Melon Quality & Ripening

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The key to good final eating quality in melons is to harvest at proper stage of maturity/ripeness.

Melons harvested at the proper stage of maturity/ripeness are already undergoing the ripening process.

Temperature can be used to manage ripening and quality changes.
Melons are very Diverse
Ripe fruit Characteristics

<table>
<thead>
<tr>
<th></th>
<th>Cantaloupe</th>
<th>Watermelon</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Honeydew</td>
<td>Honeyloupe</td>
</tr>
<tr>
<td>Days from anthesis</td>
<td>55</td>
<td>53</td>
</tr>
<tr>
<td>Weight, g</td>
<td>2200</td>
<td>1400</td>
</tr>
<tr>
<td>Respiration, µL/g-h</td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>Internal Ethylene, ppm</td>
<td>4-15</td>
<td>25-45</td>
</tr>
<tr>
<td>Firmness, kg/cm²</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Soluble solids, %</td>
<td>15</td>
<td>14</td>
</tr>
</tbody>
</table>

Melon Storage Conditions

- **Cantaloupes**
  - 2.5°C (36°F), 90-95% RH
  - 3-5% Oxygen + 10-15% carbon dioxide
  - 2-4 weeks

- **Honeydew, Specialty Melons**
  - 5 to 15°C (41 to 59°F), 80-90% RH
  - optimum temperature depends on ripeness
  - 2-6 weeks

- **Watermelon**
  - 10-20°C (50-68°F)
  - Sensitive to ethylene
  - 1-3 weeks
Melon Quality Attributes

- Flavor-sugar
- Color
- Texture

These quality attributes may vary due to:
- varieties,
- growing conditions,
- season,
- maturity at harvest,
- number of harvests,
- harvest & handling,
- storage conditions and duration

Focus on maturity/ripeness at harvest; This continues to be a challenge!

Cantaloupe Maturity/Ripeness

- Fruit begins to separate from stem
  - abscission zone; “slip”
- External color between net
- Net well developed with wax
- Subtending leaf dries up
- Internal color, firmness, soluble solids

The slip is a very useful attribute; some new LSL varieties are cut
Characterization of cantaloupe melons (cv. Laredo) harvested at 2 maturity stages. Data are averages of 12 melons per stage.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Half slip</th>
<th>Full slip, hard ripe</th>
<th>LSD.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>1367</td>
<td>1398</td>
<td>ns</td>
</tr>
<tr>
<td>External color score¹</td>
<td>2.8</td>
<td>3.3</td>
<td>ns</td>
</tr>
<tr>
<td>Internal CO2 (%)</td>
<td>1.02</td>
<td>1.08</td>
<td>ns</td>
</tr>
<tr>
<td>Internal ethylene (ppm)</td>
<td>2.42</td>
<td>4.24</td>
<td>0.7</td>
</tr>
<tr>
<td>Internal color (chroma)</td>
<td>35.2</td>
<td>35.4</td>
<td>ns</td>
</tr>
<tr>
<td>Pulp firmness (N-f, 5mm probe)</td>
<td>12.7</td>
<td>13.1</td>
<td>ns</td>
</tr>
<tr>
<td>Soluble solids (%)</td>
<td>12.5</td>
<td>12.2</td>
<td>ns</td>
</tr>
</tbody>
</table>

¹ external color score 1=green, 2=slight yellow, mostly green, 3=yellow-green, 4=greenish yellow 5=yellow or yellow-orange

Soluble solids are well correlated with sugars in melons at harvest.

The correlation is less when fruit are stored and cell wall softening contributes to the soluble solids readings.
Sugar content declines with time, while soluble solids may remain the same or decrease only a little. WHY?

Cantaloupe maturity & aroma volatiles
Aroma formation linked to ethylene production

Melon aroma research
Profiling; genetics;
Florence Negre-Zakharov
UC Davis

Horvat and Senter, 1987
Analyzed 24 hours after harvest at 20°C

 López and Cantwell, UC Davis
Melon Maturity & Quality Factors

- External Color
- Firmness (blossom end)
- Surface hairs, smoothness, wax
- Aroma
- Internal cavity condition
- Pulp color and firmness
- Sugar content (soluble solids)
- Aroma and flavor

Maturity and Ripeness Classes
Honeydew melons

<table>
<thead>
<tr>
<th>Class</th>
<th>Int. C2H4, ppm</th>
<th>Pulp firm., N</th>
<th>Sol. solids, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Immature</td>
<td>&lt;0.2</td>
<td>39</td>
<td>&lt;10</td>
</tr>
<tr>
<td>1 = Mature, Unripe</td>
<td>0.8</td>
<td>32</td>
<td>10</td>
</tr>
<tr>
<td>2 = Mature, Ripening</td>
<td>5.2</td>
<td>21</td>
<td>11-12</td>
</tr>
<tr>
<td>3 = Ripe</td>
<td>27.1</td>
<td>15</td>
<td>12-14</td>
</tr>
<tr>
<td>4 = Overripe</td>
<td>29.4</td>
<td>11</td>
<td>14-15</td>
</tr>
</tbody>
</table>

firmness: 1.1 cm probe

(average 4 cultivars; Cantwell, unpublished)
Honeydew and Orange Flesh Melons
Maturity and Ripeness Classes

- **Class 0: Immature**
- **Class 1: Mature, but Unripe:** Ground color greenish-white; peel fuzzy; no aroma; 10% soluble solids; flesh crisp, melon splits when cut; minimum commercial harvest maturity
- **Class 2: Mature, Ripening:** Ground color white; begins to develop surface wax; pulp crisp, melon splits

Minimum Eating Quality

### Honeydew Melon Maturity/Ripeness

Quality attributes of honeydew melon (cv HMX1605) harvested at 4 stages of maturity/ripeness.

<table>
<thead>
<tr>
<th>Maturity Stage (Class)</th>
<th>Weight (g)</th>
<th>Internal ethylene (ppm)</th>
<th>External Aroma</th>
<th>External color (hue)</th>
<th>Pulp firmness (N)</th>
<th>Soluble solids, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1866</td>
<td>0.09</td>
<td>1.0</td>
<td>107.7</td>
<td>29.5</td>
<td>9.6</td>
</tr>
<tr>
<td>2</td>
<td>2512</td>
<td>0.51</td>
<td>1.0</td>
<td>105.1</td>
<td>28.0</td>
<td>11.7</td>
</tr>
<tr>
<td>3</td>
<td>2686</td>
<td>2.9</td>
<td>1.3</td>
<td>102.3</td>
<td>22.8</td>
<td>13.6</td>
</tr>
<tr>
<td>4</td>
<td>2126</td>
<td>32.9</td>
<td>3.8</td>
<td>99.4</td>
<td>9.4</td>
<td>14.7</td>
</tr>
<tr>
<td>LSD.05</td>
<td>249</td>
<td>3.6</td>
<td>0.6</td>
<td>1.3</td>
<td>3.6</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Focus on
- Peel smoothness
- Stem end changes

Cantwell, UC Davis, 2011
Honeydew melons: Soluble Solids

Fruits of different ripeness classes stored 18 days plus 3 days at 20°C (68°F)

- % Soluble solids
- SS not change much with time
- During storage, SS overestimates sugar content

Honeydew melons: Pulp Firmness

Fruits of different ripeness classes stored 18 days plus 3 days at 20°C (68°F)

- Better retention of firmness at lower temperatures
- Class 2 melons did not soften more than Class 1 fruit
Modified Atmosphere - Stored Cantaloupe; Bag in Box

Open bag to de-gas (allow CO₂ to escape)
Allow 2 to 4 days at ambient temperatures to begin change of external color and development of typical aroma

1-MCP & Melons
Blocks ethylene perception

- **Western shipping cantaloupes** - not much benefit on firmness at storage temperature, but benefit at warm temperatures.
- **Eastern shipping cantaloupes** - maintain texture and firmness at warm temperatures.
- **Galia** - extend shelf-life, reduce loss of firmness
- **Honeydew** - reduce loss of firmness at warmer temperatures
- **Watermelon** - clear benefit as fruit are easily damaged by ethylene; reduce loss of firmness and internal breakdown
# 1-MCP and Honeydew Melons

cv Summerdew, commercial maturity fruit; 15 fruit per treatment
Stored 10 days at 7.5°C (45°F) plus 3 days at 20°C (68°F)

<table>
<thead>
<tr>
<th>Treatment (1 to 4)</th>
<th>Visual quality</th>
<th>External color, Hue</th>
<th>Pulp Firmness, N</th>
<th>Soluble solids, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Cooled within 6 hr</td>
<td>8.9</td>
<td>102.6</td>
<td>15.3b</td>
<td>13.0a</td>
</tr>
<tr>
<td>T2 1-MCP and cooled within 6 hr</td>
<td>8.9</td>
<td>102.4</td>
<td>23.3a</td>
<td>12.6ab</td>
</tr>
<tr>
<td>T3 Delay 24 hr before cooling</td>
<td>8.8</td>
<td>102.8</td>
<td>10.8c</td>
<td>11.7b</td>
</tr>
<tr>
<td>T4 Delay 24 hr, then 1-MCP treat and cool</td>
<td>8.7</td>
<td>103.1</td>
<td>18.7ab</td>
<td>11.1b</td>
</tr>
</tbody>
</table>

LSD.05 ns ns 5.1 1.2

1-MCP decreased softening, but had no effect on maintaining %SS

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## Ethylene effects on melons

- Improve color
- Improve aroma
- Decrease pulp firmness
- No effect or decrease sweetness
Conditioning Honeydew Melons
Conclusions from a study on cv Emerald

• 12 hours 20-50 ppm ethylene (uniform ripening)
• Hold 2-3 days at 20°C (68°F) (develop flavor and aroma)
• Maturity stage 2 (minimum ~11% SS)

- Improve external color
- Improve aroma
  - BUT
- Loss of texture
- No improvement in sugars

Ethylene and LSL Cantaloupes

• Test#1
  - 2 varieties; 100 ppm ethylene for 2, 4 or 6 days at 20°C
  - No effect of ethylene on external color
  - No effect of ethylene on aroma
  - No effect of ethylene on texture

• Test#2
  - 2 varieties; 80 or 400 ppm for 2 days at 20°C
  - No effect of ethylene on external color
  - No effect of ethylene on aroma
  - No effect of ethylene on texture

Cantwell, UC Davis, 2012
Factors Affecting Quality and Ripening of Melons

- Variety and Production
- Initial Maturity/ripeness
- Temperature
- Atmosphere
- Ethylene
- Time

Melons are in the ripening process when harvested. Manage rate of ripening mostly with temperature.