GROWER 101:

Nutrient Disorders
in Greenhouse Crops

Left: Iron toxicity in marigold; Right: Boron deficiency in plectranthus. (Photos courtesy of Paul Nelson)

Pinpoint greenhouse crop problems with this first article of a two-part series identifying nutrient disorders.

By Paul V. Nelson

Four sets of information are important when assessing the nutritional status of greenhouse crops and developing corrective procedures. First, determine irrigation water quality prior to developing the location. Do this during a wet and a dry period shortly after establishing the business and periodically thereafter, preferably annually. Based on these results, changes in the fertilization program can be made to compensate for water-quality problems such as high alkalinity, high EC, imbalance of calcium (see April 2002 issue of *GPN*) to magnesium or high levels of individual nutrients such as boron. Second, root substrate tests should be conducted during each crop to monitor substrate pH and EC and the availability of nutrients. Third, a foliar analysis should be conducted to determine the levels of nutrients successfully taken up.

If these three tests are run and properly interpreted on schedule, it should be possible to make the required periodic shifts in a fertilization program to avoid nutritional disorders. Unfortunately, this does not always occur. When a nutrient disorder occurs, a fourth set of information, visual symptomology, becomes very helpful. The following are common symptoms associated with deficiencies and the more common toxicities of nutrients in greenhouse crops. Look for more in the next issue of *GPN*.

Nitrogen Deficiency. The older leaves become uniformly chlorotic. After considerable time, older leaves become necrotic and drop off if abscission is possible for the species in question. Purple to red discoloration may develop in older leaves as they turn chlorotic in some species such as begonia, marigold and pansy.

Phosphorus Deficiency. The plant becomes severely stunted, and at the same time, the foliage becomes deeper green than normal. In some species, the older leaves develop purple coloration. Older leaves then develop chlorosis followed by necrosis. Roots become longer than normal when the deficiency is moderate.

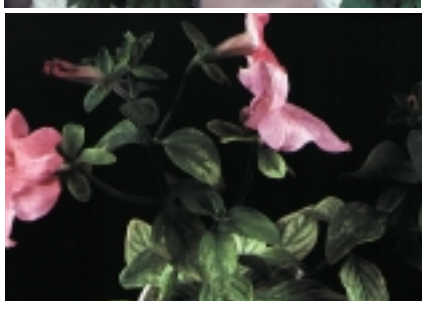
With foliage plants, older leaves may lose their sheen, becoming dull green followed by red, yellow and blue pigments showing through the green, particularly on the undersides of the leaves along the veins. These symptoms spread across the leaf. Older leaves abscise if possible. Otherwise, necrosis develops from the tip toward the base.

Magnesium Deficiency. Older leaves develop interveinal chlorosis. In several species, pink, red or purple pigmentation will develop in the older leaves following the onset of chlorosis.

In foliage plants with pinnately (netted) veined leaves, bronze-yellow chlorosis begins at the upper margins of older leaves, progressing downward along the veins, leaving a green, v-shape pattern at the top of the leaf. As chlorosis progresses down the leaf, a green, v-shape of tissue remains at the bottom. Eventually, the tip, and then the base, become chlorotic. Necrosis follows chlorosis in the same pattern.

Iron Deficiency. Young leaves of seedlings sometimes develop general rather than interveinal chlorosis. In late stages, the leaf blade may lose nearly all pigment, taking on a white appearance.

Iron Toxicity. This disorder mainly affects African marigolds, seed geraniums, basil, cosmos, dahlia, nasturtium, pepper, strawflower, tomato and zinnia. Marigolds develop bronzing on recently fully expanded leaves. The bronzing consists of numerous pinpoint spots that begin yellow and quickly turn bronze. Affected leaves become necrotic. Older leaves on the other crops develop numerous pinpoint



From top to bottom: Nitrogen deficiency in petunia plug seedling; phosphorus deficiency in chrysanthemum; magnesium deficiency in petunia.

necrotic spots across the blade. As the spots enlarge, they turn necrotic until the entire leaf dies.

Boron Deficiency. Symptoms include incomplete formation of flower parts such as fewer petals, small petals, sudden wilting or collapse of petals and notches of tissue missing in flower stems, leaf petioles or stems. Death of the bud giving rise to branching is followed by death of the new buds, eventually leading to a proliferation of shoots termed a "witch's broom." Short internodes, crinkling of young leaves, corking of young leaves, stems and buds, and thickening of young leaves all occur. Chlorosis affects young leaves but not in any definite pattern, resulting in eventual death of the root tips of short and thick roots.

Additional symptoms in foliage plants can include: brittle stems and leaves; necrotic spots (black and sunken) on stems just below nodes; nodal roots on vine plants that may become thick, short and abscise; and vines that may become highly curled at the nodes.

Boron Toxicity. The margins of older leaves become necrotic with a characteristic, reddish-brown color. Necrotic spots may also develop across the leaf blade but tend to be concentrated at the margins.

Top to bottom: Boron toxicity in elatior begonia; molybdenum deficiency; iron deficiency in elatior begonia.

Molybdenum Deficiency. Symptoms apply to poinsettia, the only greenhouse floral crop it is known to affect. The margins of leaves at the middle of the plant become chlorotic, presenting a silhouette appearance and then quickly becoming necrotic. Symptoms spread up and down the plant. These leaves may also become misshapen, resembling a half-moon pattern with some crinkling. GPN

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