Evolution of High-Density Tart Cherry Orchards in Michigan


1NW Michigan Horticultural Research Center
Michigan State University
Need for Technology and Horticultural Modernization in Tart Cherry

- Michigan Cherry Industry faces challenges from globalization
  - Inexpensive labor
  - Favorable growing conditions
  - Accessibility to suitable farmland
  - Subsidies
  - Tariff issues

- Montmorency: 250+ year-old cultivar
- Mahaleb: standard rootstock
- 20ft+ x 20ft+ spacings
- 30 year-old harvest technology
Trial #1: High Density Montmorency on Commercially Available Rootstocks

Planting established at NWMHRC in 2010
• Gisela 3®
• Gisela 5®
• Gisela 6®
• Mahaleb
• Montmorency on own root

• 12ft x 4.5ft
• Pruned/hedged to bush and central leader
• Irrigated and fertigated
Pruning

- Trained to central leader or bush
- Annual renewal pruning
  - Remove 2-3 of the largest scaffold limbs
  - Leave behind 8” stub for renewal growth
- Clean out dead wood and growth towards interior
- Simplify limbs for light penetration
- Current experimental pruning is too complex and time consuming for growers
Gi6 Central Leader

Gi6 Bush
Mahaleb Central Leader

Mahaleb Bush
All trained to a central leader system. Picture taken in spring 2018.
Data Collection

- Amount of bloom
- Leaf area
- Trunk cross-sectional area
- Tree efficiency
- Yield – first harvest 2013
  - No crop in MI in 2012
  - 2015 and 2016
    - Light crop in 2015
    - Large crop in 2016
Harvest

• Hand harvest in ‘13 and ’14 • OTR harvest in ‘17 and ’18 (help from a limb shaker)
Fruit Quality

- Collect 150 fruit total from all reps
- Measured pull force, diameter, brix, and soft fruit
Fruit Diameter

![Graph showing average diameter of fruits for Mahaleb, Gi3, Gi5, and Gi6 varieties. The graph compares the diameter between central leader and bush types.](image-url)
Brix

![Bar chart showing the average Brix values for Mahaleb, Gi3, Gi5, and Gi6. The chart compares Central Leader and Bush varieties.](chart.png)
Percent Soft Fruit

- Mahaleb
- Gi3
- Gi5
- Gi6

Central Leader | Bush
---|---|
Mahaleb | 5%
Gi3 | 25%
Gi5 | 25%
Gi6 | 10%
Tree Canopy Volume 2018

![Bar Chart: Tree Canopy Volume (m³)]

- **Mah**: 2000 m³ for Central Leader, 1200 m³ for Bush
- **Gi3**: 500 m³ for Central Leader, 300 m³ for Bush
- **Gi5**: 800 m³ for Central Leader, 400 m³ for Bush
- **Gi6**: 900 m³ for Central Leader, 600 m³ for Bush
Tree Efficiency – Central Leader

Tree Efficiency (lbs/cm²)

<table>
<thead>
<tr>
<th></th>
<th>2013</th>
<th>2014</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
<td>Mahaleb</td>
<td></td>
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<tr>
<td>Gi3</td>
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<td>Gi5</td>
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<td>Gi6</td>
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</tbody>
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Mahaleb: 0%
Gi3: 5%
Gi5: 10%
Gi6: 15%
Avg. Tree Efficiency 2014-18

Central Leader

Bush

Tree Efficiency (lbs/cm²)

Avg. Tree Efficiency 2014 - 18
Average lbs per acre – Central Leader

- Based on current tree spacing 4m x 1.5m or 674 trees per acre
Average lbs per acre – Central Leader

- Based on current tree spacing 4m x 1.5m or 674 trees per acre
Average lbs per acre – Bush

- Based on current tree spacing 4m x 1.5m or 674 trees per acre
Avg. Pounds per Acre 2014-18

**Central Leader**

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<tr>
<td>Mahal eb</td>
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<tr>
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<td>7000</td>
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**Bush**

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Variable yields compared to NW averages
• Not even moving in the same direction for some rootstocks

Mahaleb central leader has promising trajectory

Missing 2015 and 2016 yields undermines long term viability of HD investment

Yield required to be competitive with traditional system is 6875lbs per year from year 3 onward
Dwarf Yields (Bush) Vs. NW Average Yields
Dwarf Yields (Central Leader) Vs. NW Average Yields

Mahaleb trajectory may be very important for projection accuracy*

Beat NW average in 2018 at only 7rs old
What constant yield on HD systems would be required to make them even with traditional plantings? $6875lbs

- **Assumptions:**
  - Price: $0.36
  - Interest: 6%
  - Operating cost structures the same
  - Startup costs:
    - Regular: $3474
    - HD: $8316
Projections - No Missing Years versus Missing ‘15 and ‘16

Crop Failure in ‘15 and ‘16

No Crop Failure in ‘15 and ‘16
High Density Mahaleb vs. Regular Planting

Projected out into 2020 and assumes no crop loss in ‘15 and ‘16
Key Ideas

• What is the yield by tree age relationship for HD tarts and for particular rootstocks?
• How similar is the operating and harvesting cost structure?
• What are the chances of an early crop failure like ‘15 and ‘16?
• Will Mahaleb continue on its upward trajectory?
  – If so, this rootstock may play a role in a viable HD system to replace standard planting
Conclusions

• No crop in two seasons (‘15/’16)
  • Winter injury from two hard winters?
    • 2013-14/2014-15
    • Are Gisela more sensitive to cold temperatures?
  • Are we pruning too hard and removing too many buds?
    • Shading issues causing lower limb death
    • Intense pruning contributes to variability
    • Attempting to prune for increased light penetration at expense of yields

• Need to repeat trial in ‘19
  • Overall Gisela rootstocks have higher tree efficiencies and combined yields
    • Gisela yields dropped off in 2018
    • Will Mahaleb continue to increase yields over time? Can this rootstock be used at high densities?
  • Further data are needed
MDARD Specialty Block Grant