# Pitahaya postharvest management and sensory evaluation

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# Pitahaya Storage
## (near full ripe at harvest)

- **Non-climacteric fruit; moderate respiration rate**
  - very low ethylene production
  - color is not stimulated by ethylene
- **50 to 54°F, 85-90% RH for shelf-life of 2-3 week; 57°F 2 weeks**
- **68-77°F (ambient) shelf-life of ~ 1 week**
- **Chilling sensitive**
  - Maturity, temperature, time all affect chilling damage
  - Chilling occurs at 45°F or lower (but 1 study indicated best temp is 43°F)
  - 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% $O_2$ at 54°F; marketable to 30D, but decrease in sugars, Vit C, acids
  - 2 reports of MAP up to 30 days, main benefit from reducing water loss
- **What is the impact of storage on sensory quality?**

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.

# Quality aspects for fresh produce

## External characteristics

- Color
- Shape
- Blemishes
- Decay
- Affects initial decision to purchase
- Generally longer shelf life

## Internal characteristics

- **Flavor**
- Texture
- Nutrition
- Affects decision for repeat purchase
- Generally shorter shelf life

# History of Sensory Evaluation

- Late 1940's – US Army Food and Container Institute – Development of the 9-Point Hedonic Scale
- Late 1940's – Development of Descriptive Analysis Methods
- Development of Sensometrics – the application of statistics to the analysis of sensory data

# Results for Pitahaya Field Day (2007)

- **Flavor**
  - When you can see the fruit
  - Under red light which masked the appearance of the samples
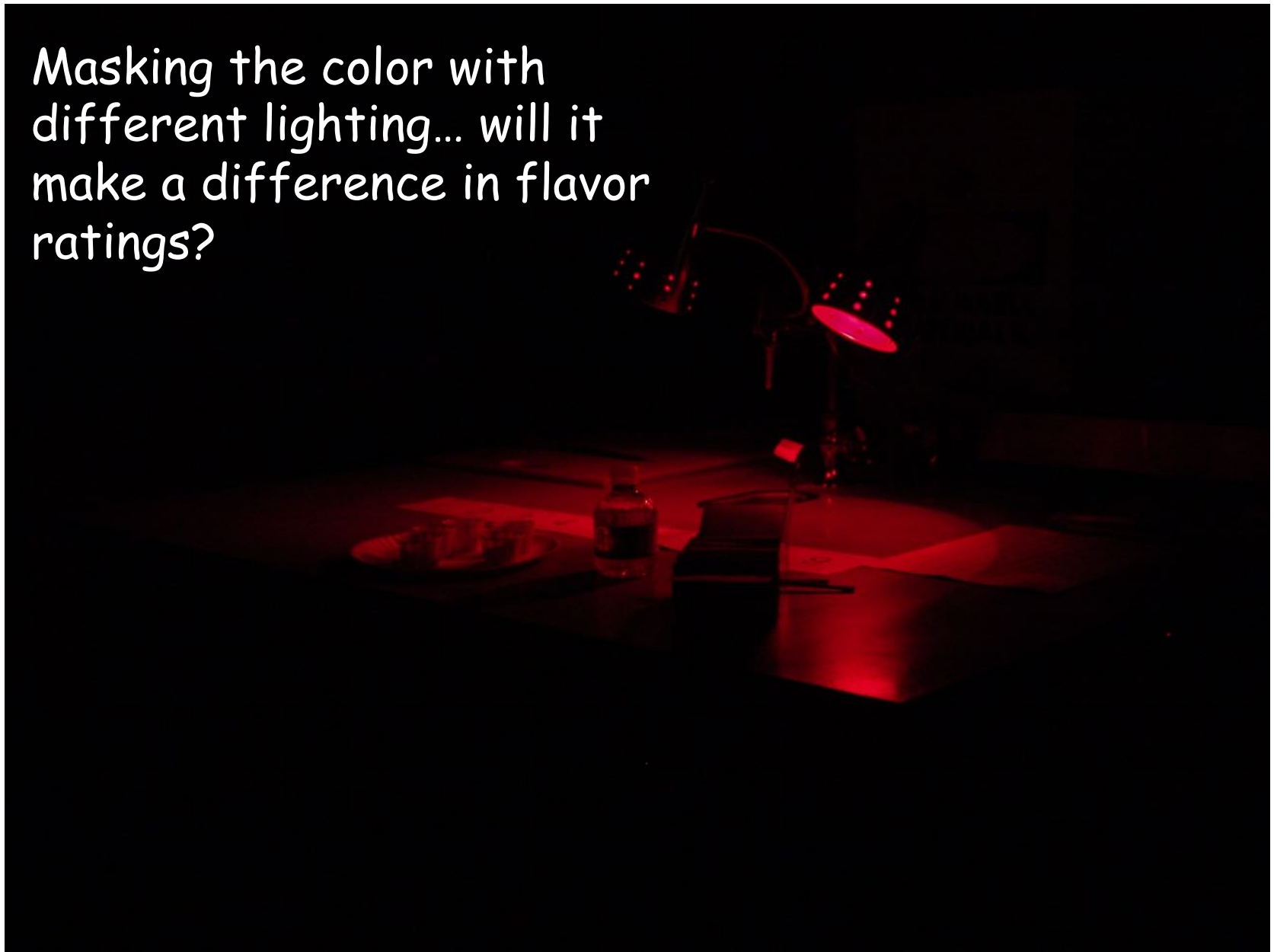
American Beauty
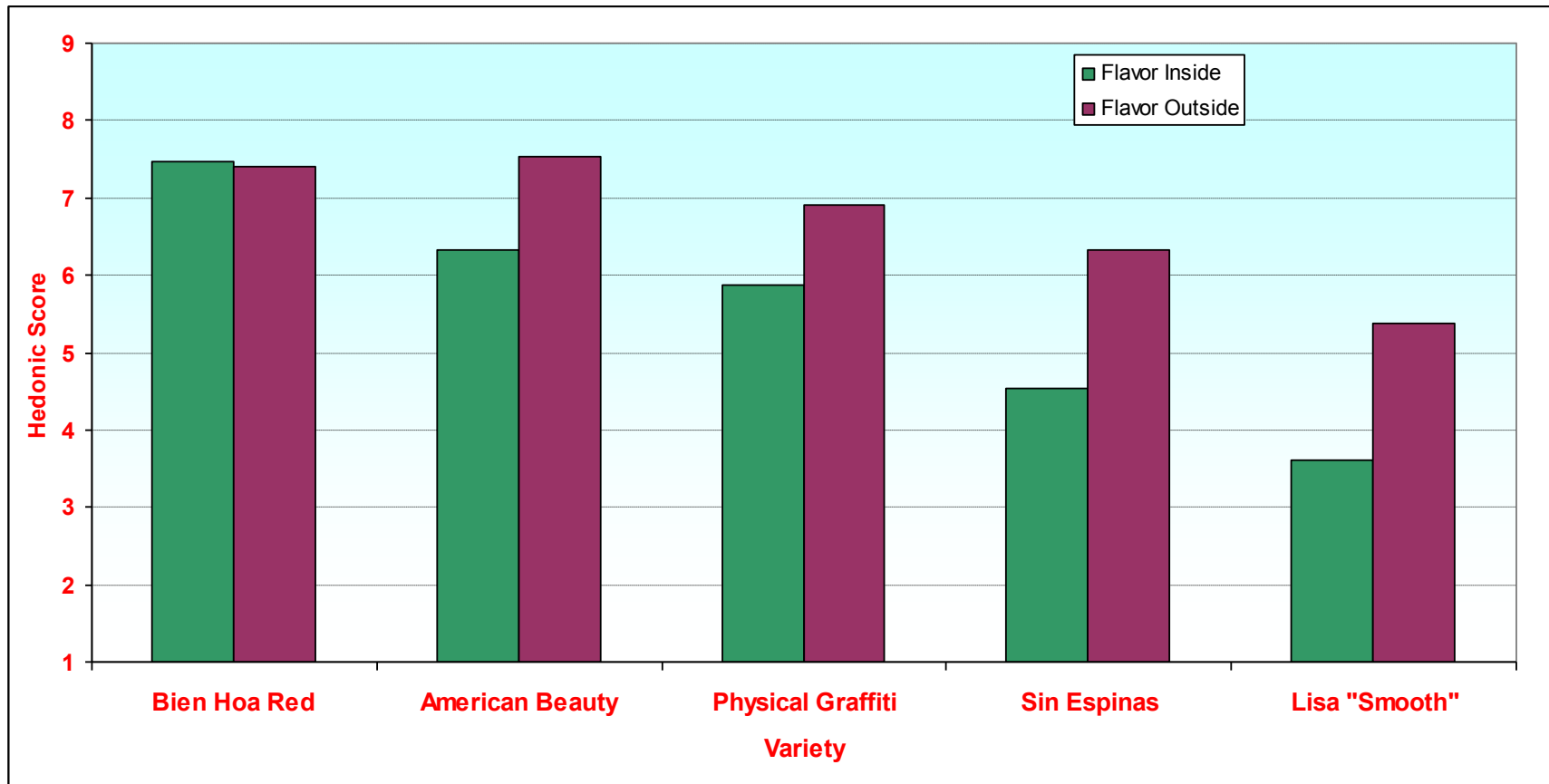
Lisa "Smooth"

Bien Hoa Red

Physical Graffiti

Sin Espinas

Masking the color with different lighting... will it make a difference in flavor ratings?
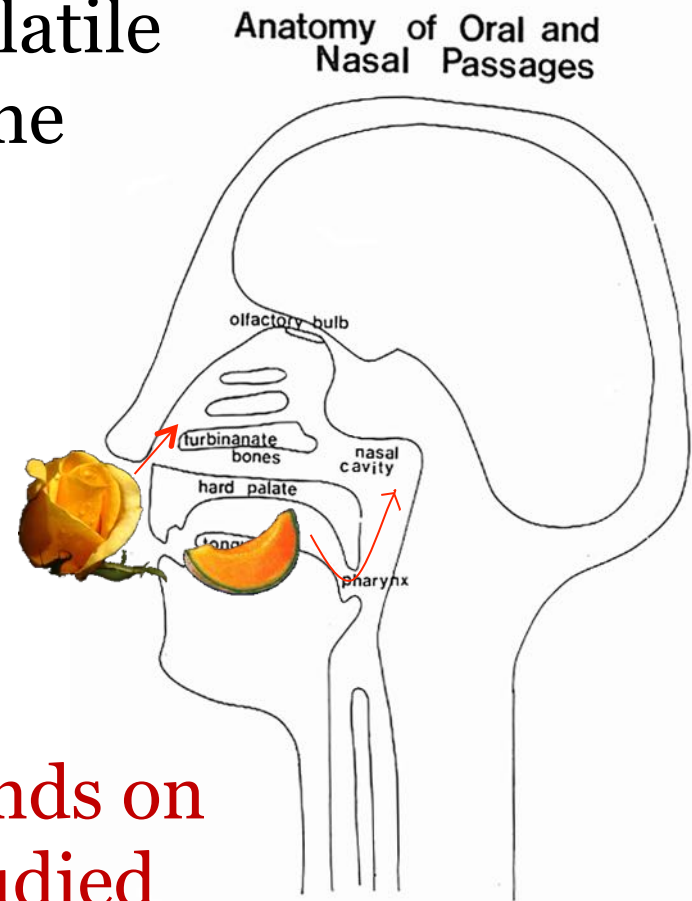
Flavor
Comparing the difference between 2 flavor tests

Note that all in hedonic (liking) rating declined when appearance was masked except Bien Hoa Red

# Aroma compounds (Volatiles)

Aroma (or smell or odor) is the sensation perceived when volatile compounds are drawn into the **nose**.

These compounds are also perceived by the brain when they travel up the **back of the throat**.

The impact of these compounds on pitahaya flavor been little studied



Anatomy of Oral and Nasal Passages

olfactory bulb

turbinanate bones

nasal cavity

hard palate

tongue

pharynx

Florence Negre-Zakharov, UC Davis

# Experiments conducted

- 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 (Cantwell)
  - Sugars, acids, betacyanins, antioxidant activity
- Sensory and volatiles (Arpaia and Obenland)
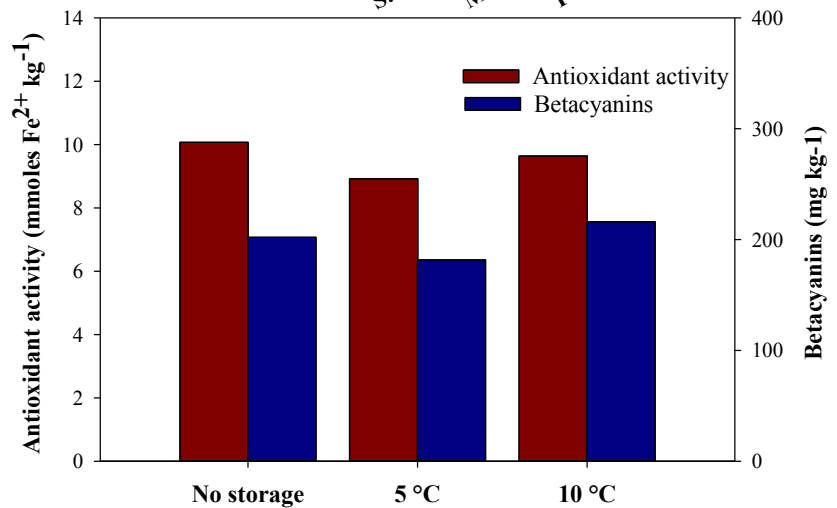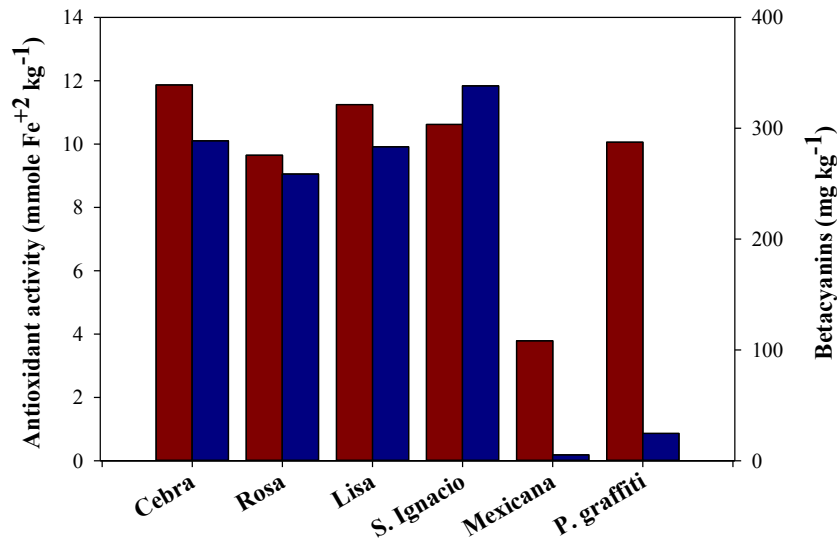  - Sensory, semi-expert panel, flavor and appearance
  - Aroma volatiles

Cebra

San Ignacio

Pitahaya
cultivars
studied

Rosa

Physical Graffiti
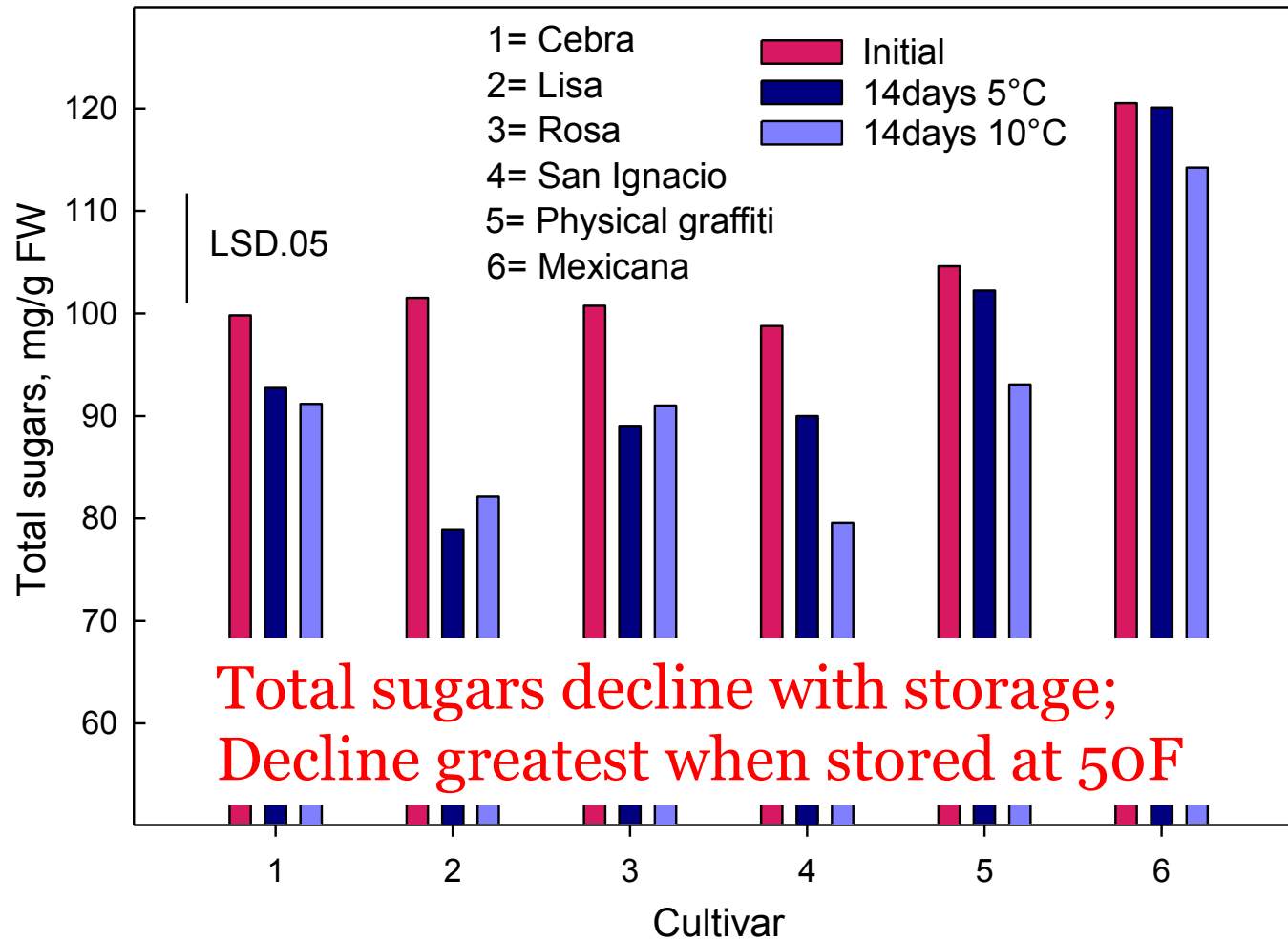
4 red flesh
1 pink flesh
1 white flesh

Lisa

Mexicana

# Fruit composition: Antioxidants and Betacyanins



- Antioxidants can help protect the body against oxidative stress
- Amount of red betacyanin pigment determines flesh color and is an antioxidant
- Varieties differ in antioxidant activity
- Pitahaya stored at 5 °C have slightly less antioxidants than those stored at 10°C or at harvest

**Fruit composition: Total sugars**

1= Cebra
2= Lisa
3= Rosa
4= San Ignacio
5= Physical graffiti
6= Mexicana

- Initial
- 14days 5°C
- 14days 10°C

LSD.05

Total sugars, mg/g FW

Cultivar

Total sugars decline with storage;
Decline greatest when stored at 50F

# Fruit composition: Total acids



Total acids decline with storage;
Decline greatest when stored at 50F

Legend:
- Initial
- 14days 5°C
- 14days 10°C

1= Cebra
2= Lisa
3= Rosa
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6= Mexicana

Y-axis: Total acids, mg/g FW
X-axis: Cultivar

LSD.05

# Fruit composition: Sugar:acid ratio
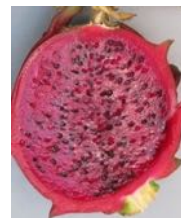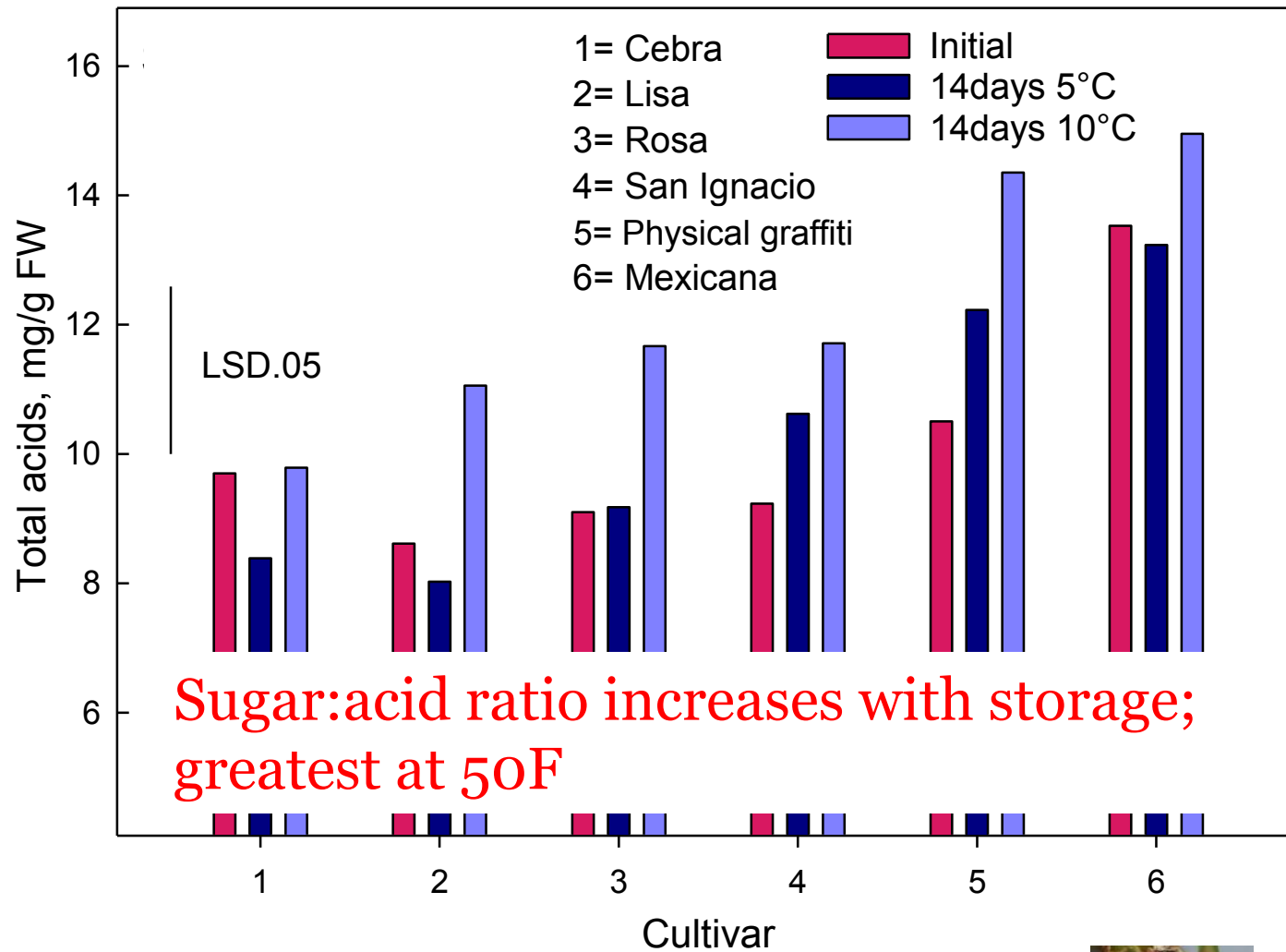


**Total acids, mg/g FW**

1= Cebra
2= Lisa
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6= Mexicana

■ Initial
■ 14days 5°C
■ 14days 10°C

LSD.05

Sugar:acid ratio increases with storage; greatest at 50F

Cultivar

# Aroma compounds (Volatiles)

Aroma (or smell or odor) is the sensation perceived when volatile compounds are drawn into the **nose**.

These compounds are also perceived by the brain when they travel up the **back of the throat**.

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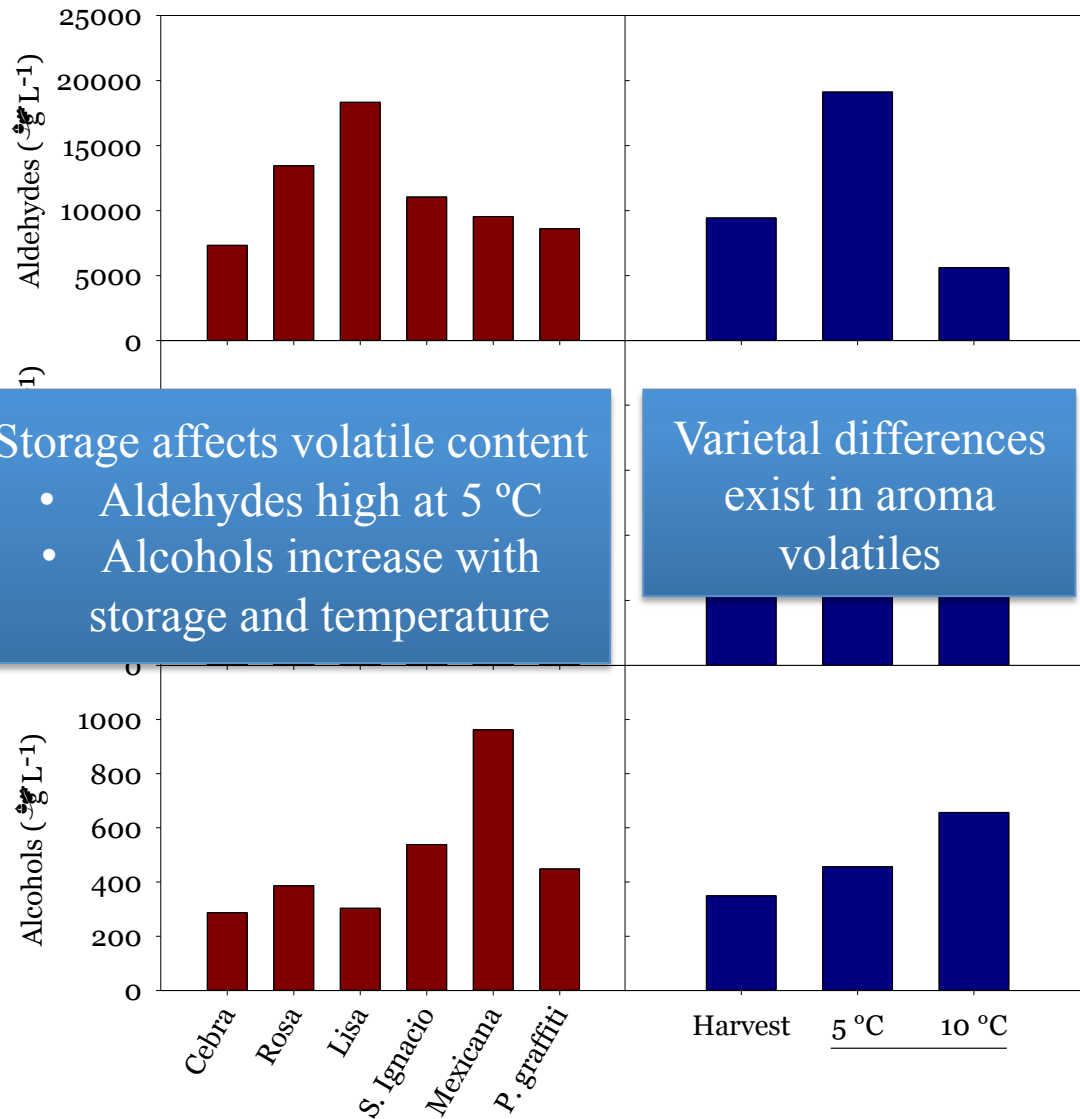Florence Negre-Zakharov, UC Davis
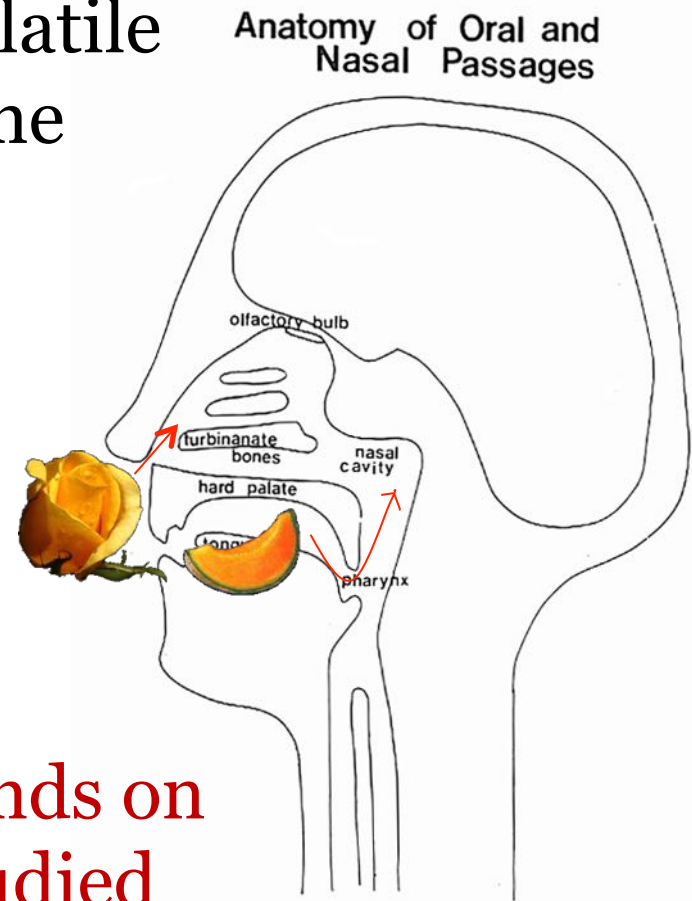
# Fruit composition: aroma volatiles

**Volatile descriptors:**

- Green, grassy
- Fruity, banana
- Fatty, waxy
- Floral, citrus

- Citrus
- Fresh

- Floral, citrus
- Green
- Fruity



Storage affects volatile content
- Aldehydes high at 5 °C
- Alcohols increase with storage and temperature

Varietal differences exist in aroma volatiles

# Flavor evaluation by sensory panel

- Semi-expert
- 12 to 15 panelists from the UC Kearney Agricultural Center

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 much | Like extremely |
| **463** | | | | | | | | | |
| **Overall Eating Quality** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Flavor** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Sweetness** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Tartness** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| **Flesh/Pulp Texture** | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

# Sensory panel results

1=Cebra
2=Rosa
3= Lisa
4= San Ignacio
5= Mexicana
6= Physical Grafitti



* = best tasting

* = best flavor and sweetness
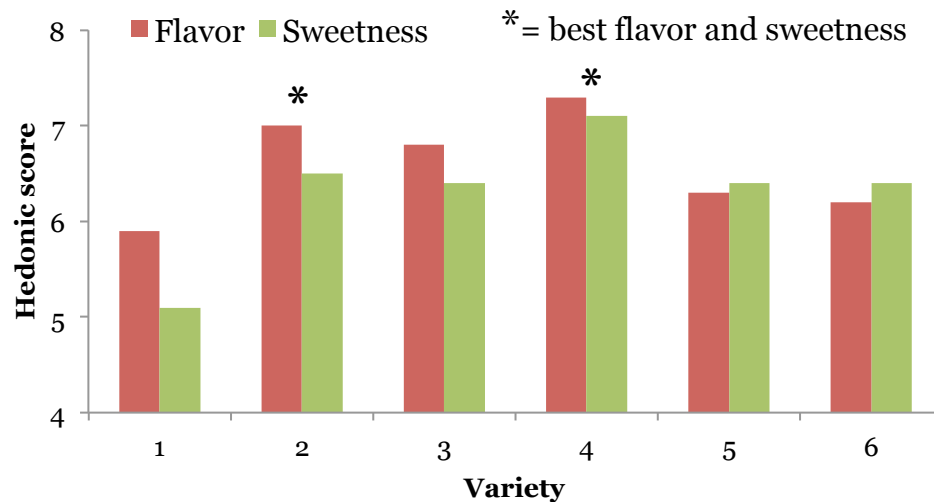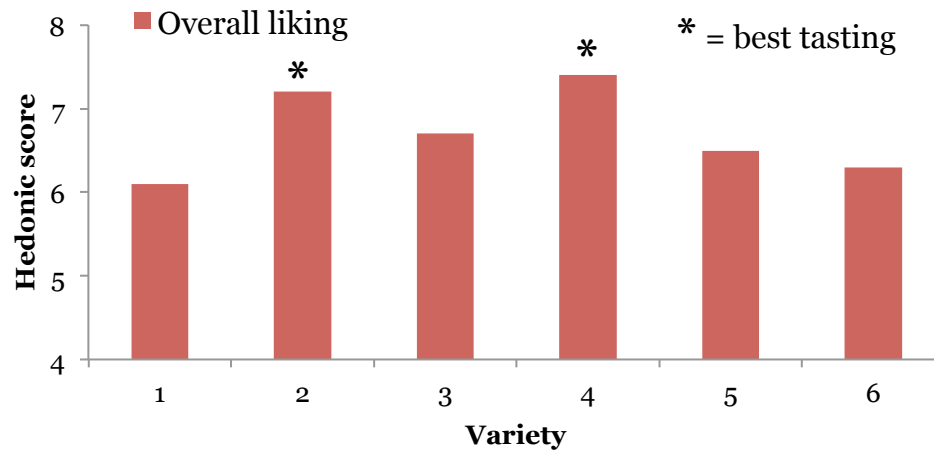
- No differences in tartness or texture
- No effect of storage on flavor or appearance
- Best tasting varieties had the most likeable flavor and sweetness
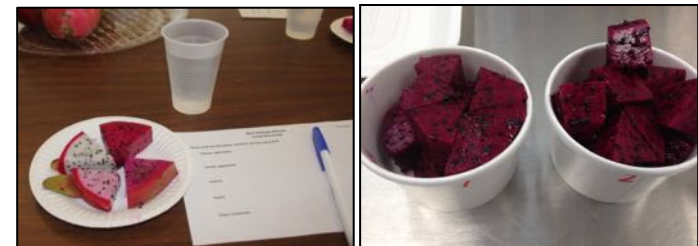
# Conclusions

- Storage of pitahayas for two weeks at either 5 °C or 10 °C caused a loss in sugars and acids and changes in aroma volatiles

- Regardless of the changes in composition sensory panelists were not able to determine differences in likeability, flavor, sweetness, tartness or texture among the storage treatments

- Antioxidant activity was slightly less in pitahayas stored at 5 °C

- Varieties that were most liked had high overall flavor scores and high sweetness

# Future research interests

- Changes in flavor/volatiles during fruit development
- Changes in flavor after storage when held at ambient temperature
- Does flavor components change during the season in relation to different flowering cycles?

Do you have any problems with storage of pitahayas?

What flavor properties do you associate with excellent pitahaya flavor?

Any questions?