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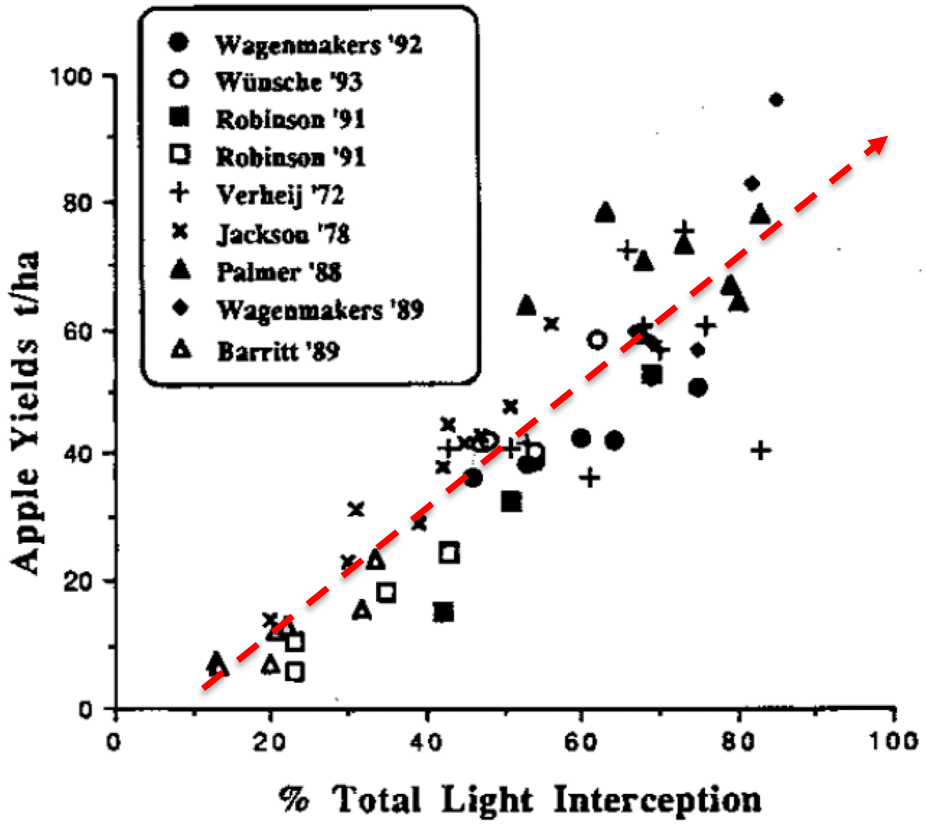
Establishing New Tree Fruit Orchards with Container-Produced Nursery Trees

Todd Einhorn, Ph.D.
Associate Professor and Tree Fruit Specialist
Michigan State University
einhornt@msu.edu

Objectives

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



Lakso, 1994

Situation

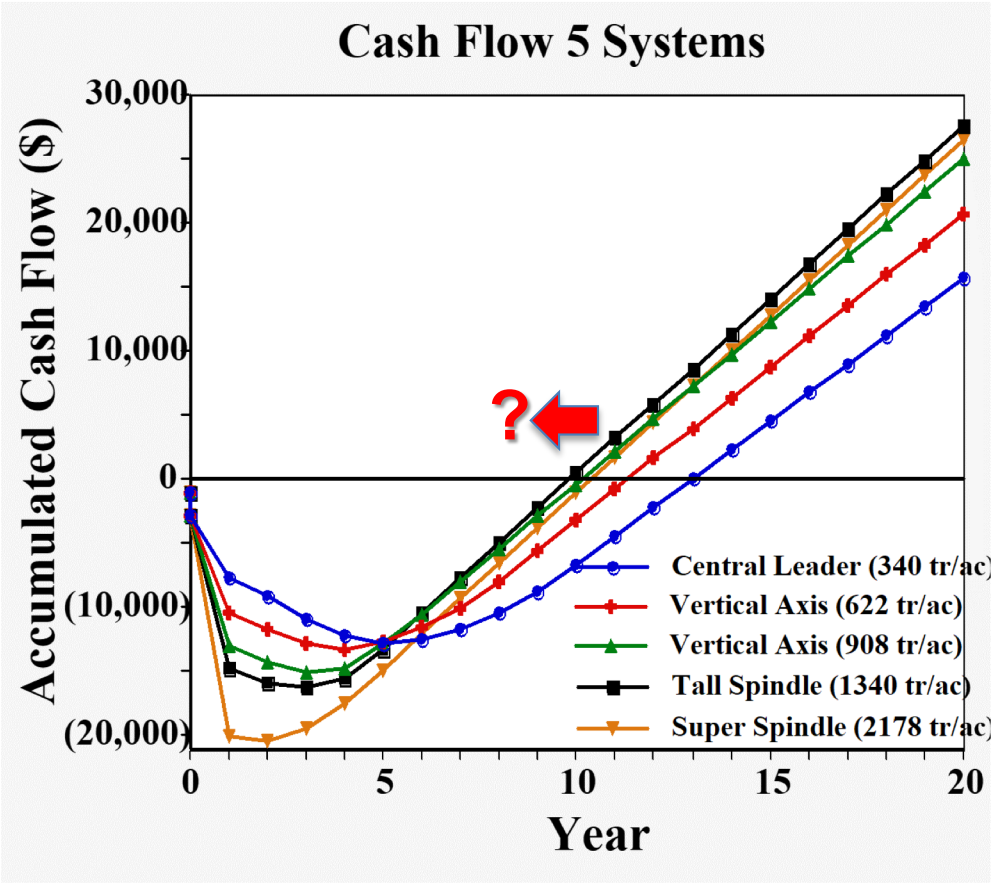
- Planting density is steadily increasing (900 to 1,500 trees/acre)
- High density plantings are very expensive ($15,000-$25,000/acre)
- They require intensive horticultural management to balance cropping and canopy development for fruit size and quality

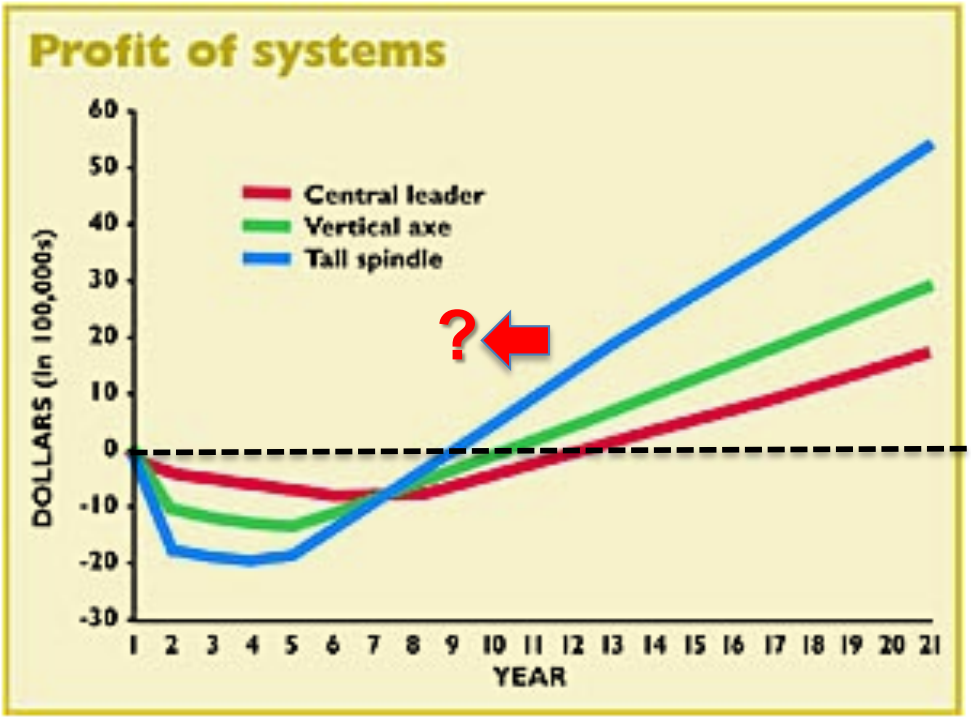
Situation

- 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 2nd or 3rd leaf in lieu of canopy growth

Situation

- The objective is to pay off the investment as soon as possible





Robinson et al., 2007

Good Fruit Grower- Richard Lehnert // Aug 1, 2010 // Apples // Production // Research Data, P. Schwallier and A. Irish-Brown, MSU

Issues with Planting Material

- Traditional bare-root nursery stock is inherently prone to transplant shock

Established spring, 2016

October, 2016

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

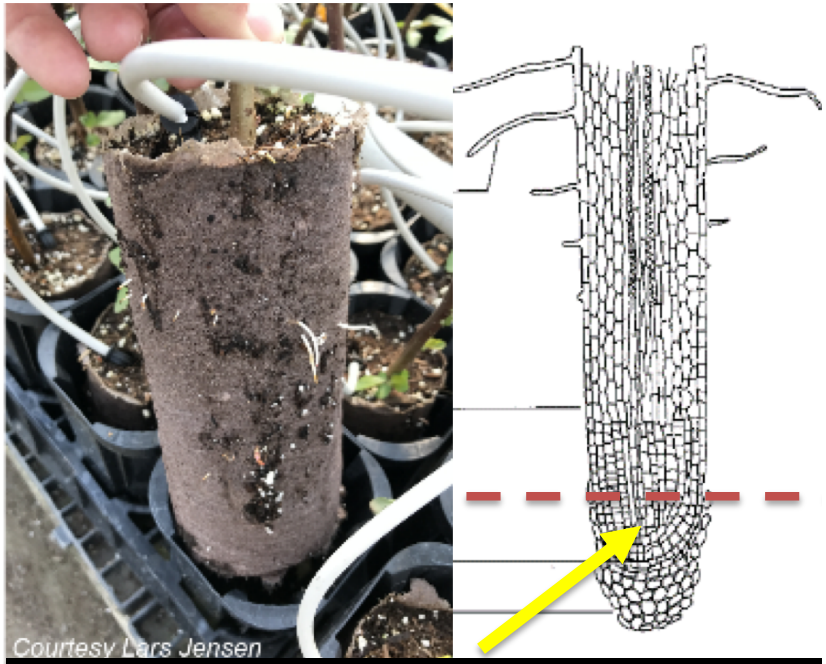
Ellepot products Ellepot.com

Container Root Systems

- 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



Removal of apical meristem

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

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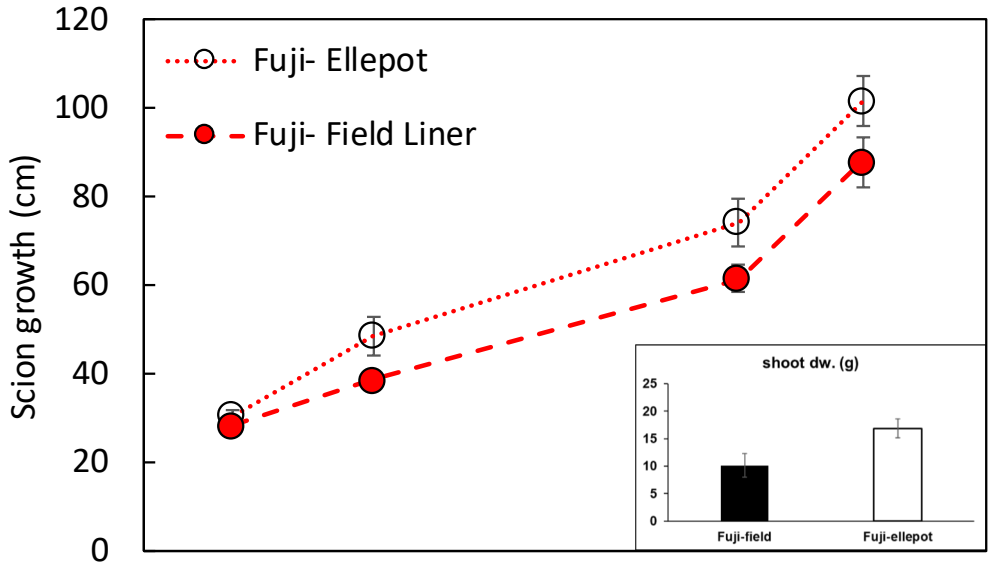
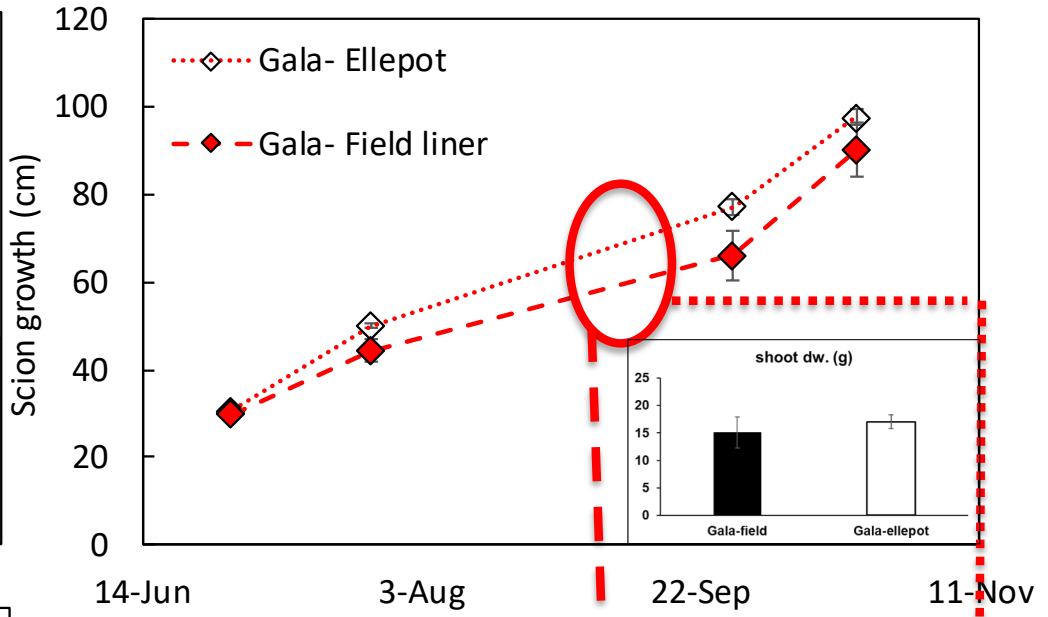
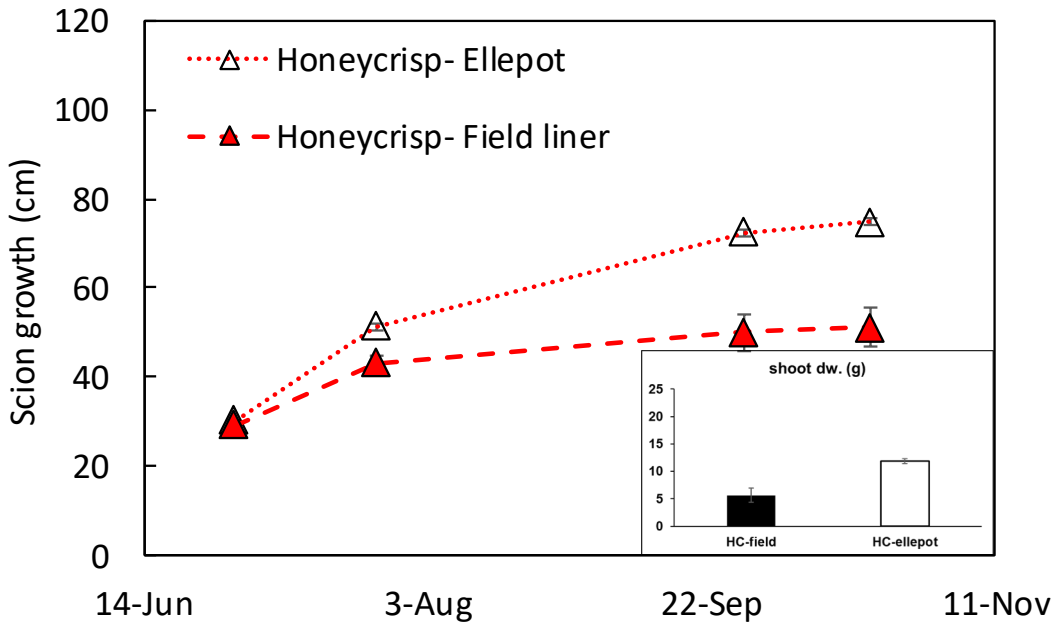
- Scion Growth







2017 MSU Ellepot Trial

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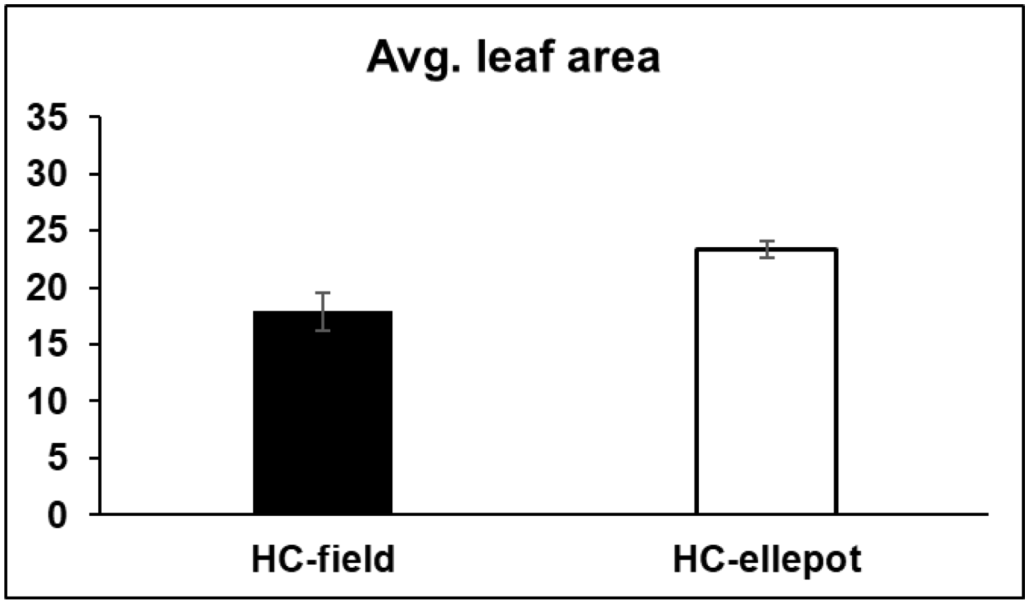
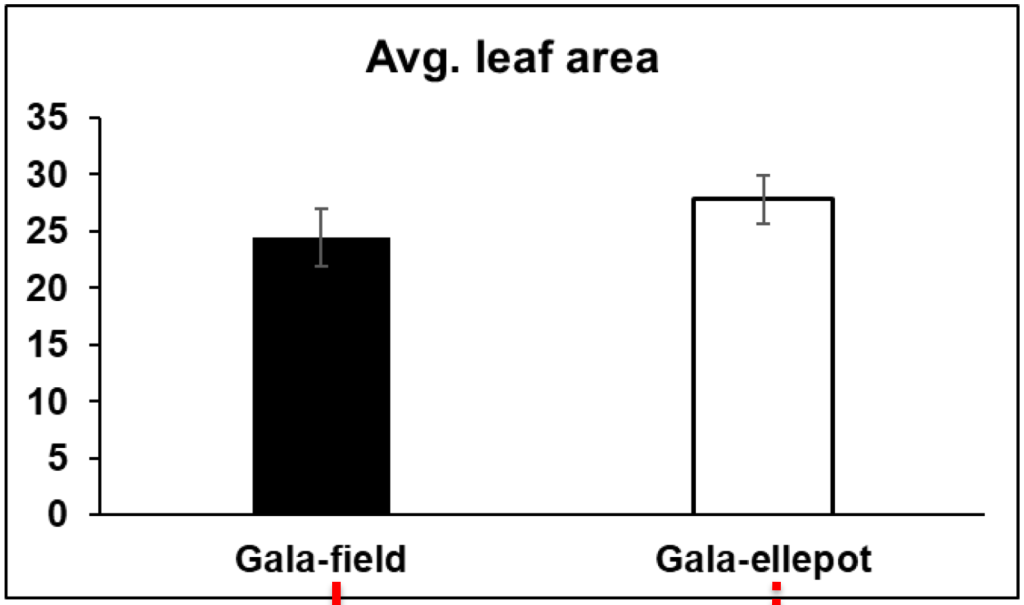
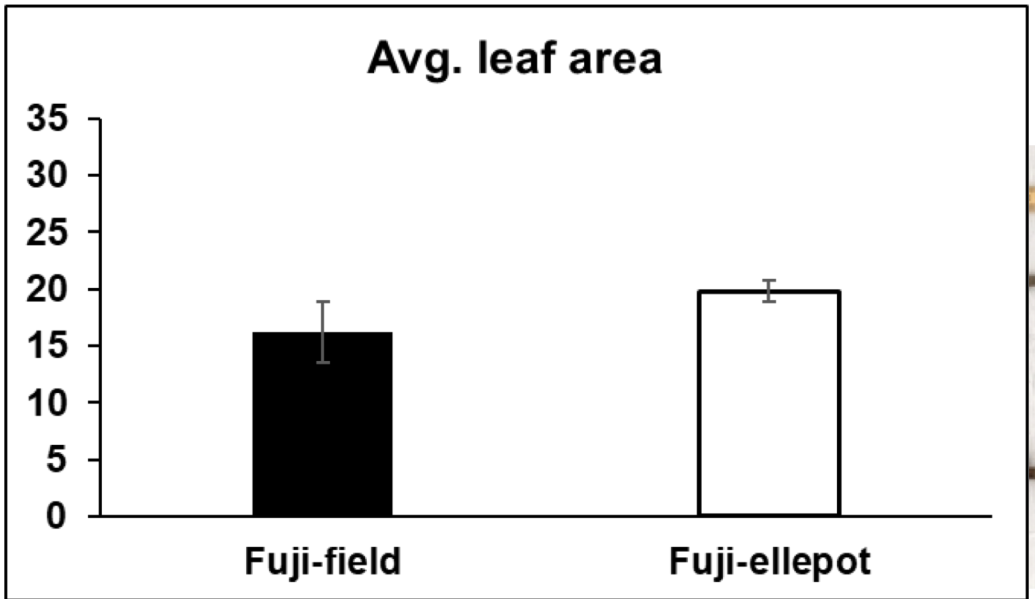
- Individual Leaf Size (cm^2)







- Ellepot-produced trees also had significantly higher ***total canopy LA***

2017 MSU Ellepot Trial

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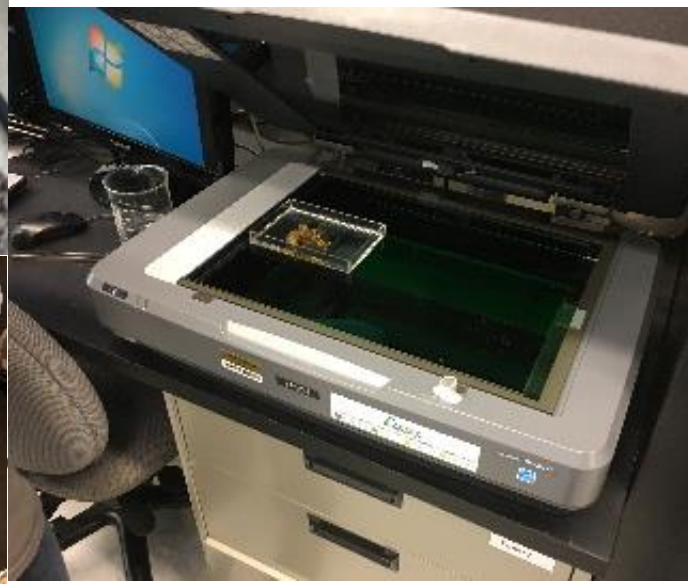
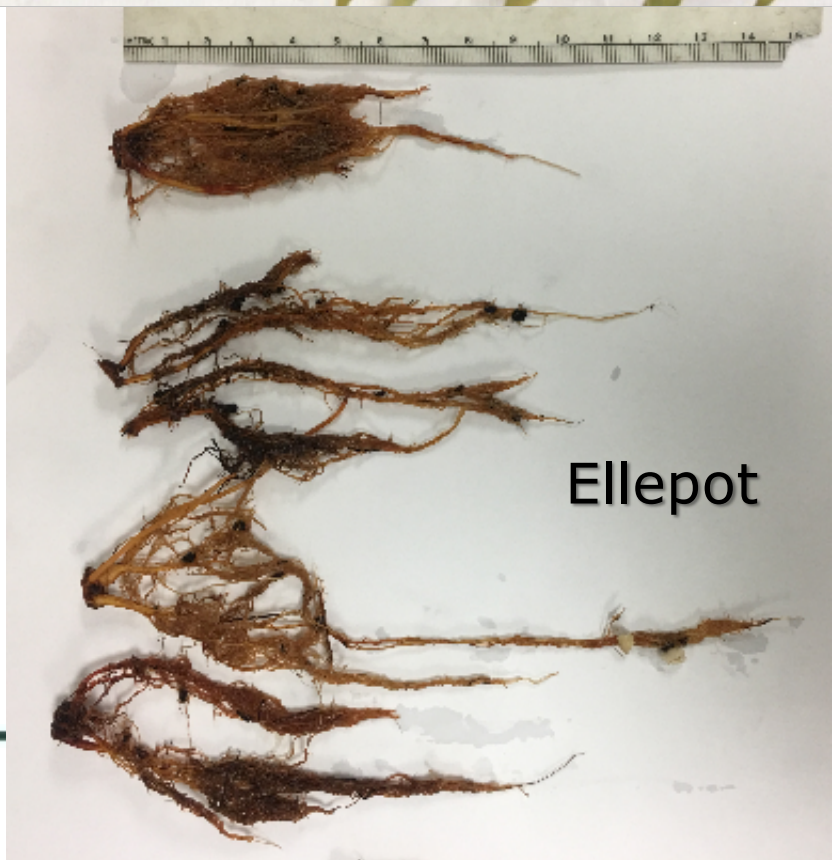
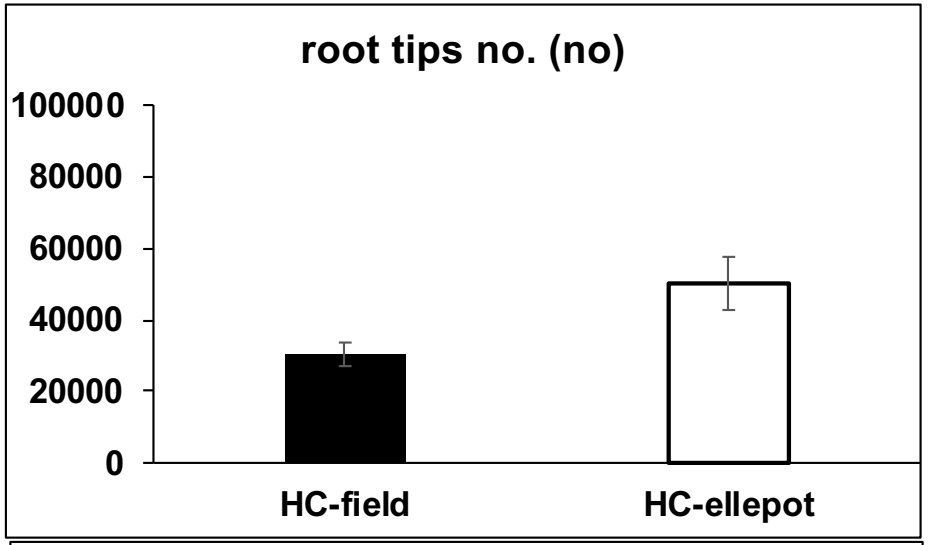


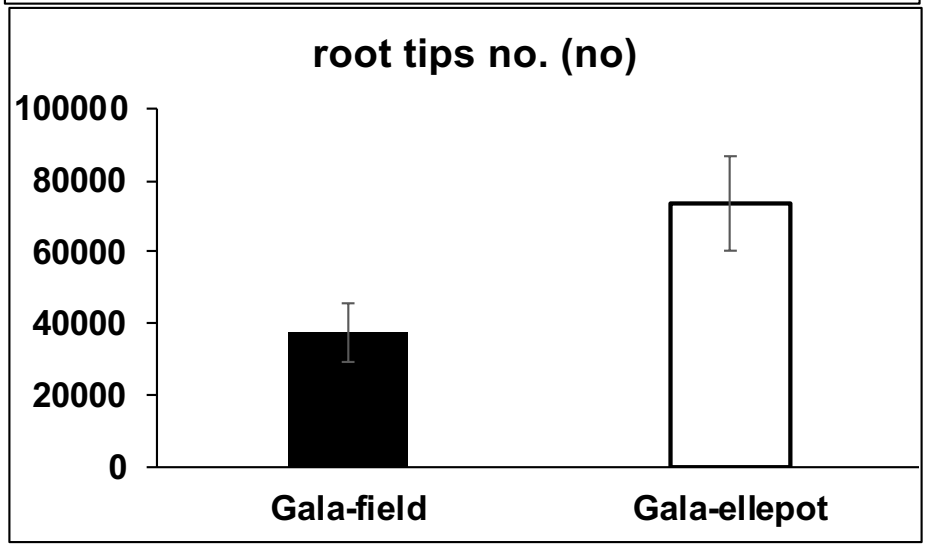

Bare-root
Ellepot

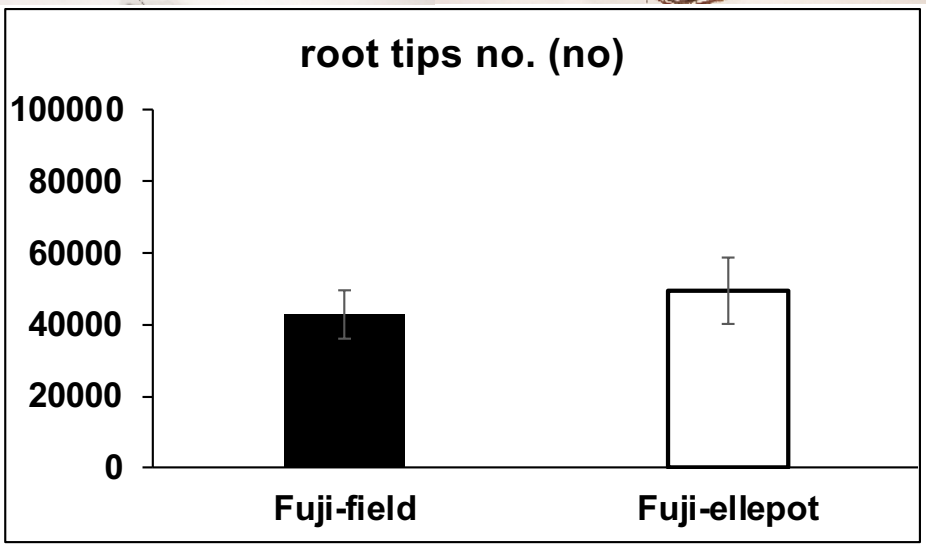

Bare-root


Ellepot

2017 End-of-season MSU Root Growth

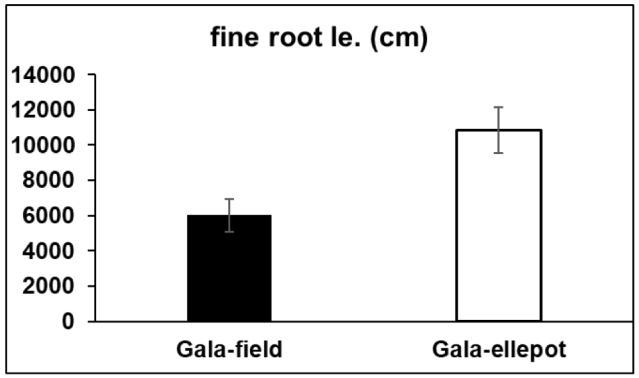


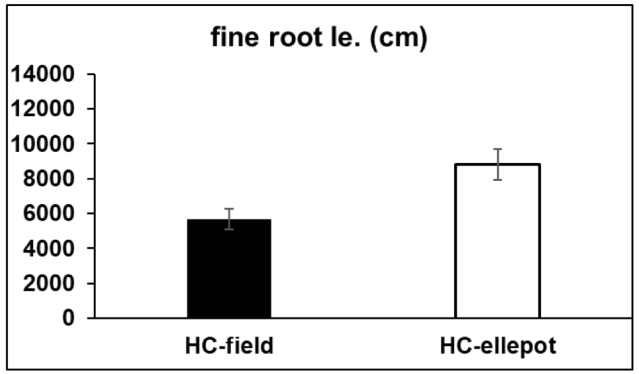


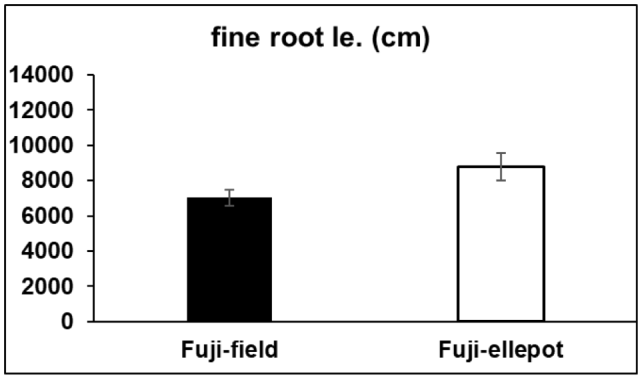


- Ellepot-produced Gala and Honeycrisp had 70% to 100% more ***root tips*** than field-produced liners

2017 End-of-season MSU Root Growth

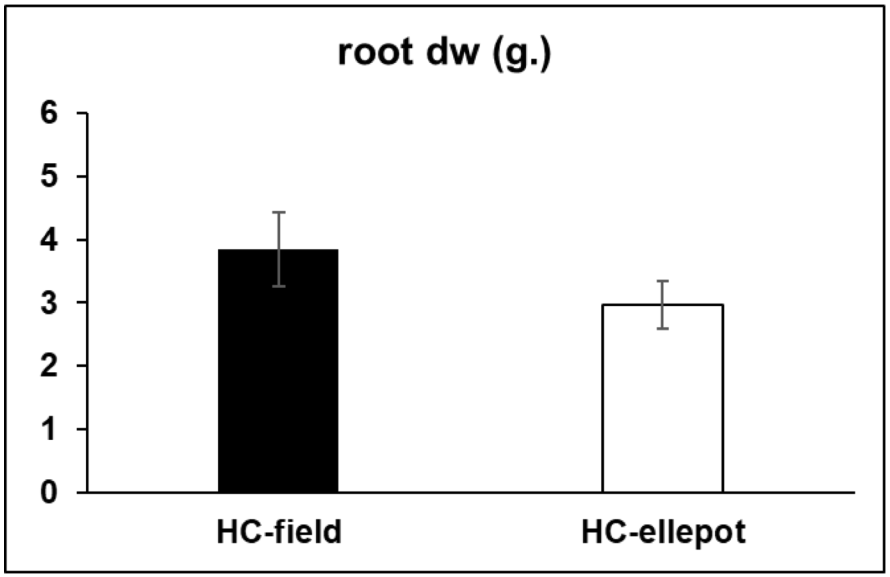


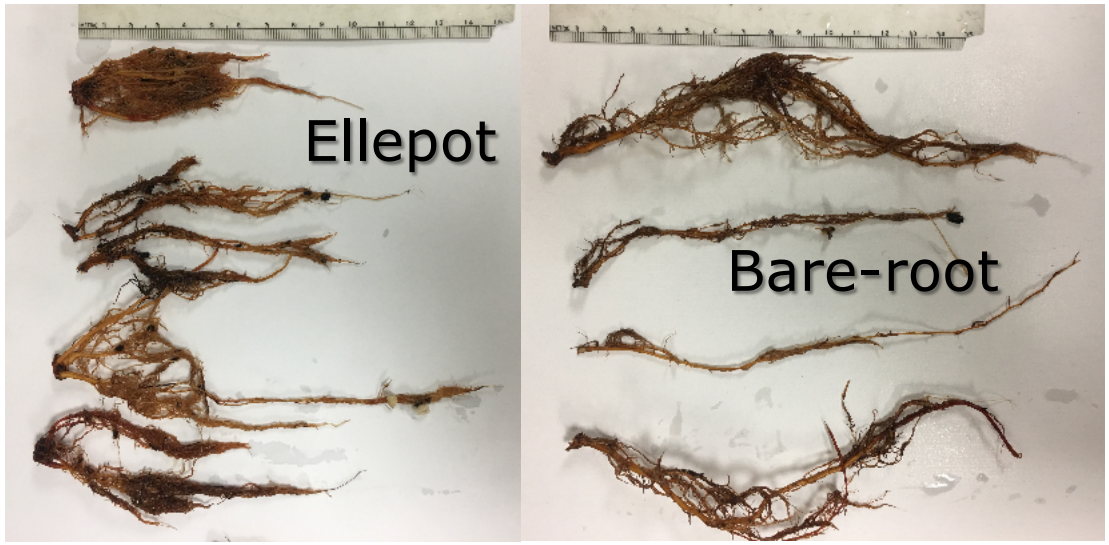


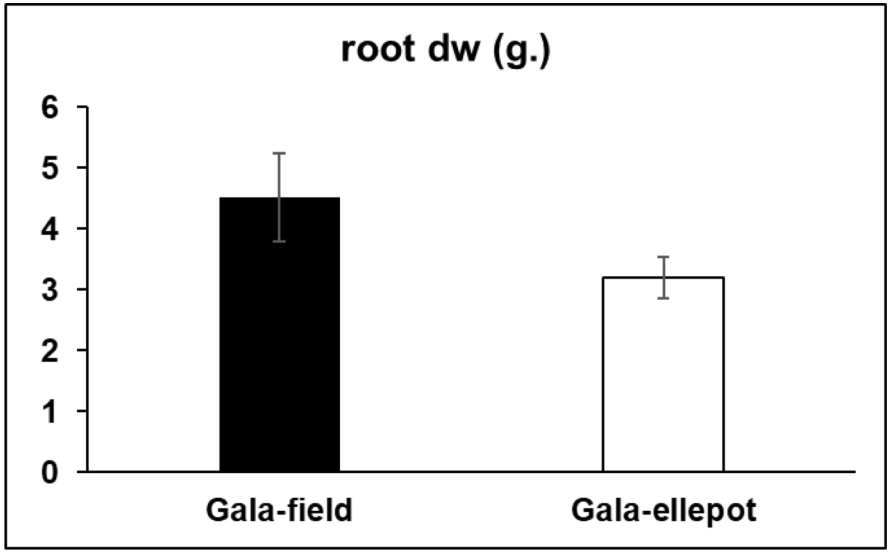


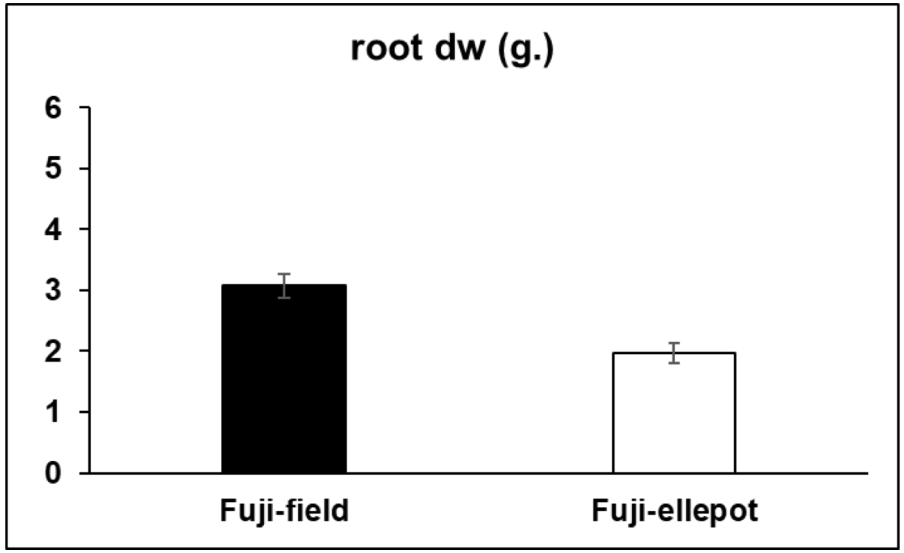
- Ellepots had 50% to 100% more ***fine-root*** production than liners
- ***Non-fine roots*** significantly greater for field-produced trees
- Fine roots account for ~95% or more of total root length

2017 End-of-season MSU Root Growth









- Field-produced trees had significantly greater ***dry weight (CHO)*** than Ellepot trees- Non-structural CHO currently being analyzed

Ellepot Trials- MSU, HTRC

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Front to back: Rep 1, Gala, Fuji, HC; Rep 2, HC, Fuji, Gala

Ellepot Trials- MSU, HTRC

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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

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2018 End h and developm

Table 1. Effect of Ellepot vs. B pple trees on M9 (Nic 29) rootstock on first means of 4 reps.

Cultivar	Nursery (location)	Produ sys	Total annual growth (cm)
Fuji	MSU	Ell	291.10
Fuji	MSU	Bare	139.36
Gala	MSU	Ell	263.43
Gala	MSU	Bare	107.26
Honeycrisp	MSU	Ell	91.08
Honeycrisp	MSU	Bare	60.41

- Ellepot-produc annual growth than ba

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)

Courtesy Cliff Beumel, Sierra Gold Nurseries

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Planting Containerized Trees

Courtesy Cliff Beumel, (Planting May 3, 2017 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

Courtesy Cliff Beumel, Sierra Gold Nurseries

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 …

- MAC, MTFC
- Cliff Beumel, Sierra Gold Nurseries
- Lars Jensen, Ellepot, USA
- Skip Blackmore, Blackmore Co.
- Bert Cregg & Tom Fernandez, MSU
- Farm staff: MSU Hort Farm and CRC
- Lab and field team: Phil Schwallier, Amy Irish-Brown, Mokhles (Cc) Elsysy, Tye Wittenbach, Mohamed Ghorab, Gail Byler, Denise Ruwersma