

## 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

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Seminar - Friday August 22, 2014  
 San Marcos Civic Center  
 3 Civic Center Dr., San Marcos, CA 92078

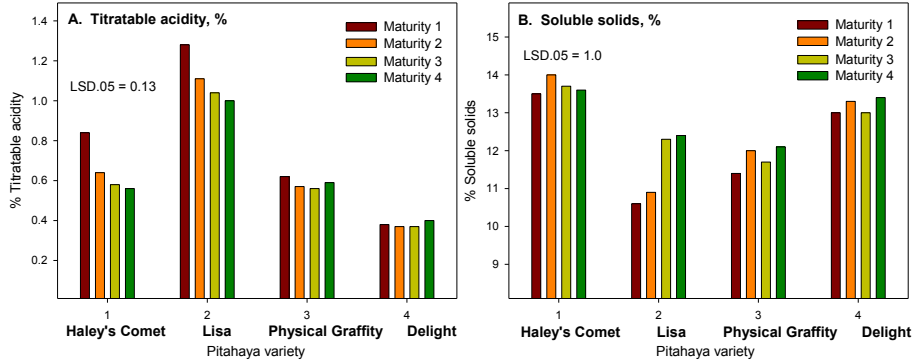
Field Day/Festival - Saturday August 23, 2014  
 UC South Coast Research and Extension Center  
 7601 Irvine Boulevard  
 Irvine, CA 92618



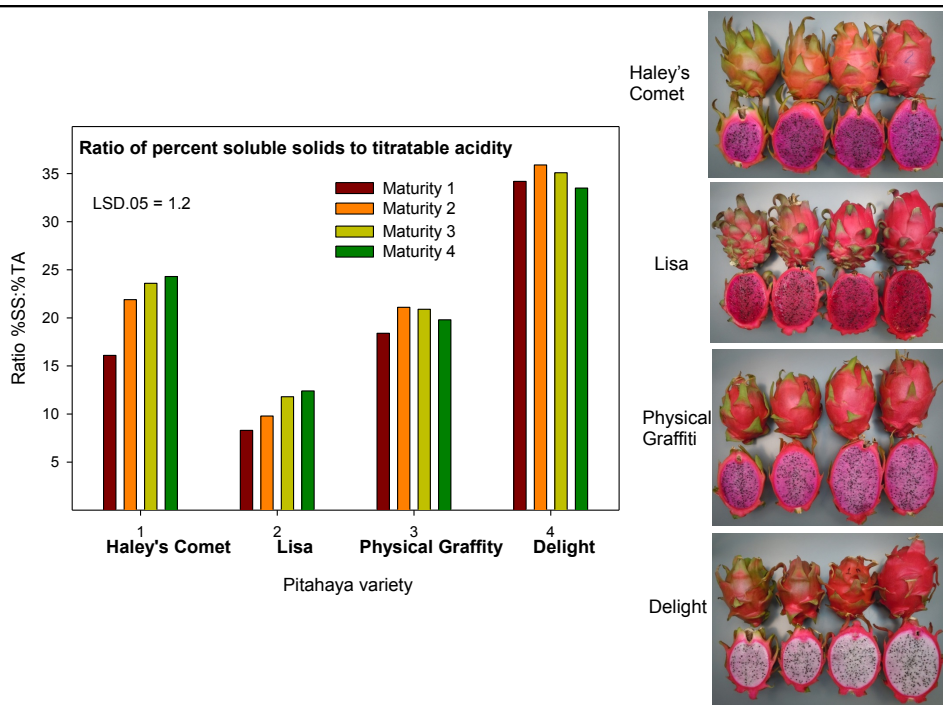
## Pitahaya Fruit Composition (near full ripe at harvest)

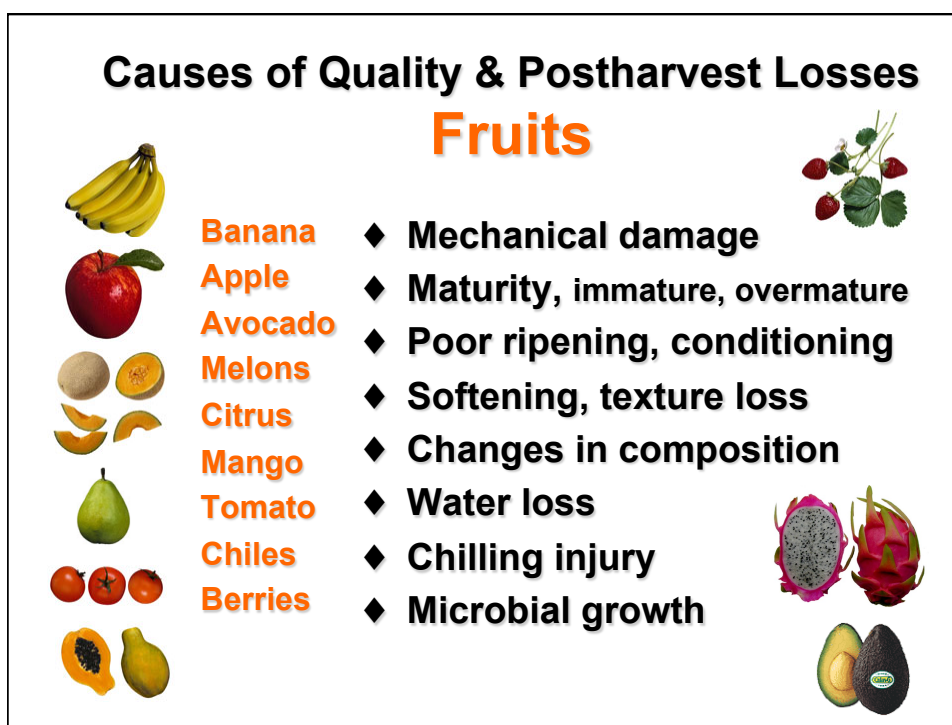
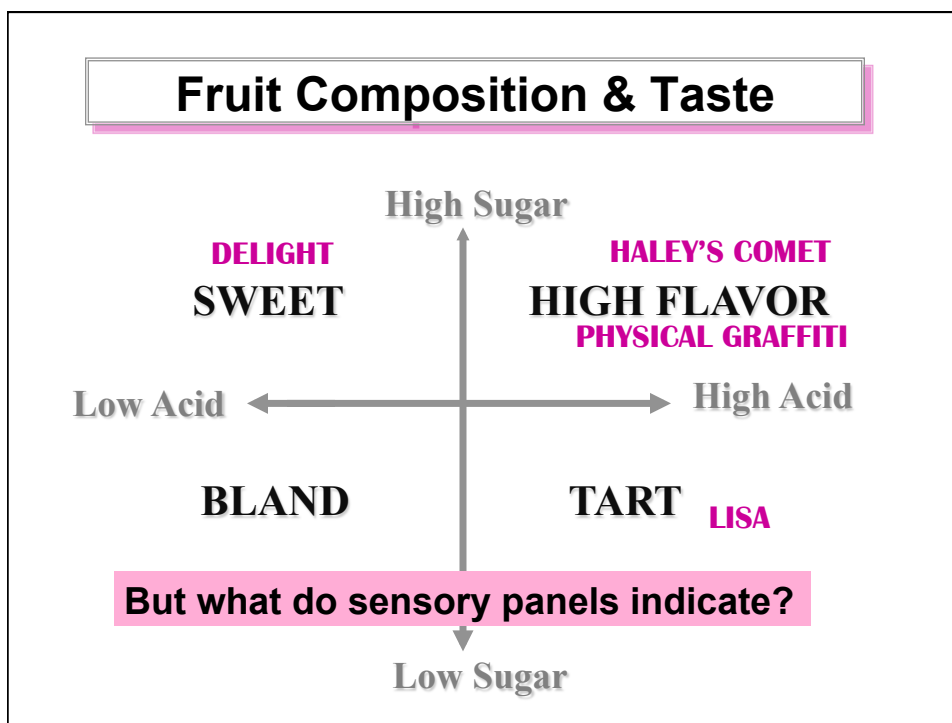
- Water (85-88%)
  - Carbohydrates (10-15%)
    - Sugars (mostly glucose, fructose)
    - Soluble solids (10-15%)
    - Dietary fiber (0.6-0.8%)
    - Mucilage, not well studied
  - Minerals: calcium, potassium
  - Vitamins: small amounts of Vitamin C
  - Pigments in red flesh: Betalains
  - Polyphenols
- 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)

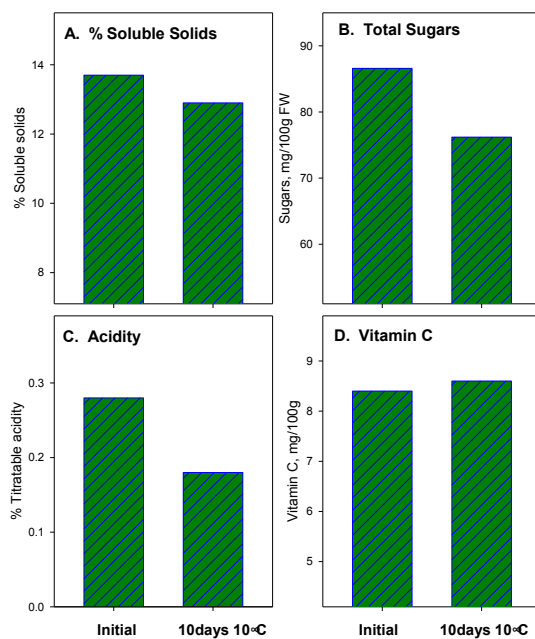


### Postharvest Losses

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% O<sub>2</sub> 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

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**Mary Lu Arpaia** and assistants

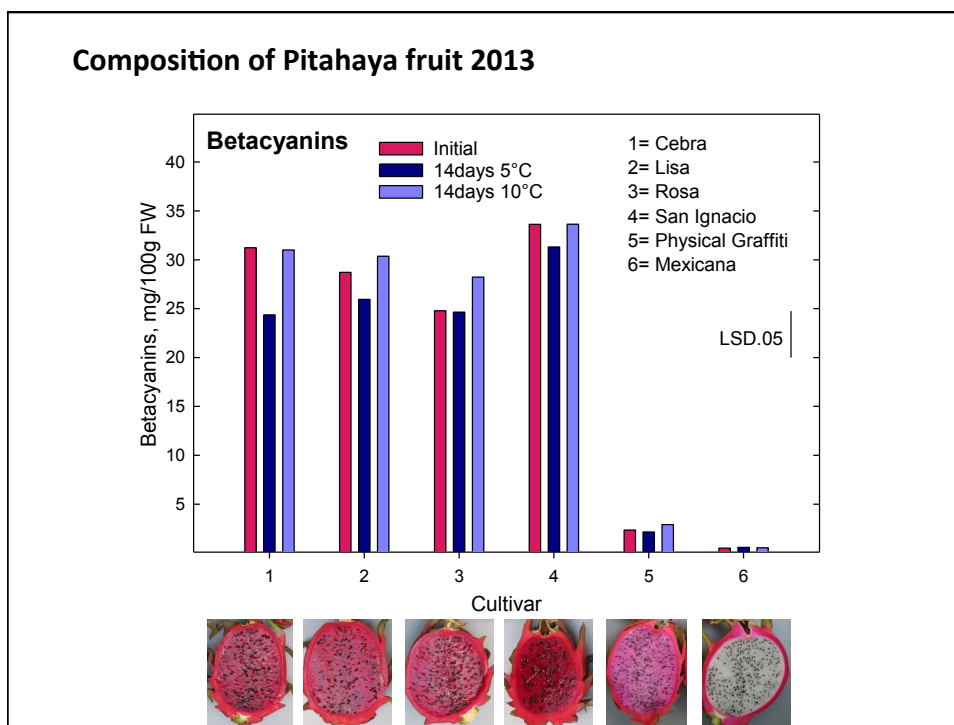
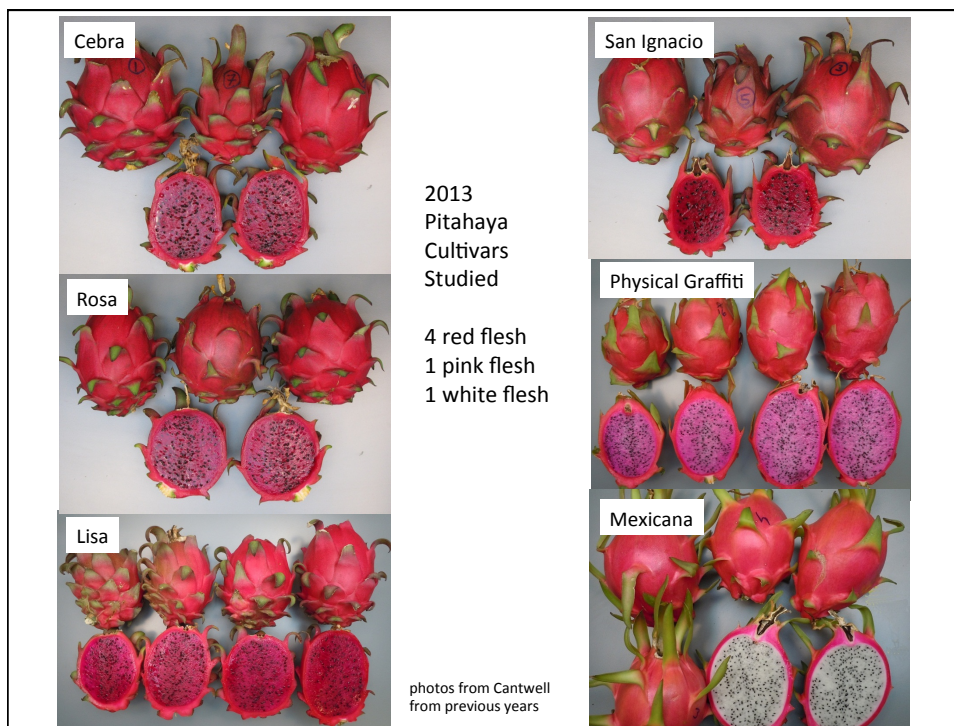
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**David Obenland**

USDA Parlier, [David.Obenland@ARS.USDA.GOV](mailto:David.Obenland@ARS.USDA.GOV)

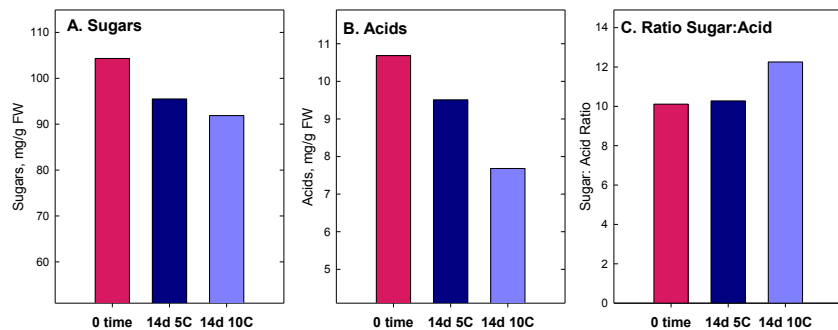
## 2013 Pitahaya Research

- 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



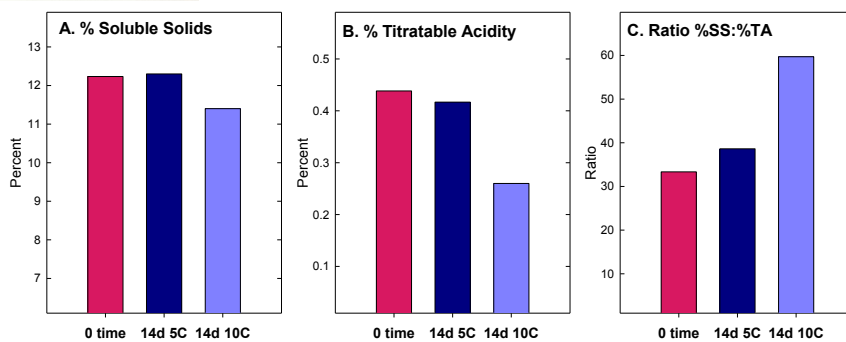
At **5C (41F)** for 14days:  
 8% loss of sugar  
 10% loss of acids  
 2% increase in sugar:acid ratio

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

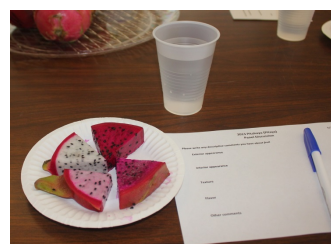


Mary Lu Arpaia, UCR at KAC



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.

	1	2	3	4	5	6	7	8	9
	Dislike extremely	Dislike very much	Dislike moderately	Dislike slightly	Neither like nor dislike	Like slightly	Like moderately	Like very much	Like extremely
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

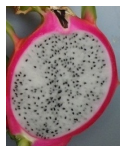


### Cebra: a high acid pitahaya



	%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
<b>Aldehydes</b>		
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
<b>Hydrocarbons</b>		
p-Cymene	pCym	Solvent, citrus
Limonene	Lim	Citrus, fresh
Dodecane	Dod	Alkane
Tridecane	Tdec	Alkane
<b>Alcohols</b>		
Ethanol	EtOH	Ethanol
Linalool	Lin	Citrus, floral
Hexanol	Hex	Green, fruity
<b>Other</b>		
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

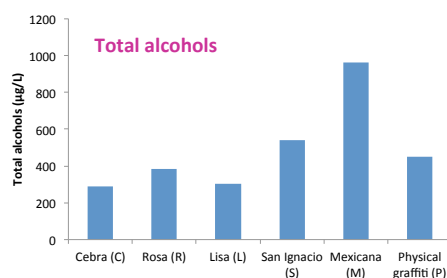
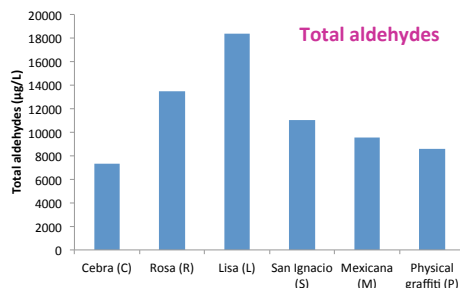
Threshold for perception

<sup>a</sup>Aroma descriptors from the University of Florida Citrus Flavor and Color Database (Rouseff, 2014) and the Good Scents Company ([http://the\\_goodscentcompany.com/index.html](http://the_goodscentcompany.com/index.html)).

From D. Obenland, USDA

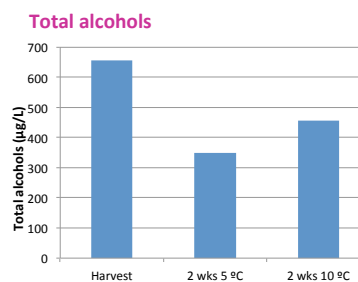
### Aroma volatiles differ among Pitahaya varieties

Examples of total aldehydes (green, herbal notes) and alcohols (floral and fruity notes)



### What happens to aroma volatiles after storage?

- Aldehydes increased
- Hydrocarbons remain same
- Alcohols and others decrease



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.

