

Diagnostic Nutrient Testing for Commercial Citrus in Florida¹

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The IFAS Extension Soil Testing Laboratory (ESTL) <http://soilslab.ifas.ufl.edu> offers several types of diagnostic tests for nutrient status and management in commercial citrus groves in Florida. This fact sheet presents the details of each test and sample submission procedures along with certain specific information. The sample submission form is provided in the PDF version of this fact sheet, which can be found by clicking on the PDF icon in the top right corner of this page. The form should be used when submitting commercial citrus soil and/or plant tissue samples to the ESTL. All the information and instructions on the form should be completely provided and followed when submitting a sample for analysis. The submission form can also be found at <http://soilslab.ifas.ufl.edu/pdf%20files/ProducerCitrus.pdf>.

Nitrogen Testing

Nitrogen recommendations are made based on the research data on crop nitrogen uptake and requirement for optimum production. There is no reliable soil test for N for any crop in the southeastern US due to the sandy soil types and warm and wet

climatic conditions. Recommendation for N depends on the age of the trees in the grove and up to the age of seven (7) years, the N recommendations are standard as provided below.

For the first three years of grove-age, the N recommendations are-

- Year 1 = 0.15-0.30 lbs/N/tree
- Year 2 = 0.30-0.60 lbs/ N/tree
- Year 3 = 0.45-0.90 lbs/ N/tree

For grove-ages 4-7 years, the variety of tree also must be specified by choosing from one among the following-

Grapefruit, Orange, Tangelo or Tangerine

The requirements for the 4-7 grove-age are also standard but are also based on the variety of tree-

- For Grapefruit: 120-160lbs/N/Acre/Year
- For Orange, Tangelo or Tangerine: 120-200 lbs/N/Acre/Year

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If the trees are eight years and older, along with the age and the variety (Grapefruit, Orange, Tangelo or Tangerine), the expected yield of the trees in either **boxes per acre** or **pounds of solids per acre** must also be provided.

Then, the recommended N rate will be computed using one of the following equations-

1. Recommended N Rate = $140 + [(boxes/acre \text{ expected yield} - 200)/100] \times 14$
2. Recommended N Rate = $140 + [(lbs \text{ solids}/acre \text{ expected yield} - 1300)] \times 2.5$

Based on the above expected yield computation and the variety, the N recommendations will be one of the following-

- Oranges: 140-250 lbs/N/Acre/Year
- Grapefruit: 120-160 lbs/N/Acre/Year
- Tangerine/Tangelo: 120-300 lbs/N/Acre/Year

Phosphorus Testing

In order to determine the type of analysis needed, any diagnostic testing for phosphorus requirement of citrus trees requires specific information on the age of the trees. For trees that are 1-3 years of age, a standard soil test alone using Mehlich-1 extractant is sufficient, where the soil test levels of phosphorus will be interpreted and the application needs determined as detailed in Table 1.

For trees that are four years and older, along with the standard soil test, a leaf tissue test has to be performed. Table 2 provides the interpretation of the soil and tissue test results and how the phosphorus recommendations are made-

Potassium

Potassium recommendations also vary based on the age of citrus trees. During the first 3 years of age, K_2O should be applied at the same rate as N (lbs K_2O /tree). For grove-ages of 4 years and above, K_2O should be applied at the same rate as N in lbs K_2O /acre.

Magnesium

For determination of magnesium needs for commercial citrus groves, the standard Mehlich-1 soil test must be performed. Table 3 below provides details on how the soil test results are interpreted and how recommendations for magnesium application are made.

Copper Toxicity

In order to determine copper toxicity, a soil test must be performed. If the soil test Cu is determined to be equal to or greater than 25 mg/kg, then a soil pH determination will be made. If the pH is found to be <5.5, then the standard Adams-Evans buffer pH test will be run and a lime recommendation will be made to raise the pH to 6.5.

If, however, the soil test Cu is <25 mg/kg, then no remedial action needs to be taken as Cu toxicity is not expected below that level.

Soil pH

A soil sample should be submitted for soil pH determination. If the soil pH is found to be <5.5, the standard Adams-Evans buffer pH test is run and a lime recommendation will be made to raise the pH to 6.5. Soil pH management is essential to prevent any trace element toxicity, particularly copper.

Citrus Nutrient Management Footnotes

In addition to the above nutrient recommendations, additional information on management is also included on the test reports. Following are the footnotes, providing the general and specific management tips, which form an integral part of the recommendations. This information should be carefully read and followed to obtain an optimum benefit from the diagnostic nutrient testing process.

General- Split fertilizer applications minimize salt damage potential, reduce leaching, and help maintain a continuous nutrient supply.

Nitrogen- Nitrogen has more influence on citrus growth, yield, and fruit quality than any other element.

For bearing trees, two-thirds of the annual N fertilizer rate should be applied between January and mid-June. The remaining one-third should be applied between early September and mid-October.

Phosphorus- If a citrus grove receives a recommendation to apply P fertilizer, the entire recommended dosage can be applied in a single annual application.

Potassium- Florida soils planted to citrus have naturally low nutrient-holding capacity in the root zone, so potassium leaches almost as readily as nitrogen.

Higher than normal rates of potassium fertilizer (up to 125% of the nitrogen rate) may be needed if the grove soil is calcareous.

Soil pH below 5.5 can solubilize soil copper to where it can become toxic. For soils high in copper, maintain soil pH close to neutral to reduce the potential for copper toxicity.

Foliar fertilizer application can reduce or eliminate soil micronutrient fertilizer applications and is the fastest method of short term micronutrient uptake if there is a deficiency. It should not be relied upon for long term tree nutrition unless the soil is calcareous.

REFERENCE:

Obreza, T. A., and K. T. Morgan. (ed.) 2008. Nutrition of Florida Citrus Trees, 2nd Edition. Univ. of Florida-IFAS, Soil and Water Science Dept. SL 253.

Table 1. Soil test interpretation and phosphorus recommendations for commercial citrus groves, 1-3 years of age.

Soil Test Phosphorus, ppm	0-10	10-15	16-30	31-60	>60
Interpretive Classes	Very Low	Low	Medium	High	Very High
Recommendation (lbs/tree)	Apply P_2O_5 at 100% of the \dot{N} rate	Apply P_2O_5 at 75% of the \dot{N} rate	Apply P_2O_5 at 50% of the \dot{N} rate	0	0

Table 2. Test interpretations and phosphorus recommendations for commercial citrus groves, ages 4 and above.

Leaf Tissue P level	Soil Test P level	P recommendation
High or Very High	Soil Test P not applicable	0 lbs of P_2O_5 for 12 months until re-evaluation
Optimum	Sufficient	0 lbs of P_2O_5 for 12 months until re-evaluation
Optimum	Less than Sufficient	8 lbs P_2O_5 /acre for every 100 boxes/acre of fruit produced during one year
Low	Less than Sufficient	Apply 12 lbs P_2O_5 /acre for every 100 boxes/acre of fruit produced during one year
Deficient	Less than Sufficient	Apply 16 lbs P_2O_5 /acre for every 100 boxes/acre of fruit produced during one year

Table 3. Test interpretations and magnesium recommendations for commercial citrus groves.

Soil Test Magnesium, ppm	<15	15-30	>30
Interpretive Classes	Low Very Low	Medium	Very High/High
Recommendation	Apply Mg fertilizer at 20% of the N rate	Apply Mg fertilizer at 20% of the N rate	No Mg recommended



IFAS Analytical Services Laboratories Extension Soil Testing Laboratory

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Producer Citrus Test Information Sheet

Note: This Lab only tests samples from the State of Florida.

Mailing Address (please print)

Name _____ Phone _____
 Address _____
 City _____ FL Zip _____
 Date _____ E-Mail _____

- This form can be downloaded from our website.
- Detailed information on this test can be obtained from SL253 accessed at edis.ifas.ufl.edu
- For further information contact your local county Extension Agent

Fill in all requested information, using one line per sample and additional sheets for more than 5 samples.

Lab Use only	County	Acre-age	Test(s) Requested (see Page 2 or back)	Age of Tree (in yrs.)	Variety* (for trees 4+ yrs)	Trees 4+ yrs Sample ID Standard Soil Test + P	Trees 4+ yrs Sample ID Leaf Tissue Test for P	Expected Yield**	Cost

NOTE:

* Variety: **For trees 4+ years old** - Please provide variety code: Orange- 63, Tangelo- 64, Tangerine- 65, Grapefruit- 66
 Expected Yield: **For trees 8+ years old- Please provide expected yield in either Boxes/acre 'or' Lbs solids/Acre

Check _____ Money Order _____ Cash _____ Total _____

Important Information for Soil Sample Collection and Submission

Before Sampling:

1. When taking a soil sample make sure and sample near the dripline of the trees and not in the row middle.
2. A sampling program is most effective if it is done annually.
3. Soil sample bags, addressed shipping boxes, and information sheets are available free from your county Cooperative Extension office. Obtain the materials you need to complete your sampling plan.

Collecting Samples:

1. In Florida, soil samples should be collected at the end of the summer rain season (August - October) before fertilizing in the fall.
2. Sample from soil surface to depth of tillage, usually 0 to 6 inches.
3. Collect soil from 20 or more spots within each area, mixing these samples in a clean plastic bucket.
4. Spread the composited material on clean paper or other suitable material to air dry. Do not send wet samples.
5. Mix the dry soil, and place about one pint of soil in a labeled sample bag.

Sending samples to the Extension Soil Testing Laboratory:

1. Enter each sample's identification on its sample bag and in the Sample ID Standard Soil Test + P column. List each sample separately.
2. Lime and fertilizer recommendations are provided only if the crop code is listed.
3. Include the analysis code for each desired test.
4. Enter the fee from the Analysis Cost list found on page 2 of this form.
5. Sum the costs of all samples and analyses. Make check or money order payable to: **University of Florida**.
6. Include the completed Producer Soil Test Information Sheet and the check or money order in the shipping box with the sample(s).

Test results:

A soil test report will be mailed to you within 5 to 10 days after your sample arrives at the Extension Soil Testing Laboratory. Contact your county Extension office if you have questions concerning the Citrus Test Report.

How To Take, Prepare, and Submit Plant Tissue Samples (for Analysis C2)

1. Ensure that each sample contains at least a generous handful of plant material (around half a gallon).
2. Be aware that spray residues, dust or soil on leaves can affect sample results; avoid sampling recently sprayed leaves; If all tissue is dusty or spray contaminated, wash leaves gently with flowing distilled water.
3. Do not sample disease-, insect-, or mechanically damaged plant tissue.
4. Place tissue samples directly into a clean paper or cloth bag or envelope. Do not use plastic containers.
5. If the plant tissue is wet or succulent, allow plant material to air dry for at least one day, before mailing.
6. When sampling suspected nutrient-deficient plants, two samples are recommended; one sample from normal plants, and another sample from abnormal plants.
7. The best time to collect 4-6 months old spring flush leaves for testing is July and August. Avoid immature leaves since they change composition rapidly.
8. Please do not provide any roots along with the sample.

Important Information

- **Soil Testing** is most useful for pH, P, Ca, Mg and Cu; **Leaf Tissue Testing** is valuable for all of the elements.
- **Nitrogen:** N rates are standard for all citrus trees up to 3 years after planting. The tree variety (orange, grapefruit, tangelo, tangerine) is needed for trees 4 to 7 years old; for trees 8 years and older the variety also must be specified. If the variety is oranges, the expected yield in boxes/acre or lbs solids/acre must be given.
- **Phosphorus:** For trees up to 3 years after planting, a standard soil test ONLY is required. If tree is 4 years or older, please provide leaf sample for a Leaf Tissue Test as well as a soil sample for a standard soil test.
- **Potassium:** The tree age must be given because the recommended K₂O rate coincides with the recommended N rate. For trees up to 3 years after planting, recommended rates are given in lbs per tree. For trees 4+ years old, the K₂O rate is given in lbs per acre.
- **Magnesium:** A standard soil test must be performed. Based on the results a recommendation will be given that is proportional to the recommended N fertilizer rate.
- **Copper Toxicity:** A micronutrient soil test must be performed. A pH test is required when Cu is greater or equal to 25 mg/kg.
- **Soil pH:** Included in the standard soil test. Liming recommendations are given based on results to a target pH of 6.5.

Analysis Code	Analysis Name	Determinations Made	Analysis Cost
C1	Standard Soil Test	pH, N, P, K, Ca, and Mg (For Trees 1-3 years of age)	\$7.00
C2	Standard Soil and Tissue Test	pH, N, P, K, Ca, and Mg (For Trees 4+ years of age)	\$15.00
C3	Micronutrient Test	Cu, Mn, Zn	\$5.00
C4	pH and Lime Requirement	pH and lime requirement	\$3.00