Pitahaya postharvest management and sensory evaluation

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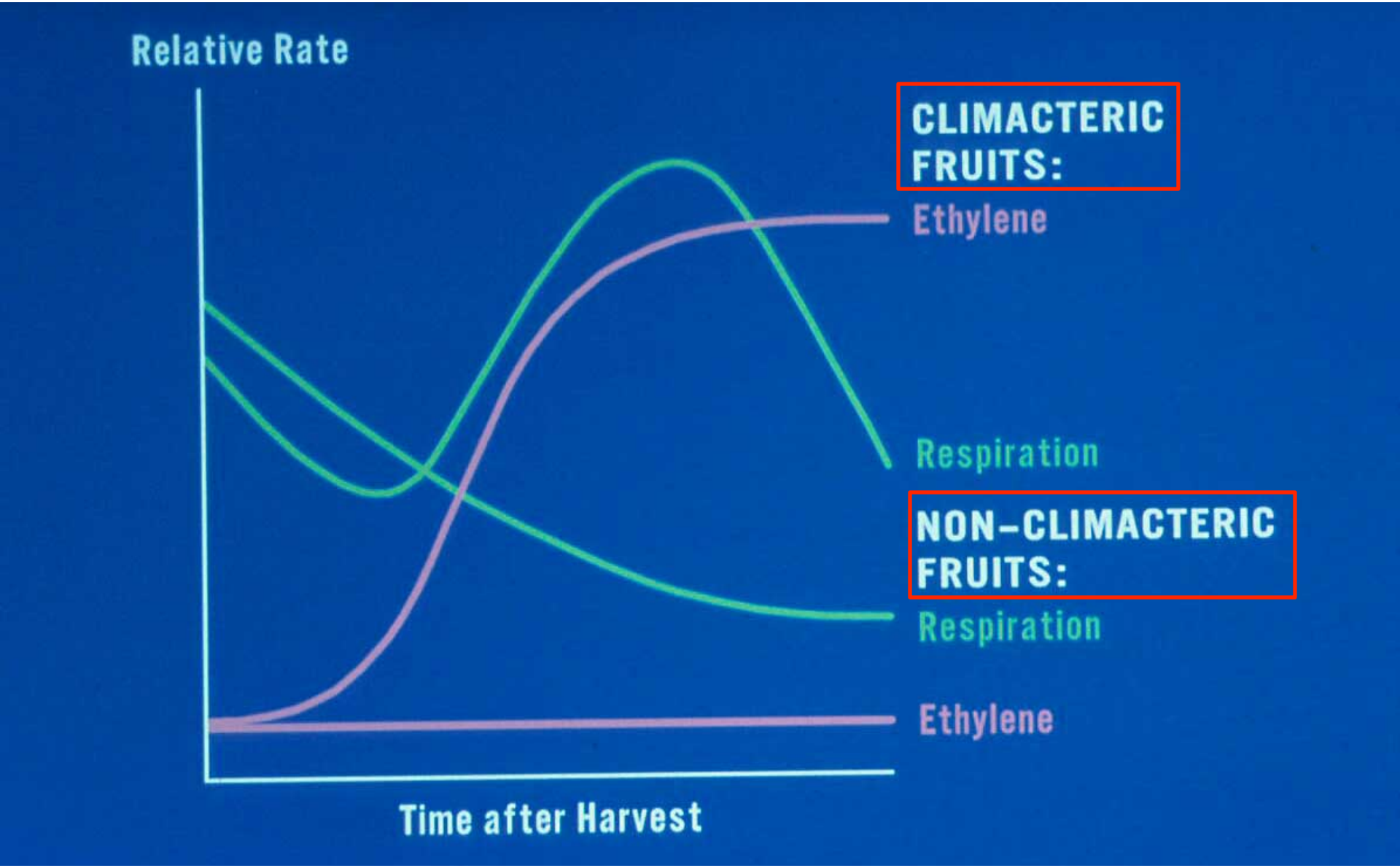
Basic Pitahaya Postharvest Biology

Pitahaya

- *Non-climacteric*
- *Chilling sensitive*

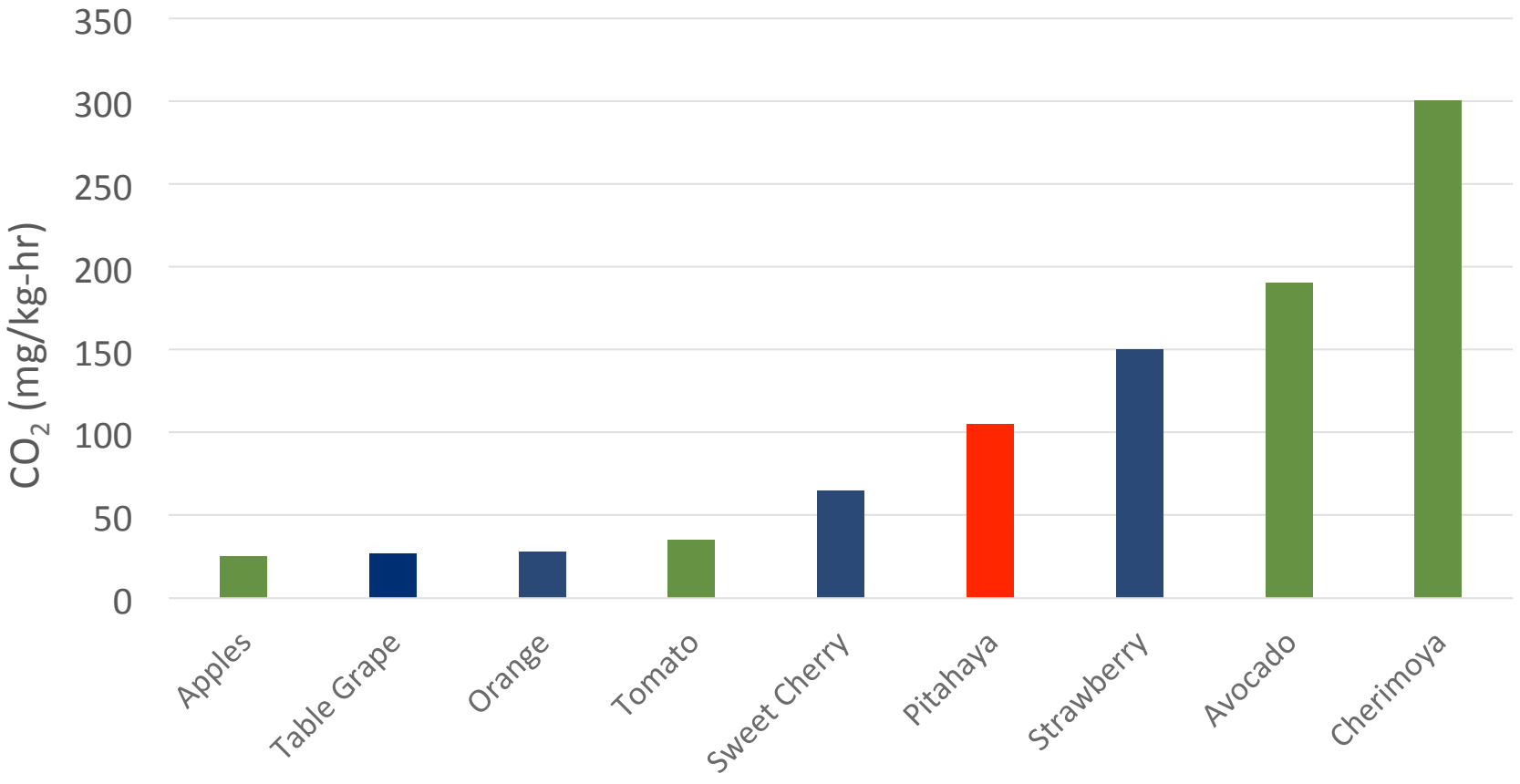
Respiration and ethylene production rates of climacteric vs. non climacteric fruit



Why are we concerned about respiration rate?

The rate of deterioration (perishability) is generally proportional to the respiration rate

Respiration Rate Comparison at 68F



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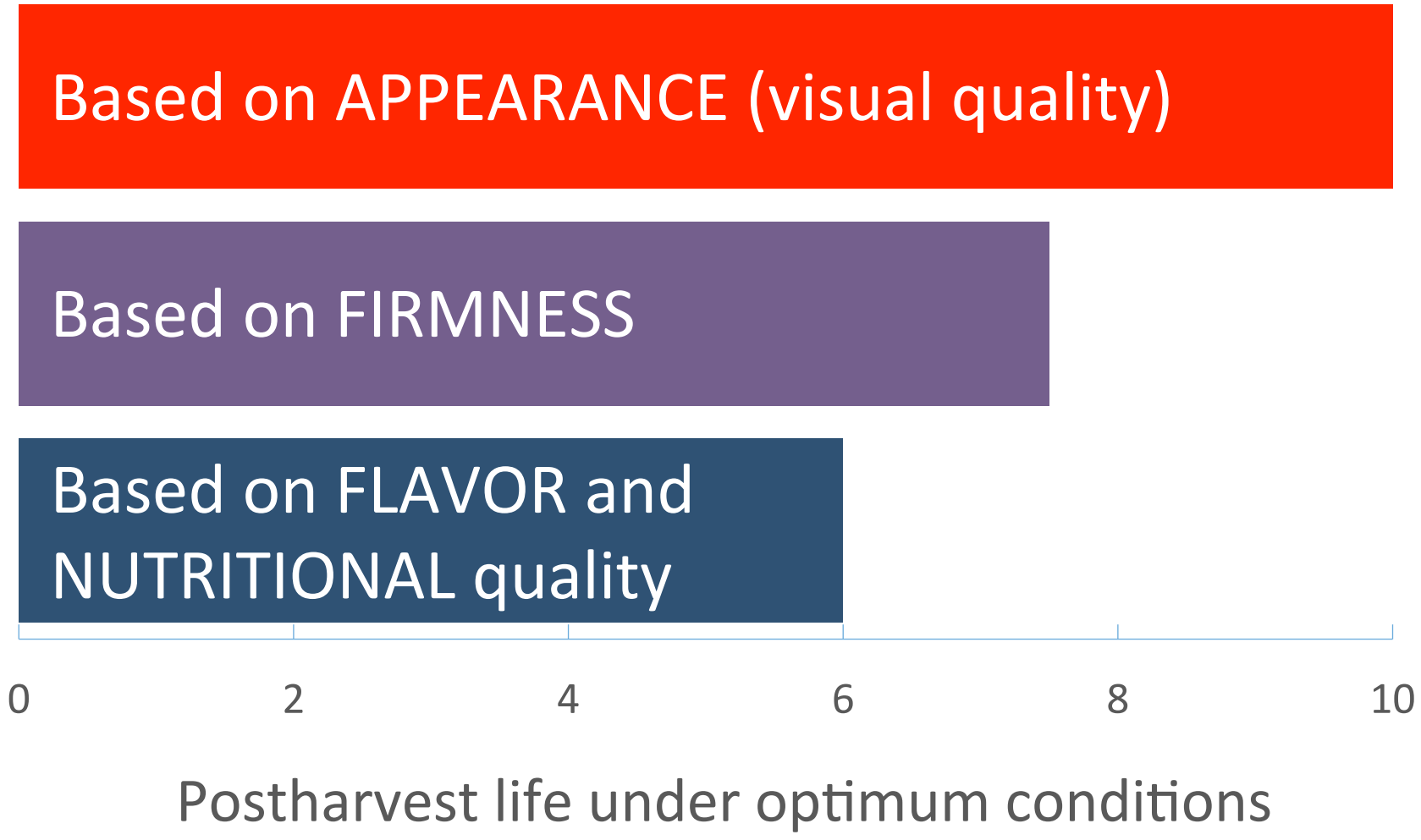
Relative Perishability	Potential storage life (weeks)	Commodity
Very High	<2	Strawberry, Blackberry, Blueberry
High	2 to 4	**Pitahaya**, Grape, Mandarin, Peach
Moderate	4 to 8	Apple, Pear, Orange, Grapefruit, Lime, Kiwifruit
Low	8 to 16	Apple, Pear, Lemon
Very Low	>16	Tree Nuts, Dried Fruits

Kader, Postharvest Biology

Flavor life is shorter than Appearance Life



When should you harvest the fruit?

Horticultural Maturity Indices include:

- Skin Color
- Internal Color
- Soluble Solids Content (SSC)
- Total Acidity (TA)
- SSC/TA ratio (40:1 has been suggested)
- Days from flowering (minimum 32 days)

Handbook 66, 2016

Handling, Storage and Chilling Injury

The main sources of fruit loss are due to:

Dehydration and Shrivel

Mechanical injury

Decay

Chilling Injury

Fruit Storage

Since Pitahaya is a group of diverse genera and species there is most likely great diversity in optimum storage requirements

General recommendations:

- 50 – 54°F, 85 – 90% RH for 2 – 3 weeks; 57°F for 2 weeks
- 68 - 77°F (ambient conditions) shelf life of ~ 1 week

Chilling Injury

- Maturity, temperature, time all influence the extent of chilling injury
- Chilling occurs at 45°F or lower (1 study concluded optimum temperature is 43°F)
- The transfer from storage to ambient conditions accentuates injury symptoms

Symptoms include: bract darkening, loss of flavor and firmness, pulp translucency

Pulp Translucency

Note darkening of pulp tissue

Symptoms can occur after ~7 days storage below 50°F

Rosendo Balois-Morales et al., 2013

Packaging

Can reduce fruit injury during subsequent marketing

Can Modified Atmosphere Packaging Prolong Storage Life?

- 1 – 3% O_2 at 54°F; fruit "marketable to 30 days but there was a decrease in sugars, Vitamin C and acids
- There are 2 reports that MAP can extend shelf life up to 30 days but the main benefit was from reducing water loss

No data on impact on eating quality

Handling Damage

mainly damage to the bracts and shriveling

Woolf et al.

Postharvest Decay

Associated with damage

Range of bacterial and fungal infections

STEM END ROT

BODY ROT

Woolf et al.

Pitahaya Storage
(near full ripe at harvest)

Postharvest Losses
Dehydration, Shrivel
Mechanical Damage
Decay
Chilling Injury

- **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.

Evaluation of California Material

Quality aspects for fresh produce

External characteristics

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

Internal characteristics

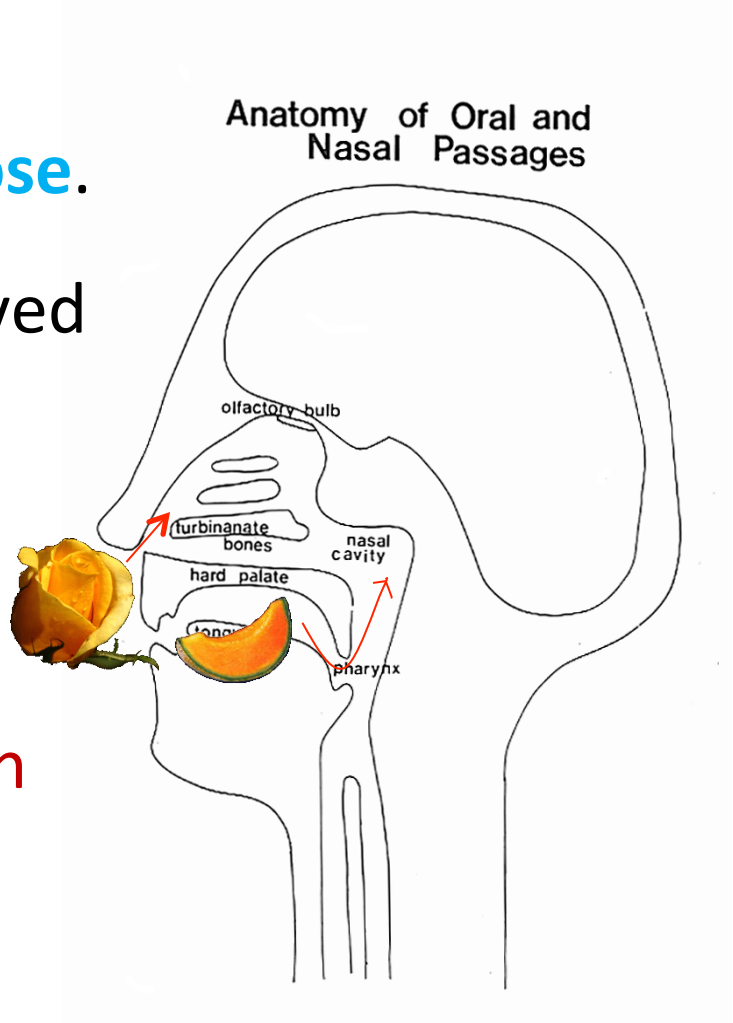
- **Flavor**
- Texture
- Nutrition
- Affects decision for repeat purchase
- Generally shorter shelf life

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



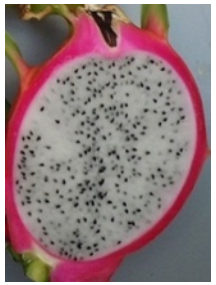
Experiments conducted

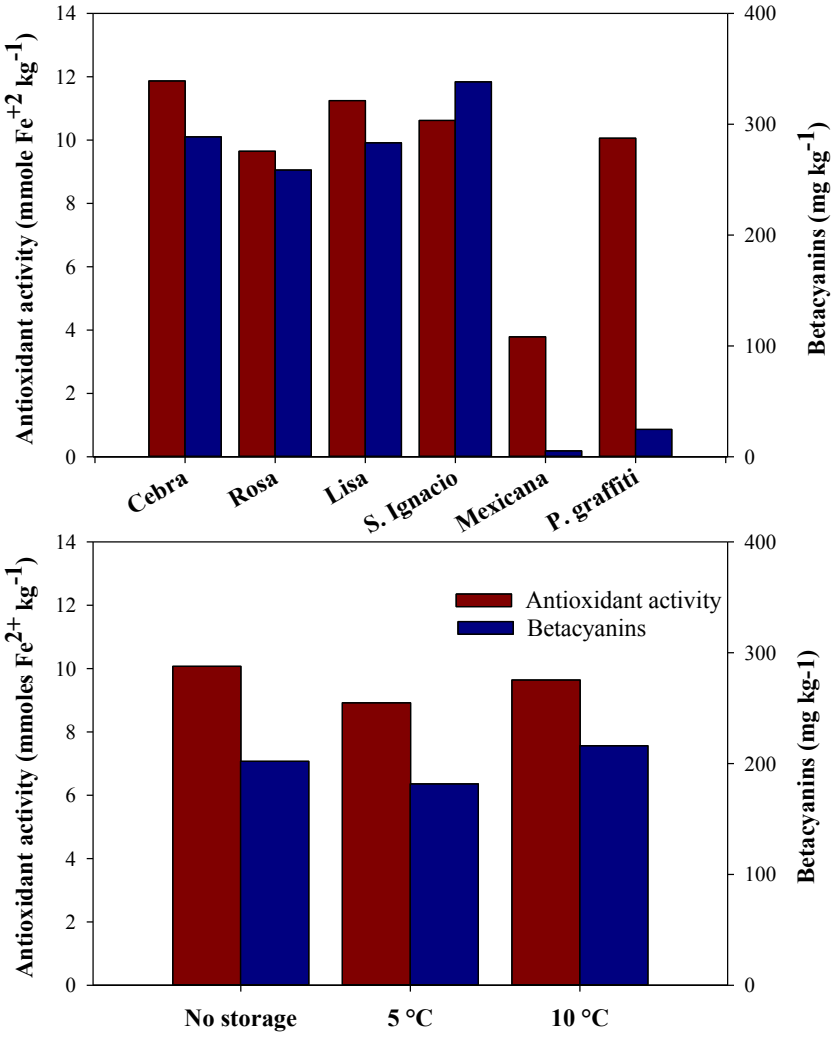
- Fully ripe fruit harvested Sept 30
- Composition, storage and sensory evaluation
- Harvest, 14d at 41°F, 14d at 50°F
- Composition (Cantwell)
  - Sugars, acids, betacyanins, antioxidant activity
- Sensory and volatiles (Arpaia and Obenland)
  - Sensory, semi-expert panel, flavor and appearance
  - Aroma volatiles

Pitahaya cultivars studied

4 red flesh
1 pink flesh
1 white flesh

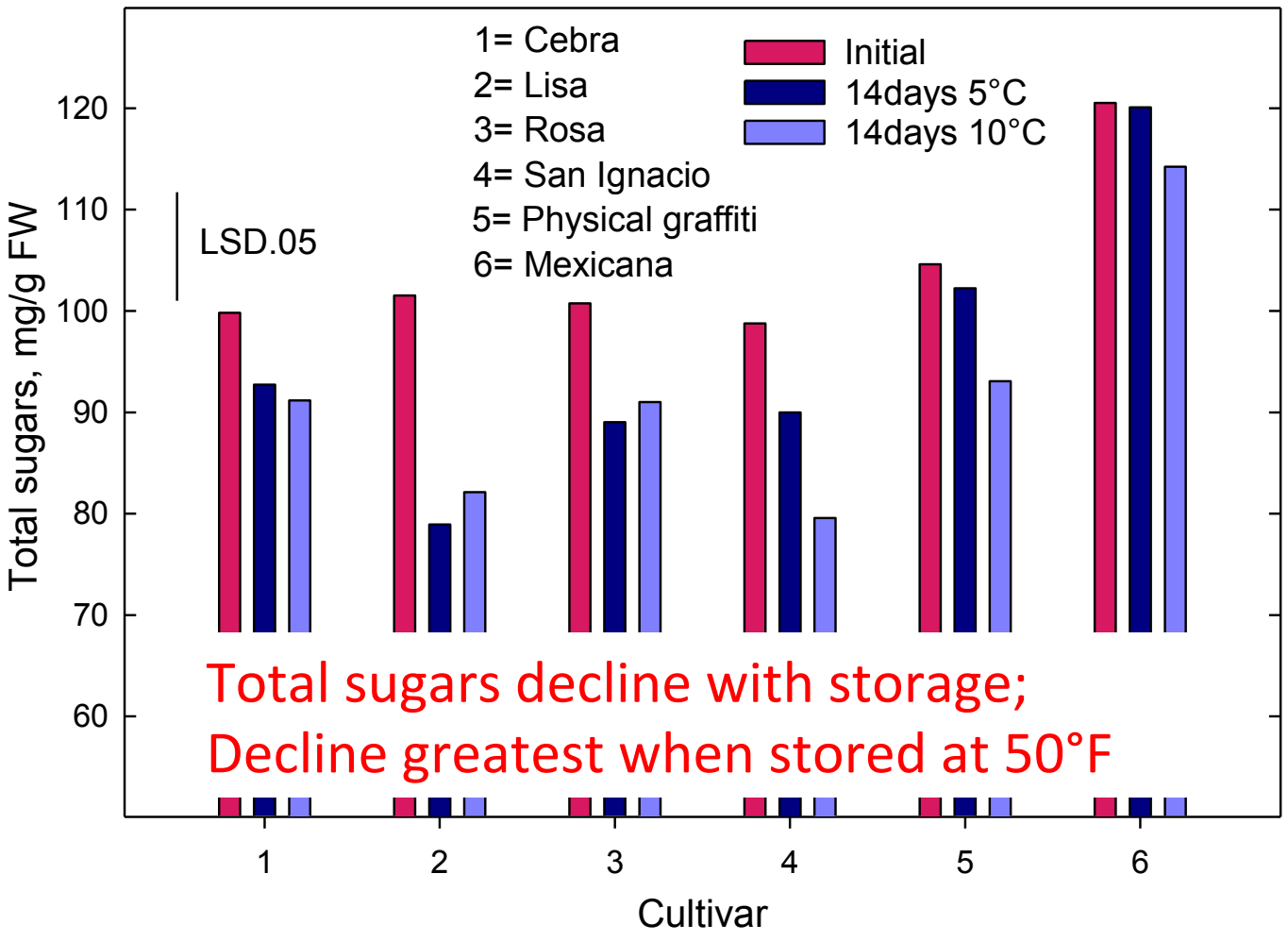
Fruit composition: Antioxidants and Betacyanins

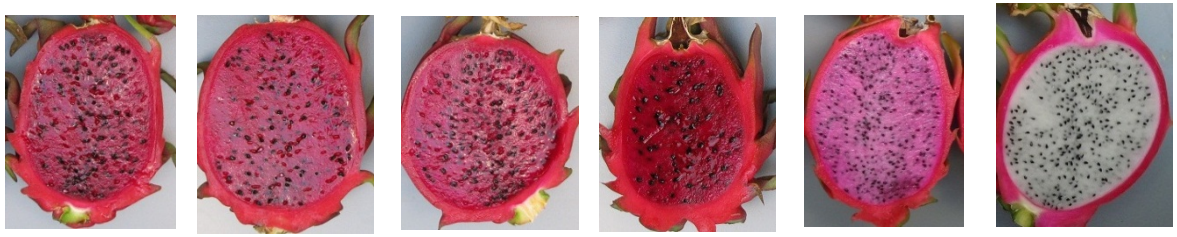




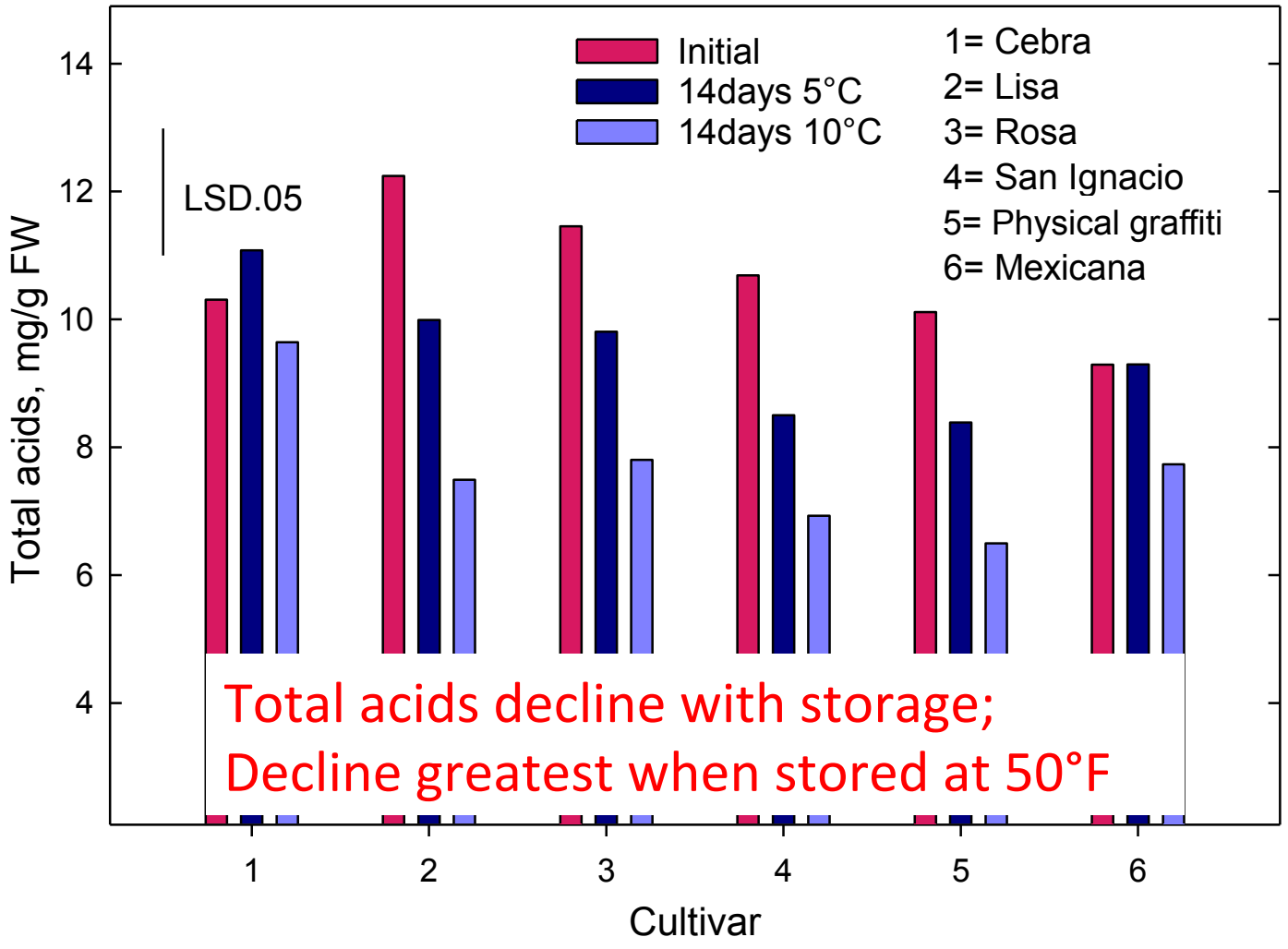
- Antioxidants can help protect the body against oxidative stress
- Amount of red betacyanin pigment determines flesh color and is an antioxidant
- Varieties differ in antioxidant activity
- Pitahaya stored at 41°F have slightly less antioxidants than those stored at 50°F or at harvest

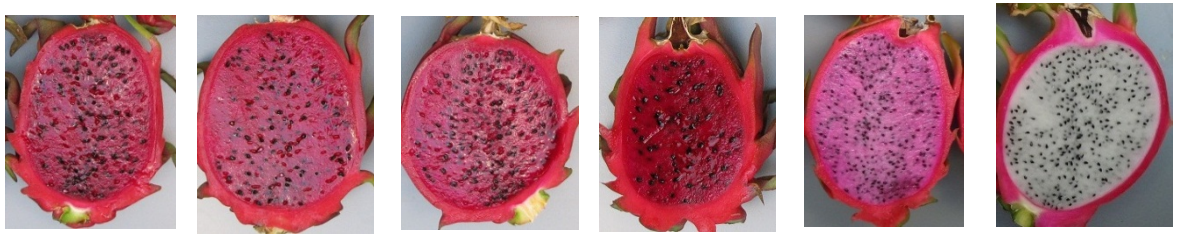
Fruit composition: Total sugars



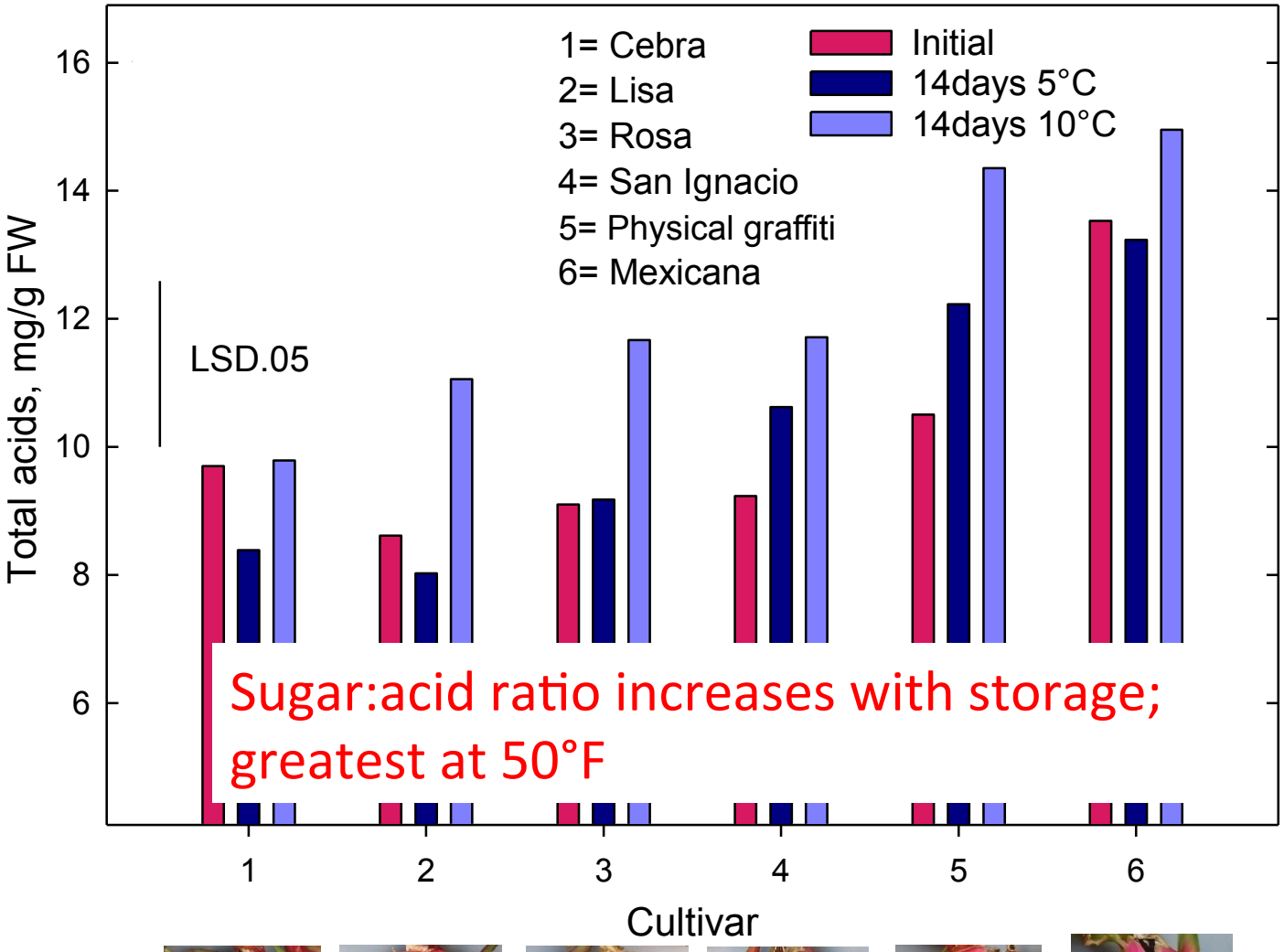


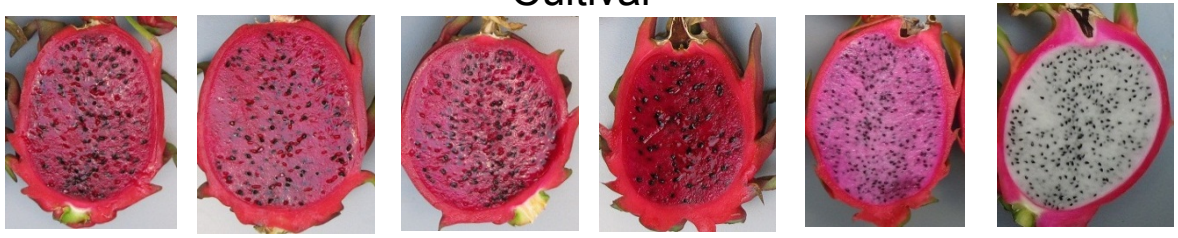
Fruit composition: Total acids





Fruit composition: Sugar:acid ratio





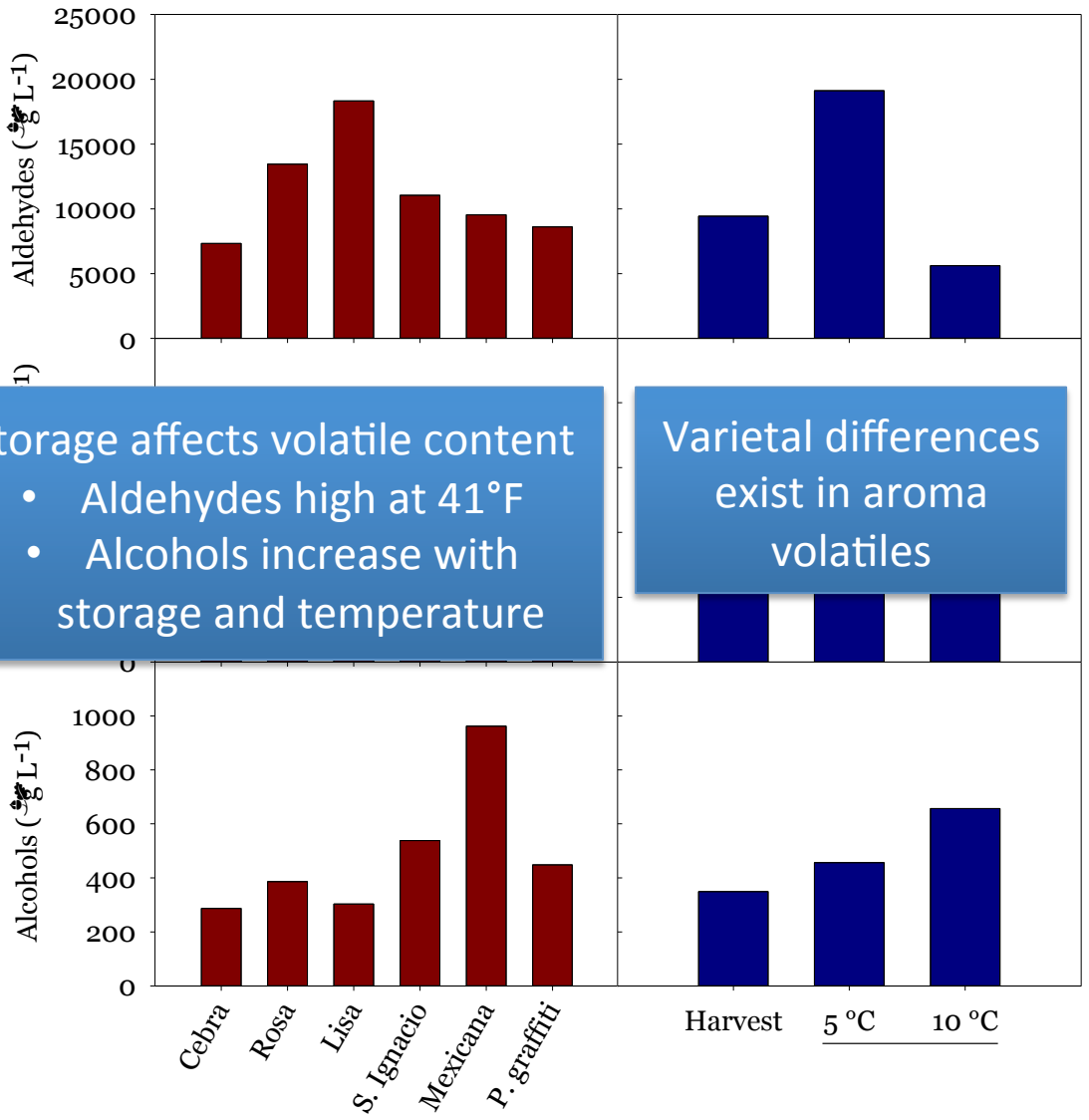
Fruit composition: aroma volatiles

Volatile descriptors:

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

- Citrus
- Fresh

- Floral, citrus
- Green
- Fruity

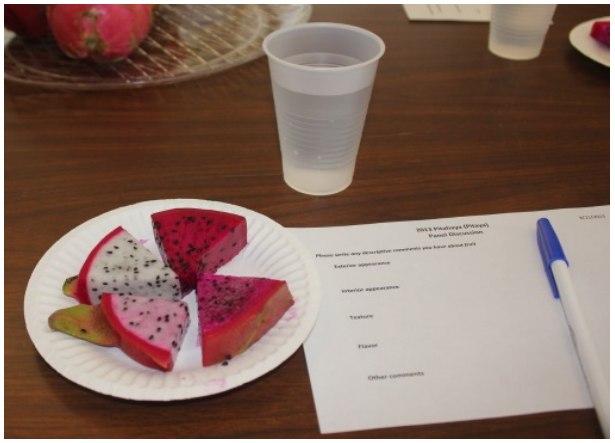


Storage affects volatile content
- Aldehydes high at 41°F
- Alcohols increase with storage and temperature

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.

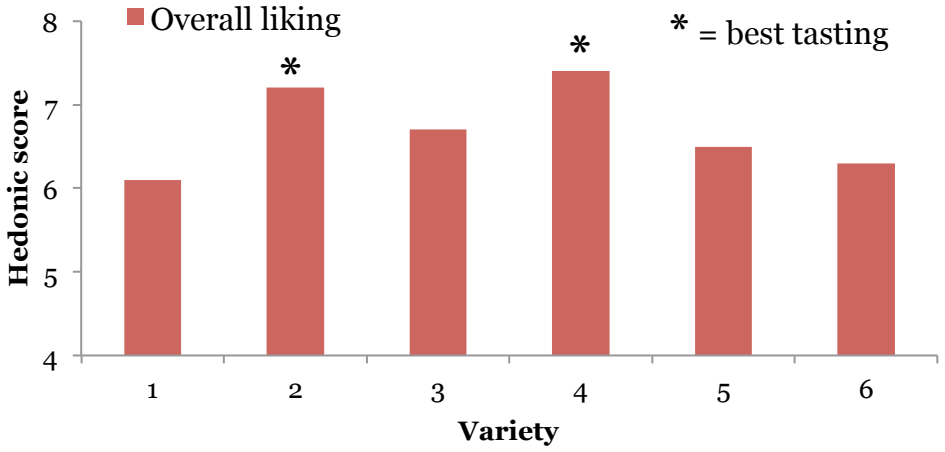
Rinse mouth with water between samples.

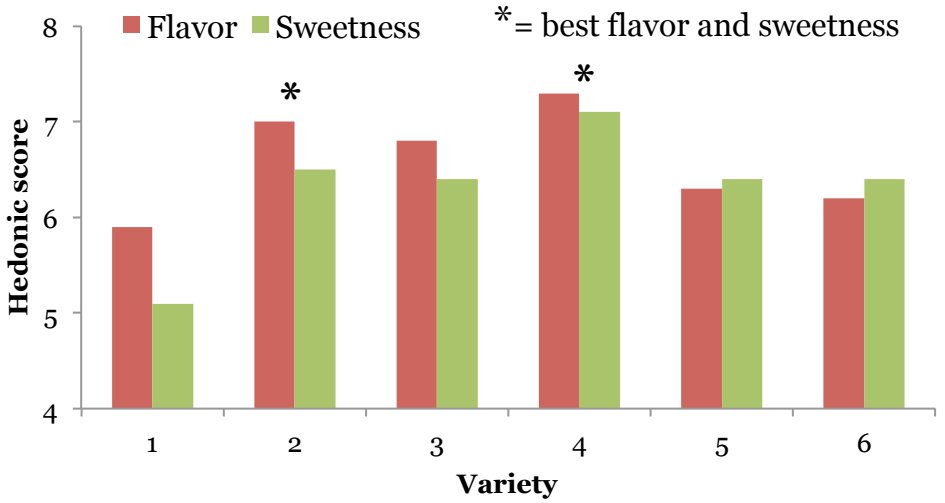
463

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





- 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 41°F or 50°F 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 41°F
- Varieties that were most liked had high overall flavor scores and high sweetness

Future research interests

- Great understanding of postharvest requirements
- Changes in flavor/volatiles during fruit development and influenced by seasonality
- Changes in flavor during and after storage
- Optimizing packaging and cooling postharvest

If you are interested in obtaining a FREE copy of this assessment manual contact me

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Do you have any problems with storage of pitahayas?

What flavor properties do you associate with excellent pitahaya flavor?

Any questions?