Enhancing Return Bloom in Apple

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Topics of Discussion

• Flowering
• Biennial Bearing
• Strategies to promote flowering
Enhancing return bloom = regulating the flowering process
Why regulate flowering?

1. Trees with low precocity (slow to bear fruit)
2. Production becomes biennial
3. Economics - trees required only 5-10% of fruit to set a commercial crop.
Schematic of production, management, profit production cycle over 3 years

Biennial Bearing

Annual Bearing

Okanagan Packinghouse Fieldmen's Group 2010 Conference Feb 18, 2010
Biennial Bearing in Apples

Possible causes

• Nutrient diversion (Kraus and Kraybill)
• Floral inhibition produced by seeds (Chan and Cain, 1967)
• Bourse shoot length x seed no (Nelson and Dennis, 1999)

Hypotheses

• Seeds produce GA’s
• Seeds compete for floral promoter
Factors influencing flowering

Decrease
- excessive nitrogen
- excessive pruning
- vigorous rootstocks
- gibberellins sprays

Increase
- branch bending
- branch ringing
- dwarf rootstocks
- fruit thinning
- Plant bioregulators (NAA, Ethephon)
Gibberellic Acid can be used to Selectively Inhibit Flowering

- $\text{GA}_3$ - stone fruit
- $\text{GA}_{4+7}$ - pome fruit

Concept: reduce or prevent flower initiation, thereby minimizing the requirement for chemical and hand thinning
**Flower Initiation**

**Definition:** the first discernable change from a vegetative bud to a floral primordium

**Flower Development:** occurs from initiation to flowering the following season. Many floral parts are developed by harvest

**Trigger:** hormones, biochemical processes, environment (light, temperature, day length)

**Period of Initiation**
- Apple: Early Summer (June, July)
- Peach: Mid Summer
- Sweet Cherry: July (after harvest)
Plant Bioregulators

Plant hormones that increase flowering in temperate tree fruit

- Ethephon
- NAA
- others
Application Details – Bearing Details

NAA:
Rate: 4 ppm
3-4 sprays starting in early July, 7 day intervals

Ethrel:
Rate: 150 ppm
Timing: as above
Ethrel responses by cultivar

<table>
<thead>
<tr>
<th>Tree</th>
<th>Non Bearing</th>
<th>Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N. Spy 1</td>
<td>N. Spy 2</td>
</tr>
<tr>
<td>Return bloom</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>Crop Load (year applied)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Yield (year applied)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Shoot Growth (yr applied)</td>
<td>-</td>
<td>X</td>
</tr>
</tbody>
</table>

Fruit Quality

<table>
<thead>
<tr>
<th>Fruit Quality</th>
<th>Non Bearing</th>
<th>Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit size</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Firmness</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Soluble Solids</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Starch Index</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Percent Red</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Colour by Instrument</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

X – no sign. effect  ↑  Sign. Increase  ↓  Sign. -  Not measured
## Summary of Experimental Results with Ethrel

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Bearing</th>
<th>Non-Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Spy</td>
<td>? Further Testing</td>
<td>✓ 1x 1500 ppm</td>
</tr>
<tr>
<td>Empire</td>
<td>✓ 2x 150 ppm</td>
<td>?</td>
</tr>
<tr>
<td>Fuji</td>
<td>✓ 3x 300 ppm</td>
<td>✓ 1x 1500 ppm</td>
</tr>
<tr>
<td>Jonagold</td>
<td>X (3 x 150 ppm)</td>
<td>X 1x 1000 ppm</td>
</tr>
</tbody>
</table>
Summary

• Ethrel sprays can effectively increase return bloom
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- Higher rates can be used on non-bearing trees with a single application
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• „Jonagold“ did not respond to Ethrel
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- Ethrel sprays can increase return bloom
- Higher rates can be used on non-bearing trees with a single application
- Ethrel can reduce tree (shoot) growth
- "Jonagold" did not respond to Ethrel
- Sprays of 4 x 4 ppm NAA improved the bloom of "Empire"
Precautions

Non Bearing Trees
- Do not use on weak trees
- Excessive fruiting could stunt the tree and cause alternate bearing

Bearing Trees
- Can cause fruit thinning if applied very close to bloom (before June Drop)
- Use at lower concentration (< 500 mg per litre)
- Apply Ethrel in “ON” year of biennial cycle. Applications in “OFF” year may contribute towards biennial bearing
Costs?

Based on 1000 litres per hectare (100 US Gallons/acre) & excluding machinery costs

Ethrel: $12 (150 ppm), $80 (1000 ppm)
NAA: $27/ha (4 ppm)

Based on: Fruitone N: $118/567 grams, Ethrel: $189/10 Litres
• Fruitone N registered in Washington
• Biennial Bearing
• Strategies to promote flowering
Further Reading and Future Research

Further Research

- Honeyscrisp, bearing trees (ongoing)
- Northern Spy

www.plant.uoguelph.ca/treefruit

Search “return bloom”