Effect of Temperature Management on Ripening of Perishable Commodities

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Effect of Temperature Management on Ripening of Perishable Commodities

- Why Do the Ripening Thing?
- Chilling Injury and Ripening
- Pre-Ripening Temperatures
- Temperature During Ripening (e.g. Heat Damage)
- Post-Ripening Temperatures (e.g. Warming/Cooling)
  - Storage
  - Cooling
  - Shipment
  - Distribution Center
  - Retail Display
  - At Home

Postharvest Losses

- Developed countries ca. 5-25%
  - Developing countries ca. 20-25%
- The USDA’s Economic Research Service estimates ~53% of the weight of fresh commodities in 2005 were not consumed.
- In the UK it is claimed that ~33% of commodities are tossed every day.

Ripening Effect on Consumer Acceptance of Fresh Fruit Crops

Chilling Injury Symptoms and Ripening
High Temp Injury
Optimum Fruit Ripening
IDEAL TRANSIT/STORAGE

GROUP II: Chilling Sensitive Commodities

- Avocado
- Feijoa
- Papaya
- Cherimoya
- Citrus
- Olive
- Sapota
- Banana
- Guava
- Passion Fruit
- Mango
- Pineapple
- Muskmelon
- Guava
- Apple*
- Feijoa
- Feijoa
- Citrus
- Olive
- Sapota
- Cassava
- Okra
- Papaya
- Passion Fruit
- Papaya
- Okra
- Tomato
- Watermelon
- Raspberry
- Prune
- Passion Fruit
- Apple*
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Surface Pitting, Surface Lesions, & Discoloration (Mango)

Tree Fruit
- Failure of mature fruits to ripen
- Loss of Characteristic Flavor and Aroma
- Shorter Storage Life (32°F vs. 41°F)

Shorter Storage Life

Formation of water-soaked areas, and development of necrotic areas in Frangipani.

Increases Susceptibility to Decay (Sweet Potatoes)

Pre-Ripening Temperature Effect on Ripening
- Short cold storage can overcome ethylene needs (e.g., Kiwifruit and European pears).
- Practical implications of low or high pre-ripening temperatures.
It's elementary, my dear Watson, it's elementary!

Practical Implications

What am I doing wrong, Holmes?

Product Flow Through the Preconditioning Process

Holding/Cooled Fruit → Warm Packing → Forcing Air Cooling

Packaging
- Wax & Fungicide
- Segregation

Preconditioning

Ripening Room Temperature (68°F)

- Low: Condensation, Decay, Cracking
- High: Fast Softening, Decay, Uneven Ripening

1-MCP

Passive Pallet Warming

10 hours

81 hours

7.5 hours

62 hours

FAST COOLING (within 6-8 Hours)

Preconditioning
Temperature During Ripening

High Temperature Damage During Ripening

Exposing mature-green bananas for:
- 1 hour at 68°F
- 5 hours at 77°F
- 24 hours at 86°F
- or 72 hours at 95°F

Heat damage > 95°F and chilling damage <56°F

Post-Ripening Temperature Management

- Ripened fruit should be stored at their lowest safe temperature until ready for retail display

Post-Ripening Temperature Management

Ripening Conditions of Ripened Fruits

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Ripening Treatment Location</th>
<th>Predicted Storage After Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pear</td>
<td>Shipping point “quality conditioning” is needed only if pears have been stored for less than 2 weeks</td>
<td>Storage life is not affected if fruit are cooled to 32°F immediately after conditioning</td>
</tr>
<tr>
<td></td>
<td>Distribution Center</td>
<td>About 7 days at 32-36°F</td>
</tr>
<tr>
<td>Stone fruits</td>
<td>Shipping point (treatment limits development of CI)</td>
<td>Up to 6 weeks at 32°F, depending on cultivar and flesh firmness</td>
</tr>
<tr>
<td></td>
<td>Distribution Center</td>
<td>3 days in unrefrigerated display, 6 days in refrigerated display</td>
</tr>
</tbody>
</table>
Ripening Conditions of Some Commonly Ripened Fruits

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Ripening Treatment Location</th>
<th>Predicted Storage after Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avocado</td>
<td>Shipping point (from harvest to within 2 weeks storage at 41°F)</td>
<td>Less than 7 days at 41°F</td>
</tr>
<tr>
<td>Banana</td>
<td>Distribution center</td>
<td>Less than 7 days at 58°F</td>
</tr>
<tr>
<td>Mango</td>
<td>Distribution center</td>
<td>Less than 7 days at 50-55°F and 95% RH</td>
</tr>
<tr>
<td>Tomato</td>
<td>Shipping point or distribution center</td>
<td>7 days after reaching the red stage</td>
</tr>
<tr>
<td></td>
<td>Mature-green stage</td>
<td>2 weeks if stored and ripened at a constant 59°F</td>
</tr>
<tr>
<td></td>
<td>Breaker stage</td>
<td></td>
</tr>
</tbody>
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Effect of Temperature on Postharvest Life

<table>
<thead>
<tr>
<th>Temperature °F</th>
<th>°C</th>
<th>Assumed Q10</th>
<th>Relative Shelf-Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>0</td>
<td>100</td>
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<tr>
<td>50</td>
<td>10</td>
<td>3.0</td>
<td>33</td>
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<td>2.5</td>
<td>13</td>
</tr>
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<td>86</td>
<td>30</td>
<td>2.0</td>
<td>7</td>
</tr>
<tr>
<td>104</td>
<td>40</td>
<td>1.5</td>
<td>4</td>
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