



How to
avoid

micronutrient toxicity syndrome

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Now is a good time to consider the phenomenon of micronutrient toxicity syndrome (MTS), which can afflict many common floricultural crops grown in the spring, including African marigolds, seed and vegetative zonal and ivy geraniums, New Guinea impatiens and vinca.

Although this disorder has been researched and seen commercially for many

years, it still occurs with some frequency. MTS is often induced on susceptible crops by less-than-ideal production practices. Growers who are aware of the factors contributing to this problem can take preventive steps to avoid it.

What is MTS?

Micronutrient toxicity syndrome is the accumulation of excessive levels of trace elements (primarily iron and manganese) over time. Typical symptoms include interveinal chlorosis, necrotic speckling/pitting and leaf deformity. MTS usually occurs in older, lower leaves, but may also show symptoms in recently matured tissue. Other factors may cause similar symptoms and it is necessary to do the proper tests to diagnose the problem.

Factors involved in MTS development include genetic make-up of the crop, growing media pH and components, water quality and the selection and application of fertilizers.

Crop species/cultivars

Crop species and cultivars have different degrees of susceptibility to MTS. Apparently,

Micronutrients are essential to producing healthy plants.

But when plants accumulate excessive levels, micronutrient toxicity syndrome can occur. Find out what MTS is, why it occurs and how you can prevent it.



Micronutrient toxicity syndrome initially shows up on geranium (above) and marigold (left) as chlorotic flecking that resembles spider mite feeding.

some species are extremely efficient at taking up any available trace elements in the growing medium. The ancestors of modern crops that had the ability to take up these elements would have had an advantage when growing in nutrient-poor soils. However, these traits in modern crops can present some potential problems. These greedy plants can rapidly take up micronutrients early in the crop cycle and store them at toxic levels in the older leaves.

Even within a species, levels of susceptibility to MTS may differ. Among geraniums, some growers have observed that red, some pink and Aurora-type colors are more prone to MTS and that green-leaf cultivars are more susceptible than dark-leaf cultivars. Other differences in susceptibility to iron toxicity and symptom development have been found within groups of African marigolds and holiday cactus.

Consult your plant supplier to get the best advice on which species and cultivars are most prone to exhibit MTS and avoid producing them if possible. This may be the most effective strategy in combating MTS, as most growers raise many crops at any given time (the majority of which are not especially susceptible to MTS). It may be impossible for a grower to devise one program that is appropriate for all crops.

Growing media and pH

Some media components such as fir bark and some hardwood barks (iron and manganese), vermiculite (iron) and starter fertilizers, depending on media pH, supply soluble micronutrients. During last spring, MTS outbreaks occurred in crops planted in various growing mixes and fed with different fertilizers.

For MTS-susceptible crops, growers should manage their growing medium pH to ideally start out at least 5.8 (saturated media extract, SME) at transplanting or soon after, and to quickly rise to at least 6-6.2. Apply a sufficient volume of irrigation water and allow an adequate amount of time for the lime charge to activate in a newly planted mix.

If the medium pH falls below the critical level of 6 (SME) during production, MTS may occur. Be sure to implement proactive steps to avoid a drop in the medium pH.

Research has shown that 'Ringo Scarlet' geraniums grown at a pH of 4-4.5 had leaf tissue levels of 900-1,200 parts per million iron and manganese four weeks after transplant compared to plants grown at 6.5-7 (only had 70-90 ppm iron and manganese). To further compound the MTS problem in geraniums, it is known that these plants actively lower the pH of their root zone by as much as two full pH points. This means that growers must pay great attention to the pH management of their growing media.

Lime effect on media pH

Lime is added to media to neutralize the acidic nature of their components (e.g., sphagnum peat moss) and raise the initial pH. Be aware that with frequent watering and the acidifying influence of some fertilizers, this lime is broken down and/or leached out of the media.

After six weeks (especially in more open, coarser mixes containing perlite and bark), the impact of the initial lime application is diminished. This is also the time when a drop in the medium pH may occur after a plant completely roots out a container. For long-term pH stability, it is imperative that growers use a fertilizer/acidification program specifically tied to their irrigation water quality (alkalinity or bicarbonate level).



MTS flecking on geranium may eventually turn reddish-brown to brown. Larger chlorotic areas become necrotic and the tissue can collapse.

Fertilizer selection

Selecting the proper fertilizer is one method of managing media pH and micronutrient levels. It is important to consider the potential acidity/ basicity and the micronutrient content and source in the fertilizer selected.

Potential acidity/ basicity is linked to the raw material ingredients of the fertilizer. Generally, fertilizers higher in ammonium or urea are acidifying (will tend to lower growing medium pH) and those higher in nitrates are neutral or basifying (tending to increase pH).

Some fertilizer micronutrient levels designated as peat-lite have a higher level of micronutrients and are designed for soilless media. Other general-purpose fertilizers are designed for mixes containing mineral soil and have lower micronutrient levels.

The raw material source will affect the solubility and availability of micronutrients. For instance, iron can be supplied in a water-soluble fertilizer as iron chelate (EDTA, DPTA) or iron sulfate. Studies have shown that applications of Fe-DPTA (one type of iron chelate) led to available iron levels in the soil solution three times higher than similar applications of iron sulfate.

The ratio between micronutrients is important. Insufficient iron levels promote manganese toxicity. For best results, use a fertilizer that will maintain an iron:manganese ratio in the medium between 1:1 and 2:1. Consult your supplier for recommendations of the best fertilizer selection for your crops based on your water quality.

Irrigation water

Irrigation water can contain significant levels of iron. A water test will confirm available iron levels, though it may be necessary to acidify the water sample first to determine micronutrient sources potentially available at a lower pH. Water with iron levels greater than 0.5 ppm may be a problem with sensitive crops. Consult a testing lab for more details.

Preventing MTS

The best way to prevent MTS is to avoid conditions favoring its development. Suggested strategies include:

- Test symptomatic tissue to confirm MTS. Viruses, thrips and other nutritional factors may result in similar symptoms.
- Avoid growing MTS-susceptible species or cultivars.
- Select cultivars or species that are less susceptible to MTS.
- Monitor media pH and soluble salts weekly throughout the production cycle. Pay particular attention to the pH trend during weeks four to six when roots are established enough to drastically drop pH in the root zone. If the pH begins to decline, implement corrective procedures.
- Choose the correct fertilizer for your crop and irrigation water.
- Test irrigation water sources and select the proper fertilizer program for the crop.

Corrective measures

Should MTS occur, here is how you can resolve the problem.

- Reduce or cease applying micronutrients by switching from a peat-lite formulation to general purpose or change to single element combinations like calcium nitrate and/or potassium nitrate (200-300 ppm total nitrogen) with no micronutrients.
- Take corrective measures to optimize growing medium pH by leaching, switching to a less acidic or a basifying fertilizer, increasing water alkalinity with potassium bicarbonate or applying lime as a topdress or in liquid form.

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