Department of Horticultural Science

Horticulture Information Leaflet 560
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Submission Procedures for Root Substrate, Water, Fertilizer Solution, and Plant Tissue Samples

Brian Whipker
Commercial Floriculture Extension Specialist

Providing the proper nutrition program for your plants is important for controlling growth. Sampling the root substrate or plant tissue is a simple check of the nutritional status of the crop and can provide clues about a crop's performance before deficiency or toxicity symptoms appear. Plant leaf tissue analysis is especially useful when one needs to determine micronutrient levels in the plant. Testing your irrigation water provides information on pH, electrical conductivity (EC), and alkalinity levels. High alkalinity can significantly increase the root substrate pH over time. The pH of your root substrate dramatically influences the availability of various nutrients to your plants. In addition, growers may want an analysis of their fertilizer solution to double check their mixing procedures or to check the calibration of their injectors. The purpose of this leaflet is to provide instructions to growers for taking representative samples for laboratory analysis. A selected list of labs specializing in greenhouse root substrate, irrigation water, fertilizer solution, and plant tissue samples is provided in Table 1.

Greenhouse Root Substrate

Conducting routine analysis is essential in determining the nutrient status of your crop. It is recommended that samples be sent to a lab every 3 to 4 weeks to check nutrient levels. A standard analysis usually includes: pH, EC, NO_3-N, NH_4-N, P, K, Ca, and Mg. In some cases growers may also want to test for sulfur and micronutrients (S, B, Cu, Fe, Mn, Mo, and Zn) in their root substrate. Generally, testing for micronutrient concentration in the root substrate is recommended only under special circumstances and not for routine analysis. Plant tissue analysis is a better indicator of micronutrient concentration.

Sampling Procedure

The substrate sample should be representative of the crop or problem you wish to analyze.

1. For routine analysis, samples should be collected from 5 to 10 pots and combined into a single sample. The sample should be collected by either: a) removing a wedged-shaped piece from the top to the bottom of the pot, excluding the top 1/2 inch of the substrate or b) pinch a handful of substrate from the center 1/3rd of the pot.
2. Thoroughly mix the subsamples together to make a single homogeneous sample. Remove any large roots or debris.
3. Problem pots or benches should be sampled individually.
4. Samples should be placed in a plastic bag, which is labeled with your name, address, the crop, and location of sample.

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Table 1. A selected list of labs specializing in greenhouse root substrate, irrigation water, fertilizer solution, and plant tissue samples. Check with the individual labs about the type of analysis conducted and if a submission form is required.

Lab / Address / Phone	Analysis Available / Cost
Cornell Nutrient Analysis Laboratories Plant Science Unit, 21A Plant Science Building, Ithaca, NY 14853-5908 607-255-4532	Root substrate and fertilizer solutions at $20/sample for pH, EC, microelements and macroelements.
	Plant tissue $25/sample for macroelements and microelements.
	Irrigation water acid injection test and rates at $10/sample.
Fafard Analytical Services 183 Paradise Blvd., Suite 106, Athens, GA 30607 800-457-3301	$24/sample for root substrate, irrigation water, fertilizer solution, or plant tissue. Analysis includes a complete testing for macroelements and microelements. *Slightly lower prices for Fafard customers.*
MMI International Laboratory 183 Paradise Blvd., Suite 108, Athens, GA 30607 800-837-8664	$30/sample for root substrate, irrigation water, fertilizer solution, or plant tissue. Analysis includes a complete testing for macroelements and microelements.
North Carolina Dept. of Agriculture 4300 Reedy Creek Road, Raleigh, NC 27607-6465 919-773-2656	Plant tissue analysis for macroelement and microelements at $4/sample. **Services available to only North Carolina residents.**
	The extraction method used for soilless root substrate is not the saturated paste extract.
Ohio State University Research-Extension Analytical Laboratory, OARDC, 1680 Madison Ave., Wooster, OH 44691 330-263-3760	Root substrate at $12/sample and includes pH, EC, NO_3-N, P, K, Ca, and Mg. The standard tests with microelements is $16/sample. NH_4-N is an additional $7/sample. Volume discounts available.
	Nutrient solutions and irrigation water testing available. Prices vary with tests conducted.
	Plant tissue analysis is $14/sample for N, P, K, Mg, Mn, Fe, Cu, B, and Zn.
Purdue University Root Media Testing Lab 1165 Horticulture Bldg., Purdue University, West Lafayette, IN 47907-1165 765-494-6619	Costs are based on the number of samples submitted during a monthly billing cycle. Root substrate and fertilizer solutions, for 1 to 3 samples are $10/sample, for 4 to 10 are $9/sample, and for >10 samples are $8/sample. Samples analyzed for the macroelements, pH and EC. *Microelements and plant tissue samples are not done.*
	Irrigation water at $6/sample for pH, EC, and alkalinity.
Scott's Testing Laboratory 6656 Grant Way, Allentown, PA 18106 800-743-4769	$28/sample for root substrate, irrigation water, fertilizer solution, or plant tissue. Analysis includes a complete testing for macroelements and microelements.

- Follow the same procedure every time you sample so you can compare results and detect trends over time.
- One to 2 pints of substrate are required for conducting analysis, but smaller volumes can be submitted, but the results may not be as accurate.
- New substrate should be wetted to container capacity by placing the sample in a growing container, watering it until drainage occurs, and after drainage stops the sample can be bagged and mailed. With mail delivery time, this allows 2 days for the lime to react and correct pH readings can be obtained.

Irrigation Water Testing

Alkalinity can be a major factor affecting pH changes in the root substrate. The higher the alkalinity level, the quicker there will be an increase in pH of soilless root substrate. Water tests are recommended for each well and should be done one to four times a year. A standard analysis usually includes: pH, EC, and alkalinity.

Growers may also want to test for macro- and micronutrients (N, P, K, Ca, Mg, S, B, Cl, Cu, Fe, Mn, Mo, and Zn) in their water. Testing for macro- and micronutrients should be done for each well at least once a year. Growers with excessive alkalinity levels will need to neutralize it by acid addition. Check to see if your lab provides an acid addition rate. (*See HIL 558 for additional information on alkalinity control.*)

Sampling Procedure

1. Allow the water to run for 5 minutes to clear the line.
2. Rinse a clean plastic 16 oz. container 2 to 3 times with the water to be tested.
3. Fill the container completely and cap tightly.
4. Label bottle with your name, address, and type of analysis requested.
5. Mail the sample within 24 hours.

Fertilizer Water Testing

Fertilizer water tests are recommended for checking the accuracy an injector or to check mixing procedures. Testing by commercial labs should be done 2 to 4 times a year. In addition, growers should conduct weekly in-house EC testing of their injectors accuracy. A standard analysis usually includes: pH, EC, NO_3-N, NH_4-N, P, K, Ca, and Mg. Before submitting a sample, growers should accurately weigh out their fertilizer and thoroughly mix it to have a representative sample.

Sampling Procedure

1. Allow the fertilizer water to run for 5 minutes to obtain a representative sample.
2. Rinse a clean plastic 16 oz. container 2 to 3 times with the water to be tested.
3. Fill the container completely and cap tightly.
4. Label bottle with your name, address, and type of analysis requested.
5. Mail the sample within 24 hours.

Plant Tissue

Plant tissue analysis can be conducted to determine the nutrient status of the crop or for problem solving. Plant tissue analysis is especially useful when one needs to determine micronutrient levels in the plant. A standard analysis usually includes: macroelements (N, P, K, Ca, and Mg) and micronutrients (B, Cu, Fe, Mn, Mo, and Zn).

Sampling Procedure

The leaf tissue samples should be representative of the crop or problem you wish to analyze.

1. For routine analysis collect leaves from 20 to 30 plants (more leaves are required for plants with small leaves) and combine into a single sample.
2. Problem plants or benches should be sampled individually.
3. If foliar nutrient sprays have been used, gently wash the leaves in distilled water for 10 to 20 seconds to remove surface contaminants.

4. Samples should be sent in a paper bag, which is labeled with your name, address, the crop, and location of sample.
5. Mail the sample within 24 hours. Try to collect the sample at the beginning of the week so delivery will not be delayed over the weekend.

- Plant analysis standards for many of the minor floriculture crops have not been established. Submit a problematic and a non-problematic sample for a comparison.
- Generally, the most recently matured, fully expanded leaves are collected from the upper part of the plant.
- Follow the same procedure every time you sample so you can compare results and detect trends over time.