (Ni).

By Mongi Zekri and Tom Obreza

FUNCTIONS OF MOLYBDENUM

- Assists in the formation of plant proteins
- Helps starch, amino acid, and vitamin formation
- Acts as a catalyst that aids the conversion of gaseous N to usable forms by nitrogen-fixing microorganisms
- Aids in conversion of nitrate to ammonium as a constituent of the plant enzyme nitrogenase

FUNCTIONS OF NICKEL

- Critical constituent of the plant enzyme urease for conversion of urea to ammonia
- Chemically related to iron and cobalt
- Stimulates proline biosynthesis in plants, which is responsible for osmotic balance in plant tissues
- Foliar sprays of Ni were noted to increase yields of many plants
- Has well-defined enzymatic functions in legumes

Figure 1. Molybdenum deficiency: large interveinal chlorotic spots.

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DEFICIENCY OF MOLYBDENUM AND CORRECTION

In Florida, Mo deficiency in citrus is commonly called "yellow spot." The deficiency occurs when trees are unable to take up sufficient Mo from an acidic soil. Deficiency symptoms appear on the leaves as large interveinal chlorotic spots in early summer (Figure 1). As the leaves age, the yellow spots develop deposits of brown gum on the lower leaf surfaces, which may eventually turn black. In many cases, an infection of anthracnose causes the areas covered by the spots to die and drop out, leaving small holes in the leaves. When the deficiency is severe, the necrotic yellow spots enlarge and extend to the margins. Affected leaves eventually drop, and trees become almost defoliated during the winter.

Symptoms are seldom observed on fruit except when the deficiency is severe. In severely deficient conditions, large irregular brown spots surrounded with yellow discoloration may develop on the fruit. The discoloration goes only into the peel and does not affect the albedo. Symptoms of Mo deficiency appear more commonly in late summer on the sunny side of trees.

Since molybdenum deficiency usually occurs in acidic soils, the most common cure is to lime the soil to pH 6.0-6.5, after which Mo deficiency often disappears. If liming does not fix the deficiency or if the soil pH was already around 6.5, it is then easy to correct Mo deficiency with a sodium molybdate or ammonium molybdate foliar spray. For example, spraying trees showing mild yellow spot leaf symptoms with 5 ounces of sodium molybdate per acre should take care of the problem. In severe cases, spray with 10 ounces per acre. If the spray is applied between summer and early fall, the leaves will re-green and the yellow spots will disappear from the upper surface. Most of the gum will also disappear from the lower surfaces of the leaves. However, black spots consisting primarily of cork cells will

Leaf analysis standard to assessing Mo status of citrus trees in 4- to 6-month-old spring-cycle leaves from non-fruiting terminals.

Element	Deficient less than	Low	Satisfactory	High	Excess more than
Molybdenum (Mo) (ppm)	0.06	0.06-0.09	0.1-1.0	2-50	50

Figure 2. Leaf burn through foliar spray of urea mimics Ni deficiency symptoms.

Figure 3. Leaf burn through foliar spray of urea and biuret toxicity mimics Ni deficiency symptoms.

remain. One spray is usually sufficient for three years or more. Soil applications are not satisfactory.

MOLYBDENUM SOURCES

- Ammonium molybdate
- Sodium molybdate

DEFICIENCY OF NICKEL

Many researchers have demonstrated that plant growth is severely impacted by Ni deficiency when urea is the sole N source. Nickel-deficient plants accumulate toxic levels of urea in leaf tips because of reduced urease activity. Nickel deficiency causes severe disruption in N metabolism and other metabolic processes exhibited as leaf tip necrosis, marginal chlorosis of leaves and premature leaf drop. Nickel is mobile in plants. Hence, deficiency symptoms first appear in the older leaves. Nickel deficiency has not been seen in soil-grown plants. Nickel is abundant in the soil with concentrations varying from 5 to 500 mg Ni per kg (ppm). At pH less than 6.5, most Ni compounds are relatively soluble. Nickel is absorbed as Ni^{2+} and competes with other divalent cations like Ca, Mg, Fe, Zn and Mn.

Nickel toxicity can be associated with biosolids application or industrial pollution and toxicity is more common in acid soils. Application of biosolids to horticultural crops is the most common cause of Ni accumulation in the soil. Soil concentrations can be in the range of 24,000 to 53,000 ppm Ni in soil near metal refineries or in dried biosolids, respectively. Optimum concentration in leaf dry matter of most crops ranges between 0.08 and 0.22 ppm.

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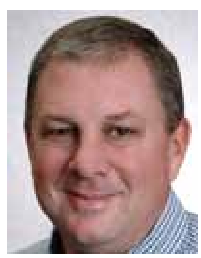

Clay Taylor, an associate at Coldwell Banker Commercial Saunders Real Estate in Lakeland, recently received the National Association of Realtors 2013 National Commercial Award.