What Growers Need to Know Now to Follow BMPs and How to Use SL 253 Efficiently

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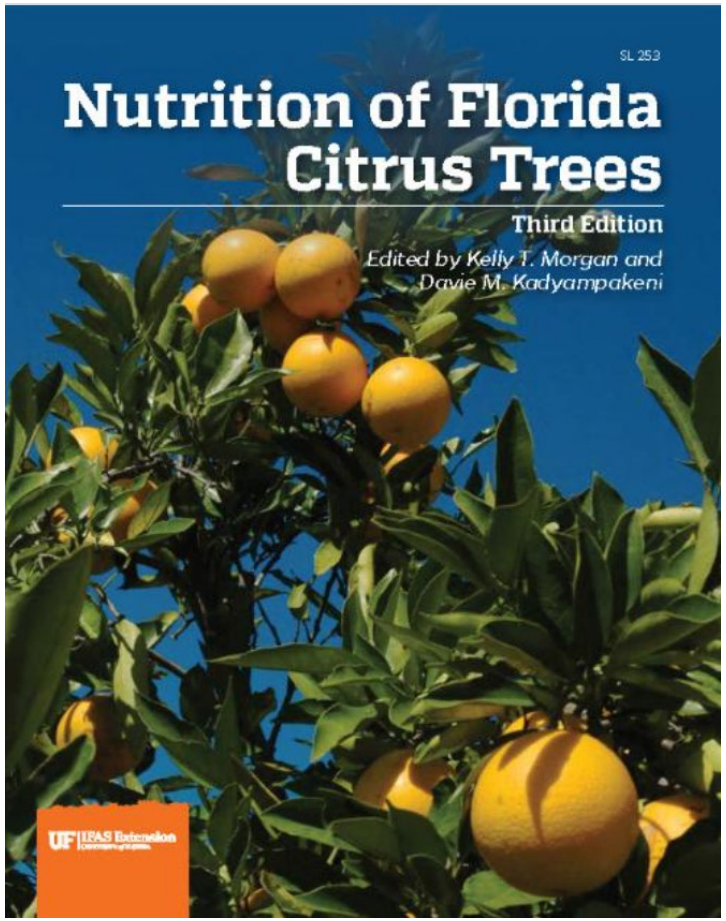
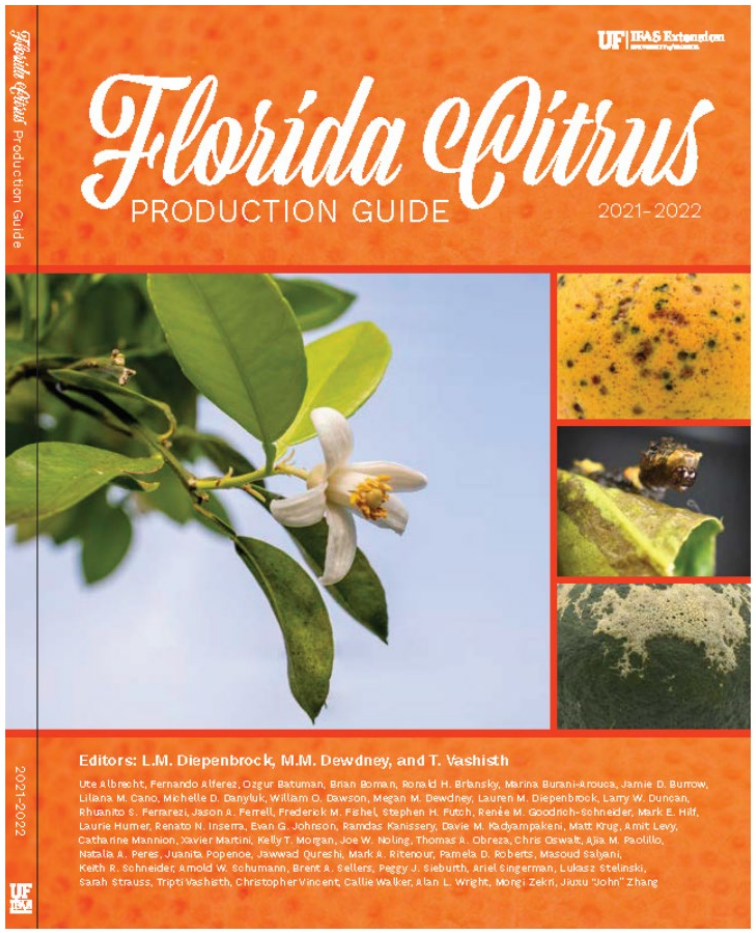
Sources for Citrus Nutrient Recommendations



SL 253 – updated in 2020



Updated yearly

Chapter 1: Intoduction

The information provided in the 2008 2nd edition is still sound for healthy citrus trees under Florida production conditions. Much of the information provided in this document on nutrients, application methods, leaf and soil sampling, and irrigation scheduling are also effective for huanglongbing (HLB) affected citrus trees. However, research conducted since HLB was detected in Florida in 2005 has established changes in many production practices, including nutrient rates, irrigation scheduling, soil pH management, and use of Citrus Under Protective Screen (CUPS). Changes to the 2nd edition of SL253 will appear in boxes similar to this one at the beginnings of chapters 2, 6, 8, 9, and 11.

Chapter 2: Soils and Land Preparation
Soil pH

Soil pH Management—Kelly Morgan, Jim Graham, and Fernando Alferez.

- Because HLB symptoms worsen in groves irrigated with wells and surface water containing dissolved bicarbonates, pH management should be adopted to maintain pH in the same 6.0–6.5 range. This is because high pH reduces availability of Ca, Mg, Fe, Zn, and Mn. In groves with high bicarbonate levels, feeder root density and root lifespan decrease and function in nutrient uptake is reduced. However, not all rootstocks are equally sensitive; Swingle is the most sensitive. Soil and water quality should be managed by a frequent application of water and nutrients to the reduced root system by the effect of HLB.

Chapter 2: Soils and Land Preparation
Organic Matter

Soil Organic Matter Management—Fernando Alferez

- Because of its benefits to soil fertility and its increased availability since the mid-1990s, organic matter addition has become more practical. This is especially true in the case of HLB-affected trees. In poor and depleted soils that are low in organic matter, addition of compost has clear benefits: soil structure improvement, higher water- and nutrient-holding capacity, an additional nutrient source, decreased soil erosion, insulating properties against heat and cold, buffer soil pH, good aeration (which results in better root growth), and an increase in populations of beneficial microorganisms and earthworms.

Chapter 4: Soil and Leaf Testing
No Changes – Testing more important than ever

Figure 1. Proper soil and leaf tissue sampling and analysis can accurately gauge citrus grove nutrition and help improve fertilizer programs.
Credits: Mongi Zekri, UF/IFAS

Table 1. Summary of the usefulness of soil testing and leaf tissue testing as citrus nutrient management tools.

Property or nutrient	Soil testing	Leaf testing
pH	✓	
Organic matter	✓	
N		✓
P	✓	✓
K		✓
Ca	✓	✓
Mg	✓	✓
Cu	✓	✓
Zn, Mn, Fe, B		✓

Chapter 4: Soil and Leaf Testing
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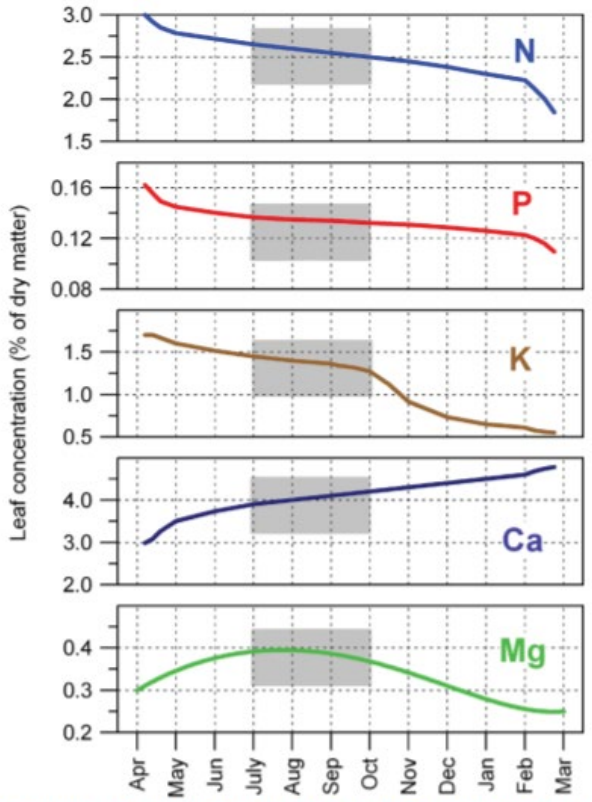

Figure 2. Changes in concentration of N, P, K, Ca, and Mg in citrus leaves with age. The shaded areas denote the recommended sampling period and the optimum concentration range for each element.

Chapter 4: Soil and Leaf Testing
No Changes – Testing more important than ever

Table 2. Guidelines for interpretation of orange tree leaf analysis based on 4-to-6-month-old spring flush leaves from nonfruiting twigs (Koo et al. 1984).

Element	Unit of measure	Deficient	Low	Optimum	High	Excess
N	%	< 2.2	2.2–2.4	2.5–2.7	2.8–3.0	> 3.0
P	%	< 0.09	0.09–0.11	0.12–0.16	0.17–0.30	> 0.30
K	%	< 0.7	0.7–1.1	1.2–1.7	1.8–2.4	> 2.4
Ca	%	< 1.5	1.5–2.9	3.0–4.9	5.0–7.0	> 7.0
Mg	%	< 0.20	0.20 – 0.29	0.30–0.49	0.50–0.70	> 0.70
Cl	%	---	---	< 0.2	0.20–0.70	> 0.70[1]
Na	%	---	---	---	0.15–0.25	> 0.25
Mn	mg/kg or ppm[2]	< 18	18–24	25–100	101–300	> 300
Zn	mg/kg or ppm	< 18	18–24	25–100	101–300	> 300
Cu	mg/kg or ppm	< 3	3–4	5–16	17–20	> 20
Fe	mg/kg or ppm	< 35	35–59	60–120	121–200	> 200
B	mg/kg or ppm	< 20	20–35	36–100	101–200	> 200
Mo	mg/kg or ppm	< 0.05	0.06–0.09	0.10–2.0	2.0–5.0	> 5.0

[1] Leaf burn and defoliation can occur at Cl concentration >1.0%.
[2] ppm = parts per million.

Chapter 4: Soil and Leaf Testing
No Changes – Testing more important than ever

Table 5. Soil test interpretations for other extraction methods compared with Mehlich 1.

Extractant	Nutrient	Soil test interpretation				
		Very Low	Low	Medium	High	Very High
		(Less than sufficient)			(Sufficient)	
Mehlich 1	P mg/kg (ppm)[1]	< 10	10–15	16–30	31–60	> 60
Mehlich 3[2]		< 11	11–16	17–29	30–56	> 56
Ammonium acetate pH 4.8[3]		≤ 11			> 11	
Bray P1[3]		≤ 40			> 40	
Bray P2[3]		≤ 65			> 65	
			Low	Medium	High	
Mehlich 1	Mg mg/kg (ppm)		< 15	15–30	> 30	
Mehlich 3[4]			< 25	25–33	> 33	
Ammonium acetate pH 4.8[5]			< 14	14–26	> 26	
		Less than sufficient			Sufficient	
Ammonium acetate pH 7.0[3]		≤ 50			> 50	
		Less than sufficient			Sufficient	
Mehlich 1	Ca mg/kg (ppm)	≤ 250			> 250	
Mehlich 3[4]		≤ 200			> 200	
Ammonium acetate pH 4.8[5]		≤ 270			> 270	
Ammonium acetate pH 7.0[3]		≤ 250			> 250	

[1] parts per million (ppm) x 2 = lb/acre.
[2] Estimated from unpublished correlation data (T. A. Obreza 2006).
[3] From Koo et al. (1984).
[4] Estimated from correlation data (Alva 1993).
[5] Estimated from correlation data (Sartain 1978).

Chapter 4: Soil and Leaf Testing
Emphasis on Phosphorus Applications

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Mehlich 3[2]		< 11	11–16	17–29	30–56	> 56
Ammonium acetate pH 4.8[3]		≤ 11			> 11	
Bray P1[3]		< 40			> 40	

Chapter 4: Soil and Leaf Testing
Emphasis on Phosphorus Applications

Table 6. Adjusting a citrus fertilization program based on soil analysis.

Property or nutrient	What if it is below the sufficiency value in the soil? Options:	What if it is above the sufficiency value in the soil? Options:
Soil pH[1]	Lime to pH 6.0.	Do nothing. Use acid-forming N fertilizer. Apply elemental sulfur. Change rootstocks.
Organic matter[2]	Do nothing (live with it). Apply organic material.	Do nothing.
P	Check leaf P status. Apply P fertilizer if leaf P is below optimum (see Chapter 8).	Do nothing.
K	Apply K fertilizer (see Chapter 8).	Lower K fertilizer rate.
Ca	Check soil pH and adjust if needed. Check leaf Ca status.	Do nothing. Check leaf K and Mg status.
Mg	Check soil pH and adjust with dolomitic lime if needed. Check leaf Mg status.	Do nothing.
Cu	Do nothing.	Lime to pH 6.5.

[1] The sufficiency value for soil pH is 6.0.
[2] There is no established sufficiency value for soil organic matter.

Chapter 6: Fertilizer Sources and Formulations Controlled Release and Liquid Fertilizers

Controlled-Release and Liquid Fertilizers—Davie Kadyampakeni, Mongi Zekri, Kelly Morgan, and Tripti Vashisth

- Citrus tree growth, fruit quality, yield, and tree health are closely affected by plant nutrition. There are many fertilizer sources and formulations available for commercial citrus production. There are also different methods of applying fertilizers. Applying the right fertilizer type at the right rate at the right time and at the right location within the root zone is very important to improve nutrient use efficiency, especially for HLB-affected trees.

Chapter 6: Fertilizer Sources and Formulations Controlled Release and Liquid Fertilizers

- CRFs have the advantages of inducing more growth and yield due to a continuous rather than a fluctuating supply of nutrients, reducing rates and frequency of fertilizer application, minimizing potential negative environmental effects, and bringing about substantial labor, time, and energy savings.
- Liquid fertilizers applied weekly, biweekly, or monthly appear to improve the performance of HLB-affected trees. Repeated application of small amounts of nutrients improves canopy size, trunk growth, root development, and fruit yield by synchronizing nutrient applications with tree seasonal nutrient demand.

Chapter 8: Recommended Fertilizer Rates and Timing Potassium and Micronutreints

- Nutrient Management—Kelly Morgan, Davie Kadyampakeni, Tripti Vashisth, and Mongi Zekri
- Unlike leaf N, foliar K concentration of K-deficient trees increased to the optimum range after KNO3 application. The application of KNO3 increased canopy volume compared to the controls. However, yields for KNO3 - treated trees were not significantly greater than yields for the controls.
- Canopy volume increased with increased application of Mn and Zn, but not B. Yield increased with the 1.5 and 3.0 annual rates of Mn and Zn but was lower for the 6.0 rate compared with the 3.0 rate. These results indicate increased growth of trees proportional to Mn and Zn within the range tested but reduced yield at the highest rate.

Chapter 8: Recommended Fertilizer Rates and Timing pH and root management

- pH Moderation and Root Management—Kelly Morgan, Jim Graham, and Evan Johnson
- Leaf Ca, Mg, Mn, and Zn concentrations were significantly different among treatments in the mature tree grove, but only significantly different for Ca, Mn, and Zn at the young tree grove when averaged over the entire 3-year study period. Root density samples indicated a significantly greater root length density with soil pH below 6.5.

Chapter 11:Special Situations
Citrus under Protective Screen

- Citrus under Protective Screen (CUPS) Production System for HLB-free Trees—Rhuanito Ferrarezi and Arnold Schumann
- The benefits of eliminating HLB include rapid tree growth, little fruit drop, and higher yields with premium-quality fruit. One of CUPS' main advantages is the reduced frequency of insecticide sprays to control psyllids.
- Nutrients can be delivered in real time to match crop requirements and maximize high-value fruit production. Most other technologies that could impact citrus production are no different in CUPS than in open-air groves, including soil and leaf sampling, liquid fertilizers for fertigation, controlled-release fertilizer.

Error – Florida Citrus Production Guide Nutrient Management for Citrus Trees

Table 3. Interpretation of soil analysis data for citrus using the Mehlich 3 extractant.

Element	Soil Test Interpretation				
	Very Low	Low	Medium	High	Very High
	mg/kg (ppm)1				
P	< 10	10–15	16–30	31–60	> 60

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Ammonium acetate pH 4.8[3]		≤ 11			> 11	
Bray P1[3]		< 40			> 40	

Summary

- Official IFAS Citrus Nutrient recommendations can be found in SL 253 Nutrition of Florida Citrus Trees (revised every 8 – 10 years) and The Florida Citrus Production Guide (revised yearly)
- Changes in micronutrient recommendations for HLB affected trees are being considered by IFAS
- Studies are under way to improve N and K recommendations for HLB affected trees
- Attempts are being made to secure funding for Mehlich 3 soil Phosphorus test evaluation and rate studies