Pear Ripening

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What we know about pear ripening...

• Pears are climacteric fruit and ripen in response to internal or external ethylene
• European pears require ethylene for ripening – climacteric fruit
• European pears do not have the capacity for ethylene production and ripening at harvest
• Ethylene treatment and/or a period of cold storage can induce the capacity to produce ethylene and ripen (conditioning)
• Requirements vary cultivar to cultivar and with harvest maturity
ETHYLENE CONDITIONING

Bartlett Pears
Harvested July 27 and Ripened
8d air 68°F
1d C₂H₄
7d air 68°F
Dessert quality of ‘Anjou’ pears ripened with and without ethylene after up to 8 weeks cold storage

Conditioned with either 100ppm ethylene (A) or no ethylene (B) for 3 days at 68°F after 0, 2, 4, 6, and 8 weeks of storage in air at 30°F

Temperature Conditioning

- At -1 to 0°C (30 to 32°F):
  - Bartlett and Bosc require 1-2 weeks
  - Comice requires 4 weeks
  - Anjou requires >8 weeks

...to ripen without added ethylene
Fig. 2. Relationship between harvest timing of ‘d’Anjou’ pears and the minimum duration of conditioning at -0.5°C (●), 5°C (○), and 10°C (□) necessary to induce ripening capacity. Ripening capacity was defined as the ability to reach <17.8 N by the end of 7 d at 20°C. Regression equations: -0.5°C: \( y = -0.032x^2 + 0.374x + 59.5, \quad R^2 = 0.97; \) 5°C: \( y = -0.039x^2 + 0.118x + 20.4, \quad R^2 = 0.98; \) 10°C: \( y = -0.038x^2 + 1.05x + 17.4, \quad R^2 = 1.0. \)

Fruit Temperature During Ethylene Exposure
Ethylene Conditioning at Lower Temperatures

Bartlett Pears

- 24 hours of ethylene at 20°C (68°F) is equivalent to:
  - 48 hours of ethylene at 10°C (50°F)
  - 72 hours of ethylene at 7.5°C (45°F)
  - Need to develop similar data for other varieties

Conditioning Options for Freshly Harvested Pears

<table>
<thead>
<tr>
<th></th>
<th>Comice</th>
<th>Bartlett</th>
<th>Bosc</th>
<th>Anjou</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Storage @ 30-32°F</td>
<td>4</td>
<td>2-3</td>
<td>2</td>
<td>8 wks</td>
</tr>
<tr>
<td>Cold Storage @ 50°F</td>
<td>2-3</td>
<td>1</td>
<td>1</td>
<td>3-6wks</td>
</tr>
<tr>
<td>100ppm Ethylene @ 68°F</td>
<td>3</td>
<td>1-2</td>
<td>1</td>
<td>3 days</td>
</tr>
<tr>
<td>100ppm Ethylene @ 50°F</td>
<td>?</td>
<td>2-3</td>
<td>?</td>
<td>? days</td>
</tr>
</tbody>
</table>

Cold storage requirements may be longer when fruit are stored in CA
Where Should Pears be Ripened?

1. Condition pears with cold or ethylene before shipping – ripen at room temperature upon arrival
2. Ship non-conditioned, early season pears to wholesale/retail – ripen with ethylene at room temperature

Pear Ripening

• At Harvest (conditioning or ripening)
  Warm temperatures (≥ 55°F)
  Ethylene exposure is usually needed
• After Cold Storage
  – Warm temperatures (≥ 55°F)
  – After 2 to 8 weeks storage, depending on variety, no ethylene needed
• At Wholesale Warehouse
  – Warm temperatures (≥55°F)
  – If conditioned by shipper, no ethylene needed
Effect of Fruit Temperature on Rate of Ripening

Rate of Pear Fruit Ripening as Influenced by Temperature
Fruit Temperature has a Tremendous Influence on Fruit Response to Ethylene During Conditioning as Well as During Ripening

It can be very Difficult to Uniformly Warm Cold Fruit for Conditioning or Ripening
Rate of Cooling within Pallet

<table>
<thead>
<tr>
<th>Pallet Level</th>
<th>One-Half Cooling Times (Days)</th>
<th>Hand-Wrapped</th>
<th>Tray-Packed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Outside</td>
<td>Inside</td>
<td>Outside</td>
</tr>
<tr>
<td>1 Bottom</td>
<td>2.1</td>
<td>3.3</td>
<td>1.8</td>
</tr>
<tr>
<td>2</td>
<td>4.9</td>
<td>8.7</td>
<td>3.2</td>
</tr>
<tr>
<td>3</td>
<td>4.9</td>
<td>12.4</td>
<td>4.3</td>
</tr>
<tr>
<td>4</td>
<td>7.0</td>
<td>15.0</td>
<td>4.6</td>
</tr>
<tr>
<td>5</td>
<td>6.4</td>
<td>15.7</td>
<td>4.2</td>
</tr>
<tr>
<td>6</td>
<td>7.0</td>
<td>13.0</td>
<td>4.1</td>
</tr>
<tr>
<td>7 Top</td>
<td>2.0</td>
<td>4.9</td>
<td>1.7</td>
</tr>
</tbody>
</table>

\*Start temperature = 71F
\*Start temperature = 67F

Factors Affecting Successful Conditioning of Pears

- Variety
- Harvest maturity
- Seasonal effects – weather
- Temperature during cold storage
- Length of cold storage
- Length of ethylene treatment
- Fruit temperature during ethylene treatment
- Interactions
Questions?

http://postharvest.ucdavis.edu