Stone Fruit and Kiwifruit Ripening

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Many slides courtesy Carlos Crisosto

Stone Fruit Ripening Terminology

- “Mature” (14-10 pounds)
- “Ready to Transfer” (6-8 pounds)
- “Ready to Buy”
- Preconditioned (4-8 pounds)
- “Ready to Eat” (2-4 pounds)

*Measured at weak position on the fruit

Production

- Tree Ripe
- Well Mature (10-14 lbs.)

Retail

Consumption (10-8lbs.)?

Warehouse (12 lbs.)

Yellow Flesh Peach Consumer Acceptance
**Production**

.Tree Ripe
.Well Mature
.(10-14 lbs.)

**Warehouse**

.(12 lbf.)
.Pre-conditioning (°F)
.Mature

**Store**

.Consumption
.(2-4 lbs.)
.“Ready to Eat”

.“Ready to Buy”
.Flesh Softening
.(6 lbs. P/N)
.(5 lbs. plums)

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**Internal Breakdown**

.Mealiness
.Lack of Flavor
.Flesh Browning
.Uneven Ripening

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**Stone Fruit Transport**

.Stone fruit temperature measured upon arrival at the retail warehouse after 3 days truck shipment, 1996

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**Effect of Temperature on ‘Carnival’ Peach Chilling Injury After Storage Plus 2 Days at 68°F**

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>Nectarine (n=103)</th>
<th>Peach (n=102)</th>
<th>Plum (n=87)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;25</td>
<td>14.7</td>
<td>5.9</td>
<td>4.4</td>
</tr>
<tr>
<td>35-50</td>
<td>69.9</td>
<td><strong>79.4</strong></td>
<td>71.4</td>
</tr>
<tr>
<td>&gt;50</td>
<td>15.7</td>
<td>14.7</td>
<td>24.0</td>
</tr>
</tbody>
</table>

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**Peach Delayed Cooling**

(43% Mealy) 0°C 20 Days  
(0% Mealy) 20°C 48 Hours + 0°C 20 Days

(100% Mealy) 5°C 20 Days  
(0% Mealy) 20°C 48 Hours + 5°C 20 Days

**Product Flow Through the Preconditioning Process**

- Arrival
- Transport
- Precooling
  - Hydrocooling
  - Forced air
  - Room Cooling
- Cold Storage
- Holding/Partial Preconditioning
- Warm Packing
- Forced Air Cooling
- Packaging
  - Wax & fungicide
  - Segregation
- Preconditioning

**Basic Requirements of the Preconditioning Program**

- Ripening room with forced air capacity
- Ethylene is not needed
- Optimize your fungicide application operation
- Slow fruit softening after preconditioning with low temperatures

**O’Henry Peach Ripening**

![Graph showing O’Henry peach ripening with 2 lbs./day](image)
KIWIFRUIT RIPENING PROTOCOL

O'Henry Peach Ripening

KIWIFRUIT RIPENING

Mature (Harvest)
- Hard
- Starchy
- Sour
- Odorless
- 6.5 - 7.0% SSC
- 17% DM

Not Ready to Eat

LOW Consumer Acceptance

Ripe (Consumption)
- Soft, Juicy
- No starch
- Sweet
- Aromatic
- Tasty
- 13.5 - 14.0% SSC
- 17% DM

Ready to Eat!

HIGH Consumer Acceptance

Many slides courtesy Carlos Crisosto
Kiwifruit Carbohydrates

<table>
<thead>
<tr>
<th>Harvest</th>
<th>Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mature</td>
<td>Ripe</td>
</tr>
<tr>
<td>Starch</td>
<td></td>
</tr>
<tr>
<td>Sugars</td>
<td></td>
</tr>
<tr>
<td>SSC = 6.2%</td>
<td>SSC = 14%</td>
</tr>
</tbody>
</table>

How to Assure Consumer Quality

- Minimum Maturity (6.5% SSC)
- Maximum Maturity (<14 pounds firmness)
- Consumer Quality (> 16.1% Dry Matter)

Buyer-Consumer Quality-DM

- Minimum 16.1% DM as a consumer quality index
- For kiwifruit with TA ≤ 1.2%, a DM index of 15.1% is the minimum quality index required for consumer acceptance

KIWIFRUIT RIPENING PROTOCOLS

('Hayward')

- IMMEDIATELY AFTER HARVEST (Shipper/ Handlers)
- AFTER COLD STORAGE (Shipper/Retail)
- HOME (Consumers)
IMMEDIATELY AFTER HARVEST

Ripening at the Shipping Point
COLD Ethylene Conditioning Treatment

- Ethylene pre-conditioning treatment is required only on freshly harvested kiwifruit or those that have been in cold storage <5 weeks.

- No ethylene is required for kiwifruit that has been stored for longer than 5 weeks.

Use of Liners During Kiwifruit Ripening

- Ethylene can penetrate liners
- Liners avoid or reduce fruit shriveling
- 80-90% RH

POST-TREATMENT HANDLING

- Maintain treated kiwifruit below 36°F.
- Ship and consume fast.
- Cold store away from kiwifruit intended for long-term storage.

Ripening at the Shipping Point Cold Ethylene Conditioning Treatment

- Ethylene applied at 100ppm for 6-12 hours at 0 to 7°C (32 to 45°F)
  - induces uniform kiwifruit softening and starch conversion into sugars
  - Continuous ethylene application with Catalytic Generator reduces exposure to 6 hours
Postharvest Life Potential of Cold Conditioned Kiwifruit

- **Cold** kiwifruit treated with ethylene at near 0°C (32°F) and maintained at that temperature may be held **3-6 weeks** longer.
- These cold treated kiwifruit will reach a firmness of about 3 pounds in 2 to 3 days after being transferred to 20°C (68°F).

Ripening by the Receiver

- Kiwifruit stored <5 weeks and/or >8-10 lbs. upon receipt
  - Treat with ethylene to enhance ripening
- Fruit stored >5 weeks and >5 lbs. and <8-10 lbs.
  - Ripen by **temperature** management

Determining Stage of Ripening

- Fruit firmness is the best measurement of ripeness
- Firmness of a **mature** fruit varies from **16-12 pounds**
- **Minimum shipping/packing** firmness of 5 lbs. recommended, depending on package type, to avoid physical damage during transportation and handling
- During ripening, fruit soften and firmness decreases, reaching values of **2-4 pounds**
- When fruit reaches **2-4 pounds** it is considered ripe or “ready to eat.” This is the level that kiwifruit will achieve its best eating characteristics
Questions?