By Chris Oswalt

Factors affecting nutrient concentration of citrus leaves

Growers may have compelling reasons to collect and analyze citrus leaf samples at different times of the year. Current tables allow growers to interpret the results of their citrus leaf analysis based on the collection and analysis of 4- to 6-month-old leaves from non-fruiting twigs (Figure 1). This begs the question of the potential consequences of interpreting samples taken from leaves other than those recommended.

Figure 1. A collection of 4- to 6-month-old spring flush leaves

This article discusses the possible implications of leaf sampling outside the current recommendation window. It also must be understood that leaf nutrient levels are transient and change during the growing season based on the nutrient supply and demand of plant growth and fruiting. The information is based on healthy trees without citrus greening.

LEAF AGE

Leaf age can affect the nutrient concentration in citrus leaf samples. Nitrogen is less consistent and variable based on nitrogen fertilization timing, specifically on sandy soils with low nitrogen reserves. Nitrogen uptake and mobility are relatively fast, and samples taken immediately after fertilizer applications will likely have higher nitrogen concentrations. Leaf nitrogen levels will decrease with leaf age. The levels are relatively stable in the 4- to 6-month age range when taken from non-fruiting twigs.

Phosphorus and potassium decrease with leaf age. Calcium, boron, iron and manganese increase with leaf age. Magnesium increases with leaf age to about the 6-month timeframe and then decreases. Copper and zinc remain stable with increasing leaf age.

NUTRIENT MOBILITY

Within the tree, the mobility of citrus nutrients will affect leaf concentrations. Nutrients considered mobile in plants are nitrogen, phosphorus, potassium, magnesium, sulfur and chlorine. These will depend on the time of year, and the source/sink relationship within the tree will move from older leaves into newly developing flush leaves. Calcium, iron, zinc, copper, manganese, boron and molybdenum are non-mobile nutrients. Thus, movement from older leaves to other parts of the tree is significantly reduced.

TWIGS AND SHOOTS

The consequences of sampling fruiting twigs versus non-fruit twigs can also result in a difference in leaf nutrient levels. Fruiting twig leaves will contain high calcium and magnesium levels and lower nitrogen, phosphorus, potassium, zinc, copper, iron and boron levels.

Leaves collected from flushing shoots have slightly lower nitrogen, potassium and magnesium levels. These lower levels are likely due to the nutrients' mobility within the tree.

Figure 2. A mature citrus tree with a large crop of fruit

LEAF SIZE AND LOCATION

The size of the leaf and the location within the tree has an effect on nutrient levels. Although differences exist, larger leaves have higher potassium levels, so the collection of normal/average size leaves is adequate. The location on the tree does affect the nutrient concentration of citrus leaves. Examples would be potassium (in Valencia orange) is significantly higher at the zero to 6-foot height than at a height greater than 6 feet. Potassium is also more elevated on inside versus outer canopy leaves, while magnesium is lower inside the canopy. So, it would be best to collect samples randomly from around the tree canopy and not just one location on all trees.

OTHER FACTORS

Considerations for tree-to-tree variation or variations due to rootstock and scion must be recognized. Samples should be collected from uniform and representative trees to minimize sample variation. Significant differences can occur between trees on different rootstocks and scions. This becomes somewhat problematic if the trees are interplanted. Suppose they are in separate blocks or interplanted. In that case, one could collect samples of each known combination to determine if there are significant differences in the nutrient concentration of the different groups of trees. Once this is done, a decision can be made on how to best handle this variation.

Irrigation management can potentially affect nutrient concentrations. Excessive irrigation can lead to the leaching of highly soluble plant nutrients, resulting in potentially deficient concentration levels in leaves.

Fruit load can also affect leaf nutrient concentrations. In "on" years (heavy crop years), magnesium levels could be lower in seedy citrus varieties, especially grapefruit. Heavy crops during "on" years can result in a decrease in leaf nitrogen, phosphorus and potassium and an increase in leaf calcium levels (Figure 2).

As previously mentioned, this information was developed on healthy citrus trees without citrus greening. So, this is in no way to be considered absolute in all situations, but hopefully provides some insight in helping with the interpretation of samples collected outside of the usually recommended leaf age and type.

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