Plant Pathology Circular No. 353
May and June 1992

Fla. Dept. Agric. & Consumer Services
Division of Plant Industry

MANGANESE TOXICITY OF PLANTS IN FLORIDA

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Although micronutrient deficiencies of plants are a more common problem for Florida growers, micronutrient toxicities sometimes damage crops as well. This circular deals with the problem of manganese toxicity of plants in Florida. Plants grown in artificial soil-less media in containers and those grown in mineral soil can both experience toxicity from the uptake of excess amounts of manganese.

SYMPTOMS OF MANGANESE TOXICITY: Symptoms of manganese toxicity generally fall into two types. The most diagnostic feature is the darkening of leaf veins, usually on older foliage. This symptom is expressed by such plants as pothos *[Epipremnum aureum* (Lind. & Andre)], hibiscus and rose-of-Sharon *[Hibiscus* spp.], bean *[Phaseolus vulgaris L.],* soybean *[Glycine max (L.)* Merr.], potato *[Solanum tuberosum L.],* chrysanthemum *[Dendranthema X grandiflorum* (Ramat.) Kitam.], tomato *[Lycopersicon esculentum* Mill.], and cucurbits *[Cucumis* and *Cucurbita* spp.]. This symptom type is illustrated in Fig. la & b, and is typical of the cases of manganese toxicity that the Bureau of Plant Pathology clinic can diagnose visually with reasonable certainty. The blackening associated with the veins is due to the accumulation of dark crystals of insoluble manganese dioxide in tissues within or alongside the veins (1, 3), and is usually visible to some degree on both sides of symptomatic leaves. In some plants, the dark crystals will accumulate outside the leaf tissues at the base of trichomes (1).

A second less diagnostic symptom of manganese toxicity is interveinal chlorosis with leaf cupping or necrotic blotching of foliage. Many factors could cause such symptoms on a wide array of plants, but this symptom resulting from manganese toxicity is displayed most notably in the cabbage family *(Brassica* spp.) and in lettuce *[Lactuca saliva* L.] (1, 2, 3).

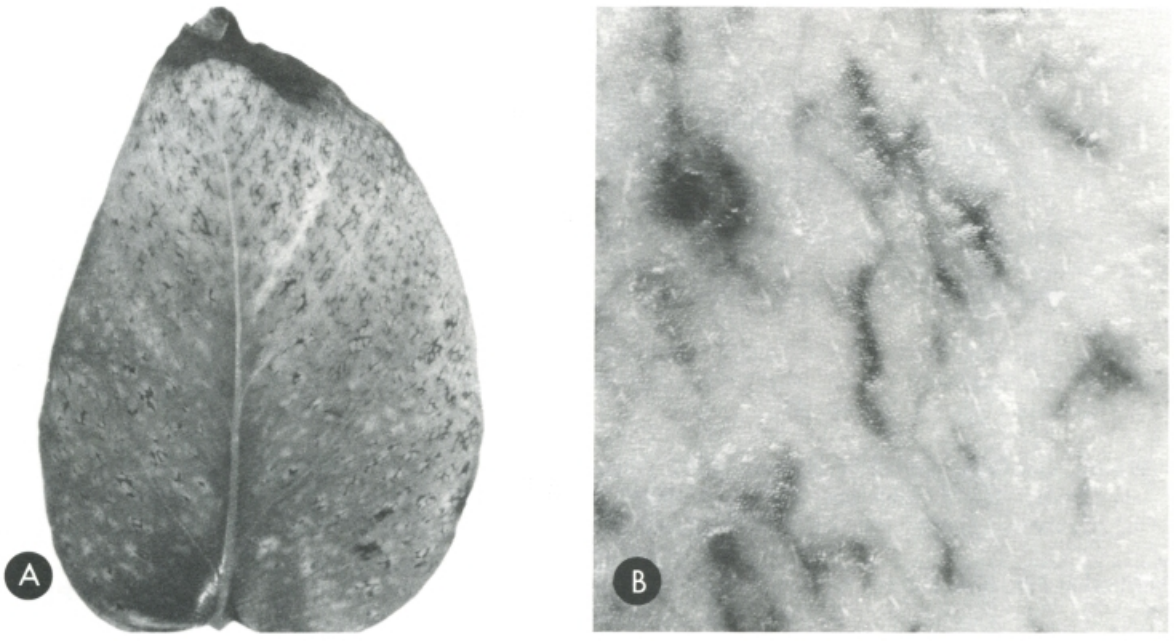

Fig. la. Abaxial side of an older *Epipremnum aureum* `Marble Queen' leaf showing darkened, smaller veins typically caused by manganese toxicity. b. View of darkened veins magnified approx. 20X.

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WHAT SITUATIONS CAN LEAD TO MANGANESE TOXICITY? In Florida, the following three situations might lead to manganese toxicity in a crop: 1) Plants are simply supplied too much manganese in fertilizers. Many "complete" fertilizers contain sufficient micronutrients for normal plant growth. The use of micronutrient supplements in the belief that deficiencies exist or that extravagant amounts of micronutrients might improve plant growth or appearance has resulted in manganese toxicity in a number of cases with foliage ornamentals. 2) Plants are grown in a soil with a low pH (1, 2). Lowering of soil pH to 5.0 or below can solubilize manganese and other metallic micronutrients that subsequently may be taken up in excessive amounts by plants. 3) Plants are grown in a steam pasteurized or heat-sterilized soil mix (I, 2, 4). Steaming or heating of soil mixes (especially soil-less greenhouse mixes or loamy mineral soils) to control soil-borne pests and pathogens releases large amounts of soluble manganese.

TREATMENT OF MANGANESE TOXICITY IN PLANTS: Knowing what situations can lead to manganese toxicity problems, the following treatments are suggested: 1) The most obvious treatment for manganese toxicity is to discontinue fertilizer applications that contain manganese. Read fertilizer labels carefully to determine if micronutrients (manganese, iron, copper, zinc, molybdenum, etc.) are included in the formulation. If so, think twice about supplying additional micronutrients on the hunch that a deficiency exists. If unsure about the crop's need for additional micronutrients, have a foliar analysis done. Although the Bureau has never encountered a case in which the use of manganese-containing dithiocarbamate fungicides such as maneb and mancozeb have induced manganese toxicity, such compounds do contribute enough manganese to consider them as a source of this nutrient. 2) Apply dolomite or lime to raise soil pH. This is especially effective if soil pH has been mistakenly lowered or if soil has gradually acidified as a result of continuous cultivation without regard to soil pH. Raising the pH of steam/heat-sterilized soil may not provide sufficient protection from manganese toxicity in all cases. 3) Leach excess soluble manganese from heat-treated soils with irrigation. Alternatively, consider chemical fumigation in place of heat sterilization, especially if the soil is naturally high in insoluble manganese.

SURVEY AND DETECTION: Visual clues can identify probable manganese toxicity, but suspect cases should be followed up with a foliar analysis in critical situations. Look for darkened sections of veins, usually on older leaves. The tissue immediately surrounding the darkened veins can become chlorotic, and symptomatic leaves senesce prematurely. In the case of brassicas and lettuce, less distinctive symptoms, namely interveinal or marginal chlorosis, necrotic blotching, and leaf cupping can indicate manganese toxicity. Inquiries into the fertilization and cultural practices may yield important clues as to causes and correction of the toxicity.

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Contribution No. 676, Bureau of Plant Pathology **P192T-18**