Ripening Mangos & Papayas

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Major Mango Cultivars in the USA

Haden

Keitt

Kent

Ataulfo

Tommy Atkins

National Mango Board

Major Papaya Types in the USA

Brookstropical.com

Solo

OregonLive.com

Maradol

Harvest Maturity and Flavor

- Mango harvest maturity is related to internal color developn
- Mangos should be harvested at a minimum of Stage 2 (Stage 3 for near mkts

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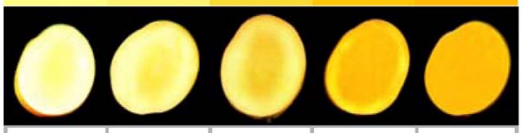
AVERAGE COLOR					
INTERIOR FLESH SAMPLES					
MATURITY/ RIPENESS	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
FIRMNESS	12 - 15	12 - 14	5 - 8	4 - 5	2 - 3
BRIX	6 - 8	9 - 11	12 - 15	14 - 16	14 - 17

- Immature mangos (Stage 1) can ripen, but will never develop good flavor

*From the National Mango Board "Maturity & Ripeness Guide"

Harvest Maturity and Flavor

- Papaya harvest maturity is related to external color development
- Papayas should be harvested at a min. of ¼ yellow color (½ is better)

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- Immature papayas (green) can ripen, but will never develop good flavor

* From Hawaii Papaya Industry Assoc. (hawaiipapaya.com)

Changes Associated with Mango & Papaya Ripening

- Color changes
  - Loss of chlorophyll & increased carotenoids
  - Skin color changes from green to yellow (most cultivars)
  - Flesh color changes from greenish-yellow to yellow to orange
- Textural changes
  - Decrease in flesh firmness and increased juiciness
- Compositional changes
  - Starch conversion into sugars in mango (not in papaya)
  - Increase in soluble solids content in mango (not in papaya)
  - Increase in characteristic aroma volatiles

Harvest Maturity Indices

Nondestructive

- Days after flowering
- Fruit shape (full shoulders & cheeks)
- External color
- Specific gravity

Destructive

- Flesh color
- Flesh firmness
- Soluble solids content
- Titratable acidity
- Dry matter

Immature Mature

Green Color Break

Mango Flesh Color (Hue) and Maturity

Maturity stage	Haden	Keitt	Kent	Ataulfo	Tommy Atkins
1	87.4 (2.08)	96.51 (1.69)	96.62 (1.20)	90.50 (2.83)	94.43 (2.83)
2	85.8 (1.62)	92.97 (1.69)	89.91 (2.02)	85.01 (2.90)	89.64 (1.29)
3	82.77 (2.08)	89.48 (2.23)	86.97 (2.37)	86.84 (1.36)	87.14 (1.60)
4	83.3 (2.21)	84.66 (2.08)	84.85 (1.41)	81.07 (1.78)	82.43 (2.93)
5	81.9 (1.82)	85.10 (1.84)	82.89 (1.09)	80.31 (1.31)	80.35 (1.99)

Values in parentheses represent the standard deviation

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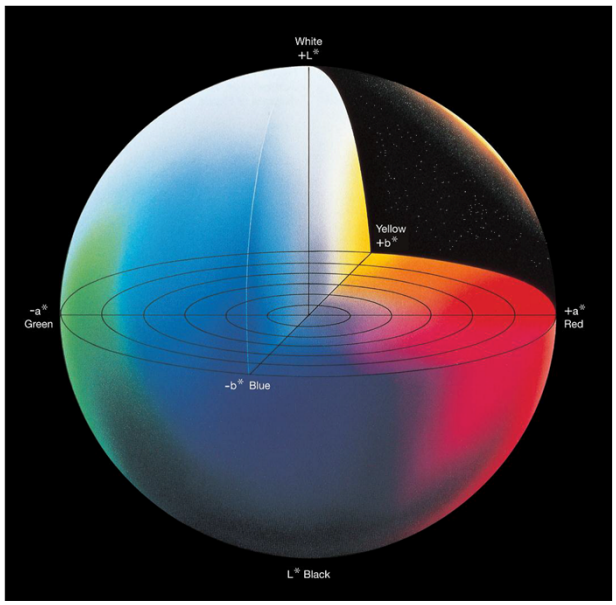
CIELab Color Sphere



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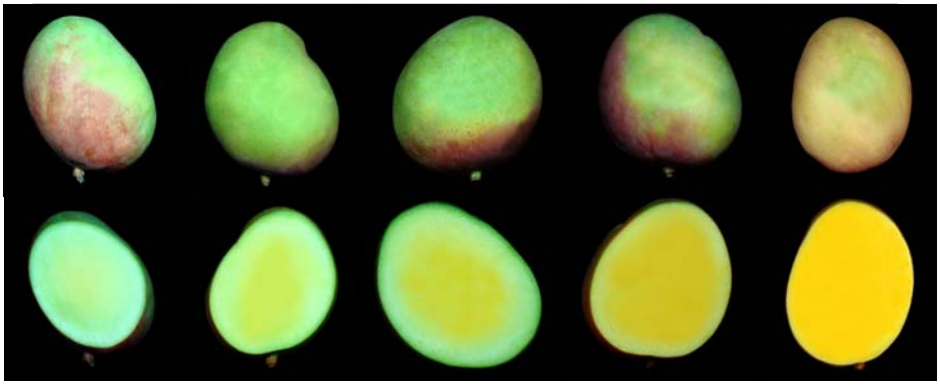
Tommy Atkins Color Stages



1 **2** **3** **4** **5**

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Mango Firmness (lb-f) and Maturity

Maturity stage	Haden	Keitt	Kent	Ataulfo	Tommy Atkins
1	13.38 (1.49)	17.63 (1.58)	20.54 (1.56)	19.67 (4.4)	18.83 (1.30)
2	9.33 (1.17)	13.65 (1.3)	16.11 (1.75)	11.74 (1.23)	15.72 (1.21)
3	6.53 (1.0)	7.69 (1.0	11.98 (1.35)	6.95 (1.37)	11.75 (1.42)
4	4.51 (0.93)	2.61 (0.96)	6.47 (1.26)	2.47 (0.61)	6.88 (1.27)
5	2.46 (0.60)	1.71 (0.73)	3.40 (1.0)3	1.83 (0.74)	4.11 (1.38)

Values in parentheses represent the standard deviation

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Mango Soluble Solids and Maturity

Maturity stage	Haden	Keitt	Kent	Ataulfo	Tommy Atkins
1	6.8 (0.56)	8.93 (1.15)	9.03 (0.83)	7.38 (0.51)	8.14 (1.12)
2	9.9 (0.65)	10.04 (1.44)	10.25 (0.89)	9.63 (0.76)	9.5 (1.34)
3	13.58 (1.32)	11.06 (0.89)	13.55 (1.61)	13.33 (0.59)	10.06 (1.15)
4	14.6 (0.86)	13.1 (0.96)	12.85 (1.29)	13.43 (1.18)	11.75 (1.34)
5	15.5 (1.07)	15.55 (1.45)	13.72 (1.35)	16.12 (1.85)	13.45 (1.46)

Values in parentheses represent the standard deviation

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Optimal Temperatures for Mango Ripening

Fruit temperature is the most important factor in mango ripening.

- Ripening at 60 to 65°F (15.5 to 18°C) may result in the most attractive skin color, but flavor remains tart
  - These mangos require an additional 2-3 days at 70-75°F (21-24°C) to attain sweet flavor.
- Ripening at 80 to 86°F (27 to 30°C) may result in mottled skin and strong, undesirable flavor
- Ripening is retarded above 86°F (30°C).

Thus, the best temperature range for ripening mangos is 68 to 72°F (20 to 22°C).

Optimal Temperatures for Papaya Ripening

Fruit temperature is the most important factor in papaya ripening.

- Ripening rate (skin yellowing, flesh softening, flesh color) increases with increasing temperature between 64 and 86°F (17.5 to 30°C)
- Ripening is retarded above 86°F (30°C)
- Best color development occurs between 72 and 82°F (22 to 27.5°C).
- Ripening occurs faster if papayas have been previously held at low temperature (50°F/10°C)

The best temperature range for ripening papayas is 72 to 82°F (22 to 27.5°C)

Other Considerations for Ripening

- The optimal **relative humidity** range to prevent excessive water loss and shrivel is 90 to 95% RH.
- **Ethylene** (10-100 ppm) treatment for 24 to 48 hours induces faster and more uniform ripening, provided that carbon dioxide is kept below 1% by ventilating the rooms with outside air once per day.
- After triggering ripening with ethylene,
  - Mangos at 65 to 72°F (18 to 22°C) will ripen in 5 to 9 days
  - Papayas at 72 to 82°F (22 to 27.5°C) will ripen in 8 to 14 days
- Once ripened, mangos and papayas can be kept at 50 to 55°F (10 to 13°C) and 90 to 95% RH for up to 1 week.

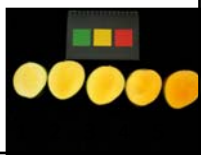
Flesh Firmness *versus* Ripeness Stage of Mangos

Ripeness stage	**Flesh firmness** (lb-force with 5/16-inch tip)	**Notes**
Mature-green (1)	>14	Treat with ethylene for 48 hours
Partially-ripe (2)	10-14	Treat with ethylene for 24 hours
Firm-ripe (3)	**6-10**	**Best stage to send to retail stores**
Soft-ripe (4)	2-6	Best stage for eating
Over-ripe (5)	<2	Good for juice

"Safe" chilling threshold temperatures* for different varieties/maturities of mangos

Variety	**Maturity/Ripeness Stage****				
	1	2	3	4	5
Ataulfo**	>55°F	>55°F	>55°F	>55°F	>55°F
Keitt	55°F	50°F	45-50°F	45°F	45°F
Kent	55°F	55°F	55°F	50°F	50°F
Tommy Atkins	55°F	55°F	55°F	45-50°F	45°F

*Based on continuous exposure for 3 weeks
**Ataulfo fruit developed chilling injury at all temperatures tested; a chilling threshold temperature was not established.



Thanks for your attention!

Questions?

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UF UNIVERSITY of FLORIDA
IFAS
Center for Food Distribution and Retailing