Compost Preparation and Use at a Commercial Nursery of Western Canada

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Organic Matter Management
and Compost Use in Horticulture
Santiago, Chile, 2013
Nursery production areas in Canada

Source: Statistics Canada, Sod & Nursery Industry Survey, 2011
Byland’s Nurseries (www.bylands.com)
2011 International Nursery of the Year
International Association of Horticultural Producers (www.aiph.org)
Compost Preparation and Use at a Commercial Nursery of Western Canada

1) Compost preparation
2) Use in field production
3) Use in container production
4) Future research
Raw ingredients are plant refuse
From the nursery and the municipal landfill
Production of finished compost per year:
Good quality  14000 m³  /  High quality  6000 m³
Core temperatures are monitored weekly. Target composting temperature is 50 to 60°C.
Piles are turned to manage temperatures. Aim is to turn 3 times during composting cycle.
Temperatures in compost pile (1996)

(°C at 1.2 meters deep, each point is the mean of 8 measures)

Target was 55 to 65°C
Temperatures in compost pile (1996)
(°C at 1.2 meters deep, each point is the mean of 8 measures)
Target was 55 to 65°C
Compost piles are watered regularly. Moisture content is measured by dry weight.
Moisture content in compost pile (2012)
(% after drying 48 hours at 80°C)
Target is 40 to 60% water content
Moisture content in compost pile (2012)
(% after drying 48 hours at 80°C)
Target is 40 to 60% water content
Moisture content in compost pile (2009)
(% after drying 48 hours at 80°C)
Target is 40 to 60% water content
Moisture content in compost pile (2005)
(% after drying 48 hours at 80°C)
Target is 40 to 60% water content
Testing finished compost for maturity
Canadian Council of Ministers of the Environment (1996)

- C:N ratio is less than 25
  and
  Oxygen uptake shall be less than 150 mg O$_2$/kg of organic matter per hour
  and
  Using cress or radish, seed germination is 90% of control
  and growth rate is 50% of control
  or
- Material is cured for 21 days and stays within 20$^\circ$C of ambient temperature
  or
- The material is cured for 6 months without re-heating.
Cucumber seed germination test

Compost must be 90% germination and 50% growth of control
Compost Preparation and Use at a Commercial Nursery of Western Canada

1) Compost preparation: Challenges
2) Use in field production
3) Use in container production
4) Future research
Challenge #1: Obtaining the correct C:N ratio
Grape pomace from wine making – Excellent C:N
Wood residue from sawmills – Very high C:N
Challenge # 2: Very high temperatures
Compost is too hot – It starts a fire
Compost is too hot – It starts a fire
Then you are in the newspaper...
Compost Preparation and Use at a Commercial Nursery of Western Canada

1) Compost preparation
2) Use in field production
3) Use in container production
4) Future research
Recall our temperatures in the compost pile (°C at 1.2 meters deep, each point is the mean of 8 measures)

Compost is “good quality”
Trees are harvested every 2 to 3 years.
Compost is applied in fall after harvest of trees.
Soil organic matter in 3 different fields
(Target is 4 to 8 %)
Compost applied since 1997 at 250 to 500 m³ / ha / 2 years
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Soil organic matter in 3 different fields
(Target is 4 to 8 %)
Compost applied since 1997 at 250 to 500 m³ / ha / 2 years
Soil pH in 3 different fields
(Target is 6.0 to 7.0)
Dolomite lime annually until 2004 at 2.25 to 4.50 tonnes / ha
Soil pH in 3 different fields
(Target is 6.0 to 7.0)
Dolomite lime annually until 2004 at 2.25 to 4.50 tonnes / ha
## Nutrients in finished compost
*(Griffin Laboratories, Kelowna and A&L Laboratories, Ontario)*

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>pH</strong></td>
<td>6.9</td>
<td>7.3</td>
<td>7.4</td>
<td>7.3</td>
<td>6.7</td>
</tr>
<tr>
<td><strong>Organic matter (%)</strong></td>
<td>27</td>
<td>36</td>
<td>37</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td><strong>Salt (dS/cm)</strong></td>
<td>2.0</td>
<td>2.0</td>
<td>1.1</td>
<td>1.3</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>NO₃ (ppm)</strong></td>
<td>56</td>
<td>12</td>
<td>11</td>
<td>19</td>
<td>63</td>
</tr>
<tr>
<td><strong>P (ppm)</strong></td>
<td>169</td>
<td>290</td>
<td>480</td>
<td>197</td>
<td>428</td>
</tr>
<tr>
<td><strong>K (ppm)</strong></td>
<td>913</td>
<td>1560</td>
<td>2985</td>
<td>1170</td>
<td>1813</td>
</tr>
<tr>
<td><strong>B (ppm)</strong></td>
<td>1.1</td>
<td>2.1</td>
<td>2.4</td>
<td>2.1</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Fe (ppm)</strong></td>
<td>123</td>
<td>98</td>
<td>103</td>
<td>10</td>
<td>351</td>
</tr>
<tr>
<td><strong>Zn (ppm)</strong></td>
<td>12</td>
<td>9</td>
<td>12</td>
<td>10</td>
<td>52</td>
</tr>
</tbody>
</table>
Soil potassium in 3 different fields
(Target is 180 to 500 ppm)
Potassium applied at 40 kg / ha until 1995
Soil potassium in 3 different fields  
(Target is 180 to 500 ppm)  
Potassium applied at 40 kg / ha until 1995
Compost Preparation and Use at a Commercial Nursery of Western Canada

1) Compost preparation

2) Use in field production: Challenges

3) Use in container production

4) Future research
Challenge # 1: Manure based compost
Impact of manure applications on soil salinity
(Electrical Conductivity in dS/cm - Target is below 2.0)
Manure added to Field G in 1994, 1995 and 1996
Challenge # 2: Suppression of plant diseases
Adding compost helps alleviate Agrobacterium
Verticillium wilt remains a problem in fields amended with plant residue compost.
Compost Preparation and Use at a Commercial Nursery of Western Canada

1) Compost preparation
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4) Future research
Compost is part of the potting media
25% plant compost + 75% conifer wood compost + fertilizers
Finished compost must be tested annually

% Porosity = % air space + % water holding
Testing porosity in potting media (2012)
Aeration porosity is critical for healthy roots in containers up to 27-cm

<table>
<thead>
<tr>
<th># tests</th>
<th>Aeration</th>
<th>Water holding</th>
<th>Total porosity</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% nursery compost + 80% hog fuel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% nursery compost + 40% hog fuel + 40% coarse wood</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20% nursery compost + 40% hog + 40% fine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target for 15-cm container</td>
<td>Over 25%</td>
<td>20 to 30%</td>
<td>Over 50%</td>
</tr>
</tbody>
</table>
Aeration porosity is critical for healthy roots in containers up to 27-cm.

| 20% nursery compost + 80% hog fuel | 10 | 40 | 13 | 53 |
| 20% nursery compost + 40% hog fuel + 40% coarse wood | 7  | 32 | 23 | 55 |
| 20% nursery compost + 40% hog + 40% fine | 10 | 28 | 32 | 59 |
| Target for 15-cm container | Over 25% | 20 to 30% | Over 50% |
Recall our temperatures in the compost pile (°C at 1.2 meters deep, each point is the mean of 8 measures)

Compost is “high quality”
Plate with selective media

White: *Fusarium*  
Green: *Trichoderma* (native local sp.)
Compost Preparation and Use at a Commercial Nursery of Western Canada

1) Compost preparation
2) Use in field production
3) Use in container production: Challenges
4) Future research
Challenge # 1: Materials not properly stabilized
Unfinished compost leads to N immobilization
Also, it may still contain root rot pathogens
Plant in unfinished compost – Rotting roots
Selective media indicates *Pythium* infection
## Root rot pathogens in different composts
(Propagules per gram of soil. Ribeiro Plant Lab, Washington)

<table>
<thead>
<tr>
<th></th>
<th>Phytophthora</th>
<th>Pythium</th>
<th>Rhizoctonia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nursery compost</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fir bark (year 1)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fir bark (year 2)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hemlock-fir compost (year 1)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hemlock-fir compost (year 2)</strong></td>
<td></td>
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**Root rot pathogens in different composts**  
(Propagules per gram of soil. Ribeiro Plant Lab, Washington)

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<th>Pythium</th>
<th>Rhizoctonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursery compost</td>
<td>0 (none)</td>
<td>60 (low)</td>
<td>0 (none)</td>
</tr>
<tr>
<td>Fir bark (year 1)</td>
<td>0 (none)</td>
<td>110 moderate</td>
<td>0 (none)</td>
</tr>
<tr>
<td>Fir bark (year 2)</td>
<td>0 (none)</td>
<td>0 (none)</td>
<td>0 (none)</td>
</tr>
<tr>
<td>Hemlock-fir compost (year 1)</td>
<td>0 (none)</td>
<td>0 (none)</td>
<td>0 (none)</td>
</tr>
<tr>
<td>Hemlock-fir compost (year 2)</td>
<td>0 (none)</td>
<td>410 very high</td>
<td>110 (moderate)</td>
</tr>
</tbody>
</table>
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Research topic # 1: There is not enough compost for the whole field
Compost is applied in bands ahead of planting
Trees are grown for 3 years with compost bands
Trees excavated September 2013 (after 1 year)
Better root development in compost band
Research topic # 2:
Using compost tea as a natural fertilizer
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Thank you for your attention