Container Nursery Crop Nutrient Deficiencies

A Photo Library, Descriptions & Acceptable Levels

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When nursery crops exhaust the nutrients needed for growth, they may exhibit specific deficiency symptoms. This color photo library and descriptions will aid in the identification of these deficiency symptoms. Testing is still necessary to confirm the deficiency, and the listing of acceptable levels will aid in interpreting the media and tissue nutrient levels.

Introduction

Nutrient deficiency symptoms can be used as an indicator of possible nutrient problems. However, potting media and plant tissue analysis are necessary to confirm the specific nutrient diagnosis and potential cause. Deficiency symptoms can be caused by imbalances of nutrients in the potting mix or plant. Multiple deficiencies can cause symptoms that are not typical of any of the individual deficient elements. Symptoms can also occur if the plant is unable to take up nutrients from the potting mix due to nonfunctional plant roots, improper pH, or disease infested roots.

Deficiency symptoms may be very distinct on one crop while less distinct on another. Therefore, what we consider typical symptoms may occur on most crops, but don't fit the expected symptoms on other crops. With the large variety of woody crops in the nursery, we expect to see some variation in symptoms on different crops that are caused by the same deficiency. Some crops (indicator plants) are also more sensitive to low levels of nutrients and would express symptoms, while more tolerant crops would have no expressed symptoms. The deficiency symptoms of phosphorous, potassium, calcium, sulfur, boron, copper and zinc are rarely seen or recognized in woody plants, although low levels may be reducing growth.

The UGA Nursery / Greenhouse Media test is used to identify low levels or excessive levels of elements in nursery potting mixes. The media test is used on all soilless nursery mixes and should include soluble salts and nitrates. The soil test bag should be 3/4 full and should not include any slow release fertilizer granules. The results will include soluble salts, pH, nitrate nitrogen, ammoniacal nitrogen, phosphorous, potassium, calcium and magnesium. The ranges of values given for each element should be considered as guideline levels only.

Plant analysis is used to determine elemental content of plant parts. The nutrient levels are compared to critical values or ranges. With critical values, only the low or deficient levels are identified. Excessive levels of elements can interact with other elements making them unavailable for plant use. Using the ratios of the elemental values for comparisons, help determine which elements may be excessive or deficient.

The combined use of media analysis and plant analysis help determine lime and fertilizer needs as well as diagnose nutritional problems. Media and plant analysis can be used to track changes in nutrient status during the production season. Maintaining records of media tests and plant analyses provide a historic record for all crops sampled. This historic log can help determine when fertilizer or lime treatments are needed as well as establish critical ranges for crops in production. With woody ornamentals, critical values have not been determined for all the different plants produced. Therefore, ranges are suggested that should include the levels that are adequate for most plants.

The combination of media and tissue analysis are used to determine if media fertility levels and applied fertilizers are sufficient to meet crop needs. The nutrient levels in the potting mix seem low when using controlled release fertilizers. However, if the tissue levels are adequate, the fertilizer is supplying the elements needed for growth at an acceptable level. In some problem cases, the nutrients are available in the media but are not being absorbed by the plant because of root or disease problems.

Proper sampling is necessary to insure representative tissues. The general rule of thumb is to sample the uppermost recently mature leaves. Young emerging leaves, older mature leaves, flowers and seeds are not suitable. Plants showing suspected nutrient deficiencies, should be sampled shortly after the visual symptoms appear. If normal plants are available, they should also be sampled for comparison. Leaves that are dusty or that were sprayed with fertilizer, minor elements or fungicides will have residues on the leaf surface. Washing the leaf surface will help remove these residues but may still affect the analysis results since all the residue is difficult to remove.

The following pages show photos (when available) of typical deficiency symptoms and list the acceptable ranges of leaf tissue and the UGA Nursery Media test for each element. A brief description of the visual deficiency symptoms describes typical symptoms and any antagonisms that may exist. The normal ratios for elements known to interact are given. The media and tissue nutrient levels and their ratios are summarized in Table 1. Suggestion for improvement and corrections are welcome.

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Nitrogen

Acceptable Range: **Leaf Tissue 1.0 to (3.0) 6.0 % N.**
UGA Media 40 to 140 ppm N.

Deficiency Symptoms:

All nitrogen forms are mobile in the plant, therefore symptoms first appear on older leaves as nitrogen is moved form the old to the young leaves. The leaves may be small and the foliage color is light green to yellow. Older leaves fall prematurely. Death of leaves occur in the severe stages of deficiency. Plants grow slowly, are weak and stunted. Root growth is reduced and branching is restricted.

N:P ratio10:1. N:K ratio 1:1. N:S ratio 15:1. High ammonium nitrogen may cause K, Ca, or Mg deficiencies.

Phosphorous

Acceptable Range: **Leaf Tissue 0.2 to 0.5 % P.**
UGA Media 4 to 14 ppm P.

Deficiency Symptoms:

Temporary phosphorous deficiency can be caused by low soil temperatures. Deficiency results in retarded growth. Symptoms include dark green older leaves. A typical purplish color to the leaves along with death of the leaf margins may occur. Deficiencies usually occur due to inadequacy in the media solution or due to a restricted root system.

N:P ratio 10:1. P:Fe ratio 29:1. High phosphorous levels will induce Zn deficiency symptoms, while high Zn will interfere with P metabolism. High phosphorous may cause iron and copper deficiencies.

Potassium

Acceptable Range: **Leaf Tissue (1.0) 1.5 to 4 % K.**
UGA Media 50 to 180 ppm K.

Deficiency Symptoms:

Potassium is mobile in the plant and deficiency symptoms first appear on older leaves. Potassium is redistributed from older leaves to younger leaves. Symptoms are light green to yellow margins and leaf tips on older leaves. Edges may scorch, or turn brown to black along the leaf margins.

K:N ratio 1:1. K:Ca ratio 4:1. K:Mg ratio 8:1. Excess potassium will cause deficient magnesium and possibly calcium.

Calcium

Acceptable Range: **Leaf Tissue 0.5 to 1.5 % Ca.**
UGA Media 70 to 220 ppm Ca.

Deficiency Symptoms:

Calcium deficiency is characterized by a reduction in the growth of meristematic tissues. Symptoms occur first in the growing tips and youngest leaves because calcium is immobile in the plant. Calcium deficient leaves become deformed and chlorotic, and in later stages leaf margins may die. Calcium levels tend to increase with plant age.

Ca:Mg ratio 2:1. Ca:K ratio 1:4. Ca:Zn ratio 45:1. Ca:B ratio 500:1

Sulfur

Acceptable Range: **Leaf Tissue 0.15 to 0.50 % S.**

Deficiency Symptoms:

Deficiencies may occur in new plants but usually disappear with root development. Symptoms are first noticed on young leaves as they becoming light yellow green and later may show red or purple coloration. Plants are stunted with chlorotic leaf tissue and short thin woody stems.

S:N ratio 1:15.

Magnesium

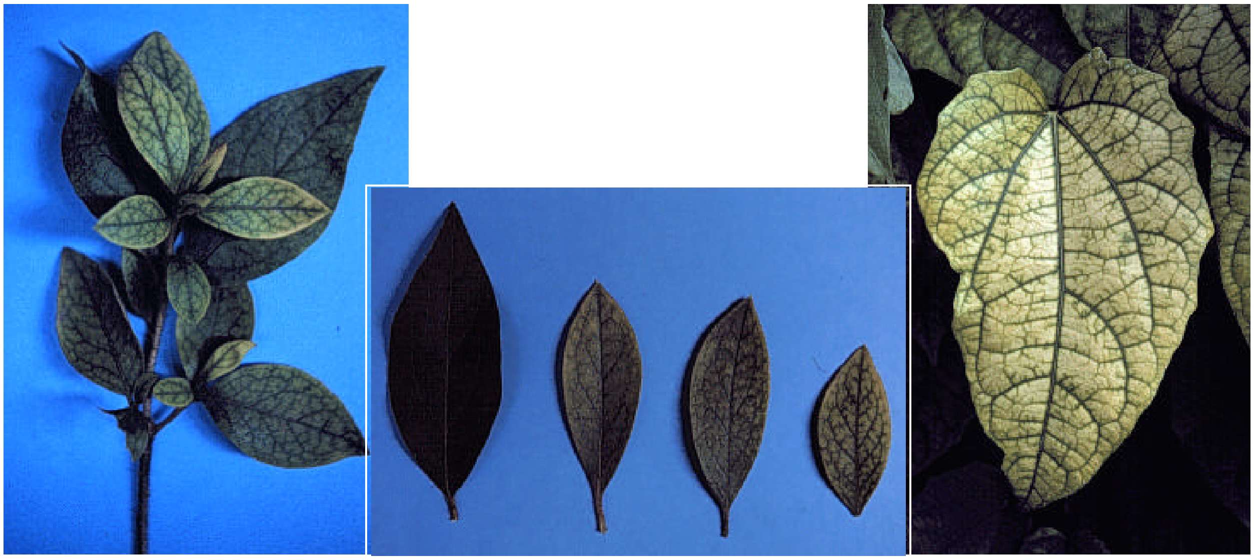
Acceptable Range: **Leaf Tissue 0.15 to 0.4% Mg.**
UGA Media 30 to 100 ppm Mg.

Deficiency Symptoms:

Magnesium is mobile in the plant and deficiency symptoms develop first on older leaves and then proceeding to the younger ones. Magnesium deficiency is characterized by an interveinal yellowing of the leaf blade that progresses from the edge to the center of the leaf. The most typical pattern of a Mg deficiency is the green veins surrounded by a yellow background. The leaves may become stiff and the veins twisted. Magnesium uptake is strongly influenced by pH; its availability markedly declines when the pH is less than 5.5.

Mg:Ca ratio 1:2, Mg:K ratio 1:8. Magnesium depresses Manganese uptake.

Iron



Acceptable Range:Leaf Tissue 50 to 300 ppm Fe.

Deficiency Symptoms:

Iron deficiency shows as an interveinal yellowing that occurs first on the young leaves. Iron is not mobile in the plant and is fixed in the older leaves. Iron does not move into the new growth when unavailable. As the severity of the deficiency increases, chlorosis spreads to older leaves, which can turn white and dry up. Iron availability and uptake are influenced by the plant species. Species are characterized as iron efficient or as iron inefficient. Iron availability is dependent on pH, with higher pH's reducing the availability to the plant.

Fe:P ratio 1:29. Nitrogen accentuates iron deficiency, high phosphorous decreases iron solubility. Boron, copper and manganese compete with iron for uptake.

Manganese

Acceptable Range: Leaf Tissue 10 to 200 ppm Mn.

Deficiency Symptoms:

Manganese deficiency often looks similar to iron or zinc deficiency. Symptoms appear first on the young foliage. Chlorosis first occurs between the veins of young leaves. Manganese deficient leaves may have broad green bands overlapping the veins while iron deficient plants have only green veins. Manganese is relatively immobile in the plant. Manganese availability is affected by pH, with decreasing pH increases manganese availability. Manganese toxicity can occur at low pH. Toxicity appears as marginal yellowing of young leaves and possible necrotic spots.

Magnesium depresses manganese uptake. Increased pH reduces manganese solubility, while iron and manganese are antagonists.

Boron

Acceptable Range: Leaf Tissue 20 to 70 ppm B.

Deficiency Symptoms:

Abnormal growing points occur with young leaves misshapen. Wrinkled, thickened and dark green leaves may occur. Terminals may die. Roots are slimy or thickened with dead tips.

B:Ca ratio 1:500 (1:100). Toxicity symptoms include leaf tip chlorosis and death with eventual leaf scorch.

Copper

Acceptable Range: Leaf Tissue 3 to 7 ppm Cu.

Deficiency Symptoms:

Young leaves are distorted or stunted and growing points may die. Young leaves may have white tips. Plant growth may be reduced. Copper is not mobile in plants.

Excess copper (greater than 20 ppm) can induce toxicity and iron chlorosis. Copper inhibits zinc uptake and vice versa.

Zinc

Acceptable Range: Leaf Tissue 20 to 75 ppm Zn.

Deficiency Symptoms:

Symptoms include interveinal chlorosis starting on the young leaves. Chlorotic areas turning light green, yellow or even white. Zinc deficiency is often characterized by short internodes and rosettes of small leaves. Stunting and leaf distrotion are frequent symptoms associated with zinc deficiency.

Zn:Ca ratio 1:45. High zinc can induce iron, manganese or phosphorous deficiencies. Excess phosphorous restricts zinc uptake. Zinc levels above 200 ppm can result in toxicity.

Table 1. Nutrient Element Summary

Suggested Media Levels, Tissue Levels & Ratios

Nutrient Elements	Container Media Level	Leaf Tissue Level	Suggested Ratios in Leaf Tissue
Nitrogen (N)	40 to 140 ppm	1.0 to 6.0 %	N:P 10:1 N:K 1:1 N:S 15:1
Phosphorous (P)	4 to 14 ppm	0.2 to 0.5 %	P:N 1:10 P:Fe 29:1
Potassium (K)	50 to 180 ppm	1.5 to 4 %	K:N 1:1 K:Ca 4:1 K:Mg 8:1
Calcium (Ca)	70 to 220 ppm	0.5 to 1.5 %	Ca:Mg 2:1 Ca:K 1:4 Ca:B 500:1 Ca:Zn 45:1
Magnesium (Mg)	30 to 100 ppm	0.15 to 0.4 %	Mg:K 1:8 Mg:Ca 1:2
Sulfur (S)		0.15 to 0.50 %	S:N 1:15
Iron (Fe)		50 to 300 ppm	Fe:P 1:29
Manganese (Mn)		10 to 200 ppm	
Boron (B)		20 to 70 ppm	B:Ca 1:500 (1:100)
Copper (Cu)		3 to 7 ppm	
Zinc (Zn)		20 to 75 ppm	Zn:Ca 1:45