Postharvest Handling Of Stone Fruits

Nectarines, Peaches, Plums

Beth Mitcham
UC Davis

Many slides from Carlos Crisosto
California Minimum Maturity Indices for Stone Fruit

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Minimum Maturity Indices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apricot</td>
<td>Color of the external surface area: &gt;3/4 yellowish green or &gt;1/2 yellow</td>
</tr>
<tr>
<td>Cherry</td>
<td>Entire surface solid light-red and 14 to 16% soluble solids (depending on cultivar)</td>
</tr>
<tr>
<td>Nectarine &amp; Peach</td>
<td>Surface ground color change from green to yellow, shape (fullness of shoulder and suture)</td>
</tr>
<tr>
<td>Plum</td>
<td>Surface color and flesh firmness (depending on cultivar)</td>
</tr>
</tbody>
</table>
Ground Color is used as a maturity/ripeness index for stone fruits.
Nectarine Maturity vs. Firmness, Soluble Solids (SS%), and Titratable acidity (TA%)

<table>
<thead>
<tr>
<th>Maturity stage</th>
<th>Firmness (lbf)</th>
<th>SS%</th>
<th>TA%</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Mature</td>
<td>13-15</td>
<td>8-10</td>
<td>0.9-1.1</td>
</tr>
<tr>
<td>CA Mature</td>
<td>10-12</td>
<td>9-11</td>
<td>0.7-0.9</td>
</tr>
<tr>
<td>Partially-ripe</td>
<td>6-10</td>
<td>11-13</td>
<td>0.5-0.7</td>
</tr>
<tr>
<td>Ripe</td>
<td>2-5</td>
<td>13-15</td>
<td>0.4-0.6</td>
</tr>
</tbody>
</table>

Acceptability of Nectarines and Peaches Increases with Higher Soluble Solids Content
More Types of Tree Fruit

• About 70 varieties released per year.
• 50% of the releases are sub acid types.

Packaging Systems

Ranch Pack  Mechanized Pack

Ranch Packing of Fruit Harvested into Buckets

Set buckets on bucket trailers → Deliver to packing area

Transfer to central cooling → Sort, size, and pack from buckets

Cool and hold → Load into refrigerated transport vehicles

Distribute

Bucket Operation
Bucket Dump Operation

Tote Dumping
Bucket & Tote Dumps

‘Ranch Pack’ Peach Handling: Simple, Clean and Careful Handling for High Quality Product

- No washing
- Now packers wear hairnets, gloves
- Forced Air Cooling
- Frequent Inspection among growers in cooperative since market under 1 label
Large-scale Packing Operation for Stone Fruits

Mechanized Packing of Fruit Harvested into Bins

1. Dump bags into field bins
2. Mechanically pack
3. Cool and hold
4. Deliver to packinghouse
5. Cool and hold in bins
6. Load into refrigerated transport vehicles
7. Distribute
Transport from field to packhouse

Hydrocooling

Bin Dump and Pre-Washing
# Brushing Washing
(Water + Detergent; Chlorinated water)

# Waxing

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## Waxing Operation

<table>
<thead>
<tr>
<th>Postharvest Fungicide</th>
<th>Stone Fruit Residues (ppm) for Domestic and International Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Chemical Names</td>
</tr>
<tr>
<td><strong>Fludioxonil</strong></td>
<td>Scholar</td>
</tr>
<tr>
<td><strong>Fenhexamid</strong></td>
<td>Judge**</td>
</tr>
<tr>
<td><strong>Propiconazole</strong></td>
<td>Mentor**</td>
</tr>
</tbody>
</table>

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Stone Fruit Decay

Brown Rot
Monilinia fructicola

Sour Rot

Grey Mold

Mucor Rot

Brown Rot

Monilinia fructicola
Sizing by Weight

Sorting by Size, Color, and Defects
Final Sorting & Packing

Tray Pack

Volume fill bulk packaging
Lidding, Palletizing and Forced Air Cooling; Inspection

Storage Stone Fruits

- -1 to 1°C
- 90 to 95% RH
- 2 to 6 weeks, depending on cultivar
- CA generally not used
cultivar dependent, may delay color and firmness change, not control decay
Physical Damage

Contamination

Inking or Staining


Internal Breakdown

- Mealiness
- Flesh browning
- Lack of flavor
- Failure to ripen

Effect of Temperature on ‘Carnival’ Peach Internal Breakdown After Storage Plus 2 Days at 20°F


Internal Breakdown Timing

- Mealiness (visual)
- Mealiness (taste)
- Flesh Browning

Carlos Crisosto
Plum market life (weeks) held at 2 storage temperatures based on chilling injury symptom development

<table>
<thead>
<tr>
<th>Category</th>
<th>Cultivar</th>
<th>0°C</th>
<th>5°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Betty Anne</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>October Sun</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Flavor Rich</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Joanne Red</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>Angeleno</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Fortune</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Hiromi Red</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Black Amber</strong></td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Purple Majesty</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>Show Time</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Friar</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Earliqueen</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>


**Controlled Delayed Cooling**

Stone fruit Conditioning program
72°F, 92% RH; hold to reach firmness

Firmness, %SS, %TA

Western Farm Press, Nov 4, 2013: 80% of CA stone fruit industry uses conditioning

How early can we pick?
(o) Fruit weight, (□) TSS, (●) Total acidity, (◆) Firmness.

### At Harvest

**Firmness (g)**

- Untreated
  - Salmon: ~215
  - Red: ~210
  - Mahogany: ~210
  - Dark Mahogany: ~210

- GA
  - Salmon: ~270
  - Red: ~250
  - Mahogany: ~250
  - Dark Mahogany: ~250

### Soluble Solids (%)

- Untreated
  - Salmon: ~10%
  - Red: ~12%
  - Mahogany: ~12%
  - Dark Mahogany: ~12%

- GA
  - Salmon: ~20%
  - Red: ~18%
  - Mahogany: ~18%
  - Dark Mahogany: ~18%
Cherry Pitting

Cherry Bruising
DTR

Pitting (%)

Shrivel (%)

Untreated

GA

Salmon
Red
Mahogany
Dark Mahogany

Salmon Red Mahogany Dark Brown Stem (%)

Decay (%)

Brown Stem (%)

Untreated

GA

Salmon
Red
Mahogany
Dark Mahogany
In Bing, Cherry Color was Closely Correlated to Sensory Cherry Flavor and Soluble Solids Content

Harvest Time Effects on Fruit Firmness

- At Harvest
- 3d at 2°C
- 3d at 2°C + 1d at 20°C
- 3d at 2°C + 2d at 20°C
### Effect of Sun Exposure on Cherry Fruit Quality

<table>
<thead>
<tr>
<th>Time in Field</th>
<th>Evaluation Time</th>
<th>Fruit Temp. °C</th>
<th>Stem Browning</th>
<th>Firmness g/mm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sun Shade</td>
<td>Sun Shade</td>
<td>Sun Shade</td>
</tr>
<tr>
<td>2 Before Storage</td>
<td>36.4</td>
<td>19.2</td>
<td>2.2</td>
<td>1.1</td>
</tr>
<tr>
<td>5</td>
<td>45.6</td>
<td>21.8</td>
<td>4.4</td>
<td>0.5</td>
</tr>
<tr>
<td>2 After Storage</td>
<td>-</td>
<td>-</td>
<td>3.2</td>
<td>1.2</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
<td>5.0</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Stem browning scale: 0 to 5

Kupferman 1998

[Graph showing temperature and relative humidity over time]

Schick and Toivonen, 2000
Cluster Cutter
Machine Vision Sorting

Some defects detected by Cherry Vision

Cherry MAP Considerations

<table>
<thead>
<tr>
<th></th>
<th>Reduced O₂</th>
<th>Increased CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beneficial range</td>
<td>3-10%</td>
<td>10-15%</td>
</tr>
<tr>
<td>Benefits</td>
<td>Firmness retention</td>
<td>Decay control, maintenance of fresh appearance</td>
</tr>
<tr>
<td>Potential for benefits</td>
<td>Moderate</td>
<td>Very good</td>
</tr>
<tr>
<td>Injurious level</td>
<td>&lt;1%</td>
<td>&gt;30%</td>
</tr>
</tbody>
</table>

Crisosto and Associates
Efficacy of selected fungicides for control of three postharvest decays of sweet cherry

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Common Name</th>
<th>Brown Rot</th>
<th>Gray Mold</th>
<th>Rhizopus Rot</th>
<th>Registered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rovral 50WP</td>
<td>Iprodione</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>Cancelled</td>
</tr>
<tr>
<td>Scholar 50WP</td>
<td>Fludioxonil</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>Yes</td>
</tr>
<tr>
<td>Allisan</td>
<td>Dichloran</td>
<td>+</td>
<td>++</td>
<td>+++</td>
<td>Yes</td>
</tr>
<tr>
<td>Elite 45WP*</td>
<td>Tebuconazole</td>
<td>+++</td>
<td>+</td>
<td>++</td>
<td>Yes</td>
</tr>
<tr>
<td>Elevate 50WDG</td>
<td>Fenhexamid</td>
<td>++</td>
<td>+++</td>
<td>-</td>
<td>Soon</td>
</tr>
<tr>
<td>Pristine</td>
<td>Mixture</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>Soon</td>
</tr>
<tr>
<td>PH-066</td>
<td>Pyrimethanil</td>
<td>++</td>
<td>+++</td>
<td>-</td>
<td>Soon?</td>
</tr>
</tbody>
</table>

* - Efficacy of Elite 45WP is rate dependent.

Questions?