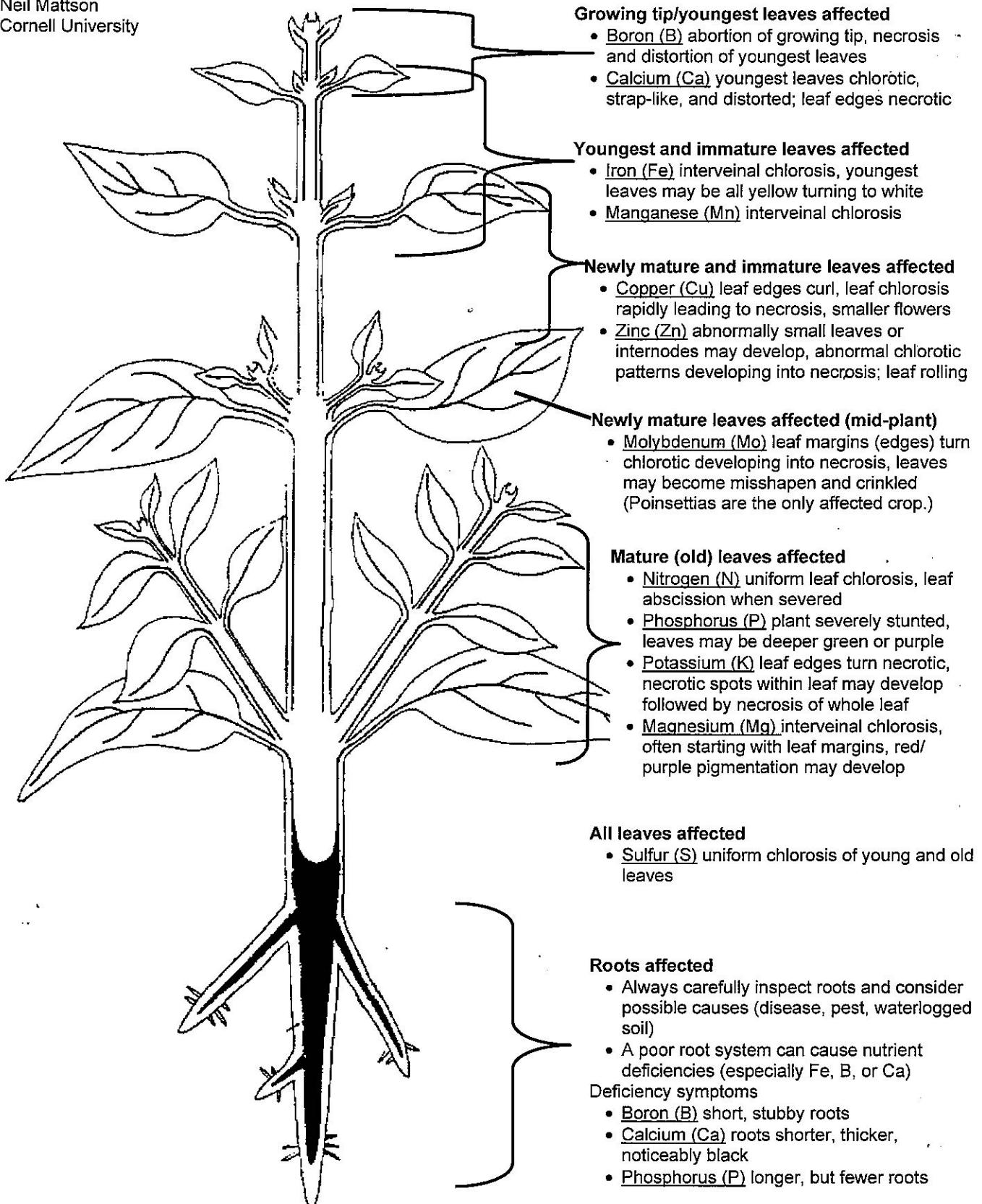


## NUTRIENT DEFICIENCY KEY

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Adapted from a written nutrient deficiency key by Brian Krug, UNH and Paul Nelson, NCSU

# Diagnosing Nutrient Disorders

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## Helpful Definitions

<u>Chlorosis</u>	leaf yellowing
<u>Necrosis</u>	tan/brown/blackened cells (tissue death)
<u>Marginal</u>	the edge of a leaf
<u>Interveinal</u>	between the veins
<u>Leaf distortion</u>	incomplete or abnormal expansion during leaf unfurling, irregular leaf shape

## How to read a substrate/tissue test to diagnose nutrient disorders

\*Important\* make sure you understand the units these are being reported in

- EC: 1 mhos/cm = 1 dS/m = 1 mS/cm = 1,000  $\mu$ mos/cm = 100 mhos  $\times$  10<sup>-5</sup> cm
- Macronutrients (N, P, K, etc.)
  - usually reported in ppm on the substrate (container media test)
  - usually reported in percent (%) on the tissue test
- Micronutrients (Fe, Mn, Zn, B, etc.)
  - usually reported in ppm on both substrate and tissue tests

## Steps to follow

- 1) Look at electrical conductivity (on soil tests – not on tissue tests)
  - High EC means plants have been overfertilized, underleached, or had high salts (such as from compost)
  - Low EC means plants have been underfertilized (check rates/injector), or overleached
- 2) Look at pH (on soil tests – not on tissue tests)
  - Remember pH effects nutrient availability
- 3) Check concentrations of macronutrients (N, P, K, Ca, Mg, S)
  - Are these within range or too low/too high?
  - Is there a pattern with many of them? (Such as several macronutrients too high = overfertilization).
  - On substrate tests nitrogen is usually listed as both nitrate (NO<sub>3</sub>) and ammonium (NH<sub>4</sub>). Ammonium (NH<sub>4</sub>) is the acidic form of nitrogen it is beneficial for keeping pH down, BUT the amount must typically be much lower than nitrate or plants can get burned from ammonium toxicity.

- 4) Check concentration of micronutrients (Fe, Mn, Zn, B, Ni, Mo)
  - Are these within range or too high or too low?
  - Is there a pattern with many of them?
    - several micronutrients too low, usually means substrate pH is too high
- 5) Look at two ratios
  - Calcium:Magnesium (Ca:Mg) this should be roughly 3:1 (too much calcium can limit magnesium uptake by the plant and vice-versa)
  - Nitrate:Potassium
- 6) Consider other causes of fertility problems
  - poor weather (low temperature and high ammonium fertilizer → ammonium toxicity)
  - poor drainage of container
  - over/under watering
  - poor light
  - nutrients can be tied up by the substrate (if pH is not balanced)
  - antagonisms with other nutrients (too much Ca can limit Mg uptake, etc.)
  - poor water quality (can lead to soluble salt burn, high pH, etc.)

## Possible Causes of Plant Disorders

### Environmental causes

- Too much/little light
- High/low temperature
- Too much/little water
- High humidity lack of air flow
- Poor substrate aeration

### Fertility Problems

- Deficiencies
- Toxicities
- pH
- High soluble salts

### Pests and Diseases

- Viruses
- Insects
- Bacteria
- Mites
- Fungus
- Water molds
- Nematodes
- Etc.

### Air pollutants

- Ammonia
- Ozone
- Ethylene

- Symptoms of ethylene (top growth deformed, leaves bending downward but not wilting [epinasty], flower bud abortion leaf chlorosis)

Phytotoxicity from chemical applications, often uniform symptoms develop a few days after application

- Pesticides
- Foliar Iron Chelate
- Growth Regulators

Herbicide Injury

- Volatilization
- Drift onto crop
- Persistence in soil
- Pots or potting mix in contact with herbicide

## **ONLINE RESOURCES**

Greenhouse Nutrient and Fertilizer Management

<http://www.greenhouse.cornell.edu/crops/nfmanagement.htm>

Contains links to several articles by Neil ☺

North Carolina State University Nutrient Deficiency Series

<http://www.ces.ncsu.edu/depts/hort/floriculture/def/>

Online version of some of the book material

Online Fertilizer Calculator

<http://extension.unh.edu/agric/AGGHFL/fertilizercalculator.cfm>

Online Alkalinity Calculator

<http://extension.unh.edu/agric/AGGHFL/Alkcalc.cfm>

## **Commercial Testing Labs for Tissue, Water, or Substrates**

- Dairy One / Agro-One <http://www.dairyone.com/AgroOne/>
  - \$24 tissue testing (Service Package 180, results only)
- A&L Eastern Laboratories <http://www.aleastern.com/>
  - \$24-30 (\$2 extra for tissue recommendation using NutriScription®)
- JR Peters Laboratory <http://www.jrpeters.com/>
  - \$36 for tissue, media, or water analysis (soil does not include OM)
- Macro Micro Laboratory <http://www.mmilabs.com/>
  - \$45 for tissue, media, soil, or water analysis
- Everris Testing Laboratory <http://protestinglab.everris.us.com/>
  - \$34 for tissue, media, soil or water analysis

Sampling procedures for substrate, water, fertilizer solution, and plant tissue

<http://www.ces.ncsu.edu/depts/hort/floriculture/hils/HIL560.pdf>