

# **THE 5RS OF SUSTAINABLE CITRUS PRODUCTION IN THE ERA OF HLB**

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August 21, 2025

# Take home message

- Frequent irrigation key to optimal tree performance
- Daily irrigation results in improved nutrient uptake.
- Use of sensors key to determining water needs of trees.
- Citrus fruit yields, juice quality, canopy size and development were enhanced with a balanced nutrition approach
- Root health and overall plant health were strengthened with elevated rates of micronutrients.

## THE 5 RS

- **Right water management**
- **Right nutrient rate**
- **Right fertilizer placement**
- **Right fertilizer source**
- **Right timing**

# **RIGHT WATER MANAGEMENT**

**Use of Florida Automated Weather Network to Schedule Irrigation or other irrigation apps**

**Use soil moisture sensors to decide when to irrigate**

**Use weather stations to monitor rainfall, if ½ inch or greater rain, avoid irrigation for 2 days.**

**Daily irrigation encouraged, irrigation every two days was IFAS guideline before HLB and works for young, healthy trees.**

# RIGHT WATER MANAGEMENT (2)

Schumann et al. 2018. Citrus Industry Magazine

Soil water sensor type	Measured soil volume	Sensitivity to air gaps / loose soil	Sensitivity to salinity	Suitability for sandy soils	Accuracy	Calibration for different soils	Maintenance
Tensiometer	large	high	low	low	high	no	high
Granular matrix	large	high	medium-high	low	low	no	high
Capacitance	medium	high	medium-high	medium	medium	yes	low
Time domain transmission (TDT)	large	medium-low	low	high	high	no	low
Time domain reflectometry (TDR)	large	medium-low	low	high	high	no	low

# Right rate of nutrients

**Rates on nitrogen and phosphorus under revision but current recommendations can still be used**

**Nitrogen 180-200 lbs/ac**

**Phosphorus follow current recommendations**

**Other nutrients Calcium, Magnesium, Potassium, Sulfur, follow current guidelines**

**Boron, Zinc, Manganese, and Iron can be applied at elevated levels for bearing trees impacted by HLB (~3 lb/ac B, 15 lbs/ac Mn, 15 lbs/ac Mn, and 10 lbs/ac Fe).**

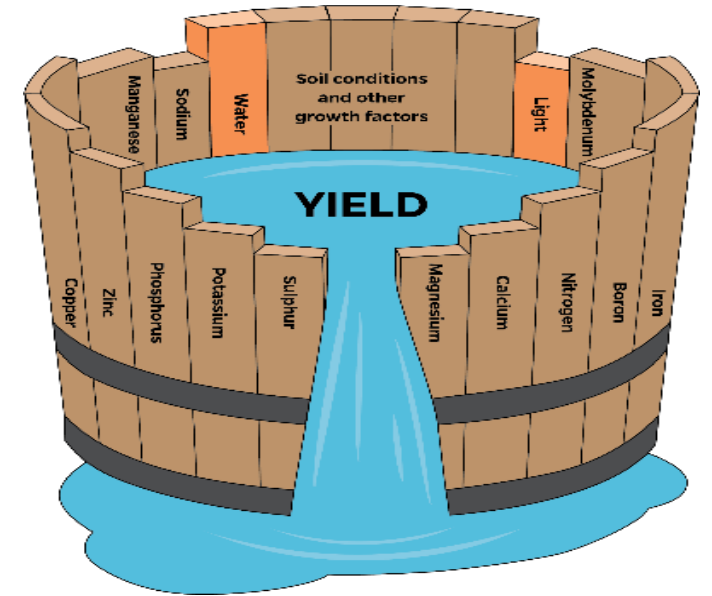


Figure 1. Liebig's Law of Minimum illustrated for plant growth and nutrition with a leaking barrel.  
Credit UF/IFAS  
Communications



# Right Fertilizer Placement

- **Ground application of granular or slow-release fertilizer: place the fertilizer in the irrigated zone or where the microjet wetting pattern is.**
- **Granular and slow-release need to have polymer-coated micros for better efficacy on HLB trees.**
- **Foliar fertilizers encouraged for micronutrients and selected macronutrients (e.g. K, Ca etc) for soils with high pH (>7) to improve plant uptake.**
- **Combined application of ground and foliar application encouraged.**

# **Right Fertilizer Source**

**Improvements in root growth efficiency as a result of using improved fertilizer blends.**

**A blend of 9-1-14, 11Ca, 7.6S, 2Mg, 0.08Zn, 0.04Mn, and 0.025B, applied at 180 lbs N/a/yr resulted in 2 times root density over a blend of 16-2-16 with other nutrients applied separately**

**Improvements in yield as a result of the improved fertilizer blends.**

- ☐ **Yields between 180 to 500 boxes per acre and**
- ☐ **Yield per tree 0.63 to 1.55 boxes per tree**



# Right Timing

- **Fertigation: weekly, biweekly or monthly**
- **Slow-release or controlled-release fertilizer: 2-3 times per year**
  - **Apply Feb, May and Sept**
- **Conventional granular fertilizer, apply in 4 splits per year**
  - **Apply in Feb, April, May and Sept**
- **Foliar fertilizer, apply 3-4 times per year**
  - **Apply Feb/March, April/May, Aug/Sept**

# Adjusting a citrus fertilization program based on soil analysis (Source: Citrus Nutrition Guide, SL253)

Property or nutrient	What if it is below the sufficiency value in the soil?	What if it is above the sufficiency value in the soil?
Soil pH <sup>1</sup>	Lime to pH 6.0.	<ol style="list-style-type: none"><li>1. Do nothing.</li><li>2. Use acid-forming N fertilizer.</li><li>3. Apply elemental sulfur.</li><li>4. Change rootstocks.</li></ol>
Organic matter	<ol style="list-style-type: none"><li>1. Do nothing (live with it).</li><li>2. Apply organic material.</li></ol>	<ol style="list-style-type: none"><li>1. Do nothing.</li></ol>
P	<p>Check leaf P status.</p> <p>Apply P fertilizer if leaf P is below optimum</p>	<ol style="list-style-type: none"><li>1. Do nothing.</li></ol>

# Adjusting a citrus fertilization program based on soil analysis (Source: Citrus Nutrition Guide, SL253)

Property or nutrient	What if it is below the sufficiency value in the soil?	What if it is above the sufficiency value in the soil?
K	1. Apply K fertilizer	1. Lower K fertilizer rate.
Ca	Check soil pH and adjust if needed. Check leaf Ca status.	1. Do nothing. 2. Check leaf K and Mg status.
Mg	Check soil pH and adjust with dolomitic lime if needed. Check leaf Mg status.	1. Do nothing.
Cu	1. Do nothing.	1. Lime to pH 6.5.

## Guidelines for interpretation of orange tree leaf analysis based on 4 to 6-month-old spring flush leaves from non-fruiting twigs Source: SL253)

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 <sup>1</sup>
Na	%	---	---	---	0.15 – 0.25	> 0.25
Mn	mg/kg or ppm <sup>2</sup>	< 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

# Conclusion and Take Home Messages

- Frequent irrigation key to optimal tree performance
- Daily irrigation results in improves nutrient uptake.
- Use of sensors key to determining water needs of trees.
- Citrus fruit yields, juice quality, canopy size and development were enhanced with a balanced nutrition approach.
- Root health and overall plant health were strengthened with elevated rates of micronutrients compared to current recommendations.

# Acknowledgments

K. Morgan (UF/IFAS SWFREC)

A. Wright, L. Rossi, Ritenour and F. Zambon (UF/IFAS IRREC)

T. Vashisth, E. Johnson, J. Grosser (UF/IFAS CREC)

My Lab Team Members: A. Atta, S. Kwakye, Q. Uthman, E. Esteves, W. Bandaranayake, W. Pihilla, A. Hernandez, T. Chinyukwi, M. Peddapuli, N. Ul. Basar, T. Thompson, A. Atta, J. Pereira, D. Sambani

Citrus Pathology Lab Members: D. Bright, T. McIntosh and K. Gerberich



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**THANK YOU**