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Visual Symptoms of Plant Nutrient Deficiencies in Nursery and Landscape Plants

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To determine elemental plant deficiencies, most agriculturists rely primarily on visual symptoms, soil analysis, and plant tissue analysis. In the field of landscaping in Hawaii, little plant nutrition research is available.

The sixteen essential plant elements are carbon (C), hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sulfur (S), iron (Fe), zinc (Zn), manganese (Mn), copper (Cu), boron (B), molybdenum (Mo), and chlorine (Cl). Carbon, hydrogen, and oxygen are obtained from air and water. Nitrogen, phosphorus, and potassium are obtained from general fertilizers. Calcium, magnesium, and sulfur are variously obtained from calcium carbonate (limestone), calcium hydroxide (hydrated lime), dolomite (calcium and magnesium carbonate), epsom salts (magnesium sulfate), elemental sulfur, and sulfate salts. Iron, zinc, manganese, copper, boron, and molybdenum are obtained from minor element formulations, including soluble foliar fertilizers.

The location of the initial symptoms of nutrient deficiency generally occurs on either new or old leaves.

If symptoms appear on new leaves, the deficiencies could be from lack of iron, zinc, manganese, copper, boron, chlorine, calcium, or sulfur. Manganese toxicity, certain pesticide toxicities, aphid infestation, broad mite problems, and certain virus problems can also occur on the new leaves and confuse the diagnosis.

If deficiency symptoms appear on old leaves, the problem could be from lack of nitrogen, phosphorus, potassium, or magnesium.

Molybdenum deficiency symptoms first appear between the old and new leaves. In ornamental potted plants, Mo deficiency is not common, except for poinsettia.

Factors that can confuse diagnosis of plant nutrient deficiency include excessive top growth beyond the capacity of the root system to support, damage from high salinity, pesticide toxicity, damage to the root system by mites, nematodes, insects, or disease, or any other conditions detrimental to the root system and its environment.

The information on pages 2–3 may help to diagnose nutrient deficiency and toxicity symptoms.

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Old leaves affected first
(mobile nutrients)

Nitrogen

Type: primary macronutrient

Deficiency symptoms: Leaves turn light green to yellow or becomes necrotic and drop off; plants are stunted and secondary shoot development is poor.

Toxicity symptoms (nitrogen): Plants are stunted, deep green in color, and secondary shoot development is poor.

High N causes vegetative bud formation instead of reproductive bud formation.

Toxicity symptoms (ammonium): Roots turn brown and appear unhealthy, with necrotic root tips; plant growth is decreased; necrotic lesions occur on stems and leaves; vascular browning often occurs in stems and roots; severe chlorosis and stunting of new leaves are symptoms on some plants.

Ammonium toxicity is common in soilless media, in highly acidic media, and under low temperatures. High carbohydrate and potassium levels in the plant can prevent some of the toxicity symptoms in some plants. Ammonium fertilizers tend to make the soil more acidic, and nitrate fertilizers tend to make the soil more alkaline.

Phosphorus

Type: primary macronutrient

Deficiency symptoms: Growth is stunted and old leaves initially dark green; older leaves may turn purple.

In mineral soils, very acidic conditions can dramatically decrease P availability. High P in the plant can cause Fe and Zn deficiencies. High P levels in the soil can help to deter aluminum toxicity in very acidic conditions.

Potassium

Type: primary macronutrient

Deficiency symptoms: Leaf margins turn chlorotic and then necrotic; scattered chlorotic spots often occur on the leaves, and these spots may later turn necrotic.

High amounts of K can cause Ca, Mg, and N deficiencies. High sodium can cause K deficiency. High K levels can help against ammonium toxicity.

Magnesium

Type: secondary macronutrient

Deficiency symptom: Interveinal chlorosis on older leaves.

High sodium, K, and Ca can cause Mg deficiency. High Mg can cause Ca deficiency. For Mg deficiency, apply dolomite or epsom salt every three months. Very acidic conditions can cause Mg to be less available. Some researchers recommend that the Ca:Mg ratio be at least 2:1.

New leaves affected first
(non-mobile nutrients)

Sulfur

Type: secondary macronutrient

Deficiency symptom: Uniform chlorosis first appearing on new leaves.

Sulfur is needed for formation of chloroplasts (not part of chlorophyll molecule). After the plant is deficient for a long time it may be difficult to tell S deficiency from N deficiency.

Calcium

Type: secondary macronutrient

Deficiency symptoms: Light green color or uneven chlorosis of young leaves; margins of young leaves fail to form (strap-leaves); growing points of stems and roots cease to develop (blunt end); poor root growth and roots short and thickened.

High Ca can cause Mg or B deficiencies. High sodium, K, and Mg can cause Ca deficiency. Very acidic conditions can cause Ca to be less available.

Iron

Type: micronutrient

Deficiency symptoms: Interveinal chorosis of new leaves followed by complete chlorosis and/or bleaching of new leaves (see Figure 1).

Alkaline conditions, high P, high Zn, Mn, Cu, or nickel in acid soils, poorly drained soils, and other poor root conditions can induce Fe deficiency. Iron deficiency also results in reduced rates of growth. Very acidic conditions can result in iron toxicity but this is not common in Hawaii.

Zinc

Type: micronutrient

Deficiency symptoms: Interveinal chlorosis of new leaves with some green next to veins; short internodes and small leaves; rosetting or whirling of leaves.

High pH and high P or Mn can induce Zn deficiency.

Manganese

Type: micronutrient

Deficiency symptoms: lnterveinal chlorosis of new leaves with some green next to veins and later with grey or tan necrotic spots in chlorotic areas.

Alkaline soils, poorly drained soils, and soils high in available Fe can induce Mn deficiency. High available Mn can cause Fe deficiency. Very acidic conditions can result in Mn toxicity (new leaves with necrotic edges, necrotic spots, malformation, and stunted); this is common in Hawaii with certain soils high in Mn. Under the same acidic conditions aluminum toxicity can also occur in Hawaii (results in short, stubby, damaged roots). Aluminum toxicity is not as common here as Mn toxicity.

Copper

Type: micronutrient

Deficiency symptoms: lnterveinal chlorosis of new leaves with tips and edges green, followed by veinal chlorosis and finally rapid and extensive necrosis of leaf blades.

References

The information was taken from the following sources:

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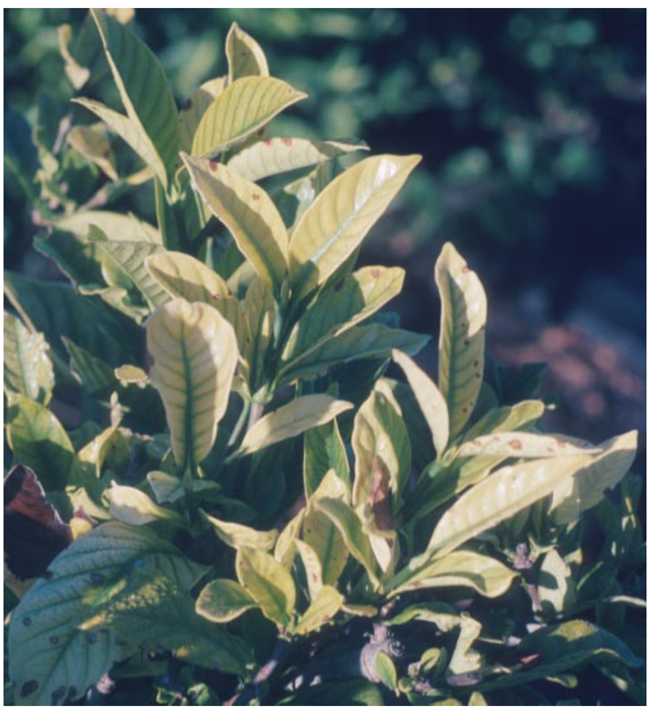
Figure 1. Iron deficiency in four ornamental plants.

Ixora

Hibiscus



Gardenia

Psittacorum heliconia