

Postharvest Quality of Pitahaya

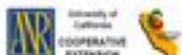
- A. Quick Review about Quality & Storage
- B. 2013 Cooperative Research
 - 6 varieties, at harvest and stored
 - Composition
 - Aroma volatiles
 - Sensory evaluation

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



Seminar - Friday August 22, 2014
San Marcos Civic Center
3 Civic Center Dr., San Marcos, CA 92076

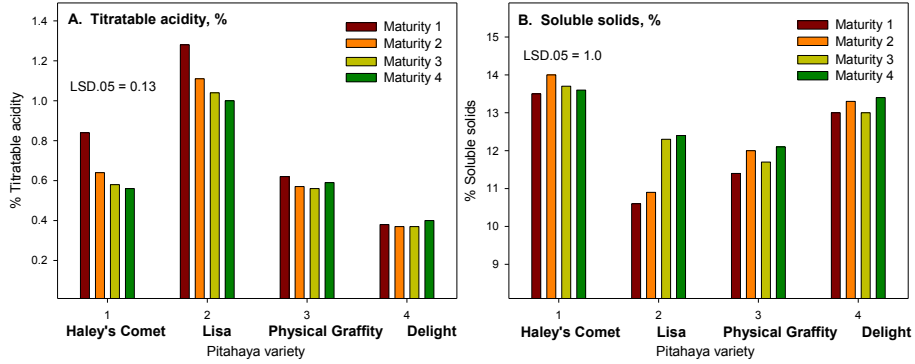
Field Day/Festival - Saturday August 23, 2014
UC South Coast Research and Extension Center
7501 Irvine Boulevard
Irvine, CA 92618



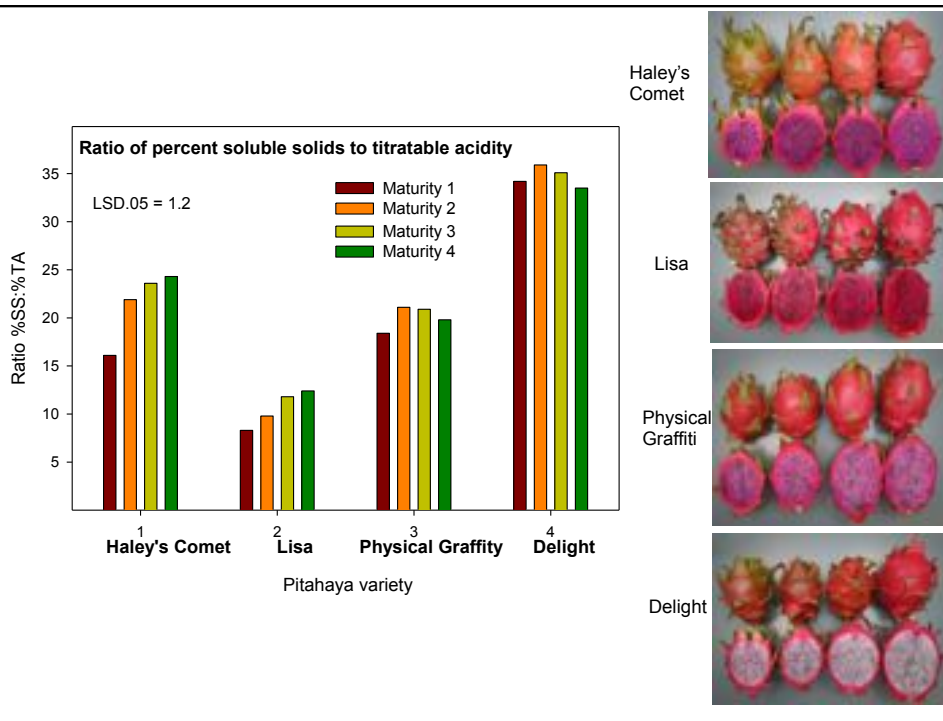
Pitahaya Fruit Composition (near full ripe at harvest)

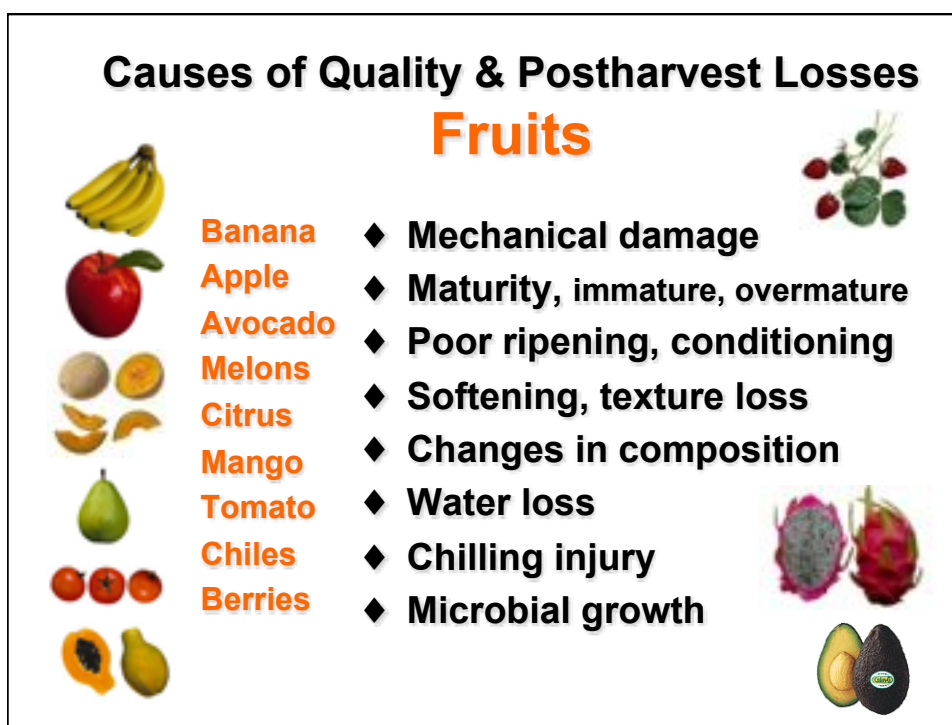
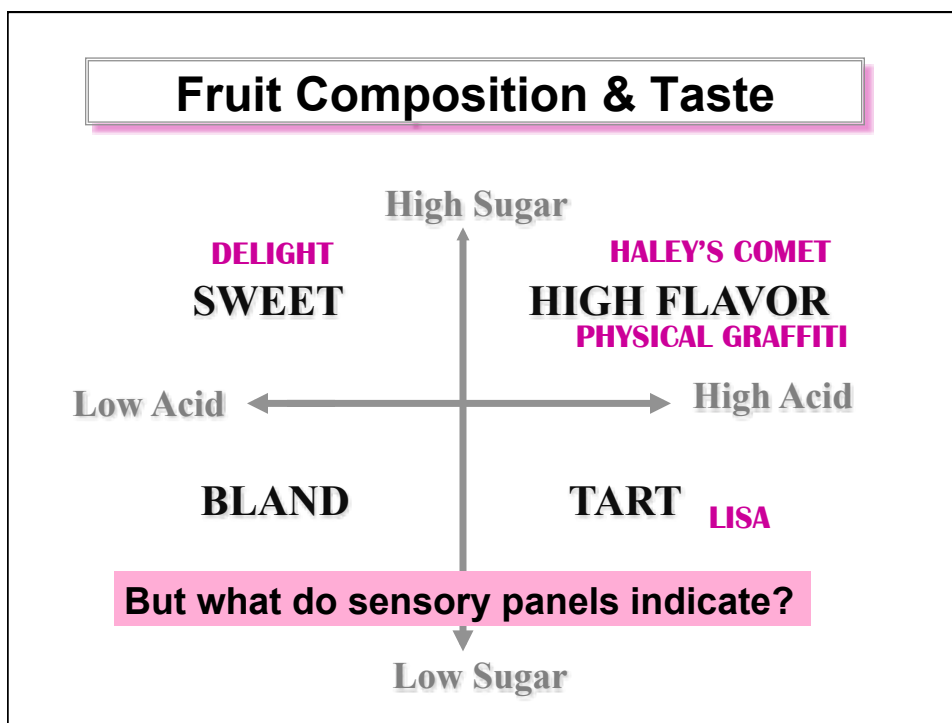
- Water (85-88%)
 - Carbohydrates (10-15%)
 - Sugars (mostly glucose, fructose)
 - Soluble solids (10-15%)
 - Dietary fiber (0.6-0.8%)
 - Mucilage, not well studied
 - Minerals: calcium, potassium
 - Vitamins: small amounts of Vitamin C
 - Pigments in red flesh: Betalains
 - Polyphenols
- Sugars to not increase after harvest
 - Harvest maturity is key for good eating quality
- } High Antioxidant & Antiproliferative Activities in Red Flesh fruits

Important differences among pitahaya varieties in acidity and soluble solids
 Acid and soluble solids are also affected by fruit maturity



2012 research, Cantwell and Lobo





Pitahaya Storage (near full ripe at harvest)

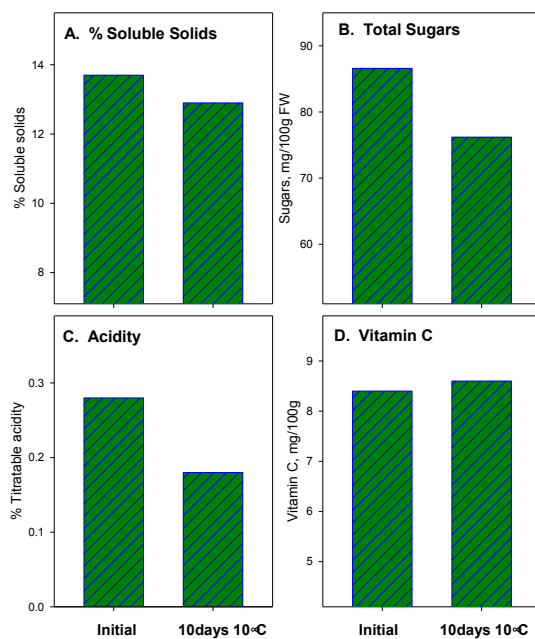


Postharvest Losses

Dehydration, Shriveled
Mechanical Damage
Decay
Chilling Injury

- **Non-climacteric fruit; moderate respiration rate**
 - very low ethylene production
 - color is not stimulated by ethylene
- **10 to 12°C, 85-90% RH for shelf-life of 2-3 week; 14°C 2 weeks**
- **20-25°C (ambient) shelf-life of ~ 1 week**
- **Chilling sensitive**
 - Maturity, temperature, time all affect chilling damage
 - Chilling occurs at 8°C or lower (but 1 study indicated best temp is 6°C)
 - transfer from storage to warm conditions accentuates chill symptoms
 - Symptoms: bracts darken, lose flavor and firmness, pulp translucency
- **Postharvest decays**
 - Bacterial and fungal, associated with damage
- **Modified atmospheres**
 - 1-3% O₂ at 12°C; marketable to 30D, but decrease in sugars, Vit C, acids
 - 2 reports of MAP up to 30 days, main benefit from reducing water loss
- **Quarantine treatments required for imported fruit**
 - Pitahaya and related cactus fruits are host for various fruit flies
 - Heat treatments (hot water and hot air); Irradiation

Corales & Canche 2008; Hoa et al. 2006; Lau et al., 2009; LeBellec et al. 2006; Nerd et al. 1999; Paull, 2002; Punitha et al. 2009; Vargas et al. 2007.



Pitahaya Storage Changes in Composition

Data average 6 varieties, 2011

After 10 days 10°C:

- 9% decrease soluble solids
- 12% decrease sugars
- 36% decrease acidity
- No change Vitamin C

Cebra (#1), Rosa (#2), Orejona (#3),
Lisa (#4), Delight (#12), Haley's Comet (#14)

Cooperative Project

Pitahaya 2013 Composition and Sensory Quality at Harvest and after Storage

Ramiro Lobo, UCCE San Diego County

relobo@ucanr.edu

Marita Cantwell and assistants

Dept. Plant Sciences, UC Davis; micantwell@ucdavis.edu

Mary Lu Arpaia and assistants

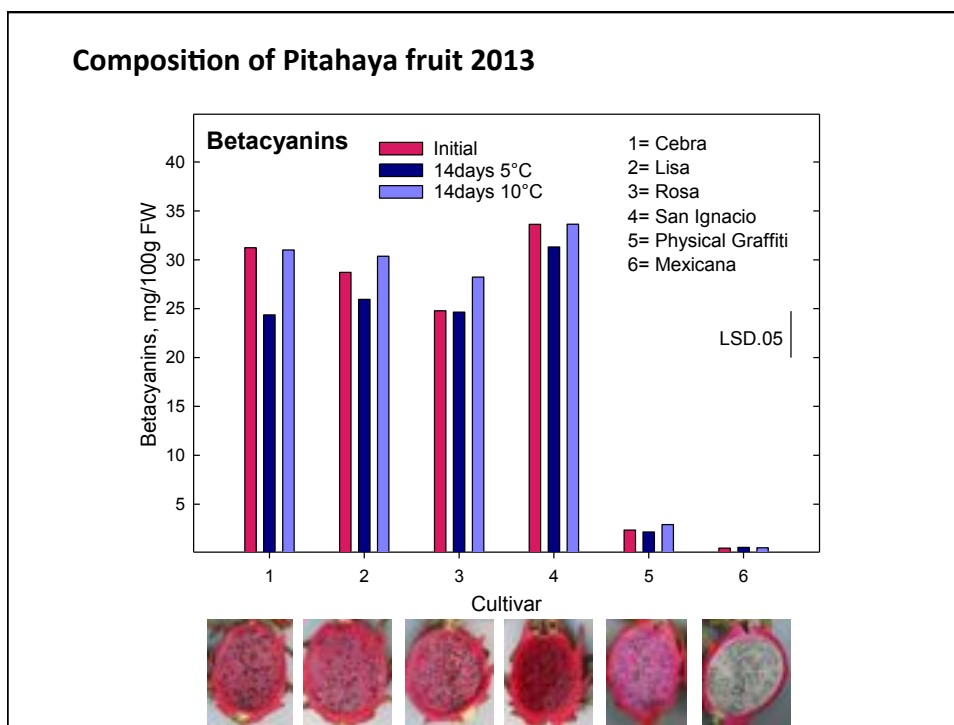
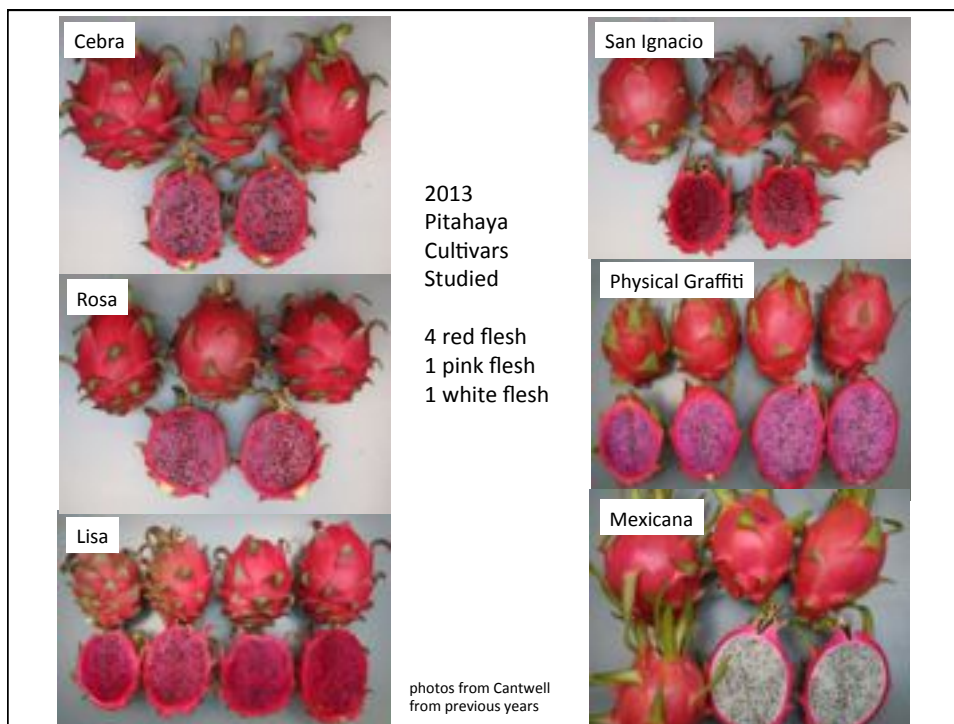
Dept. Plant Sciences, UC Riverside at KAC, mlarpaia@ucanr.edu

David Obenland

USDA Parlier, David.Obenland@ARS.USDA.GOV

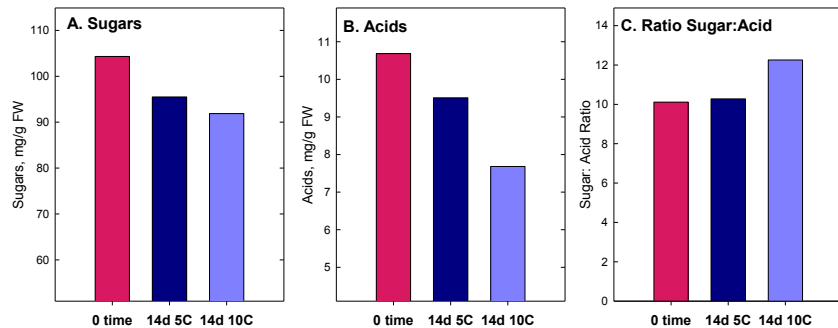
2013 Pitahaya Research

- Fully ripe fruit harvested Sept 30
- Composition, Storage and Sensory Evaluation
- Harvest, 14d at 5°C (41°F), 14d at 10°C (50°F)
- Composition
 - Sugars, acids, betacyanins, antioxidant activity } Cantwell lab
- Sensory and Aroma
 - Sensory, semi-expert panel } Arpaia and Obenland labs
 - Aroma volatiles



Average Changes in Composition 6 Varieties

HPLC Analyses



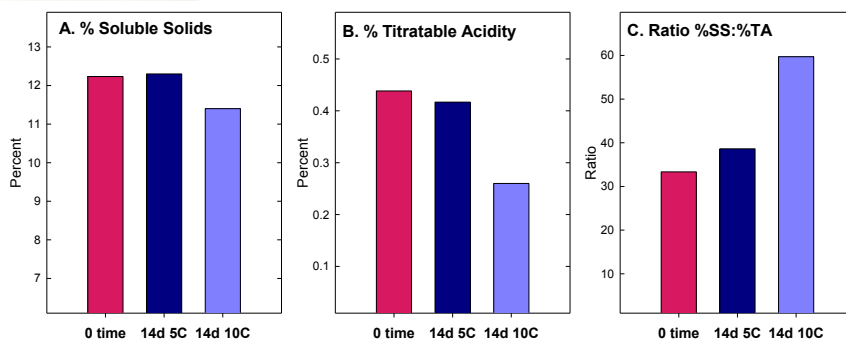
At **5C (41F)** for 14days:
 8% loss of sugar
 10% loss of acids
 2% increase in sugar:acid ratio

At **10C (50F)** for 14days:
 12% loss of sugar
 25% loss of acids
 22% increase in sugar:acid ratio

2013

Average Changes in Composition 6 Varieties

Refractometer and Titration



At **5C (41F)** for 14days:
 0% loss of soluble solids
 5% loss of titratable acidity
 16% increase in %SS:%TA ratio

At **10C (50F)** for 14days:
 7% loss of soluble solids
 40% loss of titratable acidity
 79% increase in %SS:%TA ratio

2013

2013 Pitahaya Research



Mary Lu Arpaia, UCR at KAC



David Obenland, USDA Parlier

- 6 varieties; evaluated at harvest, and after 14 days at 5 and 10C
- Sensory evaluation
 - Semi-expert panel
 - Appearance (color, shape, size)
 - Internal visual (color)
 - Flavor (overall, sweetness, tartness, texture)
- Aroma Volatiles (GC-MS)
 - Identification (aldehydes, alcohols, hydrocarbons, other)
 - Quantified at harvest & after storage



An example of the score sheet for flavor characteristics

Flavor Quality Evaluation Name _____

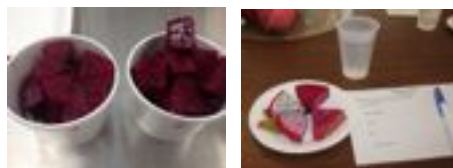
How do you like this fruit? Please place a check mark in one box in each row that best reflects how you like each sample.

Rinse mouth with water between samples.

	Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
	1	2	3	4	5	6	7	8	9
463 Overall Eating Quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flavor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sweetness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tartness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flesh/Pulp Texture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

From M.L. Arpaia

Example 2013 Sensory Data



Cebra: a high acid pitahaya



	%SS	%TA	SS:TA	Flavor score*	Sweetness score*	Tartness score*
At harvest	11.6	0.59	19.7	5.8	4.8	5.3
14d 5C	11.5	0.61	18.9	5.6	4.6	5.6
14d 10C	9.6	0.33	29.1	6.3	5.8	6.2

Mexicana: a low acid pitahaya



	%SS	%TA	SS:TA	Flavor score*	Sweetness score*	Tartness score*
At harvest	13.9	0.20	69.5	7.2	7.1	6.5
14d 5C	13.5	0.17	79.5	6.1	6.0	5.2
14d 10C	12.5	0.10	125.0	5.5	5.8	4.8

* Higher the score, the better liked by sensory panel

Table 1. Aroma volatiles identified in pitahayas after harvest and following storage.

Aroma volatile	Abbreviation	Descriptor
Aldehydes		
Acetaldehyde	Aa	Pungent, solventy
Butanal	But	Fruity, green, banana
Pentanal	Pen	Green, grassy, nutty
Hexanal	Hex	Fresh, green
E-2-hexenal	EHex	Green, banana
Heptanal	Hep	Green, herbal
Octanal	Oct	Fatty, citrus
Nonanal	Non	Citrus, floral, green
Decanal	Dec	Waxy, citrus, floral
Hydrocarbons		
p-Cymene	pCym	Solvent, citrus
Limonene	Lim	Citrus, fresh
Dodecane	Dod	Alkane
Tridecane	Tdec	Alkane
Alcohols		
Ethanol	EtOH	Ethanol
Linalool	Lin	Citrus, floral
Hexanol	Hex	Green, fruity
Other		
Methyl heptenone	Mhep	Citrus, green, apple
Butyl butanoate	Bbut	Fruity, banana,
2-Pentyl furan	2Pfur	Fruity, green, earthy

Fruit Flavor

Taste: sugars and acids

Flavor: taste + aroma volatiles

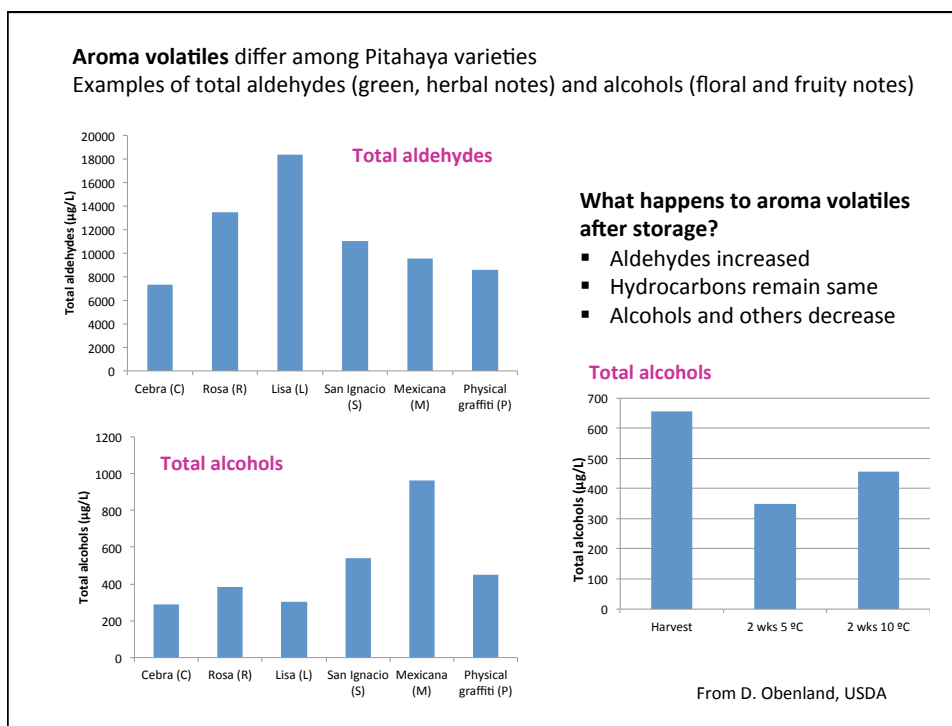
Aroma Volatiles

Concentration

Threshold for perception

^aAroma descriptors from the University of Florida Citrus Flavor and Color Database (Rouseff, 2014) and the Good Scents Company (http://the_goodscentcompany.com/index.html).

From D. Obenland, USDA



2013 Pitahaya Postharvest Research Conclusions

- Composition (sugars, acids, betacyanins) of 2013 fruit similar to that of previous years
- First research on aroma volatiles of pitahaya and notable differences among varieties; volatiles change with storage
- Storage (14d) results in significant changes in content of sugars, acids and volatiles, and sensory panel liking increased or decreased depending on the variety
- Market low acid fruit rapidly; higher acid fruit can be stored at recommended temperature for short period and have similar or better flavor.

