Root-Zone Update

Alternative substrates!
Fertilizer!
Media testing!

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The “Rootzone Triangle”

Irrigation

Greenhouse? Outside?

Media

Fertilizer

Substrate update

COMPOSTED BARK

“Nursery” media
“Perennial” mixes

Peat-lite mixes

SPHAGNUM PEAT

Price difference?
Bark: scarcer than hen’s teeth?
- Byproduct of lumber/pulp industry
- Slowed due to lack of construction/crappy economy
- USDA Biomass Crops Assistance Program (BCAP) subsidy of $45/ton for switchgrass, forestry products
- Price goes up, availability goes down

Sphagnum peat moss
- low pH
- 3.0-4.0
- Very low mineral content
- Great moisture retention

Peat & sustainability
- www.peatmoss.com

Aggregates
- Increase air space, drainage, decrease bulk density
- Vermiculite
  - Moderate pH (depends on source)
  - Good cation exchange capacity (CEC)
  - Bit of K, Mg, Ca
  - Perlite
  - Virtually inert
  - Fluoride?

Bark pile
- Turn frequently
- Add moisture if needed

Perlite
- Virtually inert

Vermiculite
- Virtually inert
Whole trees

- LOTS of research – Virginia Tech, NC State, Auburn, corporate R&D
- Loblolly Pine (South) or Eastern White Pine (North)
- Whole trees are chipped and ground in a hammermill
  - (with or without bark, limbs, needles)
- Or clean chip residual – byproduct of tree harvesting process
  - (40% pine wood, 50% bark, and 10% needles)
Commercial sources
- Fafard TT is a new blend of proprietary components
  - “TimbaTek” + peat + aged pine bark
  - Note lighter color - even when wet

Coir
- By-product of Piña Coladas
- Water holding capacity
  - Comparable to peat
- CEC
  - Lower?
- pH varies
- Soluble Salts
  - Higher
  - Na K Cl
  - KCl fertilizer
- Supply/availability?

Coir – new products
- Coir from Mexico (Agrococo, others)
  - Whole husk
  - Low sodium but potassium through the roof
  - EC 3.5 dS/m
Coir – new products
- Coco Crunch (!)
- Van der Knaap (Netherlands)
- Product of Dominican Republic (proximity!)
- EC 0.9 dS/m
- Ships in compressed 56.5 cu ft bales

Parboiled Rice hulls
- Research at Mississippi State in mid-90s gave thumbs-up
- Dr. Mike Evans, Arkansas, current work
- Use for aeration/aggregate substitute for perlite/vermiculite (Perlite Institute no likey)
- Pointy bits
- Appearance

<table>
<thead>
<tr>
<th>Substrate composition</th>
<th>Bulk density (g/cm³)</th>
<th>Avg particle density (g/cm³)</th>
<th>Total porosity (%)</th>
<th>Air-filled porosity (%)</th>
<th>Water holding capacity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100% peat/30% bulk</td>
<td>0.80</td>
<td>0.51</td>
<td>76.7</td>
<td>12.6</td>
<td>10.4</td>
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<tr>
<td>70% peat/30% bulk</td>
<td>0.83</td>
<td>0.58</td>
<td>76.7</td>
<td>12.6</td>
<td>10.4</td>
</tr>
<tr>
<td>50% peat/50% bulk</td>
<td>0.83</td>
<td>0.58</td>
<td>74.0</td>
<td>12.7</td>
<td>10.3</td>
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<tr>
<td>40% peat/60% bulk</td>
<td>0.80</td>
<td>0.64</td>
<td>69.0</td>
<td>12.2</td>
<td>9.8</td>
</tr>
<tr>
<td>90% rice husk</td>
<td>0.20</td>
<td>0.69</td>
<td>66.6</td>
<td>12.2</td>
<td>5.4</td>
</tr>
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<td>90% rice husk</td>
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Switchgrass – what can’t it do...
- New study from James Altland (USDA Wooster, OH)
- Limited study but hammermilled/screened Panicum virgatum worked well as a growing substrate!
- Nice airspace
- pH on the high side (6.5-7.5), poor buffering
- Need Ca source other than dolomitic lime
Substrate additives: Mycorrhizae
- Endomycorrhizae added to growing media
- I have opinions on this that may differ from yours.
- Arguments: $5 or a pint of beer

Substrate additives: Biocontrols
- Bacteria (Bacillus) “protect plant roots from disease organisms”
  - Cease, Subtlex, Companion
- Bacteria (Streptomycyces)
  - Actinoiron, Actinovate, Mycostop
- Fungi
  - Gliocladium – Presto, SoilGard
  - Trichoderma - Rootshield

Fertilizer update
- New controlled-release fertilizers
  - Scotts Professional now Everris
  - “Fusion Technology”
    - The “no-spill prill”
    - Kudos from some perennial growers...
    - 19-6-9, 5-6 month
    - 20-4-7, 8-9 month

New controlled-release fertilizers
- Osmocote 12-7-18 (w/micros)
  - “mini-prill” – 2-3 months @ 70 F avg. soil temp
  - in trials, not yet on the market
**Water Soluble Fertilizer**

- Trends
  - Less phosphorus. MUCH less phosphorus.
  - More attention on micros (chelated delivery), higher iron

**Jack’s FeEDs**

- Low P, higher micros esp. chelated iron (EDTA, EDDHA, DTPA)
  - Chelation keeps Fe available over wide range of pH
  - 15-2-20 Spring Pansy feed for early perennial crops
  - High nitrate-N (low ammonium)
  - Lotsa iron

**Plantex “No Stretch”**

- For use late in production cycle
- 60% nitrate
- NO phosphorus
- Higher potassium

**Substrate testing**

- You ARE testing your media, right?

**What to test:**

- Media
- Water soluble fertilizer?
  - Check injectors
  - EC guidelines on fertilizer bags
  - What should be coming out of the hose “end”

**Using the PourThru Method for Perennials**

- Easiest way to check pH and EC
- CLF
  - One hour after fertigation
- Controlled release
  - One hour after irrigation
Calibrate your meter…

Apply enough distilled water to get ~50 ml of leachate…

How much water to add?

Collect leachate after a few minutes…

Measure and record pH and EC

What to look for…

- pH
  - Range of 5.4-6.2
  - Not as crucial with a complete CLF
- EC
  - Range of 0.5-4.0
  - Species-specific…

Quart: 75 ml

"Trade" gallon: 100 ml

Full gallon+: 125-150 ml
**Salvia nemerosa**  
EC and Dry Weight

**Astilbe chinensis**  
EC and Dry Weight

**Phlox paniculata** 'David' – 8 wks

**EC ranges for use with the PourThru** (mS/cm)

<table>
<thead>
<tr>
<th></th>
<th>Lower Fertility</th>
<th>Moderate Fertility</th>
<th>Higher Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phlox paniculata 'David'</td>
<td>50 ppm N</td>
<td>200 ppm N</td>
<td>350 ppm N</td>
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<tr>
<td>Heuchera sanguinea</td>
<td>0.75 – 2.00</td>
<td>2.01 – 3.5</td>
<td>3.6 – 5.0</td>
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<tr>
<td>Physostegia virginica</td>
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<tr>
<td>Scabiosa columbaria</td>
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<tr>
<td>Dianthus plumarius</td>
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<td></td>
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<tr>
<td>Salvia nemerosa</td>
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<tr>
<td>Astilbe chinensis</td>
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<tr>
<td>Achillea millefolium</td>
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<tr>
<td>Campanula carpatica</td>
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<tr>
<td>Coreopsis verticillata</td>
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<td></td>
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<tr>
<td>Gaara lindheimeri</td>
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<tr>
<td>Lamium maculatum</td>
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<tr>
<td>Perovskia atriplicifolia</td>
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<tr>
<td>Veronica x 'Goodness Grows'</td>
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<tr>
<td>Penstemon x 'Sour Grapes'</td>
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</tbody>
</table>

**Irrigation impacts fertility**
- Subirrigation?
- Excess nutrients not removed by leaching
- EC rises over time
- Apply 30-50% less fertilizer

**New: Direct measurement probes**
- FieldScout EC probe by Spectrum Technologies
- W.E.T. sensor with HH2 Meter (Delta-T, distributed by Dynamax)
- Other brands, too
Potential nutrition problems...

- **Nitrogen** form
- High NH$_4^+$ ratio = decreases pH
- High NO$_3^-$ ratio = increases pH
- Watch for pH “creep”
  - 15-16-17 or 20-10-20: acidifying
  - Remedy: calcium nitrate or a complete fertilizer with high nitrate-N to ammonium-N ratio

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Environmental conditions

- Can dictate nutrient requirements
- Cool, cloudy weather
- If media has high WHC, may not get to fertigate
- Switch to low- or no-ammonium feed

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Acidity and Basicity of Common Fertilizers

<table>
<thead>
<tr>
<th>Acid</th>
<th>Neutral</th>
<th>Basic</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-10-20</td>
<td>15-16-17</td>
<td>15-5-15</td>
</tr>
<tr>
<td>9-45-15</td>
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<td>15-0-15</td>
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<tr>
<td>10-30-20</td>
<td>15-0-0</td>
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<tr>
<td>20-20-20</td>
<td>13-0-44</td>
<td></td>
</tr>
<tr>
<td>21-7-7</td>
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</tbody>
</table>

100+ formulations at: [http://www.msue.msu.edu/ae/floriculture/Formulations1.PDF](http://www.msue.msu.edu/ae/floriculture/Formulations1.PDF)
Potential nutrition problems…
- A lot depends on time-span of production
- Ca & Mg incorporated pre-plant…
- Can be excessive leaching in outdoor production
- Supplement with Epsom salts and/or calcium nitrate or use a CalMag fertilizer formulation

Deficiencies effect both shoot and root growth
- Iron deficiency in Verbena canadensis ‘Homestead Purple’, 14 DAT
- Nitrogen deficiency in Helianthus annuus ‘Bressingham Doubloon’, 14 DAT
- Calcium deficiency in Veronica ‘Goodness Grows’, 14 DAT
- Phosphorus deficiency in Veronica, 14 DAT

Bonus: new pots
Questions?

Echinacea thoughts
- Keep EC low (very low going into overwintering)
- pH