



UNIVERSITY OF  
**FLORIDA**

HS905

EXTENSION

Institute of Food and Agricultural Sciences

## Tissue Testing of Vegetable Crops Grown in Florida in the BMP Era<sup>1</sup>

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This publication is one of a series entitled Fertilizer and Irrigation Management in the BMP Era.

This series is divided into nine principles described in the Introduction Chapter (HOS-897). This publication is part of Principle 3, "Monitor Crop Nutritional Status and Discover How Healthy the Plants Are" BMP implementation requires a global approach to production management. However, for presentation purposes, each aspect of vegetable production is described in a separate publication.

Efficient fertilizer management for vegetable crops is required to reduce costs, conserve natural resources, and minimize the impact of production on the environment. Efficiency goals can be achieved through optimum fertilizer management. Understanding the concept of crop nutrient requirements (CNR) is one of the keys to efficient fertilizer management. Moreover, tissue testing is an important tool in fertilizer management through monitoring and diagnosis the plant's nutritional status. Not all nutrients present in the soil are available for crop uptake. Processes such as chemical precipitation, competition or change in chemical form affect availability. It is therefore, essential to assess the efficiency of a fertility program by monitoring crop nutritional status. As a management tool, tissue

testing can increase a growers return by preventing deficiencies that can dramatically reduce yield(s), and market quality, and thereby profitability.

### Working Definition

Tissue testing is the analysis and diagnosis of the plants nutritional status based on its chemical composition. It is commonly done as analyses on dried leaves or dried petioles or on sap from fresh petioles, with results compared to sufficiency ranges.

### Plant Sampling - Things to Do

- Perform testing as soon as possible after symptoms are evident if trying to diagnose a suspected nutrient deficiency.
- Begin sampling once the crop is established and continue at regular intervals (weekly or biweekly).
- Sample the "most recently matured leaf" (MRML). The MRML leaf is the leaf that has turned from a light-green, juvenile color to a darker-green color and has reached full size. For most crops the MRML is the 5<sup>th</sup> or 6<sup>th</sup> leaf from the growing tip.

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- Collect enough leaves so that the sample is representative of the crops stand, and make sure the sample is large enough to perform the required analysis.
- Remove similar leaf (i.e., physiological age and position) from each plant sampled.
- Collect one composite sample from the area exhibiting the disorder and a second sample from “normal” (asymptomatic) plants for comparison when trying to diagnose a nutrient deficiency.
- Separate and properly label the “disorder” sample and the “normal” sample in order to make a valid comparison after analyses.
- Keep notes on condition of crop and stage of growth, weather, variety, etc. for future reference.

### **Choosing a Laboratory for Tissue Testing - Things to Do**

- Select a reliable, accredited laboratory with a routine turnaround time of less than 48 hours.
- Continue testing with the same laboratory throughout the season in order to avoid differences in recommendations due to different analytical methods and interpretations.
- Select a laboratory that also provides interpretations and recommendations based upon the test results and which are appropriate for your growing region and are based on research and that does not sell fertilizers.
- Properly label each sample, provide a matching list, and clearly specify the analysis requested.

### **Preparation for Shipping - Things to Do**

- Be careful not to crush or damage sample during cleansing. In most typical situations, cleansing is not needed. Rinse the leaf samples (if they are contaminated with soil, dust or other materials) in a dilute (2%) non-phosphorus detergent solution for 3 minutes followed by two distilled-water rinses.

- Blot the samples dry with absorbent paper after rinsing and air-dry the samples several hours before shipment.
- Wrap the samples in absorbent paper and place in a large envelope if a plant analysis kit is not available.
- Mail immediately to the analytical laboratory.

### **Plant-sap Quick Tests for Nutrient Analysis - Things to Do**

- Use these “quick tests” in conjunction with routine foliar analysis. These “quick tests” are used for the mobile nutrients, particularly nitrate-nitrogen and potassium.
- Some kits read the nitrogen values in nitrate and some in nitrate-nitrogen. Most calibration tables for nitrogen are in nitrate-nitrogen values. For kits that read out in nitrates ( $\text{NO}_3$ ), the reading must be divided by 4.43 to find the nitrate-nitrogen value, which can then be compared to chart values. Potassium is usually read directly and is expressed in parts per million or mg/l.
- It is essential for the quality of the interpretation that results of fresh-sap testing are compared to threshold values also based on fresh-sap samples. Only fresh petiole sap nutrient values can be used with fresh petiole sap-testing procedures.
- Make consistent readings at the same time for each sampling event to minimize variability due to crop water status at time of sampling.
- As recommended for foliar sampling, collect the most recently mature leaves, separate leaf blades from petioles, and place petioles in a plastic bag on ice if storing is necessary. Note: petioles can be stored on ice for up to 8 hours or frozen overnight without appreciable changes in the nitrate reading.
- Store petioles only, not sap, in a plastic bag at room temperature (70° F).

- Calibrate petiole-sap test kits and test with standards, which are known nitrate and potassium solutions available from the test kit manufacturer.
- Warm cold petioles to room temperature before extracting sap, so that temperature differences between sap and meter do not affect results.
- Make the measurement of the pressed sap within one or two minutes of pressing. Otherwise, nitrate readings could change from the fresh petiole condition when the sap is exposed to air.

### Things to Avoid: Potential Pitfalls

- If samples have not been washed, avoid all plant tissue testing if the crop has received foliar nutrient sprays containing fertilizers or nutrient-containing pesticides nutrients, especially micronutrients.
- Avoid sampling plants damaged by pests, diseases, or chemicals when trying to monitor the nutritional status of the crop.
- Avoid using tap water to rinse leaf samples since it can be high in certain nutrients such as calcium, iron, magnesium, or sulfate sulfur.
- Never use plastic bags for shipment because of the risk of ammonia volatilization.
- Do not expose sap “quick test” kits to higher temperatures.

### Applicable Technical Criteria

Nutrient sufficiency ranges for Florida vegetables have been published in “Special Series SSVEC-42”, *Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida*, by Hochmuth et al. (1991), available from county extension offices.

### Operation and Maintenance Issues

Store test kits and chemicals in a protected place, within the proper temperature ranges specified by the manufacturer.

### Other Considerations

- One of the main reasons for tissue testing is to monitor the plants nutritional status during the growing season. This is especially useful if the grower has a means of adjusting fertilization regulating nutrition under field conditions.
- Tissue testing may also be used to diagnose a suspected nutritional deficiency, toxicity or imbalance.
- Individual plants, even side-by-side, may have a different nutritional status. Therefore, sample a large number of plants to account for this variability.
- Sample decontamination is essential when the sample contains visible amounts of soil or when micronutrient levels will be determined.
- It is preferable to include a soil sample together with a tissue sample when submitting to a diagnostic lab since the soil sample may indicate other factors, such as pH, that may influence crop growth, nutrient availability, and uptake.
- When possible, request analytical results to be returned to you via electronic mail or facsimile.
- Use reputable lab or other sources for interpretation of lab results. Interpretation guidelines should be based on actual field research, not on “typically observed”, or historical lab databases.

### Additional Readings

Plant Petiole Sap-testing for Vegetable Crops, Circ. 1144, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. <http://edis.ifas.ufl.edu/CV004>

Plant Tissue Analysis and Interpretation for Vegetable Crops in Florida, SS-VEC-42, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla.

Plant Tissue Test Information Sheet, SL181, Fla. Coop. Ext. Ser., IFAS, Univ. of Fla. <http://edis.ifas.ufl.edu/SS182>

Plant Analysis Handbook II (Athens, Georgia)