Managing Plant Nutrition of Greenhouse Ornamentals

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Common Nutrient Problems Of Spring Greenhouse Crops

- Too much or too little fertilizer?
- pH problem - Iron deficiency on petunia and pansy.
- pH problem - Iron/manganese toxicity on some species.
- Water quality as it affects nutrient problems.

Fertility & pH for Vegetative Annuals

<table>
<thead>
<tr>
<th>Fertility Level</th>
<th>pH Range</th>
<th>Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low pH 5.5-5.8</td>
<td>Low fertility 150-200 ppm</td>
<td>Snapdragons, Coleus, New Guinea impatiens, Double impatiens, trailing impatiens</td>
</tr>
<tr>
<td>Medium pH 5.8-6.2</td>
<td>Medium fertility 200-250 ppm</td>
<td>Scabiosa, Brachycome, Diascia, Sanvitalia, Verbena</td>
</tr>
<tr>
<td>High pH 6.2-6.5</td>
<td>High fertility 250-300 ppm</td>
<td>Calibrachoa, Petunia</td>
</tr>
</tbody>
</table>

pH Ranges for Bedding Plants (North Carolina Plug Research Group)

<table>
<thead>
<tr>
<th>Plant</th>
<th>pH Range</th>
<th>Why?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most bedding plants</td>
<td>5.4-6.8</td>
<td>pH tolerant</td>
</tr>
<tr>
<td>American marigolds</td>
<td>6.0-6.8</td>
<td>Prevent Fe/Mn toxicity</td>
</tr>
<tr>
<td>Geranium</td>
<td>6.0-6.8</td>
<td>Prevent Fe/Mn toxicity</td>
</tr>
<tr>
<td>Dianthus</td>
<td>6.0-6.8</td>
<td>Prevent Ca deficiency &amp; ammonium toxicity</td>
</tr>
<tr>
<td>Pansy</td>
<td>5.4-5.8</td>
<td>Prevent B &amp; Fe deficiencies</td>
</tr>
<tr>
<td>Petunia</td>
<td>5.4-5.8</td>
<td>Prevent B &amp; Fe deficiencies</td>
</tr>
<tr>
<td>Salvia</td>
<td>5.4-5.8</td>
<td>Prevent B deficiency</td>
</tr>
<tr>
<td>Snapdragon</td>
<td>5.4-5.8</td>
<td>Prevent B &amp; Fe deficiencies</td>
</tr>
<tr>
<td>Vinca</td>
<td>5.4-5.8</td>
<td>Prevent B &amp; Fe deficiencies</td>
</tr>
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</table>

Excess Soluble Salts

- Excess soluble salts is still a common problem. High EC results from too much fertilizer, poor drainage, or root disease.
- Symptoms can be confusing.

Iron Deficiency

Plants that are susceptible to iron deficiency are often called "iron-efficient" or the "petunia group". Symptoms occur when pH is >6.5.

- Azaleas
- Bacopa
- Calibrachoa
- Dianthus
- Nemesia
- Pansy
- Petunia
- Scabiosa
- Snapdragon
- Verbena
- Vinca
Preventing Iron Deficiency

- Target pH 5.5-5.8 (below 6.5).
- Acid injection with alkaline water.
- Use supplemental or corrective iron chelate drench.

Iron Chelate Fertilizer

- Apply iron chelate every 2-3 weeks or at every watering.
- Sprint 330 (DTPA) is effective up to pH 7, but is less so at higher pHs.
- Sprint 138 (EDDHA) is effective above pH 7.

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Water pH, Alkalinity & Iron Deficiency

- pH 7-8, alkalinity below 100 mg CaCO₃
  - Iron deficiency? Probably not. Why? Growing mix and fertilizer are the major influences on pH.
- pH 7-8, alkalinity well above 100 mg CaCO₃
  - Iron deficiency? Yes, for susceptible species. Why? “Liming” effect of water may be great enough to raise pH.

I. Match Fertilizers to Water Quality

<table>
<thead>
<tr>
<th>Water alkalinity test (mg CaCO₃)</th>
<th>Fertilizer analysis</th>
<th>% Acidic nitrogen (ammonium &amp; urea)</th>
<th>Potential reaction Acidic or Basic (CCE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>27-7-7</td>
<td>100%</td>
<td>A 1560</td>
</tr>
<tr>
<td>200</td>
<td>20-10-10</td>
<td>60%</td>
<td>A 469</td>
</tr>
<tr>
<td>150</td>
<td>15-5-15</td>
<td>40%</td>
<td>B 1</td>
</tr>
<tr>
<td>50</td>
<td>15-0-15</td>
<td>10%</td>
<td>B 402</td>
</tr>
</tbody>
</table>

Iron/manganese Toxicity

- Geraniums, marigolds, celosia, and impatiens are very susceptible to iron/manganese toxicity.
- Plants susceptible to toxicity are called “iron efficient” or “geranium group”. Symptoms occur at pH<6.0.
- The toxicity is often called “bronze speckle” disorder.

Causes of Bronze Speckle

- Low growth medium pH.
- Use of acidic fertilizers.
- Inappropriate use of acid injection.
- Use of supplemental micronutrient fertilizers.

Follow the “Iron Out” program from UNH.
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Water pH, Alkalinity & Fe/Mn Toxicity

- pH 7-8, alkalinity below 100 mg CaCO₃
  - Problem? By itself, probably no effect.
  - Why? Growing mix and fertilizer are the major influencers on pH.

- pH 7-8, alkalinity well above 100 mg CaCO₃
  - Problem? No, irrigation with this water might help prevent toxicity.
  - Why? "Liming" effect of water may be great enough to raise pH.

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II. Potential Nutrient Problems Due Related to Water Quality

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low calcium (&lt;30 ppm)</td>
<td>Use Ca-containing fertilizers</td>
</tr>
<tr>
<td>Low magnesium (&gt;2 ppm)</td>
<td>Use Mg-containing fertilizer or epsom salts</td>
</tr>
<tr>
<td>High boron (&gt;0.5 ppm)</td>
<td>Use Ca-containing fertilizers and maintain pH &gt;6</td>
</tr>
<tr>
<td>High sodium (&gt;50 ppm)</td>
<td>Use Ca and Mg-containing fertilizers and leach.</td>
</tr>
</tbody>
</table>

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Overview of Organic Fertilizers for Spring Greenhouse Crops

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Using Organic Greenhouse Fertilizers

The ideal approach to using organic fertilization is to try the "3-legged stool". Provide nutrients from several organic sources to prevent nutrient deficiency and achieve normal growth of greenhouse plants.

1. Growth medium components (especially compost).
2. A granular organic fertilizer mixed in the growth medium preplant.

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Promising Organic Fertilizers

<table>
<thead>
<tr>
<th>Fertilizer</th>
<th>Type</th>
<th>Nutrient sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature’s Source 3-1-1</td>
<td>Liquid</td>
<td>Oilseed extract</td>
</tr>
<tr>
<td>Eco-Vita 7-5-10</td>
<td>Granular</td>
<td>Feather meal, fermented sugar beet and sugar cane molasses, bone meal, soybean meal, and cocoa shell meal.</td>
</tr>
<tr>
<td>Sustane 8-4-4</td>
<td>Granular</td>
<td>Composted turkey litter, feather meal and potassium sulfate.</td>
</tr>
</tbody>
</table>
Tips & Recommendations
Mixing and applications of liquids. Syrupy texture, spoilage after dilution leads to smell. Best to mix and then use immediately.
Fertilizer analysis. Additional nutrient sources may be necessary for unbalanced types like 9-0-0. Consider Sustane or similar preplant granular fertilizer.
Effects on growing medium EC.
Acid vs. basic pH reaction?
Overcoming reduced growth vs. chemical WSF. Add more?
Plant species specific responses. Do trials.

Interveinal Chlorosis
Interveinal chlorosis is most likely caused by excess ammonium. Overall yellowing indicates N deficiency. Chlorosis occurs on some species. Use organic fertilizers in combination.

Does increasing fertilizer level make plants grown with organics the same size as chemically grown ones?
Plant species may respond differently to organic fertilizers.

Take Home Tips on Organics
1. For best results use a liquid and a granular fertilizer in combination.
2. Do a trial before applying to all plants.
3. Best use is for short-term crops of less than 6 weeks duration. Reduce or stop use before growth differences or chlorosis becomes apparent.
Nutrient Problems
Zonal Geraniums

- Fe/Mn toxicity due to low pH (top).
- High soluble salts due to excess fertilizer versus growth rate (bottom). Check roots for disease!

Factors Affecting the Success of a Fertilizer Program

- Fertilizer level (ppm).
- Fertilizer type.
- Frequency of application.
- Volume of fertilizer solution applied.
- Clear water irrigations and leaching.
- Environment and plant growth rate.
- Interactions.

Fertilizer Strategy
Zonal Geraniums

- pH 6.2-6.5. pH can drop suddenly.
- Begin fertilizing shortly after potting with 200 ppm. Monitor pH and EC regularly. Continue 200-250 ppm to finish.
- Make an application of liquid limestone?
- Use Cal-Mag 15-5-15, 15-5-25, 15-0-15 or other low acidity fertilizers. Don't go too long with 0 P fertilizers!