e-GRO Alert

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Target Leaf Tissue Sampling for Precise Nutrient Diagnosis

Substrate pH influences nutrient availability. When substrate pH rises or falls below the optimal species-specific range, nutrient deficiency or toxicity symptoms can develop. Sampling plant leaf tissue for nutrient analysis will aid in identifying nutritional symptomology and determining the appropriate corrective procedure.

In floriculture, high-quality crops are those free of pests and diseases; the plant is proportional to the container size; foliage is blemish free and colorful for foliage crops; and are budding and flowering. These characteristics influence the overall aesthetic appeal, marketability and profitability of a crop. However, during production, nutritional disorders such as deficiencies and toxicities can occur affecting crop growth and development and thus, the aesthetic appeal and value.

Nutritional deficiencies and/or toxicities can develop as a result of environmental, physiological, mechanical, chemical, and/or cultural factors. The most common factor inducing nutritional deficiencies and/or toxicities is substrate pH drift. When substrate pH rises above a species-specific optimal pH, nutrients such as P, Fe, Mn, B, Zn, and Cu become less available for update and plant develop deficiency symptoms. When substrate pH falls below a species-specific optimal pH, Ca and Mg become less available for uptake resulting in deficiency symptoms. Furthermore, at low substrate pH, Fe, Mn, B, Zn, and Cu are more available for uptake and lower, matured leaves can develop toxicity symptoms. To best identify nutrient disorders or to determine the nutrient status of a crop, growers should 1) perform in-house nutritional testing of the substrate pH and soluble salts [referred to as electrical conductivity (EC)] by conducting either a 1:2 Dilution, Saturated Media Extraction (SME), or PourThru; and 2) sample leaf tissue for nutrient analysis.

When sampling leaf tissue for nutrient analysis, growers should consider sampling recently matured or lower leaves; older, symptomatic; and/or symptomatic leaf tissue. Sampling lower or older, symptomatic leaf tissue will help capture micronutrient toxicities. Nonetheless, growers should consider sampling recently matured leaves and location-dependent symptomatic leaves for nutrient concentration comparison, as most lab reports do not provide species-specific sufficiency ranges. To sample leaf tissue for general routine nutrient analysis, please follow this general procedure:

1. Collect 20 to 30 leaves from plants of the same crop (species and cultivar) by removing recently matured, fully expanded leaves from upper plant parts (Fig. 1).
    - Smaller leaf species such as bacopa and calibrachoa may require sampling more plants to obtain a sufficient amount of leaf tissue than species with larger leaves such as geranium and New Guinea impatiens.
2. Gently wash sampled leaves in distilled water for 20 to 30 seconds (Fig. 2).
    - Removes fertilizer or spray residues or other contaminates that can skew nutrient results. In some instances, analytical labs will wash leaf tissue therefore follow your preferred lab-specific sampling and preparation procedures.
3. Gently dry leaf samples with a paper towel (Fig. 3).
4. Place leaf samples in a paper bag or lab issued envelope (Fig. 4). Do not place leaf samples in plastic bags due to the potential of rot.
    - Label paper bags with your greenhouse business name, address, sample date, crop/cultivar, and location of sample.
5. Provide all requested information to your preferred lab such as crop notes, fertility regime, chemical applications, and/or when the symptoms were first noticed.
6. Mail or ship leaf tissue sample(s) within 24 hours
    - If possible, collect samples at the beginning of the week so delivery will not be delayed over the weekend.

Figure 1. Collect 20 to 30 leaves from plants of the same crop (species and cultivar) by removing recently matured, fully expanded leaves from upper plant parts. Photos by: W. Garrett Owen.

For plants exhibiting abnormal vegetative or root growth or visual deficiency or toxicity symptoms, sample leaves individually or as another combined sample. It is important to differentiate samples by labeling them as 'normal growth' and 'abnormal growth' or similar, thereby allowing you to compare leaf tissue nutrient concentrations (Fig. 5; Owen et al. 2018). Please note, for all sampling and to obtain best results, follow your preferred lab-specific sampling and submission procedures. Most times, sampling procedures or guides are available online or upon request.

To learn more about nutritional monitoring procedures, refer to e-GRO's fertdirtandsquirt.com. For more nutritional monitoring of greenhouse crops, read

e-GRO Alert 7-02: Corrective Procedures for Modifying Substrate pH and Electrical Conductivity (EC) and to download a free corrective procedures poster (11" × 17"), refer to "Corrective procedures for high and low substrate pH and electrical conductivity".

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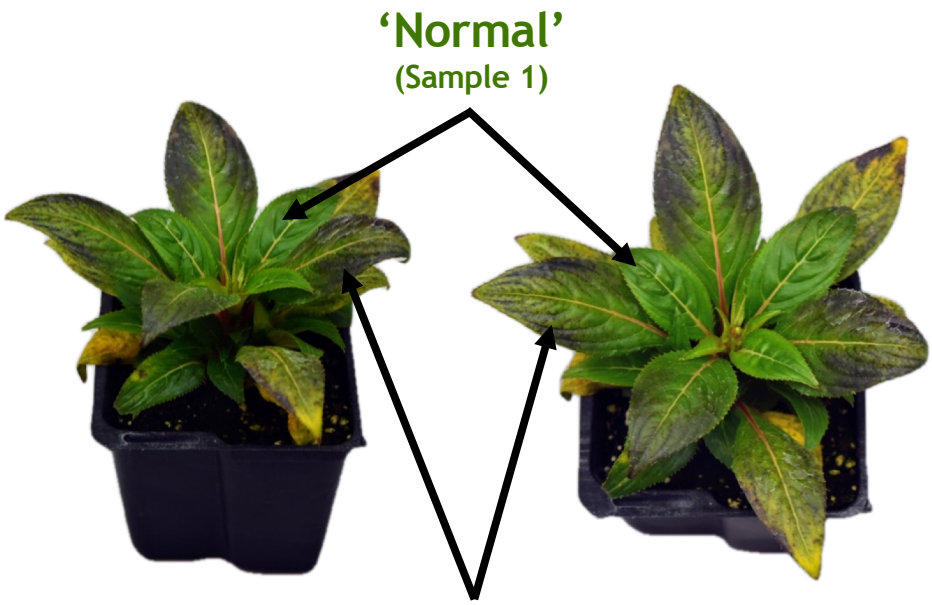
Owen, W.G., B.E. Whipker, J.B. Henry, P, Cockson, and H. Landis. 2018. Low substrate pH-induced iron/manganese toxicity of New Guinea impatiens: A diagnostic guide. Plant Health Prog. 19:324–328.

Figure 2. Gently wash sampled leaves in distilled water for 20 to 30 seconds. Photo by: W. Garrett Owen.

Figure 3. Gently dry leaf samples with a paper towel. Photo by: W. Garrett Owen.

Figure 4. Place leaves in a paper bag or lab issued envelope. Photo by: W. Garrett Owen.



New Guinea Impatiens

(Owen et al., 2018)

	N %	P %	K %	Ca %	Mg %	S %	Na %	B ppm	Cu ppm	Fe ppm	Mn ppm	Zn ppm
Upper Leaves	4.34	0.23	1.17	2.55	1.15	0.51	0.03	16.8	2.13	129	170	45.6

	N %	P %	K %	Ca %	Mg %	S %	Na %	B ppm	Cu ppm	Fe ppm	Mn ppm	Zn ppm
Lower Leaves	5.53	0.70	1.95	2.73	1.11	0.78	0.04	45.1	3.81	1560	860	51.0

Figure 5. Example of leaf tissue samples and corresponding nutrient concentrations that differentiated between 'normal' (upper leaves) and 'abnormal' (lower leaves) visual leaf discoloration. Figure by: W. Garrett Owen.

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