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Are Your Geraniums Happy?

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Zonal geraniums are a popular spring crop for North Carolina greenhouses with over \$7 million dollars of plants being grown in 1997. We are at the start of the spring season and unfortunately two major problems associated with geraniums are already appearing at the NCSU Plant Diagnostic Clinic: (1) micronutrient toxicities caused by too low of a root substrate pH and (2) Bacterial Blight [*Xanthomonas campestris* pv. *pelargonii*].

The easiest one to monitor and correct is the micronutrient toxicities caused by too low of a root substrate pH. Symptoms of micronutrient toxicities (Fe and Mn) are lower leaf yellowing, followed in more advanced cases to necrotic spots or margins on the lower to mid-level leaves. The condition is common from the Piedmont westward. The problem is that most of western North Carolina is blessed with too good of a water source. There is little alkalinity in the irrigation water to buffer the change in pH caused by the use of an acidic fertilizers (like 20-10-20). In addition, geraniums don't seem to know what is good for them. They naturally acidify the root substrate, much to their detriment.

What to do? Monitor the pH of your geraniums. Do this by in-house testing or sending samples out to a commercial lab. The optimal pH for zonal geraniums

is between 6.0 to 6.5. If it strays out of this range, take one of the corrective actions listed in Table 1.

The more serious problem is Bacterial Blight (*Xanthomonas*). It is a devastating disease that result in loss of whole blocks of infected plants. The disease is spread by propagation from infected stock and splashing water. Leaf symptoms may appear as small, tan to brown, round spots on the leaves with well defined yellow margins. The spots may continue to enlarge into yellow patches or brown wedges and can eventually turn the entire leaf brown. Leaf wilt is also a common symptom seen in the greenhouse, especially late in the spring when greenhouse temperatures become hot. Bacterial Blight can infect zonal geraniums and ivy geraniums. It is a good idea to avoid placing geranium hanging baskets above benches containing geranium plants. If leaf wilt is noticed, the first thing to do is to check the roots. If the roots are discolored, then *Pythium* root rot may be the cause. If the roots look white and healthy, the wilt may be Bacterial Blight. Symptomatic plants should be immediately removed and isolated from other geraniums. After handling infected plants, thoroughly wash hands and tools before working with other geraniums. The only way to confirm Bacterial Blight

(see *Geraniums*, continued on page 15)

is by testing. Send a few suspect plants to a university-based (North Carolina growers should submit samples through their local Cooperative Extension Service office) or private testing lab. There are no chemical control measures for Bacterial Blight. If the disease is confirmed, roguing of infected plants is the only option. Increasing the temperature to between 70 and 85 °F will help speed the appearance of the wilt symptoms so roguing can be done.

Table 1. Recommended corrective measures for geranium pH problems.

Continual Control:

Monitor the root substrate pH on a weekly or bi-weekly basis. Adjust with an acidic fertilizer (20-10-20 or 20-9-20) to lower the pH or basic fertilizer (calcium nitrate $[\text{Ca}(\text{NO}_3)_2]$ plus potassium nitrate $[\text{KNO}_3]$ or Excel[®] 15-5-15 Cal-Mag) to increase the pH.

Corrective Measures:

1. Lower pH: If modifications are required, the pH can be lowered with an acid-based fertilizer (20-10-20, 20-20-20, or 21-7-7 [The fertilizers are listed in an increasing degree of acidity. Keep in mind that acid-based fertilizers contain a high percentage of ammonical or urea type nitrogen, which can result in 1) plant stretch or 2) ammonium toxicity during the cooler growing conditions]) or acid injection.
2. Increase pH: The pH can be increased with a basic fertilizer, dolomitic limestone, or hydrated lime.

Rapid Corrective Measures:

These are rapid corrective measures to use to adjust the root substrate pH in pots or benches already containing plants. Iron sulfate, aluminum sulfate, and hydrated lime will burn most plant tissue. Apply only to the root substrate. Rinse plants if solution comes in contact. Some plants may be sensitive, so test a small area or a few plants before treating a large area. Adjustment is pH is rapid, but effects are not long lasting. Recheck the pH in a week and reapply if necessary.

1. To lower pH: Dissolve 1 to 2.5 pounds of iron sulfate $[\text{FeSO}_4 \cdot 7\text{H}_2\text{O}]$ or aluminum sulfate $[\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}]$ in 100 gallons of water. Apply to the root substrate and rinse the foliage after application. Both iron sulfate and aluminum sulfate will increase the root substrate EC level and may release toxic levels of minor elements from the root substrate's exchange sites.

2. To increase pH:

In a plastic bucket, mix 1 pound of hydrated lime with 3 to 5 gallons of warm water. Allow the mixture to settle and pour off the clear solution into another plastic bucket. Apply the clear solution with a fertilizer injector set at 1:100 or 1:128. Hydrated lime is corrosive, avoid contact with skin and metal. Hydrated lime may displace ammonium from the root exchange sites of the root substrate into the soil solution causing root injury. Avoid using hydrated lime if high levels of ammonium fertilizer are present in the root substrate.