Fruit Thinning

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Topics of Discussion

- Economics of Thinning
- Horticultural basis for thinning apples & peaches
- New mechanical technology
- Strategies
Economics of Thinning

- Approximately $500/acre (based on $10/hr w/o benefits)
- Labour intensive practices will be more challenging in the future
- Harvest efficiency is directly related to crop load
- Thinning nearly always reduces yield per tree
Horticultural Basis for thinning Apples & Peaches

- Tree fruit trees produce an excessive number of flowers.
- 5-10% fruit set is needed to produce a desirable crop.
- To promote return bloom.
- To maintain tree growth and structure.
Several Approaches to Thinning (Crop Load)

- Mechanical (Pruning)
- Mechanical (Blosssom)
- Chemical: Blossom & Fruitlet Thinning
- Chemical: Flower Inhibition
- Hand
Adjusting Crop Load by Dormant Pruning

Before

After
Adjusting Crop Load by Dormant Pruning

Calculation based on:
- Estimated yield/acre (bins)
- Target fruit size (eg, 88’s)

50 Bins/acre, Target size: peak on 88’s = 0.48 lbs/fruit
Yield/acre = 50 bins x 18 bu/bin x 42 lbs/bu = 37,800 lbs
Tree Density = (18” x 11’) = 2641 t/a
Yield/tree = 37,800 lbs /2641 trees = 14.3 lbs/tree
Fruit per tree = 14.3 / 0.48 = ~ 30 fruit per tree
Blossom Thinning

Chemicals: Lime sulphur, ATS, surfactants, oils

Mechanical: specialized implements, hand

**Advantages**
- Conducted early in the season
- Carbon Credits - tree photosynthates are distributed between fruit that remain on the tree
- Mechanized - low labour
- Quick, easy

**Disadvantages:**
- Potential for spring frosts following removal
- Uncertainty of environmental conditions for pollination
- Unpredictable response with chemical
- Not many registered products
Rope Thinner

Photo courtesy of Dr. Bob Belding
2009 Research Objectives

To assess the effectiveness of mechanical blossom thinning on:

- Reduction in hand thinning
- Fruit size and yield
- Labour savings
Mechanical String Thinner

- Designed by Fruit-Tec, Germany
- Cost: $C 15,000 for Model 300
- Has front mount 3PH, fixed, or fork-lift mounts
- Model evaluated Darwin 300
Source: Pen State University

Mechanical String Arrangements

9 Strings

<table>
<thead>
<tr>
<th>Variety</th>
<th>Timing</th>
<th>Rotations Per Minute</th>
<th>Miles Per Hour</th>
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<tbody>
<tr>
<td>Autumn Glow</td>
<td>Pink</td>
<td>150 &amp; 180</td>
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<tr>
<td>Red Haven</td>
<td>Pink</td>
<td>160</td>
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<tr>
<td>PF17</td>
<td>Pink</td>
<td>180</td>
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<tr>
<td>Saturn</td>
<td>Pink</td>
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<tr>
<td>Fantasia</td>
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18 Strings

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<td>130</td>
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2 On, 2 Off

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<th>Timing</th>
<th>Rotations Per Minute</th>
<th>Miles Per Hour</th>
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<tbody>
<tr>
<td>Red Haven</td>
<td>Pink</td>
<td>150 &amp; 180</td>
<td>1</td>
</tr>
<tr>
<td>PF17</td>
<td>Pink</td>
<td>150 &amp; 180</td>
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2 On, 2 Off (Opposing)

<table>
<thead>
<tr>
<th>Variety</th>
<th>Rotations Per Minute</th>
<th>Miles Per Hour</th>
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<tbody>
<tr>
<td>White Lady</td>
<td>Pink</td>
<td>150 &amp; 180</td>
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Two On, Every Third Off

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<th>Rotations Per Minute</th>
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<tr>
<td>PF17</td>
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<td>180</td>
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2 On, 4 Off

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<tbody>
<tr>
<td>White Lady</td>
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Four On, Four Off

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<tbody>
<tr>
<td>Red Haven</td>
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Materials and Methods - Peaches

Experiments: Blossom Thinning Peaches

- 8-yr old “Catherina” peach 1.8 x 2.4 m (841 t/ha) – central leader
- 5-yr old “Allstar” peach 1.8 x 4.8 m (1121 t/ha) – tall spindle
- Goal was to evaluate: RPM, string configuration and to compare with hand thinning
Treatments

- Hand thinned control
- 180 RPM, 18 strings
- 180 RPM, 9 strings
- 240 RPM, 18 strings
- 240 RPM, 9 strings

In other experiments evaluated
- RPMs
- String configurations
- Comparison with chemical thinners (Apple)

Ground speed: 2.1 miles per hr
Timing: Full Bloom
Measurements

- Percent blossoms removed
- Fruit set (on selected branches)
- Number of fruit thinned per branch
- Time required to hand thin
- Harvest: Number of fruit per tree, yield, fruit size, split pits,
Video of Thinning Allstar Peaches NOTL
Allstar: 37-53  Catherina: 60-85%
• Mechanical thinning reduced fruit
• RPM greater effect than String configuration
Labor Savings

Hand thinning per Acre
- 77 hrs (Allstar)
- 20 hrs (Catherina)

Reduction
- 21-50% (Allstar)
- 10-50% (Catherina)

Savings (at $10 per hr)
- $160-290 (Allstar)
- $20-100 (Catherina)

<table>
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<th>Treatment</th>
<th>(hr/acre)</th>
<th># hrs</th>
<th>%</th>
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<tr>
<td><strong>Allstar</strong></td>
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<td>Hand thinned control</td>
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<td>180 RPM, 18 Strings</td>
<td>61.0</td>
<td>16</td>
<td>21</td>
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<td>180 RPM, 9 Strings</td>
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<td>17</td>
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<td>240 RPM, 18 Strings</td>
<td>39.3</td>
<td>37</td>
<td>49</td>
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<td>240 RPM, 9 Strings</td>
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<tr>
<td><strong>Significance</strong></td>
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<td>P value</td>
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<td>Effect of 18 vs 9 strings</td>
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<tr>
<td>Effect of 180 vs 240 RPM</td>
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| **Catherina**                 |           |       |      |
| Hand thinned control          | 20.3      |       |      |
| 180 RPM, 18 Strings           | 13.0      | 7     | 35.9 |
| 180 RPM, 9 Strings            | 18.2      | 2     | 10.7 |
| 240 RPM, 18 Strings           | 10.2      | 10    | 49.8 |
| 240 RPM, 9 Strings            | 11.9      | 8     | 41.7 |
| **Significance**              | **        | <0.0001|      |
| P value                       |           |       |      |
| **Contrasts (P value)**       |           |       |      |
| Effect of Hand vs Mechanical Thinning | 0.0029 |       |      |
| Effect of 18 vs 9 strings     | 0.0001    |       |      |
| Effect of 180 vs 240 RPM      | <0.0001   |       |      |
Yield and Fruit Size

Total Weight per Tree
- No effect (Allstar)
- Mechanical thinning reduced yields 9 to 45% (Catherina)

Fruit size
- Mechanical thinning increased fruit size 8 – 15%
Materials and Methods – Apples

- 6-yr old “Gala”/M.9  2.0 x 4.5 m (888 t/ha) – vertical axe
- 6-yr old “Ambrosia”/M.26  2.0 x 4.5 m (888 t/ha) – vertical axe

Objectives:
- Compare mechanical thinning with hand thinning
- Compare mechanical thinning with chemical thinning
- Combine both mechanical and chemical thinning
Results – Apples

- Mechanical thinning (MT) reduced crop load comparable with hand thinning for Gala, less effective on Ambrosia
- Chemical thinning (CT) alone had comparable crop loads as hand thinned trees
- MT+CT effect was additive and resulted in over-thinning for Gala, but not Ambrosia
- Fruit weight was increased when crop load was reduced
Results – Pennsylvania

- Evaluated in vertical axis (apple) and “V” peach systems
- Mechanical thinning (MT) reduced crop load by 36%
- Decreased hand thinning by 20-40%
- Increased fruit size
- Net economic impact ranged from $175/ha to $1966/ha
- Increased spread of FB when moving from inoculated to non inoculated trees

HortTechnology 18:660

Ngugi and Schupp, 2009.
Hort Science 44:862
Mechanical Contact in Relation to Ground Speed at 180 RPM
Estimate of Mechanical Thinning Device Costs

Based on initial purchase price of $15,000
10 yr life span
8% interest (interest costs around $6,500)

Costs of Purchase = ~ $2,100/year
Would need to factor in tractor, operator costs, maintenance etc.
Challenges & Future Research

- Untested on sweet cherries
- Tree architecture will need to be adjusted to make best use of this technology
- Effects on leaf injury are unknown
- Other `soft` chemical approaches for blossom thinning tree fruit is merited
www.plant.uoguelph.ca/treefruit
http://www.fruit-tec.com
http://www.abe.psu.edu/SCRI
Acknowledgements

Debbie Norton
Agricultural Technician

University of Guelph
Ontario Ministry of Agriculture, Food and Rural Affairs
Fruit & Vegetable Growers' Association