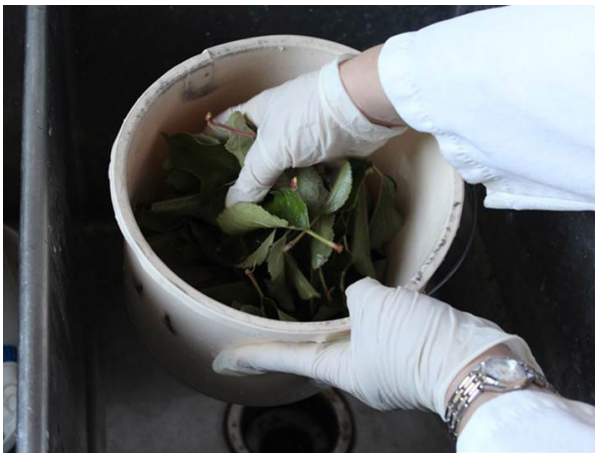

Washing Plant Tissue Samples for Mineral Nutrient Analysis

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS134E

Introduction

Plant tissue analysis is a means of learning the nutritional status of young or established fruit trees and vegetables. To obtain accurate test results, it is essential to prepare the best tissue samples possible. One of the important steps in tissue sample preparation is cleaning and hand-washing leaves gently and thoroughly to free them from dust or any other surface contamination. Leaves contaminated with the residues of various spray materials, such as insecticides, fungicides, or foliar-applied nutrients, may result in an erroneous analysis and thus an erroneous nutrient recommendation. Unless leaves are washed, the nutritional analysis will report what is *on* the leaves, instead of what is *in* them (Figure 1).

Figure 1. Leaves contaminated with dust or residues from insecticides, pesticides, or foliar-applied nutrients may result in an erroneous mineral nutrient analysis.

How to Choose the Correct Cleaning Solution

The choice of cleaning solution depends on the following two factors:

- ***The characteristics of the leaf.*** Leaf surfaces have different textures; some are smooth, some are rough, and some are covered with tiny hairs. Simply washing with water can remove contaminants from smooth leaves, but not from rough-textured leaves.
- ***The nature of the contaminant.*** Contaminants, such as pesticides and foliar-applied fertilizers, are difficult to remove by simply washing with water. In the case of pesticide contamination, wash with a weak acid or hydrogen peroxide. If dust is all you see on your samples, washing them under running water is adequate (Figure 2).

Figure 2. Remove dust from leaves by running them under tap water.

How to Choose the Correct Washing Method

Four different washing methods are presented here. Choose the proper method to use based on the leaf characteristics and the nature of the contaminants present, as well as on the availability and suitability of the washing solutions for your situation (Figure 3).

- *Washing with Deionized Water*
  This method involves washing leaves with running tap water followed by rinsing in deionized water. Distilled (pure) water can be used in place of deionized water. This cleaning method can remove major contaminants that easily detach from the

Figure 3. Prepare weak detergent, weak acid, or hydrogen peroxide solution.

leaves. The drawback of this method is that it may not work for more resistant contaminants, such as calcium chloride. Distilled water can be purchased inexpensively at most grocery stores.

- *Washing with Weak Detergent*
  This method involves rinsing the samples under running tap water and then washing them with detergent at a 0.25% detergent to water ratio (1 fluid ounce in 3.1 gallons of water). This is followed by rinsing samples twice in deionized water. The detergent solution is a dispersant, which will force dust molecules to detach from the surface of leaves. As noted earlier, this method may not be sufficient to remove harder materials, such as calcium chloride.

  Some useful detergents include Igepal CA-630 (about $12.00/oz) and Triton X100 ($15.00/oz). Other detergents that are available in local stores, such as phosphate-free FOCA and Palmolive, can be used in place of Igepal CA-630 or Triton X100.

- *Washing with Weak Acid*
  Using this method, samples are first rinsed under running tap water. The samples are then washed in diluted weak acid, such as hydrochloric (muriatic) acid. Two final deionized water rinses will complete the cleaning process. Chemical washing using weak acid is recommended for materials that adhere to leaves more tightly after spraying, such as calcium chloride. Various weak acids are available in many local hardware stores. Make sure you know what concentration of the weak acid you need to purchase.

  Weak acids must be diluted to a benign level in order to prevent leaf-tissue disintegration. For example, muriatic acid (one gallon can be purchased for as low as $7.00) is available in many hardware stores at a concentration of 20%. It must be diluted to an appropriate concentration to avoid dissolving leaf tissue. For example, to make one quart of dilute muriatic acid solution, mix 1.6 tablespoons of the muriatic acid in one quart of water. This diluted muriatic acid is no longer corrosive and can be disposed of by letting it go down the drain during sample washing. In contrast, undiluted acid must be stored and handled according to the Washington State local hazardous material storage and disposal code. These storage and handling requirements can be found on the Washington State Department of Ecology website at http://www.ecy.wa.gov/programs/hwtr/.

- *Washing with Hydrogen Peroxide and Salt*
  Hydrogen peroxide can replace detergents or weak acids for washing leaf samples. It is easily accessible and cheap. The best recommendation is to use 3% hydrogen peroxide (16 oz costs about $6.00). The washing steps remain the same as those for weak-acid- or detergent-based washing. However, first mix the hydrogen peroxide and salt in water. To do this, fill a clean plastic bucket with a known amount of water (for example, one quart). Add 6 teaspoons of hydrogen peroxide plus two teaspoons of salt to the water. Hydrogen peroxide is much easier to remove from leaves when repeatedly rinsed with deionized water. The final step involves rinsing the samples twice using deionized water. Hydrogen peroxide in diluted form can be purchased at most grocery stores and pharmacies. Follow the label instructions for storage and handling.

How to Ensure the Best Sample Condition

The following list offers some guidance for obtaining and sending quality leaf samples for nutrient analysis.

- Make sure leaf samples are not physically cut or torn in order to avoid the leaching of some nutrients into the washing solution.
- Avoid letting samples soak for an extended time in a solution of weak detergent or acid to prevent leaching, which can happen even when leaves are undamaged.
- Washing must be completed quickly, generally in less than one minute; less than half a minute if the solution is a weak acid or hydrogen peroxide, in order to avoid nutrient leaching.
- Do not use concentrated detergent or acid for washing because it could damage tissue samples. (A solution of 0.25% to 3% in weight/volume (W/V) or in volume/volume (V/V) are generally considered a weak concentration.)
- Not all off-the-shelf detergents qualify for sample washing.
- Air dry samples thoroughly before sending them for analysis (Figure 4).
- Place dried leaves in a clean, clearly labeled paper bag (Figure 5). (Never send fresh samples in plastic bags or other unventilated containers.)

Figure 4. Rinse leaves and let them dry on clean tissue until all moisture drains or evaporates.

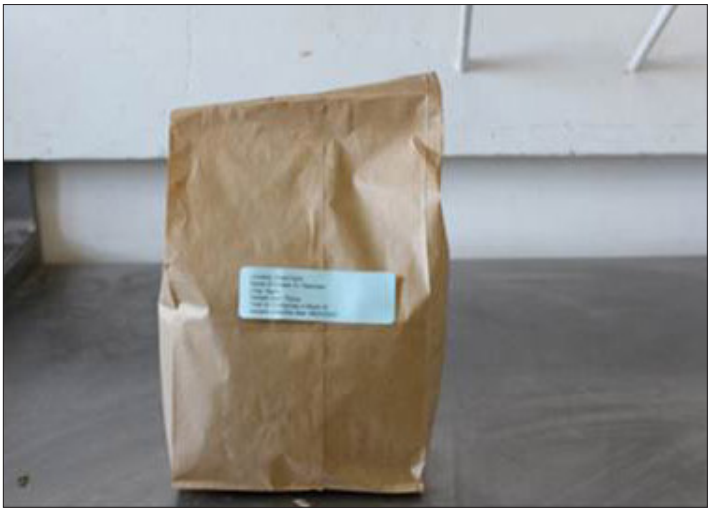

Figure 5. Prepare samples and place them in a clearly labeled paper bag. (Never send samples in plastic bags or other unventilated containers.)

- Send leaf samples immediately to the lab for analysis.

How to Handle Acids Safely

- **Always** follow the directions on the product label.
- Always wear gloves and eye protection when handling acids of any kind.
- Always work in well-ventilated spaces to avoid chemical fumes.
- Always add acid to water **NOT** water to acid to avoid splashing hazards.

How to Handle a Chemical Accident

- Remove the source of the chemical spill.
- Remove clothing and other items that have been in contact with the chemical.
- Lightly brush off any chemical residue, using sterile cloths.
- Rinse affected area with gently running water for 15 minutes or more.
- Carefully cover burns with an ice pack wrapped in a wet washcloth.
- Wrap dry, sterile bandages around the burn.
- Seek medical attention.

Summary

Leaves contaminated with residues of various spray materials, such as insecticides, fungicides, or foliar-applied nutrients, may result in an erroneous laboratory report and thus an erroneous nutrient recommendation. Correctly washing any residue off plant tissue samples is an important step in minimizing erroneous lab results. As discussed earlier, samples can be washed with tap water, weak acid, weak detergent, or hydrogen peroxide, depending on the type of leaf and residue present. Regardless of cleaning solution, tissue samples must be rinsed again twice with deionized water. It is important to avoid using a concentrated washing solution that may damage a tissue sample, and it is important to perform the washing as quickly as possible to avoid leaching of nutrients out of the leaf tissues. Following the guidelines in this fact sheet will allow you to send the best tissue samples possible, ensuring the most accurate test results and, thus, the most accurate nutrient recommendations.

Resources

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