UCDAVIS POSTHARVEST TECHNOLOGY

Postharvest Handling Melons and Winter Squash

Marita Cantwell, UC Davis
micantwell@ucdavis.edu
http://postharvest.ucdavis.edu

Ripe Melon Characteristics

	Cantaloupe		Watermelon	
	HoneyDew	HoneyLoupe	Canary	Casaba
Days from anthesis	55	53	43	60
Weight, g	2200	1400	2250	3000
Respiration, µL/g-h	16	23	17	15
Internal Ethylene, ppm	4-15	25-45	<1	<0.1
Firmness, kg/cm²	3	4	6	3
Soluble solids, %	15	14	13	11

Extreme genetic variation among the melons

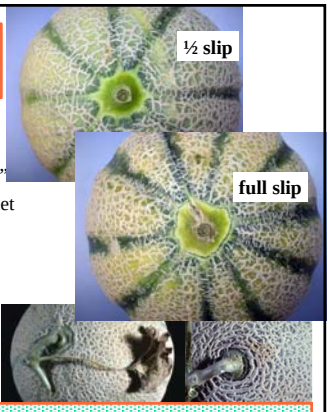
Melon Quality Attributes

- **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 cvs.

Evaluate melon varieties based on minimal changes

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

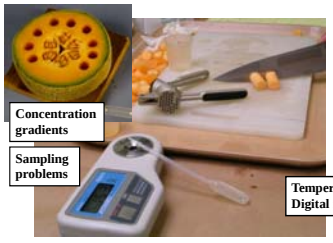
Attribute	½ slip	Full slip, hard ripe	LSD.05
Weight (g)	1367	1398	ns
External color score[1]	2.8	3.3	ns
Internal CO2 (%)	1.02	1.08	ns
Internal ethylene (ppm)	2.42	4.24	0.7
Internal color (chroma)	35.2	35.4	ns
Pulp firmness (N-f, 5mm probe)	12.7	13.1	ns
Soluble solids (%)	12.5	12.2	ns

[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

MELON FLAVOR

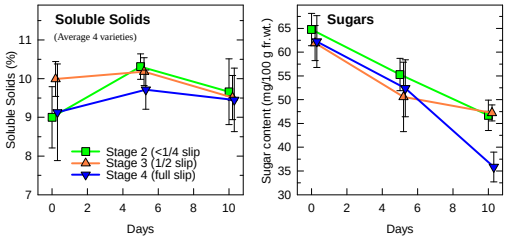
Sugars (**>50% sucrose, 20% glucose, 26% fructose**):
At harvest, % soluble solids correlates well with extracted sugars
For good flavor: Cantaloupe 10% & Honeydew 11-12% S.S.
Sugar content determined at harvest
Acids <0.1%, important for good flavor?
Aroma volatiles specific compounds for characteristic flavors



Sugar Measurement
- **Destructive: % S.S.**
- **Nondestructive** IR analysis

Temperature compensated refractometer Digital readout eliminates errors

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.

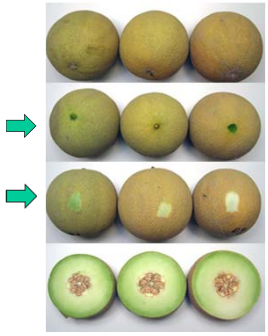


Typical loss over 10 days at 5°C (41°F):
S.S. 0-10%
Sugars 10-20%

Are these melons at optimum maturity/ripeness?

Fresh Plaza
28June2012 Italy

External and internal appearance of Galia melons (cv. Deneb) harvested at 3 stages of maturity (California, 2003).



1 2 3
Maturity/Ripeness Stage

% Soluble solids
Stage 1 = 9.3
2 = 10.4
3 = 10.2

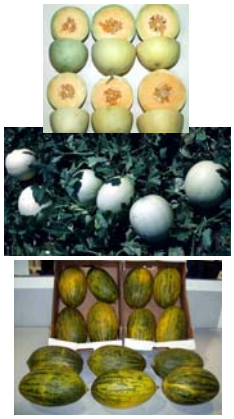
Aroma score
Stage 1 = 2.8
2 = 4.2
3 = 5.0

Pulp firmness
Stage 1 = 26.9 N
2 = 27.2
3 = 10.0

Internal Ethylene
Stage 1 = 0.2 ppm
2 = 0.8
3 = 1.1

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**



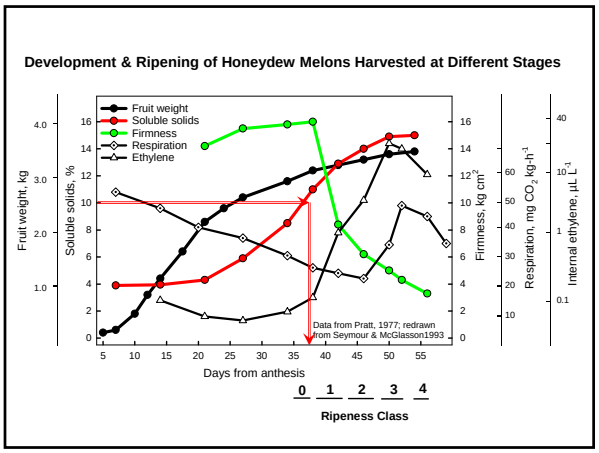
Honeydew and Orange Flesh Melons
Maturity and Ripeness Classes

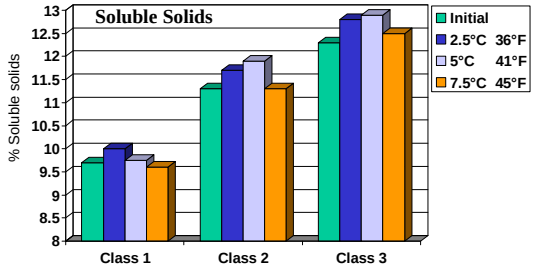
- Class 0: **Immature**
- Class 1: **Mature, but Unripe**
  Ground color greenish-white; peel fuzzy; no aroma; 10% soluble solids; flesh crisp, melon splits when cut; minimum harvest maturity
- Class 2: **Mature, Ripening**
  Ground color white; begins to develop surface wax; pulp crisp, melon splits

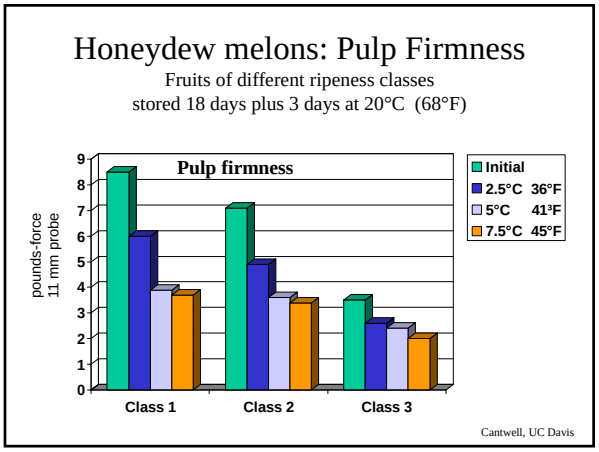
Average 4 cvs Honeydew melons

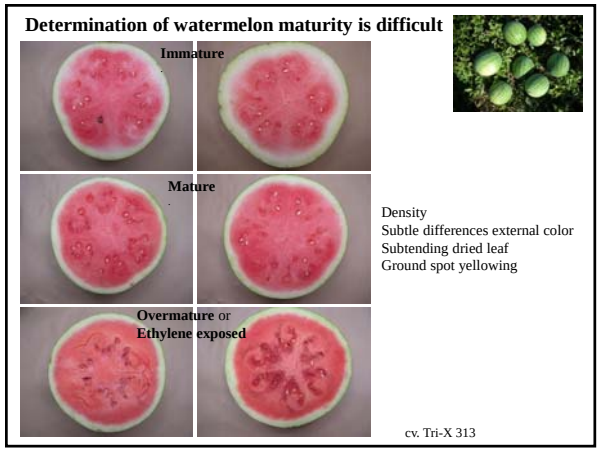
Class	Int. C2H4, ppm	Pulp firm., kg-f	Sol. solids, %
0 = Immature	<0.2	3.8	<10
1 = Mature, Unripe	0.8	3.1	10
2 = Mature, Ripening	5.2	2.1	11-12
3 = Ripe	27.1	1.5	12-14
4 = Overripe	29.4	1.1	14-15

firmness: 1.1 cm probe









Melon Storage Conditions

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

Galia melons (cv Deneb) stored 4 weeks at 10˚C (upper) or 7.5˚C (lower) and then after transferred to 20˚C for 2 days.

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%)

MA-stored cantaloupe; Bag in Box

Open bag to de-gas
Allow time (2-3 days, ambient) to change color, improve aroma

Conditioning or Ripening Melons
Honeydew Melon Example

Conclusions from a study on cv Emerald

- 12 hours 20-50 ppm ethylene
- Hold 2-3 days at 20°C (68°F)
- Maturity stage 2 (minimum ~11% SS)

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

Honeydew melon harvest
and packing in field or shed

Field packing watermelon
and cantaloupes

Galia melon harvest Pakistan 2012

Cantaloupe harvest, Honduras 2010

Greenhouse Galia harvest

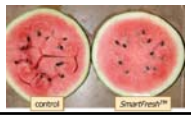
Forced air cooled
4-8 hours required
Gravity flow racking

Field packed melons waiting to be cooled

Night harvest of cantaloupes

1-MCP & Melons

- Western shipping cantaloupes-not much benefit on firmness at storage temperature.
- Eastern shipping cantaloupes-maintain texture loss at warm temperatures.
- Galia; extend shelf-life, reduce firmness loss
- Watermelon-clear benefit; reduce firmness loss



Watermelon photo D. Huber

Delays to Cool and 1-MCP treatment of Honeydew Melons

Quality attributes of honeydew melon (cv Summerdew) **stored 10 days at 7.5°C** (45°F) **plus 3 days at 20°C** (68°F). Data average of 15 melons per treatment.

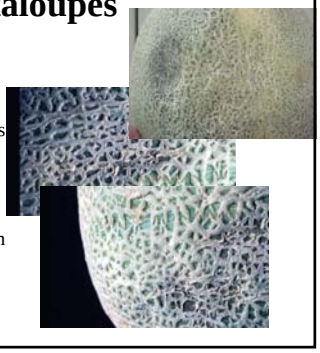
T1=fruit cooled to 7.5C (45F) within 6hr after harvest.
T2=fruit cooled and treated with 1-MCP at 7.5C within 6hr after harvest.
T3=fruit held at 22C (72F) for 24hr and then cooled to 7.5°C.
T4=fruit held at 22C for 24 hr and then cooled and treated with 1-MCP at 7.5C.

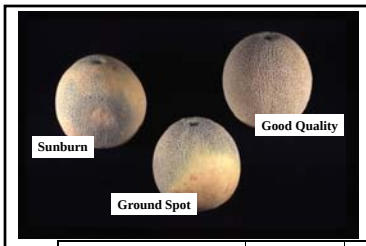
Treatment	Visual quality	Surface Discoloration	Decay Stem-end	Decay surface	External color (Hue)	Pulp Firmness, N	Soluble solids, %
T1	8.9	1.1	1.0	1.0	102.6	15.3	13.0
T2	8.9	1.1	1.0	1.0	102.4	23.3	12.6
T3	8.8	1.1	1.1	1.1	102.8	10.8	11.7
T4	8.7	1.1	1.1	1.1	103.1	18.7	11.1
Average	8.8	1.1	1.0	1.0	102.7	17.0	12.1
LSD.05	ns	ns	ns	ns	ns	5.1	1.2

Cantwell, 2011

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



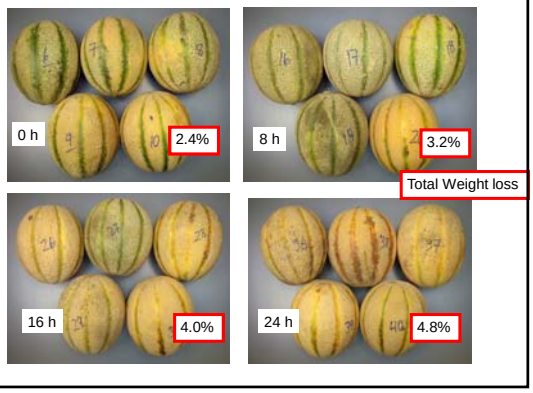


Melon Defects (severe) and Internal Quality

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

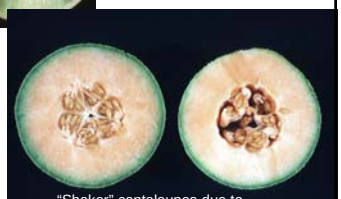
* 5 mm diameter probe

Melon visual quality after delays to cool at 37°C storage at 10d 5°C + 4d 20°C
Suture Browning associated with increased water loss due to delays to cool



Internal damage to Honeydew due to drops

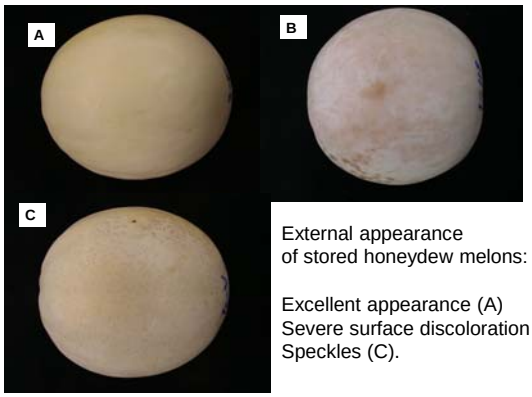
Internal breakdown
Overmature



"Shaker" cantaloupes due to excessive rolling or dropping

Common Postharvest Defects:
Honeydews

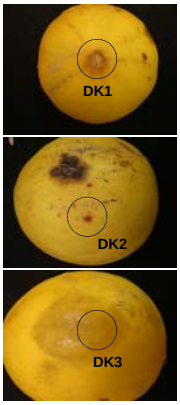
- Harvested immature
- Overripe
- Chilling injury
- Brown blotch
- Decay
- Internal breakdown
  - -dropping
  - -impact injuries



External appearance
of stored honeydew melons:

Excellent appearance (A)
Severe surface discoloration (B)
Speckles (C).

Golden Honeydew
Stored 1 month 10°C

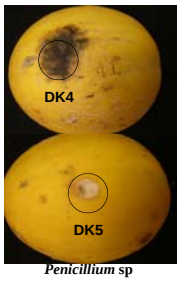


Fusarium sp.

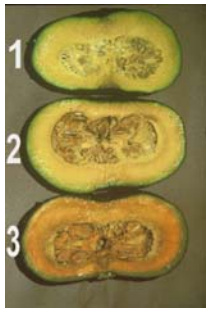
Epicoccum sp

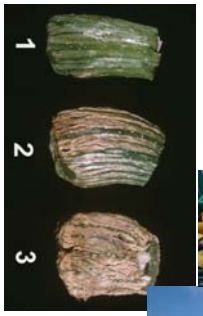
Sclerotinia sp.

Botryodiplodia sp



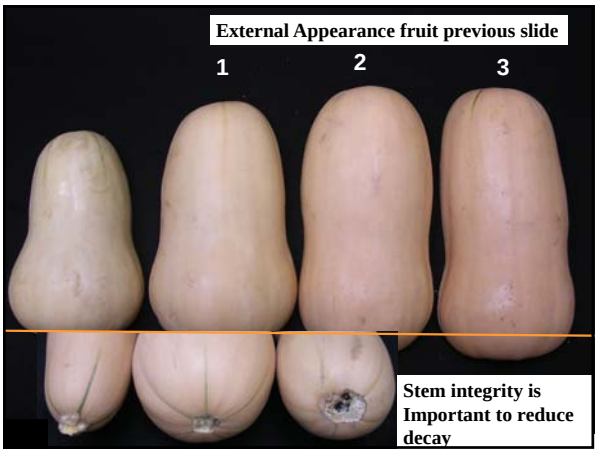
Penicillium sp

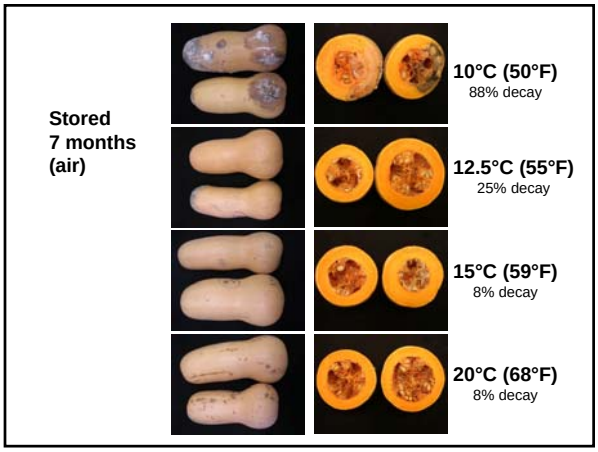


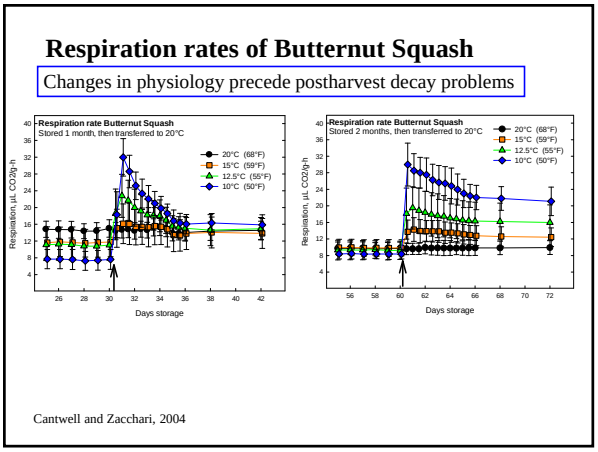


Kabocha
squash

Maturity at harvest is key
Careful Handling is essential
Curing important for storage life
Squash are chilling sensitive







Winter Squash and Pumpkin Storage Conditions

- Well cured
- Temperature: 12.5-15°C (55-59°F)
- RH: 50-70% with 60% usually considered optimum
- 2-6 months
- Avoid ethylene
- Modified atmosphere not beneficial