

## IRON & MANGANESE TOXICITY ON GERANIUMS

*This disorder is caused by an accumulation of iron (Fe) and/or manganese (Mn) in plant tissue.*



### What Does Fe/Mn Toxicity Look Like?

- Symptoms vary slightly across classes of geraniums (*Pelargonium x hortorum*, *P. peltatum*, *P. domesticum* and interspecific hybrids) and even among cultivars within a series, but they always appear on the oldest leaves first.
- Symptoms often start as chlorosis (yellowing) along the leaf margin or chlorotic speckles from the centers out to the edges of leaves. Chlorosis advances across affected leaves over time.
- As symptom severity increases, the yellowed leaf margin and/or speckles in the middle of leaves will start to look burned (necrotic) and dark-colored splotches will appear in the affected areas.
- If the disorder advances further, entire leaves will become necrotic and crispy. As lower leaves die off, symptoms will start to appear higher up in the canopy (on newer growth).

## Why Does Fe/Mn Toxicity Happen?

This disorder frequently occurs because the growing media pH gets too low. Plants in the *Pelargonium* genus evolved in areas with naturally high soil pH, so they evolved to be *especially* good at acidifying the soil around them, to make nutrients like Fe and Mn available. Check out this nice [factsheet from Purdue Extension](#) on soil pH and how it affects nutrient availability for more info. The abbreviated explanation is—low soil pH makes it so easy for plants to absorb Fe and Mn ions that they can't *not* take them up.

Plants also can't excrete waste and excess nutrients, so they push surplus Fe and Mn ions into the vacuoles (membrane-bound “sacs” in the middle of cells) of leaf cells to “get rid of them.” As it does in many living things, accumulation of these heavy metals disrupts cell function and eventually causes damage to tissues with accumulated Fe/Mn ions.

## What Causes Fe/Mn In My Crops?

As previously stated, Fe/Mn toxicity occurs when these nutrients become overly abundant or available for uptake in the rootzone. On rare occasion, this occurs because a grower overapplied micronutrients (doing their math wrong on an Fe chelate drench). However, Fe/Mn toxicity in geraniums is most often the result of too-low growing media pH. This occurs for any number of reasons, but the most common ones I see are:

**Overuse of acidic fertilizers.** Ammonia- and urea-based fertilizers like 20-10-20, 21-5-20, and 20-20-20 are acidic and “acid special” formulations like 21-7-7 are *highly acidic*. Depending on the amount of alkalinity (buffer capacity) in your water (see my past tip on alkalinity [HERE](#) for more info), frequent use of these types of fertilizers can drive soil pH down too low over time.

Overcorrection of alkalinity via acid injection. Growers who inject acid to reduce alkalinity in their irrigation water need to monitor water quality regularly. If water quality changes suddenly and alkalinity drops, the amount of acid that has been injected previously is too high. This often removes most of- or all the buffering capacity in your irrigation water and causes your raw irrigation water to be slightly acidic at baseline. Add an acidic fertilizer formulation to the mix and the pH of your growing media will crash quickly. In this situation, even a nitrate-based fertilizer isn't basic enough to correct the pH of the fertilizer solution and the net result is still acidic.

**Insufficient lime buffer at manufacture.** Commercially produced soilless mixes have a dolomitic lime charge added when they are created. This helps keep the pH in a range that is optimal for plant growth and resist changes in pH due to acid reactions that occur in the rootzone. Sometimes, manufacturers experience equipment malfunctions and the mixing line does not add enough lime to the media as it is manufactured. This *can* happen but is not often the cause of Fe/Mn toxicity in geraniums. When it does occur, toxicity symptoms show up in high-pH-loving crops like geraniums first, but incidences are often become widespread throughout other

crops within a few weeks (if you grow most crops in the same mix). More often than manufacturer error, the cause is ...

**Burned-out lime buffer in growing media.** Use of acidic fertilizers, root respiration and cation exchange (uptake of positively charged ions) by roots are all different types of acidic reactions that occur in the rootzone. The longer the grow time on a crop, the more these reactions occur. The more these acidic reactions occur, the more lime buffer gets burned away. Once the lime buffer is gone, soil pH drops rapidly. It becomes very difficult to correct—especially on a mature crop—and geraniums often struggle to recover in this scenario unless the buffer is replenished somehow.

### **How Do I Avoid and Correct Fe/Mn Toxicity?**

The best way to avoid this disorder in your geraniums is: regularly monitor the pH of your growing media.

- A pour-thru (see my quick how-to video [HERE](#)) on a few pots or hanging baskets each week is a quick way to make sure soil pH is in an appropriate range for geraniums.
- Target soil pH of 5.8 or higher for ivy and interspecific geraniums to keep out of trouble.
- Target soil pH closer to 6.0 for zonal geraniums, as they are less tolerant of lower pH.

If you start to see early indicators of Fe/Mn toxicity, act quickly. Once damage is done, affected leaves will not recover. Corrective measures often take a few days to affect symptom progression, so the longer you wait, the worse the problem will get. To start, check soil pH ASAP and figure out how strongly you need to react:

- If soil pH is about 5.6 to 5.7, symptoms are mild, and only one or two cultivars are showing symptoms, you can often correct soil pH with a simple switch to a nitrate-based fertilizer like a Cal-Mag (like 15-5-15).
- If you already use a nitrate-based fertilizer but you inject acid to your irrigation water, reduce your acid injection concentration slightly.
- If you don't inject acid into your irrigation water *and* already use a nitrate-based fertilizer, apply a periodic drench of potassium bicarbonate to your geraniums. These types of products are water-soluble and easy to apply through an injector, but only aid in minor/temporary minor pH correction.

Unless you accidentally used a highly acidic fertilizer once or twice, it is likely that all or most of your media's lime buffer is gone. Apply a flowable lime agent (such as CalOx pH) that contains multiple forms of lime (fast-acting and long-lasting) to correct soil pH and help keep it stable over a longer period. Continue to monitor soil pH and reapply as needed.

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