COVER STORY

Living with yellow dragon disease

A grower nutrition survey reveals production practices for successful HLB management.

By Tripti Vashisth and Christopher Vincent

These days, in nearly every conversation about HLB, mineral nutrition comes up in some way. It seems that in a conversation between three people, there will be about four opinions on what, why, where and how to provide nutrition to citrus trees in the Age of the Yellow Dragon. Some growers have achieved economic yields under HLB with a diversity of mineral nutrition programs. Given the diversity, the academic community has been slow to address this area, and there are few peer-reviewed studies addressing nutritional management under HLB.

We have begun to address this by assessing what growers are doing and the state of their groves and trees in terms of nutrition and tree health. A number of growers have been surveyed, and eight farming operations that are succeeding in achieving economic yields were chosen for a more in-depth survey. This survey is still underway, so the current results are just the beginning. We asked the growers about their fertilization practices, then took soil and foliar tissue samples to look at pH, mineral nutrient content and soil organic matter content.

GROVE MANAGEMENT

All the surveyed growers agreed that with HLB, they have become more intensive with grove care and management practices, with a focus on nutrient management. From the survey, it was clear that there was no fixed recipe for good grove management that fits all. The programs were site specific and often required close monitoring of grove conditions, soil and foliage samples and analysis, and then timely responses to satisfy the needs of the trees.

Some of the common grove management practices which were reported included focusing on irrigation, nutrition and soil pH. Scheduling small and frequent irrigation was preferred as it helps in avoiding drought or flooding conditions, thereby reducing stress on the root system.

FOCUS ON NUTRITION A COMMON FACTOR

Intensive nutrition management was one of the most striking common factors among different grove management programs the surveyed growers use. Nutrition management programs ranged from use of controlled release fertilizer, conventional granular fertilizer, fertigation, foliar nutritional sprays or a combination of two or more methods. The key factor for all was frequent split applications.

All the growers emphasized constant, readily available supply of nutrients to the roots. All programs resulted in a balanced and optimal

	N %	P %	K %	Mg %	Ca %	B ppm	Zn ppm	Mn ppm	Fe ppm	Cu ppm
Optimal range	2.5-2.7	0.12-0.16	1.2-1.7	0.30-0.49	3.0-4.9	36-100	25-100	25-100	60-120	5-16
Site 1	3.0	0.11	1.3	0.3	3.6	84.3	27.0	34.3	113.5	97.8
Site 2	2.5	0.10	1.2	0.4	4.0	62.1	114.4	73.0	71.1	213.8
Site 3	2.9	0.15	1.4	0.4	3.3	95.2	32.4	35.2	70.0	45.6
Site 4	2.9	0.10	1.2	0.3	4.2	95.7	21.7	25.2	59.8	9.5

Table. 1: Nutrient analysis results of leaves collected from four sweet orange commercial groves that are performing well under HLB-prevalent conditions. Green color of cells shows optimum levels of nutrients as per Koo et al. (1984) and Obreza and Morgan (2008).

range of essential macronutrients and micronutrients, with no significant overdosing of a specific nutrient (Table 1, page 10). Nitrate, sulfate and chelated forms were popular forms of nutrients. Interestingly, use of muriate of potash was minimal in most of the operations.

PAYING ATTENTION TO pH AND AMENDMENTS

A majority of the growers are paying attention to soil pH and irrigation water pH to ensure optimal nutrient availability, given the current knowledge of effects of soil solution pH on citrus root growth. Generally, soil pH is maintained between 6 and 6.5 (Figure 1).

Some growers are using soil amendments containing a variety of products such as sulfur, organic acids, compost and mulch. The organic matter content of soil at all of the surveyed locations was found to be approximately 1 to 1.5 percent, which is good for Florida soils. Overall, growers are paying attention to tree needs and ensuring that the stress on trees is minimal.

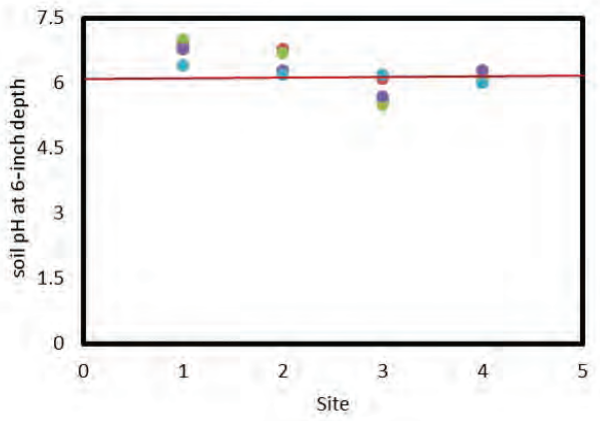

Figure 1. Soil pH at four commercial sweet orange groves. The average soil pH at 6-inch soil depth was around 6 to 6.2.

FORMS OF FERTILIZER

Although there are very few peer-reviewed studies of citrus nutrition under HLB, we have a wealth of knowledge about citrus nutrition in general. Several studies have found a benefit to using mostly nitrate forms of nitrogen, but these studies were not performed in soils like Florida's sands. Although nitrate is a more preferred form of nitrogen than ammonium for citrus, in Florida nitrate is rapidly lost, and ammonium is quickly converted to nitrogen. This is because the soil is sandy, highly aerated and with moderate to alkaline pH, and bacteria that convert ammonium to nitrate are very active.

One study in Florida found that about 50 percent of ammonium applied was converted to nitrate in the 24 hours after application. Based on this, ammonium vs. nitrate forms of nitrogen may not be as helpful in Florida as in other citrus-producing regions of the world.

Avoiding muriate of potash, however, may have a positive impact. Most crop plants are sensitive to sodium accumulation, but citrus is different. Citrus is sensitive to chloride, much more so than to sodium, so fertilizers in which a mineral nutrient is conjugated with chloride may cause salinity stress because of chloride accumulation. Muriate consists of potassium chloride, so it may be causing salt stress in citrus trees, which makes them more sensitive under HLB. Other sources of potassium, such as potassium sulfate or potassium orthophosphate, though more expensive, are probably safer options for potassium nutrition.

BALANCE SOIL pH

Keeping soil pH balanced is another factor that can improve plant health under HLB. Other researchers have found about a 20 percent recovery of root mass when high pH is brought into the optimal 6 to 6.5 range. The growers who were surveyed demonstrated that they were taking steps to manage pH within or near optimal pH ranges in the root zone.

COLLABORATION TO CONTINUE

There is no way to infer from the results of this survey what would have happened if a producer had changed or not changed any of these practices. However, what we can do is look at common practices among growers who are having a degree of success in living with HLB. Most of these adjustments probably would have been beneficial in the absence of HLB. But the presence of the disease and its negative impacts on root systems and mineral nutrient translocation mean that optimal practices are now programmatically necessary. We look forward to continued collaboration with growers in this research as we pursue solutions together.

Tripti Vashisth and Christopher Vincent are assistant professors at the University of Florida Institute of Food and Agricultural Sciences Citrus Research and Education Center in Lake Alfred.