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Pentas: Lower Leaf Yellowing and Necrosis

Pentas are sensitive to low substrate pH conditions, which can lead to lower leaf chlorosis, interveinal chlorosis, and necrosis. Learn how to diagnose the situation and take corrective actions.

A group of pentas (*Pentas lanceolata*) plants were observed in a greenhouse with lower leaf interveinal chlorosis and necrosis (Fig. 1). Based on the symptoms, my initial thought focused on the possibility of a magnesium (Mg) deficiency (Fig. 2), but some leaves also had pronounced necrotic spotting (Fig. 3) I have not worked extensively with pentas, so I looked at a few production guides and books to determine what problems were reported. A deficiency caused by the lack of Mg was not included in the problems lists, although I have observed the problem in NC greenhouses.

In the Ball Seed GrowerFacts sheet on Pentas Butterfly, they note a few possible problems related to pH levels less than 6.0. Ball Seed recommends a

Figure 1. Lower leaves of pentas exhibiting both interveinal chlorosis and necrotic spotting.

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substrate pH of 6.5 to 6.8. This range will help avoid slowed, stalled growth and symptoms of foliar necrosis due to iron toxicity or foliar puckering due to a deficiency of calcium and magnesium (*see sidebar Pentas Butterfly Grower-Facts for additional details*).

This range is higher than the 6.0 to 6.5 recommend-

Figure 2. Lower leaves of pentas exhibiting only interveinal chlorosis.

ed by Proven Winners for pentas. I have observed elevated substrate pH induced iron (Fe) deficiencies when the pH is above 6.5 (Fig. 4), so in my opinion a 6.0 to 6.5 range is more appropriate for pentas.

In an effort to diagnose the cause of these symptoms, the substrate was tested for pH and electrical conductivity (EC). After conducting a PourThru test of the substrate, the pH values of the four plants tested were 4.8, 4.9, 5.0,

Figure 3. Lower leaves with pronounced red to purple leaf spots.

and 5.0 and the EC results ranged from 0.6 to 1.12 mS/cm.

The results clearly indicate the symptoms are associated with a low substrate pH. Detailed in the sidebar, low substrate pH problems could be due to toxic levels of iron/manganese or deficiencies of calcium/magnesium. To confirm the diagnosis a tissue sample was taken from the affected plants and analyzed for nutrient levels at the Agronomic Division Lab of the North Carolina Dept. of Agriculture (Table 1). The sample was collected from the lower foliage (LL) that exhibited leaf chlorosis and necrosis. Analysis of the LL sample detected an iron (Fe) concentration of 14,400 ppm. This was almost 10X times higher when compared to the general recommended range for iron (Whipker, unpublished data). There are no published reports of tissue levels for pentas to use as a comparison.

Manganese (Mn) levels were not elevated, so that microelement was not accumulating. Calcium levels were at 0.95%. These levels were within the

Figure 4. When the substrate pH is greater than 6.5, intervienal chlorosis symptoms typically appear.

range of plants grown in the NC State Nitrogen rate study. Magnesium levels were found to be at 0.32%, which was lower than the mean of 0.52% (sample range varied from 0.47 to 0.58%) of plants grown at NC State. On many plants a level of 0.40% is considered to be upper limit of the deficient range.

Elevated Fe levels can result in lower leaf black spotting in many other species such as ageratum, gerbera, pansy, fuchsia, and zinnia. In plants such as geraniums and streptocarpus, a red coloration can develop with low substrate pH conditions (*See e-GRO Alert 3.29*). These results, (elevated tissue Fe and low substrate pH) helped confirm that the spotting was related to low pH induced micronutrient toxicity of iron. In addition, the intervienal chlorosis also indicates that the plants had low levels of magnesium. So it appears there were two sets of symptoms on the plants.

The substrate pH should be monitored during production of pentas to avoid low levels. Corrective procedures for low pH include the application of hydrated lime, flowable lime, or potassium bicarbonate. Application details are provided in e-GRO Alert 4.02. To overcome the magnesium deficiency problem, the application of 2 pounds of Epsom salts per 100 gallons of water should be applied as a drench.

Pentas Butterfly GrowerFacts

The following information comes from Ball Seed.

Nutritional Problems:

Iron toxicity: *Excessive iron levels or pH below 6.2 for extended time will cause marginal burn on leaves in upper foliage. Raise pH by adding limestone.*

Iron/Manganese toxicity: *Extremely low pH can induce iron and manganese toxicity, indicated by brown or tan lesions on the foliage. Switch to a base-forming fertilizer, such as 15-0-15. If symptoms do not improve, or if the pH is below 6.0, irrigate the crop with a hydrated lime solution. Be sure to rinse foliage after application to avoid phytotoxicity.*

Calcium and magnesium deficiency: *If pH falls below recommended target values, lower leaf interveinal chlorosis and foliar puckering can develop, especially during flowering when pH can fall as much one unit in 24 hours due to plant roots actively acidifying the substrate. Use fertilizers that contain magnesium during early crop development. Supplement with calcium nitrate as directed above to adjust pH. Avoid wide fluctuations in substrate moisture levels.*

Note: *To increase soil pH, apply 12 oz. hydrated lime per 100 gal. water (90 g. per 100 l) as a soil drench.*

Follow up with 1 tablespoon of limestone (dolomite or calcium carbonate) per pot. Do not apply hydrated lime if the medium ammonium level is above 10 ppm (1:2 extraction).

http://www.ballseed.com/utility/seedcolumnpdf.aspx?txtphid=048000222003332

Table 1. Leaf tissue nutrient analysis results for pentas (*Pentas lanceolata*).

Element	Most Recently Matured Leaves from Flowering Plants[1] (Mean and range)	Lower Leaves with Chlorotic and Necrotic Symptoms (Flowering Plants)
Nitrogen (%)	3.94 *(3.22 to 4.43)*	2.08
Phosphorus (%)	0.93 *(0.61-1.24)*	0.31
Potassium (%)	3.80 *(3.28-4.62)*	2.11
Calcium (%)	0.92 *(0.87-0.95)*	0.95
Magnesium (%)	0.52 *(0.47-0.58)*	0.32
Sulfur (%)	0.35 *(0.32-0.40)*	0.13
Sodium (%)	0.35 *(0.27-0.45)*	0.12
Iron (ppm)	151.5 *(114.0-184.6)*	**14,440**
Manganese (ppm)	140.5 *(124.9-154.6)*	127
Zinc (ppm)	51.8 *(44.9-58.0)*	214
Copper (ppm)	5.7 *(3.5-10.1)*	5.67
Boron (ppm)	35.9 *(33.1-39.5)*	35.6

[1] Source: Whipker (unpublished data) from a nitrogen fertilization rate study funded by the Fred C. Gloeckner Foundation. 'Butterfly Deep Pink' plants were fertilized with 100 and 200 ppm N. Plants sampled at flowering. Mean of 8 plants.

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