Ripening Avocados

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What we know about the avocado and why it responds to ethylene

- A climacteric fruit showing an increase in respiration and ethylene production during ripening
- Influenced by maturity, time after harvest, temperature and atmosphere

Adapted from Eaks (1978) for 'Hass'

The avocado is susceptible to low temperatures

Body Rot
Stem End Rot

The avocado is susceptible to postharvest decay

Why Ripen Avocados?

Increase Uniformity
Decrease Checkerboarding

Factors that you can't control but should think about

- Preharvest Influences
- Small fruit sizes (why is the fruit small???)
- Maturity
- Age of fruit (days from packing)
- Temperature history (harvest, precooling and post packing management)

Realize that all these variables will influence the ripening behavior of the fruit
Relationship between dry matter (maturity) and final peel color

Final Peel Color = 3.06261 - 0.00264DW - 0.00004DW^2

where DW = Dry weight

R^2 = 0.621 ***

Pre-ripening inspection

**What to know**

- Age of fruit (days from pack)
- Source of fruit (country and relative maturity; shipping conditions, I-MCP)
- Temperature and stage of arrival ripeness (firmness)
- Keep a log of your observations
- Assess if any external decay or chilling injury present
- Destructive sampling is necessary for good quality control - use common sense

Ripening Management

- Uniform heating and cooling is ABSOLUTELY ESSENTIAL
- Refrigeration needs to control the heat (6000 BTU/pallet)
- Forced air ripening is critical (1000 cfm/pallet)
- Venting (preferably flow through, keep CO2 below 1%)
- Source of Ethylene - as low as possible, physiologically you only need ~10 ppm
- Fruit needs to be easily accessible in ripening room for monitoring; especially if fruit is of varying arrival condition or multiple lots of fruit
- Keep good records

Factors under your control

_Educate yourself about the potential differences between varying sources of fruit - there are differences_

- Pre-ripening inspection
- Ripening management
- Postripening management

Ripening Management

**When do you turn off the gas?**

- You don't need the gas until ripe; a short duration treatment will "trigger" ripening
- Fruit may soften but may not color - maturity and other factors involved
- The best way to gauge the rate of softening is with a penetrometer...not your fingertips or buttons "popping"
- Fruit maturity is an important variable
  
The penetrometer is a tool to judge the relative stage of ripeness
**Ethylene dose considerations**

- Ethylene concentration
  - >20 ppm: no more than 100 ppm
- Fruit Maturity
  - Less mature: longer treatment
- Time after Harvest
  - With increasing time after harvest; shorter durations needed

**How much to apply?**

- Short exposures to ethylene can trigger ripening
- Threshold is believed to be around 10 ppm
- Commercial application of 20 - 100 ppm is recommended

Source: I. L. Eake, UC, Riverside

**Time after harvest**

- Ethylene has maximum benefit within 1-2 weeks of harvest
- Imported fruit if conventional shipment will need less time (24 hours or less)
- Imported fruit if CA shipped or 1-MCP treated may need longer treatment times

**Suggested treatment times for California 'Hass' avocados**

- Early season fruit (November - February) 36 - 72 hours
- Mid-season fruit (March - June) 24 - 36 hours
- Late season fruit (July - October) 8 - 24 hours

Even within lots of fruit there is variability in ripening – a way to control this is sorting by degree of ripeness into different categories
### Management Issues

**Temperature**

- Ventilation/Air exchanges
  - Careful Monitoring
  - Prompt Movement of fruit
  - What is the proper stage of ripeness?
  - Where do you ripen the fruit?

**Impact of high temperatures**
- Delayed/uneven ripening
- Increased decay

#### Temperature Management

- Avocados have a **VERY** high rate of respiration during ripening = HEAT
- Efficient warming/cooling of fruit essential
- Airflow essential to maintain proper pulp temperature (68F; 20C)

### Ventilation

- Buildup of carbon dioxide (inhibits ethylene action)
- Airflow essential to maintain proper pulp temperature (68F)

Preliminary data suggests that short durations of high carbon dioxide (up to 3%) can be tolerated but will slow overall ripening.

### Managing Ripe Fruit

- Decay increases with increasing ripeness; accelerates in "overripe" fruit
- Don't hold fruit for long periods of time that are partially ripe - increased chilling injury
- Bruising increases with advancing ripeness - Protect fruit
- Peel color at "slicing" or "guacamole" ripe does not necessarily mean the fruit needs to be completely black!

*These are issues wherever fruit are ripened*
The outcome of “ripe” fruit

Ripe fruit at retail level has greatly increased consumption, HOWEVER…..
• Greater challenge in temperature management
• Fruit sensitivity to damage greatly enhanced

Considerations for successful avocado ripening

• Temperature management is CRITICAL
  - Too high; ripening inhibited and increased decay
  - Too low; ripening is slowed and lose benefit
• Fruit Maturity
  - More mature; less time
• Time after Harvest
  - After storage; less time
• Avoids delays in marketing
• Minimize fruit handling

CONSUMER/MARKET Education

Additional information

• Contact me
  arpaia@uckac.edu
• UC Davis Postharvest Center website
• California Avocado Commission website
  information on avocado ripening industry research reports (go to grower section)
• General information on avocados
  www.avocadosource.com

Time after harvest

Average Days to Eating Ripeness (<1.5 lb) in response to ethylene and storage at 41°F. Fruit treated with 40 ppm ethylene for 24 hours.
Postripening Management

- Temperature and softening rate
- Chilling injury susceptibility
- Move fruit as quickly as possible to end user
- Protect the fruit from damage

Important considerations

- Know storage conditions
- Delivery schedule to end user
- Know the demographics of your market; i.e. how fast fruit moves at individual stores
- Know how fruit is displayed (refrigerated or not)

The average incidence of fruit quality problems judged to be either slight or moderate to severe

Problems that you can find at the retail level in spite of doing it right

Market Survey, 2005