The Right Cropload, Precision Apple Thinning

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Precision Orchard Management
Precision Cropload Management

- Adjusting cropload is most important practice.

- Predicting Fruitset Model
Precision Crop Load Management
It is a Strategy to achieve a IDEAL number of fruit/tree by using information and orchard practices.

- Use pruning
- Use chemical thinning
- **Gather & use information**
- Use predictive models, *Predicting Fruitset.*
- Use hand thinning.
Prune to a 1.5x budload of target fruit/tree
## Precision Crop Load Management

<table>
<thead>
<tr>
<th>Steps</th>
<th>Example Tall Spindle Apples/tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine the IDEAL cropload.</td>
<td>100</td>
</tr>
<tr>
<td>Dormant prune to a specific budload.</td>
<td>150 (1.5x)</td>
</tr>
<tr>
<td>Michigan’s Target Budload</td>
<td>2x or 200</td>
</tr>
</tbody>
</table>
Precision Thinning

- Initial Flower Load: 400 clusters/tree
- Target Cropload, MI: 100 fruit/tree
  - Prune bud Load to 2x target: 200 buds/tree
  - WA = 1x, NY = 1.5x
# Statewide Precision Thinning

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Flower Load</td>
<td>400 clusters/tree</td>
</tr>
<tr>
<td>Target Cropload, MI</td>
<td>100 fruit/tree</td>
</tr>
<tr>
<td>Therefore Target</td>
<td>1.5x</td>
</tr>
<tr>
<td>70% Underpruned</td>
<td>2x to 3x (5x)</td>
</tr>
<tr>
<td>30% Pruned close</td>
<td>1x to 1.25x</td>
</tr>
<tr>
<td>Chem Application</td>
<td>1 to 3 Apps</td>
</tr>
<tr>
<td>Hand Thinning</td>
<td>30%</td>
</tr>
</tbody>
</table>
Before
Target 100/tree
500 clusters

After
Target buds
1.5x
Mark Clusters

- 15 clusters/tree on 5 trees
- 75 total clusters
- Pink to bloom
- Representative clusters
- Not high not low
Precision Cropload Flow Chart

Initial Flower Load

Carb Model

Bloom

Carb Model

Petal Fall

Carb Model

10 mm

Carb Model

16 mm

Carb Model

Target Fruit Number

Carb Model

Fruit Set Model

Fruit Set Model

Fruit Set Model

Fruit Set Model

Hand Thinning
Predict if a Fruit Will Persist or Abscise

- **Persist**: A fruit was predicted to persist if the growth rate over the measurement period was at least 50% or greater of the fastest growing fruit.

- **Abscise**: A fruit was predicted to abscise if the growth rate of the fruit slowed to 50% or less of the growth rate of the fastest growing fruit.
DAYS AFTER NAA APPLICATION

FRUIT DIAMETER (MM)

Persist
Abscise

**       ***      ***          ***

DAYS AFTER NAA APPLICATION

**  ***  ***  ***
# Predicting Percent Fruitset

## Table 4. Predicting Percent Fruitset Summary Sheet Example.

<table>
<thead>
<tr>
<th>Summary Sheet</th>
<th>Farm: Test Data Farm</th>
<th>Block: Test Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target Fruit Number</td>
<td>35</td>
<td>Target % Fruitset</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number</th>
<th>Sampling Date</th>
<th>Days between sample dates</th>
<th>Diameter (mm)</th>
<th>Diameter Growth (mm)</th>
<th>Number of Fruit</th>
<th>Predicted % Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5/1</td>
<td>0</td>
<td>10.05</td>
<td>3.54</td>
<td>64</td>
<td>12.7</td>
</tr>
<tr>
<td>2</td>
<td>5/4</td>
<td>3</td>
<td>13.21</td>
<td>3.32</td>
<td>50</td>
<td>9.9</td>
</tr>
<tr>
<td>3</td>
<td>5/7</td>
<td>3</td>
<td>15.98</td>
<td>1.88</td>
<td>43</td>
<td>8.5</td>
</tr>
<tr>
<td>4</td>
<td>5/10</td>
<td>3</td>
<td>17.56</td>
<td>2.72</td>
<td>38</td>
<td>7.5</td>
</tr>
<tr>
<td>5</td>
<td>5/13</td>
<td>3</td>
<td>19.88</td>
<td>1.68</td>
<td>41</td>
<td>8.1</td>
</tr>
<tr>
<td>6</td>
<td>5/16</td>
<td>3</td>
<td>21.31</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>7</td>
<td>5/19</td>
<td>3</td>
<td>#DIV/0!</td>
<td>#DIV/0!</td>
<td>0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Predicting Percent Fruitset

Predicted % fruitset of the original measured fruitlets (blue bar).

Predicted number of fruit setting (blue bar).

Target number of fruit (green bar).
**Precision Cropload Flow Chart**

**Initial Flower Load**

- Carb Model
- Carb Model
- Carb Model

**Bloom**

- Petal Fall
  - 10 mm
  - 16 mm

**Target Fruit Number**

- Carb Model
- Carb Model
- Carb Model

**Hand Thinning**

- Fruit Set Model
- Fruit Set Model
- Fruit Set Model
Natural Apple Background Sensitivity to Thinning

We applied S+M and S+N every 3.5 days to determine when thinning occurred. Started at PF and ended 28 days later.

To Gala for 8 years.
Natural Apple Background Sensitivity to Thinning

CROPLOAD = % FRUIT/TREE OF UTC

DAFB = Days After Full Bloom
Natural Apple Background Sensitivity to Thinning

CROPLOAD = % FRUIT/TREE OF UTC

DAFB = Days After Full Bloom
Nibble or Precision Thinning Concept

Precision Thinning
– Start thinning early
– Plan multiple sprays.
Precision Cropload Flow Chart

Initial Flower Load → Bloom

↓

Bloom → Petal Fall

↓

Petal Fall → 10 mm

↓

10 mm → 16 mm

↓

16 mm → Target Fruit Number

↓

Target Fruit Number → Hand Thinning

↓

Hand Thinning → 0 to 5%

↓

0 to 5% → 10 to 20%

↓

10 to 20% → 35%

↓

35% → 5%

↓

5%
100 Apple/tree Target
Yet 400 cluster/tree or 2000 flowers/tree
We will often let the early thinning window go by because we are unsure of fruit set.

- Trees and fruits are resilient
- Frost, bee activity, pollination, fertilization is unknown.
- All make us unsure of set.
- Abundant initial flower numbers will follow with abundant fruit numbers.
Precision Thinning

Lets thin a little at every opportunity

Less Risk

More Success

More Confidence
Precision Thinning

Natural Apple Background Sensitivity to Thinning

CROPLOAD = % FRUIT/TREE OF UTC

Percent

Full Bloom  Petal Fall  6 mm  8 mm  10 mm  12 mm  15 mm  20 mm  24 mm

0 5 10 15 20 25 30 35
Predicting Fruitset Project 2014

Kim Kropf
- Start dormant, set target
- Prune to correct budload
- Thin early, Full Bloom and Petal Fall
- Nibble the cropload down
- Use **models** and Information
- Re-thin where needed.
Mark Clusters

- 15 clusters/tree on 5 trees
- 75 total clusters
- Pink to bloom
- Representative clusters
- Not high or low in tree
Predicting Fruitset Project 2014

Bethany Blattner

Jill Blattner
Theory of Fruitset

- Temperature affect demand of energy (carbon) from fruit and other tree growth.
- When fruitlets demand energy that exceeds supply, the weakest fruitlets drop.
- When energy is abundant, fruitlets set and resist thinning.
MaluSim Carbohydrate Model

- Carbohydrate Model of Cornell University
  - Alan Lakso
  - Terence Robinson

- Predicts Tree Carb Balance
  - Max, Min, Solar Radiation, Latitude
MaluSim Sparta Carbohydrate Model 2013

Carbohydrate Balance

Full Bloom
Petal Fall
6 mm
10 mm
12 mm
14 mm
22 mm
25 mm
35 mm

Stress Stress No Stress

% Thinning
0 0% Thinning

Carb Bal
4 Day Ave

72 62 73 33 25 7 22 0 0
Honeycrisp Timing Thinning 2013

Cropload

AFW

Stress

No Stress
Sparta Carb 2014 6-17-14

- Full Bloom, #3 NAA 15 ppm, #4 Maxcel 100 ppm
- All other treatments, Odd # S+N 1 pt + 15 ppm
- Even # S+M 1 pt + 50 ppm

Thinning applications.

- Balance
- 4 Day Ave
NAA 15 ppm Full Bloom Honeycrisp
MaxCel 100 ppm Full Bloom Honeycrisp
What is Precision Cropload Management?

1. Set a Target Cropload/Tree.
2. Prune to a Precise Budload/Tree.
3. Start Chemical Thinning Early.
4. Use Models to Predict Set.
5. Repeat Chemical Thinning as needed.
6. Hand Thin
You are at the home of Michigan State University's website featuring our news, recommendations and resources for growing delicious apples.

**MSU EXTENSION APPLES NEWS**

**Spring tree fruit meeting April 10 in Flint**

Hear a variety of presentations designed to help you get ready to grow another high-quality fruit crop.
deficiencies or excesses of some elements are similar and symptoms may vary in the field. Diagnoses are further complicated when crops are deficient in more than one element at the same time. A limitation of managing apple nutrition based on symptoms and plant tree appearance is that symptoms indicate a problem already exists—reductions in growth, yield or fruit quality may have already occurred. The goal in fertilizing is to avoid nutritional problems. Symptoms of the nutrient disorders commonly seen in Michigan fruit plantings are described in “Apple Nutrition (pdf)” by Eric Hanson, MSU Department of Horticulture.

Varieties

For a list of apple varieties with pictures, see the 2011 Apple Variety Showcase (pdf).

Pollination

See our Pollination page for information on apple pollination, pollinators, and pesticide use.

Thinning

PGRs and Thinning Strategies (pdf) - Thinning is the most difficult and important practice, yet necessary for a grower to perform each year. Making a mistake will compromise both this and next year's crop, but today with a more scientific approach to thinning, we can achieve successful and consistent annual croploads.

Predicting Fruitset 2014 (xls) - This spreadsheet tool allows growers to evaluate ongoing fruitset and helps to access the effectiveness of their chemical thinning applications. Read more about how to use the Predicting Fruitset spreadsheet (pdf).
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