Establishing New Tree Fruit Orchards with Container-Produced Nursery Trees

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Objectives

• New plantings need to fill orchard space rapidly and then be shifted to cropping

Lakso, 1994
Situation

- Planting density is steadily increasing (900 to 1,500 trees/acre)
- High density plantings are very expensive ($15,000-$25,000/acre)
- They require intensive horticultural management to balance cropping and canopy development for fruit size and quality
Situation

• With cultivars such as Honeycrisp, inherent dwarfing and precocity markedly limit canopy development

• Returns of $500-$800/bin don’t aid the decision to drop fruit in the 2\textsuperscript{nd} or 3\textsuperscript{rd} leaf in lieu of canopy growth
Situation

• The objective is to pay off the investment as soon as possible
Issues with Planting Material

• Traditional bare-root nursery stock is inherently prone to transplant shock
Containers: Alternative option?

• By contrast, containers offer minimal disruption of the rhizosphere at planting

• Balance between above and below-ground growth is maintained

• Carbohydrate and nutrient reserves are available for establishment

Courtesy Dr. Bert Cregg
Container Diversity

- Containers differ widely in construction and principle
  - Plastic containers
  - Injection-molded materials
  - Paper liner/membranes

http://www.acwsupply.com/index.php/downloadable-catalog

Rootmaker products rootmaker.com

Ellepot products Ellepot.com
Potential issues with container production

- Circling roots
- J-roots
- Future Girdling
- Poor spreading after established in field
Air Pruning Systems

- Air pruning pot systems
  - Encourage root branching by removing inhibitory signal for lateral root initiation
  - Increase root length density of fibrous (feeder) roots
  - Eliminates root circling and future girdling
Air Pruning

Courtesy Lars Jensen
Management Considerations

- Containers offer planting Flexibility
  - Spring planting vs. Fall planting
    - Opportunities to take advantage of H2A ‘down time’ between harvests
  - Planting when soil and climatic conditions are favorable
  - Paper liners (Ellepot systems) increase flexibility in the timing of planting since containers can be planted before roots have filled pot volume
Cost Considerations

- Containerized trees have additional production costs
  - Media, molded trays, etc.
  - Freight/Shipping costs depend on origin, tree size and state (i.e., green or dormant) and may all affect price
  - Do the benefits outweigh the costs?

Courtesy Cliff Beumel
Sierra Gold Nurseries
2017 MSU Ellepot Production Trial

• Starting material: Nic29 Bench grafts (Honeycrisp, Gala, Fuji)
Ellepot System
2017 MSU Ellepot Production Trial

- Experiment: Comparison of Bare root or Ellepot production systems for apple trees (Honeycrisp, Gala, Fuji)
2017 MSU Ellepot Trial

- **Scion Growth**

![Scion growth graphs for different apple varieties: Fuji, Gala, and Honeycrisp, showing growth from 14-Jun to 11-Nov.](image)

- **Scion growth (cm)**
  - Fuji - Ellepot
  - Fuji - Field Liner
  - Gala - Ellepot
  - Gala - Field Liner
  - Honeycrisp - Ellepot
  - Honeycrisp - Field Liner

![Shoot dry weight graphs for Fuji and Gala varieties, comparing Ellepot and Field Liner.](image)
2017 MSU Ellepot Trial

- Individual Leaf Size (cm²)

- Ellepot-produced trees also had significantly higher total canopy LA
2017 MSU Ellepot Trial
2017 End-of-season MSU Root Growth

- Ellepot-produced Gala and Honeycrisp had 70% to 100% more root tips than field-produced liners.
Ellepots had 50% to 100% more fine-root production than liners.

Non-fine roots significantly greater for field-produced trees.

Fine roots account for ~95% or more of total root length.
Field-produced trees had significantly greater dry weight (CHO) than Ellepot trees. Non-structural CHO currently being analyzed.
Front to back: Rep 1, Gala, Fuji, HC; Rep 2, HC, Fuji, Gala
Ellepott Trials - MSU, HTRC

Rep 3, Gala
Rep 3, Honeycrisp
Rep 3, Fuji
2018 Orchard Plantings

• We established 3 orchard sites with Ellepot and bareroot trees produced in 2017
  – Clarksville, Traverse City and Sparta
  – At Clarksville, monthly above-ground measurements were taken (shoot growth, shoot number and leader height)
  – In November, ~100 whole trees (including root systems) were excavated to evaluate root growth and development one year after transplanting
2018 End of season tree growth and development: MSU trees

Table 1. Effect of Ellepot vs. Bare Root nursery production of Fuji, Gala and Honeycrisp apple trees on M9 (Nic 29) rootstock on first year growth in the orchard (Clarksville Research Center). Data are means of 4 reps.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Nursery (location)</th>
<th>Production system</th>
<th>Branches (no./tree)</th>
<th>2018 Leader growth (cm)</th>
<th>Total 2018 shoot growth (cm)</th>
<th>Total annual growth (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuji</td>
<td>MSU</td>
<td>Ellepot</td>
<td>6.3</td>
<td>232.7</td>
<td>58.4</td>
<td>291.10</td>
</tr>
<tr>
<td>Fuji</td>
<td>MSU</td>
<td>Bare Root</td>
<td>4.5</td>
<td>107.7</td>
<td>37.6</td>
<td>139.36</td>
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<tr>
<td>Gala</td>
<td>MSU</td>
<td>Ellepot</td>
<td>5.0</td>
<td>199.7</td>
<td>63.7</td>
<td>263.43</td>
</tr>
<tr>
<td>Gala</td>
<td>MSU</td>
<td>Bare Root</td>
<td>3.3</td>
<td>63.9</td>
<td>43.6</td>
<td>107.26</td>
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<tr>
<td>Honeycrisp</td>
<td>MSU</td>
<td>Ellepot</td>
<td>3.2</td>
<td>50.7</td>
<td>38.3</td>
<td>91.08</td>
</tr>
<tr>
<td>Honeycrisp</td>
<td>MSU</td>
<td>Bare Root</td>
<td>1.8</td>
<td>20.9</td>
<td>39.6</td>
<td>60.41</td>
</tr>
</tbody>
</table>

• Ellepot-produced trees had ~50% to 150% greater total annual growth than bare-root trees...depending on the scion.
Challenges of Container Production

• Given the small rooting volume, containers are **unforgiving** of horticultural errors
  • Water use/irrigation
  • Media offers relatively no buffering capacity
  • Water quality
  • Nutrition
  • Light/Temperature (i.e., receiving green plants)
Planting Containerized Trees

• With Ellepots, the paper liner is planted
• All containerized trees...
• Depending on the length of the rootstock shank, planting depth may vary, but...
• Soilless media wicks moisture
• Top of media needs to be covered

Courtesy Cliff Beumel  (planting site, Yakima, WA)
Courtesy Cliff Beumel, (Same Planting October, 2017 Yakima, WA)
“Quick Start” Fuji on Bud 10
Side By Side with 2 Year Nursery Tree on M9
Planting Date June 1
Summary

• Container produced trees offer planting flexibility and **reduce transplant shock** by maintaining tree balance and necessary reserves.

• Container systems with air pruning stimulate production of fine roots practically eliminating poor root development.

• These benefits led to improved canopy growth and development in the first establishment year.

• Early and higher production would be expected to easily compensate for the increased costs associated with products.
Thank you!

I would like to acknowledge ...

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