Overview Melon Quality for Fresh-cut Processing

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Intact Melon Quality Attributes

- Color
- Texture
- Flavor

MELON COLOR

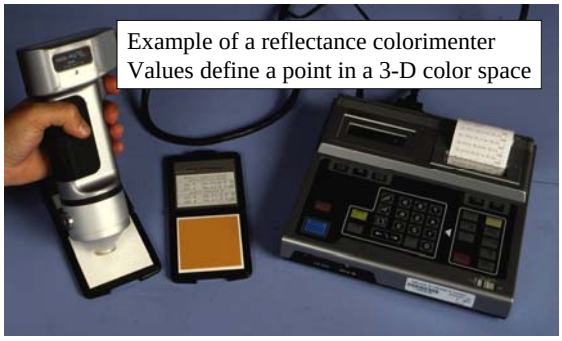
Color due to pigments

Orange-flesh fruit: carotenoids, especially beta-carotene (85%)

Green-flesh fruit: chlorophyll & low content of carotenoids

Pigment content determined at harvest

Color measurement: extraction of pigments or by color meters

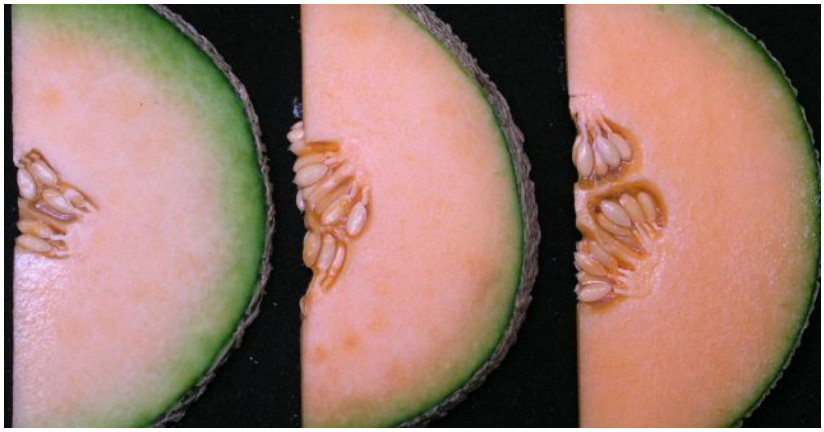


Example of a reflectance colorimenter
Values define a point in a 3-D color space

L* = Lightness/darkness
Chroma =intensity, brightness
Hue = true "color"

For Cantaloupe:
High chroma value = bright orange flesh

Chroma values can vary from <30 to >40



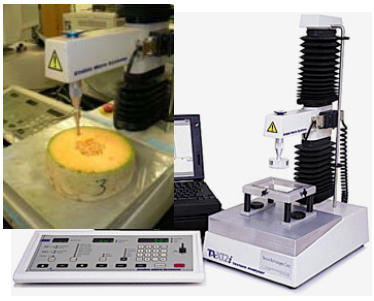
For Cantaloupe:
High chroma = bright orange flesh
Chroma values can vary from <30 to >40

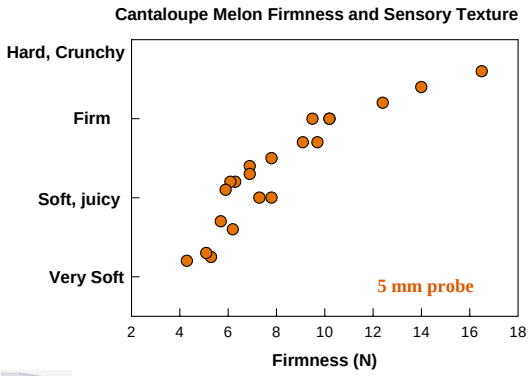
Melon Texture

Force to Rupture

probe shape
probe diameter

Units of force
N=Newtons
1 N= 9.81 kilogram-force
1 N= 4.45 pound-force





- **Rupture force related to whole fruit nondestructive compression firmness**
- **Postharvest/postcutting changes:**
  - inconsistent among melon varieties
  - variable, gradient within a fruit

Sugar Measurement

- **Destructive**
  - **% SS**
  - **Total sugars by colorimetry**
  - **HPLC for individual sugars**
- **Nondestructive**
  - Infrared on-line analysis

Concentration gradients

Temperature compensated refractometer
Digital readout eliminates errors

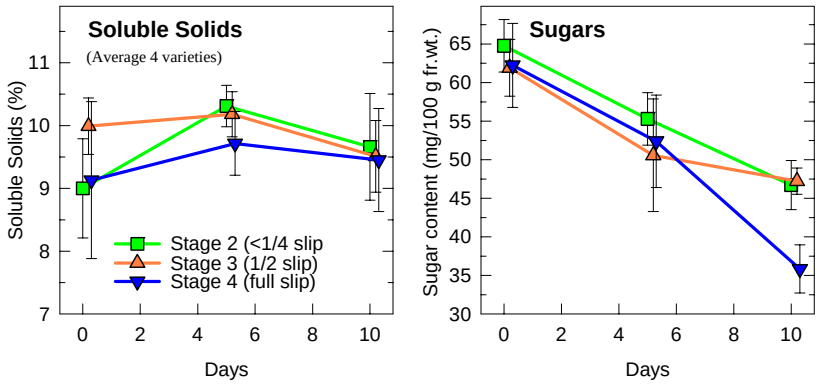
MELON FLAVOR

- **Sugars (>50% sucrose, 20% glucose, 26% fructose)**
  - At harvest, % soluble solids correlates well with extracted sugars
  - For good flavor:
    Cantaloupe 10% & Honeydew 11-12% SS
  - Sugar content determined at harvest

- **Acids**
  - <0.1%, important for good flavor?

- **Aroma volatiles**
  - specific compounds for characteristic aromas/flavors

Sugar loss in fresh-cut cantaloupe may be considerable, but Soluble solids do not change much; Sugar loss typically is not as extreme as in this example.



Typical loss over 10 days at 5°C (41°F):

S.S. 0-10%

Sugars 10-20%

Melon Quality Attributes

- **Flavor**
- **Color**
- **Texture**

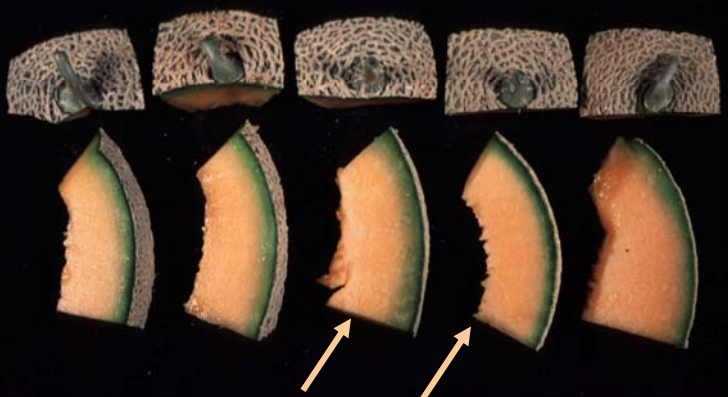
These quality attributes may vary due to: varieties, growing conditions, season, maturity at harvest, number of harvests, harvest & handling, storage conditions and period……..

Focus on maturity/ripeness at harvest since this continues to be problematic

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 & applicable to old & new cantaloupe varieties



Half to ¾ slip stages of maturity or ripeness produce good eating quality melon

Characterization of cantaloupe melons (cv. Laredo) harvested at 2 maturity stages. Data are averages of 12 melons per stage.

Attribute	**½ slip**	**Full slip, hard ripe**	**LSD.05**
Weight (g)	1367	1398	ns
External color score[1]	2.8	3.3	ns
Internal CO2 (%)	1.02	1.08	ns
Internal ethylene (ppm)	2.42	4.24	0.7
Internal color (chroma)	35.2	35.4	ns
Pulp firmness (N-f, 5mm probe)	12.7	13.1	ns
Soluble solids (%)	12.5	12.2	ns

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

Cantwell, 2003 MCP#3

Table 1. Evaluations at harvest of 4 varieties harvested at 2 stages of maturity. Data are averages of 4 fruit per stage. (2003)

Variety	Maturity	Weight, g	External Color score	Internal ethylene (ppm)	Texture, N-force, 5mm probe	Soluble Solids, %
Sandstone "Expt."	¼-pull	1810	1	0.97	17.4	7.8
	Full slip, pull	1578	4.2	6.73	11.3	11.6
Impact	¼-pull	1875	1	1.93	9.3	9.4
	Full slip, pull	1728	3.8	20.83	5.2	11.2
Western Express	¼-pull	1915	1	1.45	12.0	9.7
	Full slip, pull	1850	4	17.42	8.0	11.1
Ocotillo	¼-pull	1581	1	1.91	12.5	8.1
	Full slip, pull	1674	3.8	11.49	12.0	10.6
LSD.05		ns	0.7	5.5	2.0	1.5

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

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** ← **Fresh-cut**
  Ground color white; begins to develop surface wax; pulp crisp, melon splits

Maturity and Ripeness Classes for Honeydew melons

Class	Int. C2H4, ppm	Pulp firm., kg-f	Sol. solids, %
0 = Immature	<0.2	3.8	<10
1 = Mature, Unripe	0.8	3.1	10
2 = Mature, Ripening	5.2	2.1	11-12
3 = Ripe	27.1	1.5	12-14
4 = Overripe	29.4	1.1	14-15

firmness: 1.1 cm probe

(average 4 cultivars; Cantwell, unpublished)

Honeydew Melons

Fruit Characteristics at 4 Stages of Ripeness

Stage Ripeness	Internal C_2H_4 ppm	Soluble Solids %	Firmness* Newtons	Firmness* Pounds
0	0.6	9.0	42	9.4
1 ♠	2.4	10.8	38	8.6
2 ♠	4.0	12.4	38	8.5
3	16.3	12.3	25	5.7

cv. Morning Ice

♠ = typical commercial maturity

* Maximum rupture force with 8 mm probe

Cantwell & Suslow, UC Davis. 1999

Melon Storage Conditions

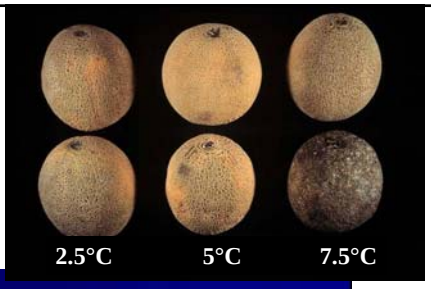
- **Cantaloupes**
  - 2.5°C (36°F), 90-95% RH
  - 3-5% Oxygen + 10-15% carbon dioxide
  - 2-4 weeks
- **Honeydew, Specialty Melons**
  - 5 to 15°C (41 to 59°F), 80-90% RH
  - optimum temperature depends on ripeness
  - 2-6 weeks

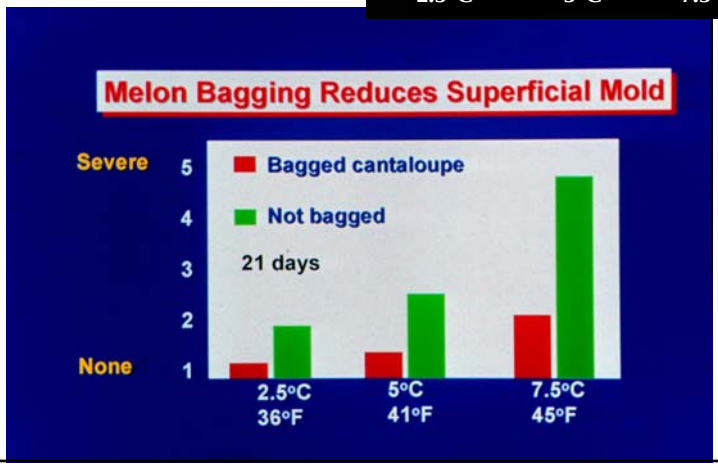
Decay Control: Cantaloupe

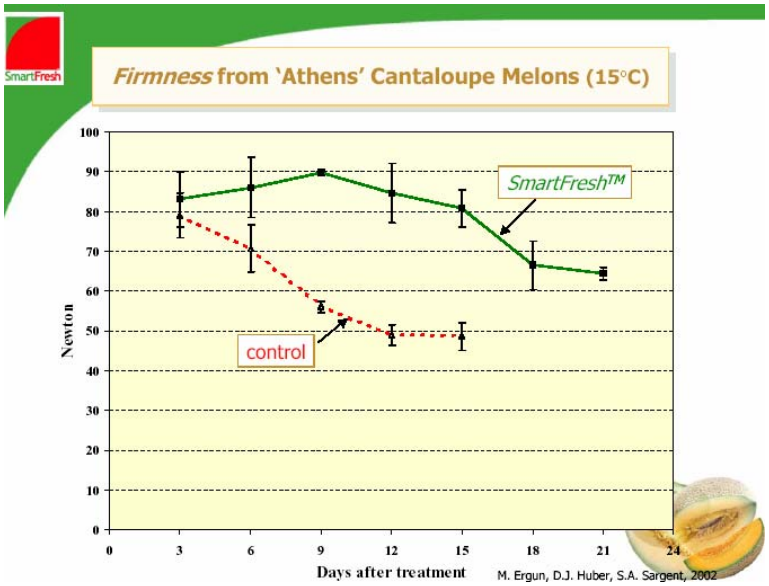
- Minimize physical injury
- Storage temperature: 2-3°C (34-36°F)
- Chlorinated water wash (100 ppm)
- Fungicide in wax
- Hot water dip (135°F for 3 min)
- High CO2 concentrations (10-15%)

Bagged

No Bag

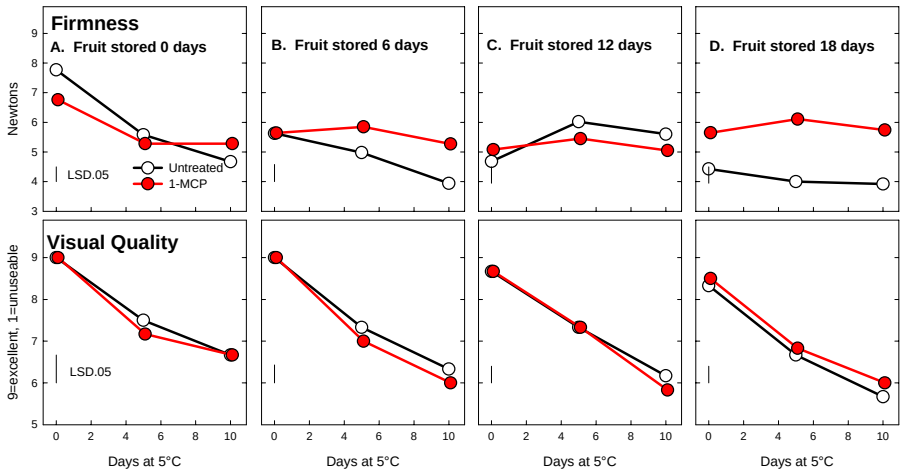


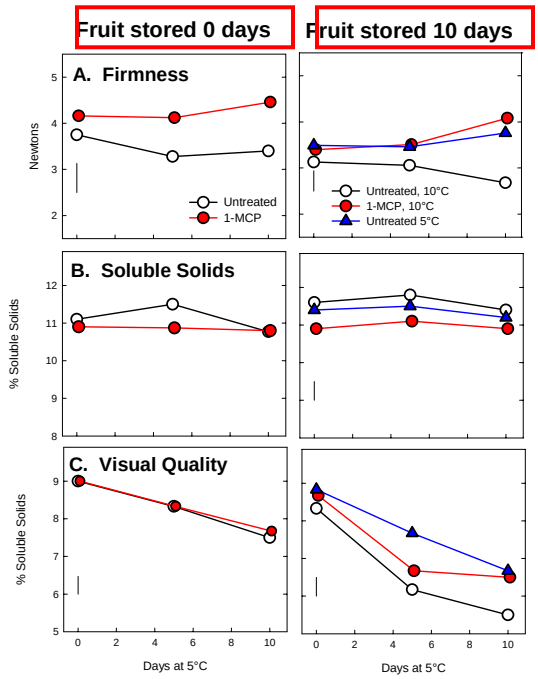


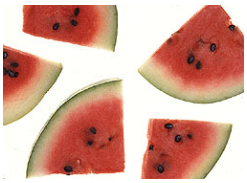


(From Tony Beltran/Rodrigo Cifuentes talk at IFPA, April 2004)

1-MCP and Cantaloupes: Melons treated and stored before cutting: not much benefit at low storage temperatures





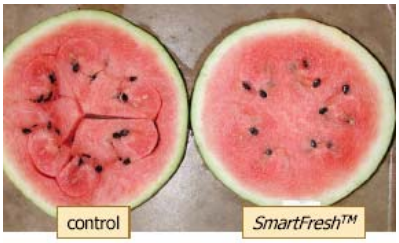


Intact watermelon

Untreated; MCP

Store 0, 5 or 10 days

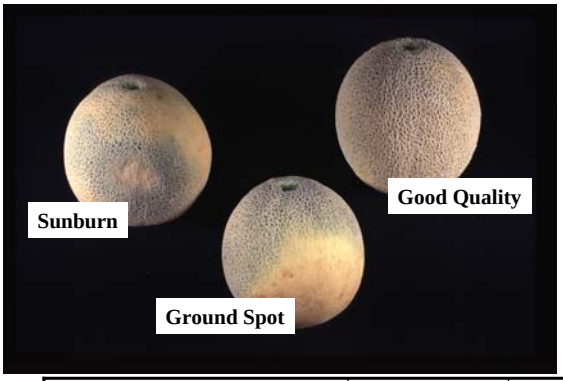
Fresh-cut pieces



From D. Huber

Common Postharvest Defects:
Cantaloupes

- Harvested immature
- Overripe
- Sunken areas on surface
  - scuffing, water loss
- Discolored surface areas
  - sunburn, scuffing
- Soft ground spot
- Decay, especially on stem end
- “Shaker” melons



Melon Defects and Internal Quality

Parameter	Good Quality	Ground Spot	Sunburn
Firmness (N)* (LSD=0.3)	10.7	9.3	6.3
Soluble Solids (%) (0.6)	11.5	10.5	7.9
Color (chroma) (0.7)	32.4	32.2	31.7

* 5 mm diameter probe

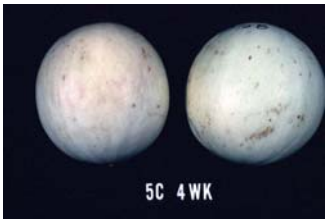
Internal damage to Honeydew due to drops

Internal breakdown Overmature

"Shaker" cantaloupes due to excessive rolling or dropping

Common Postharvest Defects:
Honeydews

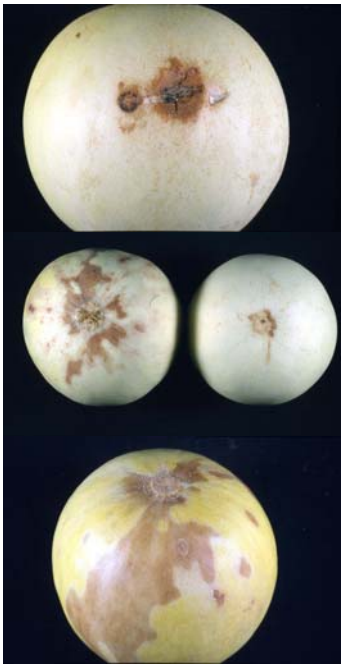
- Harvested immature
- Overripe
- Chilling injury
- Brown blotch
- Decay
- Internal breakdown
  - -dropping
  - -impact injuries



Chilling induced
Discoloration
O.P. honeydew
Air, 5°C (41°F), 4 wks

Hami melon
Air, 2.5°C (36°F), 3 wks.

Honeydew Chilling Symptoms
(None, slight, severe)



cv. Saturno: decay and mechanical damage

cv. Saturno: discoloration at left increased during storage; right, no discoloration after storage at 7.5°C

cv. Saturno: severe brown blotching, Sometimes associated with overmaturity

Modified atmospheres and fresh-cut melon products

- **Potential Advantages**
  - retard softening, sugar loss, color loss
  - retard microbial decay
- **Potential disadvantages**
  - off-flavors due to CO_2 >10% or O_2 <5%
  - cannot compensate for poor temperature control

Relative Importance of Temperature and Modified Atmospheres for Fresh-cut melon

10 days

7.5°C (45°F)

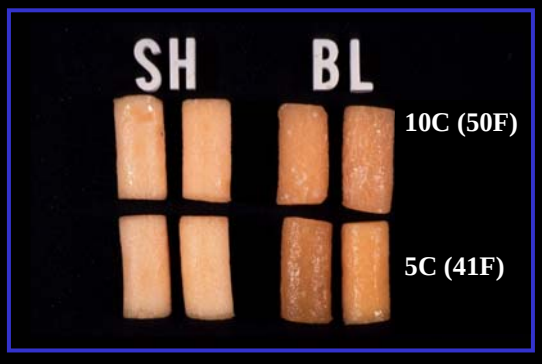
5°C (41°F)

2.5°C (36°F)

Air | 1% O2 | Air + 10% CO2 | 1% O2 + 10% CO2

Translucency Defect

- Differences among melon cultivars
- Probably growing & nutrient conditions affect



Experimentally Induced Translucency

BL=blunt blade
SH = sharp blade

Translucency not reduce firmness
Calcium chloride dips reduce translucency

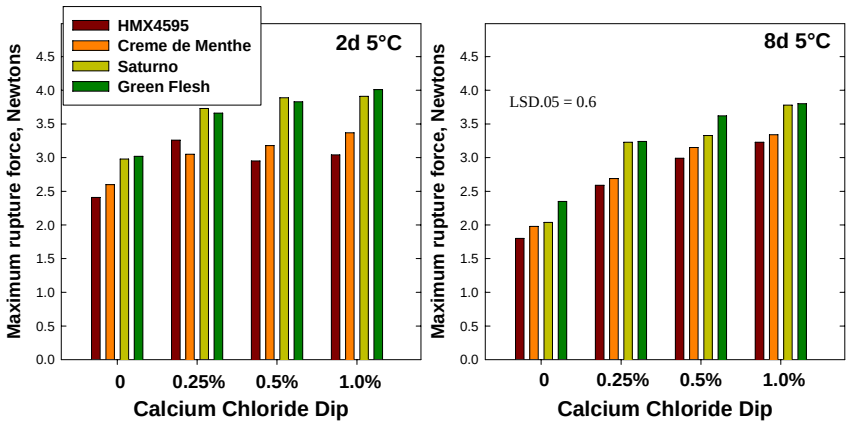
Fresh-cut Melon

Potential Benefits of Calcium dips

- Increase firmness immediately
- Concentrations as low as 0.25% CaCl2 are effective
- Maintain high firmness levels during useful shelf-life
- Effect depends on maturity stage; riper the melon, greater the effect
- Reduce translucent appearance
- Reduce juice loss
- Retard decay development
- Effective for cantaloupe, honeydew, but not watermelon

Sensory quality?

Calcium chloride dips & Honeydew Melon Firmness: Low concentrations provide firmness benefit



Cantwell & Suslow, UC Davis