Relación entre pre y post cosecha de la palta

Mary Lu Arpaia
University of California, Riverside

Quality and the Farmer
What is under your control?
The continuum

The most important thing to remember is that there is a continuum from the grower to the consumer

The steps in the continuum
Grower - Packer - Distribution - Consumer

Quality

The inherent properties or attributes of a product which determines its relative degree of excellence
Avocado Quality Attributes

Can mean many things, depending at what point one is assessing the fruit

How do you as a grower perceive “quality”?

Appearance Factors

- Fruit size and shape, peel texture
- Freedom from defects such as insect scarring, wind damage, limb rub

Avocado Quality Attributes cont.

Past the grower - the Packinghouse

- Appearance to maximize packout of #1 fruit
- "History of the grove" - STRESS, LOCATION
- Picking conditions - HOT, DRY vs WET
- Delay from harvest to packer
- Time of season - MATURITY
Avocado Quality Attributes cont.

Past the grower - Distribution

- Source of fruit at certain times of the year - MATURITY
- Product Uniformity
- Ability to take ethylene in a predictable manner
- Have some storage life to adapt to marketing situations

Avocado Quality Attributes cont.

Past the grower - Consumer

- Source of fruit? California vs other???
- Product Uniformity
- Ability to predict when ready to eat
- Freedom from defects
- Eating quality
Problems that you can find at the retail level with avocados

Body Rot

Stem End Rot
Postharvest Diseases

- Anthracnose
- Body Rot
- Dothiorella
- Stem End Rot
- Alternaria
- Stem End Rot

Different symptoms of internal bruising
- Seed cavity
- Air pocket
- Bruising underneath Peel
- Extending into the flesh
- Internal Bruising
Peeling ease ranging from extremely difficult (left) to very easy (right)

Shriveling

Flesh/Mesocarp Discoloration

Preharvest factors influencing fruit quality
Preharvest Factors

- Environmental
- Rootstock/Scion
- Spacing and Pruning
- Pest Management
- PGRs
- Irrigation
- Nutrition

These factors are interactive and influence each other

How preharvest factors may influence fruit quality

- Development and maturation
- Physical effects on quality and packout
- Susceptibility to physiological and pathological breakdown
Climate and environment

- Temperature
- Wind
- Rainfall
- Air quality
- Fruit position on tree

Freeze Damage = Cold Stress

Beware of discoloured stems

Can see increased decay and low temperature damage after storage

Effects could last for several weeks/months
More body rots develop when fruit are harvested during the rainy period than dry summer months.
During rainy periods (like January), Colletotrichum is most common. During dry periods, Colletotrichum remains common but Dothiorella and other fungi are found.

**Things to ponder**

- Should freeze damaged fruit go into the market stream?
- Should you be tempted to pick up fruit from the ground?
- Should you pick after rain?
Rootstock and Variety Interactions

**Effect of avocado cultivar and clonal rootstock on fruit quality following 28 days at 5.5°C**

% freedom from chilling injury

Kohne and Kohne, 1992 (unpublished)

**Rootstock and Variety Interactions**

Results from Australia
20 yr-old trees
4 wks @ 5°C

Rootstocks affect ‘Hass’ avocado fruit rots and physiological disorders

Marques, Hofman 2002
Effect of long-term irrigation regimes on the browning potential of ‘Fuerte’ avocado after 30 days storage

Irrigation effects on fruit quality

Increased browning potential following storage = mesocarp discoloration

J.P. Bower, 1988
**Effects of tree vigor on fruit quality**

Individual tree yield records were maintained.

Based on overall tree yield and storage quality the following observations were made:

- In vigorous, low yielding trees all forms of chilling injury were observed in higher amounts following 28 days at 5.5°C.
- Low yielding trees had lower pulp calcium, zinc and manganese.

D. Smith, 1992 (unpublished RSA)

---

**Tree yield and fruit rots (Australia)**

![Graph showing the relationship between fruit yield and Anthracnose](image)

- Higher yield for same size tree may also reduce postharvest decay.
- Associated with smaller fruit and higher fruit Calcium.

Hofman, Vuthapanich, Whitey, Klieber, Simmons 2001
Tree vigor influences calcium levels in the fruit
Calcium affects the rate of ripening

Canopy Management/Pruning
May have an effect on fruit quality
Aim at fruit requirements not wood
Increased vegetative vigor from pruning can result in increased decay and physiological disorders.

The relationship between subsoil (Ca+Mg)/K ratio and the incidence of grey pulp in avocados.

The role of plant nutrition.

The influence of fruit calcium and zinc levels on the incidence of pulp spot.
HIGH NITROGEN

- EXCESSIVE VIGOUR
- LACK OF CALCIUM, BORON AND CARBOHYDRATES TO FRUIT
- MAY RELATE TO CARBOHYDRATE TRANSPORT
- ENZYME CO-FACTORS
- CELL FUNCTION

The influence of nitrogen nutrition on moderate/severe chilling injury after 6 weeks at 5°C.

The role of Nitrogen on 'Hass' fruit quality

The influence of nitrogen nutrition on the time to eating ripeness.
Calcium fruit levels influence susceptibility to physiological problems and decay.

Flesh minerals and diffuse discolouration

<table>
<thead>
<tr>
<th>Year</th>
<th>Holding conditions</th>
<th>Ca</th>
<th>Mg</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>7°C, 3 wks</td>
<td>-0.07</td>
<td>-0.13</td>
<td>0.55 *</td>
</tr>
<tr>
<td>1995</td>
<td>7°C, 5 wks</td>
<td>0.30</td>
<td>0.31</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td>2°C, 5 wks</td>
<td>-0.83 **</td>
<td>-0.75 **</td>
<td>0.51 *</td>
</tr>
</tbody>
</table>
INTERNAL DISORDERS

- TRADITIONALLY CALCIUM IMPLICATED

SUGGEST THAT

- MULTI-FACTOR PROBLEM
- CALCIUM NOT ALWAYS MAIN FACTOR TO TREAT

SOLUTIONS

- ENHANCE FRUIT SINK STRENGTH FOR:
  - CRITICAL ELEMENTS (VARIES WITH SITE)
  - CARBOHYDRATES
  - CRITICAL STAGES IN FRUIT DEVELOPMENT
PRE-HARVEST GROWING CONDITIONS

INTERACTION BETWEEN

* pre-harvest orchard temperatures
  mainly external defects
* vegetative growth
  external and internal defects

MASKING EFFECT

* water stressed trees

Harvesting Operations

• Minimum Maturity Standards
• Harvesting Methods
• Delay between field and packer
• Harvesting conditions
Quality vs. Maturity

Immature
9 Poor quality when ripe
9 More shriveling and physical damage

Mature
9 Good quality when ripe
9 Longest postharvest life

Overmature
9 Poor flavor
9 More Physiological disorders, decay

Immmature Fruit Quality Problems
Physiological disorders accentuated with low maturity fruit

Flesh Discoloration
External Chilling Injury

Fruit quality to consumers is limited by harvest maturity:

- Immature - watery, shriveling, inconsistent ripening, physiological disorders, susceptible to decay
- Overmature - can be dry, rancid, seed germinating and more susceptible to decay
Checkerboarding = Ripening Variability

Difficult to predict time of ripeness

Great variation in the days to ripe within a package even with ethylene treatment

RESULT:
Lack of ripe uniformity means more loss at point of purchase

Poor RIPE Skin Colouration
TASTE

California 2002-03 results with Ventura Co. Hass fruit

Clearly at lower DW values, acceptability of fruit is marginal.

Data suggest that for a score of 6 the CA dry matter will be approximately 23%
Skin spotting
(Nodule damage)

Discrete patches
(chilling damage)

Physical damage and chilling

![Chart showing % damage for different stages: Hand harvested, In field, At shed, After brushing, After packing. The chart indicates higher % damage for Discrete patches (% area) compared to Skin spotting (% nodules).]
Physical damage and chilling

The importance of temperature management when harvesting
Protecting the fruit after harvest from high temperature has implications in the market place

During the course of the day, fruit in the TOP 12” of the bin with no protection can reach temperatures in EXCESS of 100 F whereas covered bins or those held in the shade can maintain temperatures close to ambient. Fruit at the BOTTOM of the bin stay cool during the day.

Source: Arpaia, M. L., 1994; ‘Hass’ fruit harvested from Riverside county.

What is the outcome of high temperatures in the field after harvest?

Fruit from the BOTTOM of the bin (lower temperatures) had lower decay and less chilling injury after storage at 41F and ripening.

However, fruit from the TOP of the bin, which were warmer, had higher levels of both decay and chilling injury. This is especially true for the fruit which came from the uncovered bins.

Source: Arpaia, M. L., 1994; storage was for 6 weeks at 41F.
Considerations in the grove

- Keep fruit in a cool place, out of the sun
- Work with packinghouse to minimize delays from time of harvest to cooling
- Avoid picking when temperatures are high especially with late season fruit
- Avoid picking during or shortly after a rain event - more decay
- Worker Safety; HAACP considerations for the future

Limitations to avocado postharvest handling

- **Fruit maturity and quality at time of ripeness**
  - Immature - watery; inconsistent ripening
  - Overmature - can be dry; seed germination and more susceptible to decay

- **Time after harvest and how fruit are managed**
  - Increased risk of physiological disorders

- **Stage of ripeness**
  - Ripe for tonight
  - More difficult to handle “ripe” fruit