

Principales aspectos de postcosecha determinantes en la calidad y condición de la palta chilena de exportación



The continuum

Always remember, there is a continuum from the grower to the consumer

The steps in the continuum

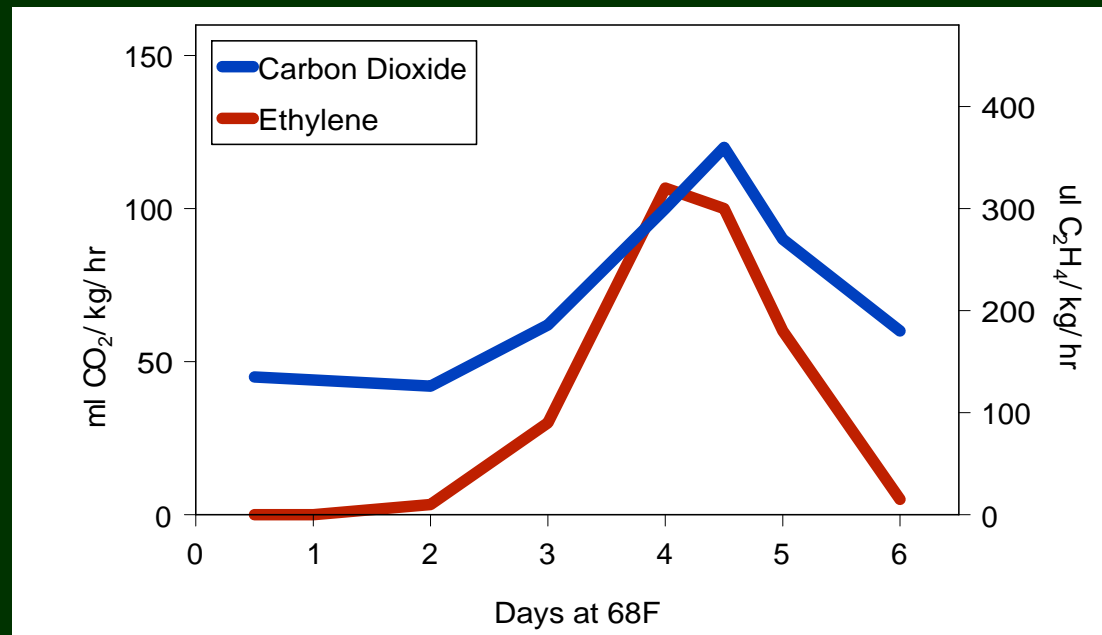
Grower – Packer – Distribution – Consumer

For this reason it is imperative that growers be involved at all levels of the industry

What we know about the avocado fruit

- 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'



Susceptibility to low storage temperatures



External Chilling Injury



Internal Chilling Injury

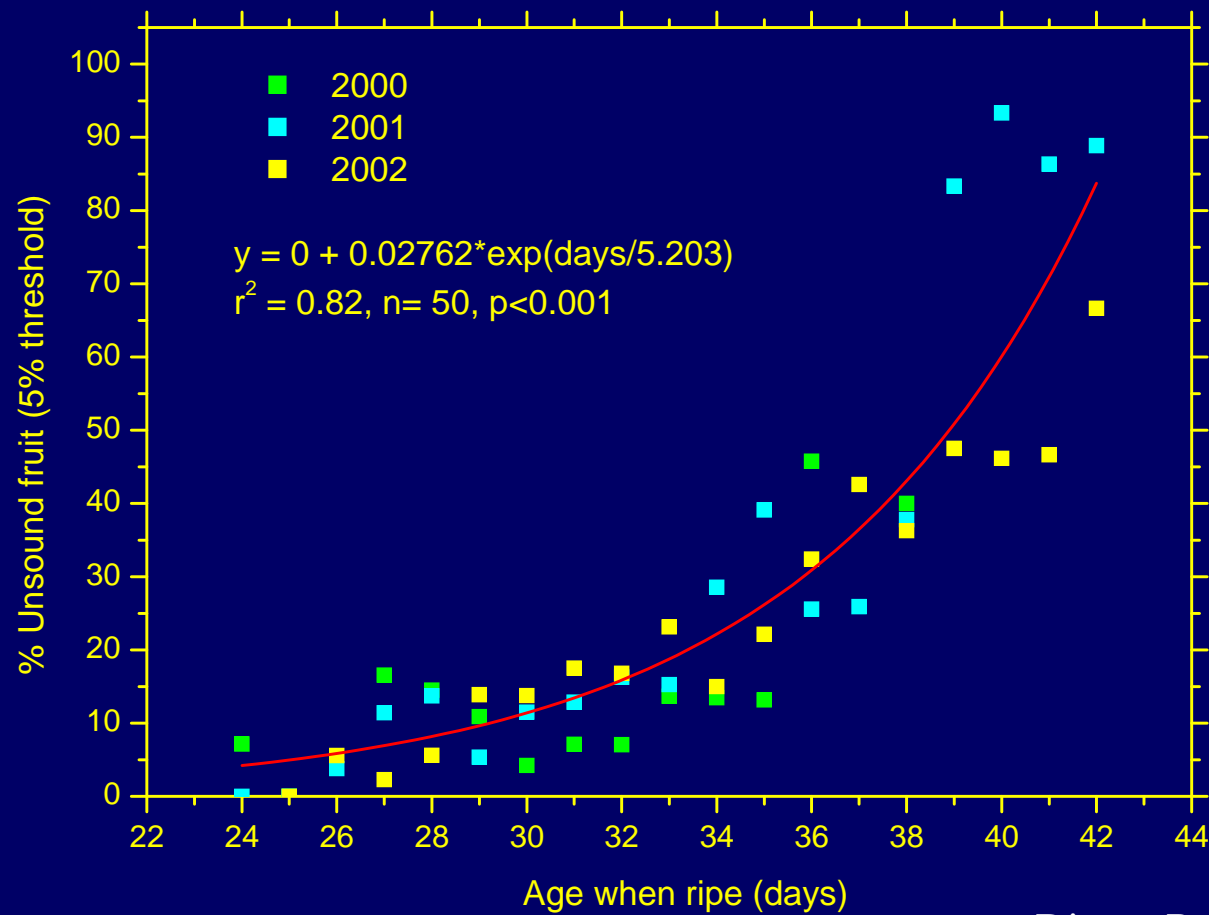


Postharvest Diseases

Stem End Rot



Relationship between fruit age and unsound fruit



Dixon, Pak and Cutting

There are problems with fruit arrivals



Who is at fault?
Remember the continuum



Grower Inputs

Need to work closely with your packhouse

Maturity – optimize shipping quality

Rainfall and decay

Temperature management at harvest

Speed at which fruit is moved to packinghouse



Quality vs. Maturity

Immature

- o Poor quality when ripe
- o More shriveling and physical damage

Mature

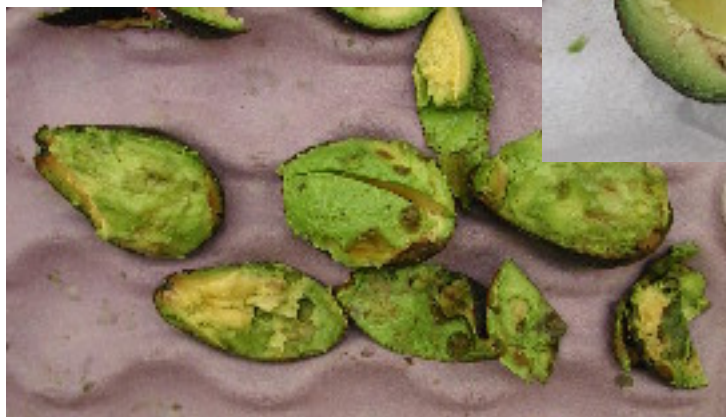
- o Good quality when ripe
- o Longest postharvest life

Overmature

- o Too soft, poor flavor
- o More Physiological disorders

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



Physiological disorders accentuated with low maturity fruit

External Chilling Injury



Flesh Discoloration



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

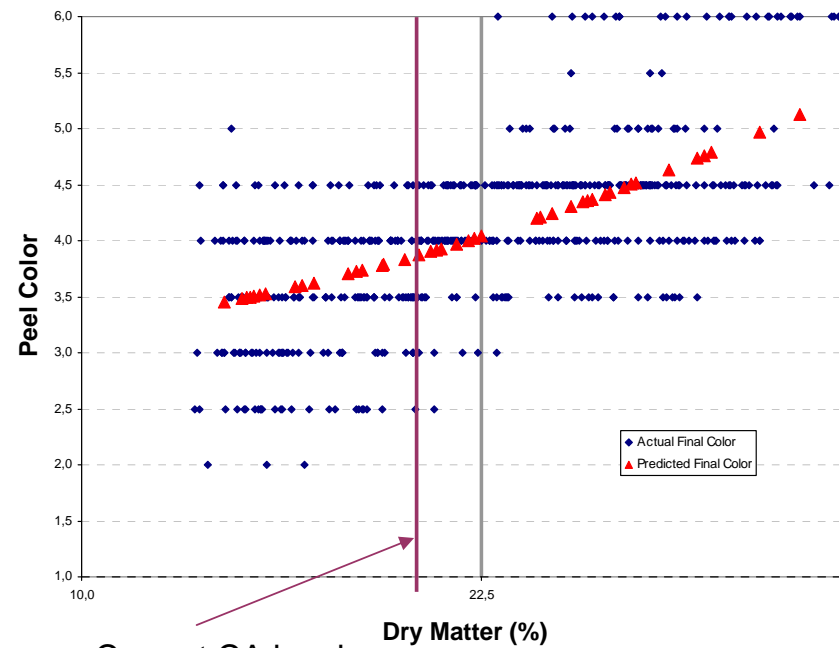
Poor RIPE Skin Colouration



Relationship between dry matter and final peel color

$$\text{Final Peel Color} = 3.06261 - 0.00264\text{DW} + 0.0020\text{DW}^2$$

where DW = Dry weight
 $R^2 = 0.621$ ***



Current CA legal minimum

Stringiness



Skin Shriveling



Sabor !



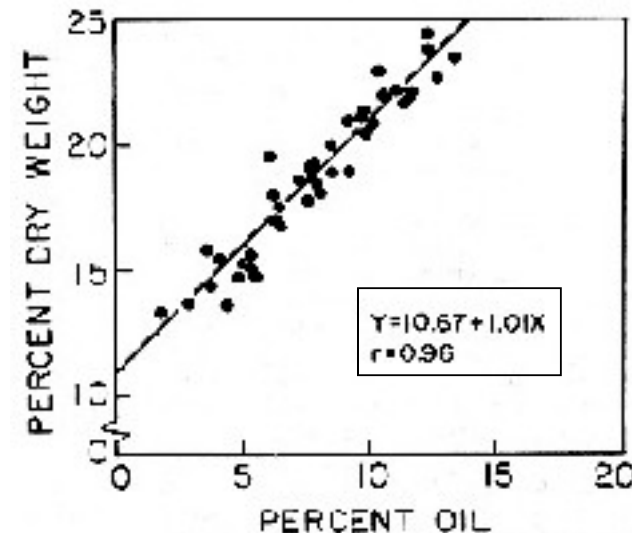
Determination of fruit maturity



Using dry matter as the standard
reference when talking about fruit
maturity

Correlation between oil and dry matter

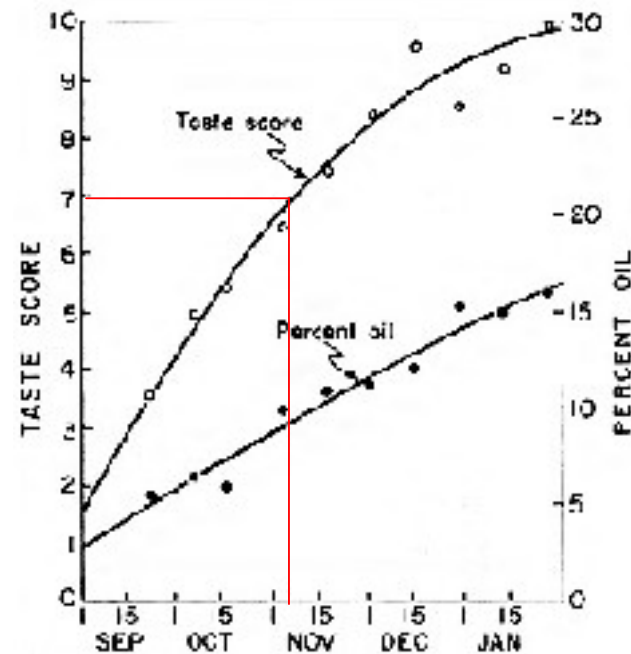
- ❑ Lee et al, 1983, J. Amer. Soc. Hort Sci.
- ❑ Demonstrated relationship between oil and dry matter
- ❑ Basis of recommendation to CA industry to switch to dry matter
- ❑ Now internationally used for maturity standard



Relationship between percent dry weight and percent oil during development and maturation of 'Hass' fruit at Escondido.

Relationship between oil and acceptability

- Lee et al, 1983, J. Amer. Soc. Hort Sci.
- Minimum acceptable taste score = 7
- HASS variety
 - Oil content = 11.2%
 - Dry weight equivalent = 22.8%

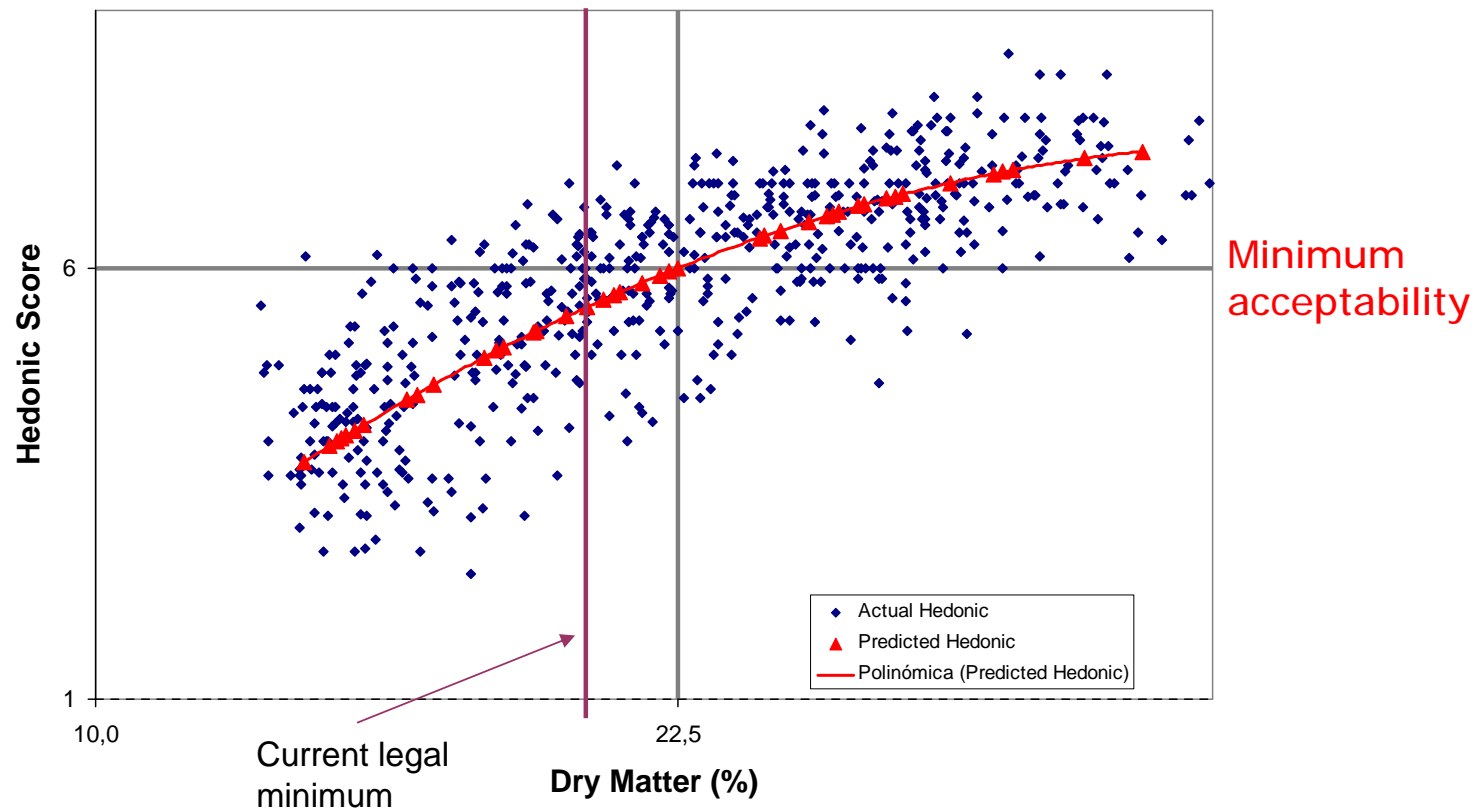


Taste and oil development during maturation of '**Fuerte**' fruit grown at Irvine.

California 2002-03 results with Ventura Co. Hass fruit

Regression analysis

Hedonic Score = $2.92669 + 0.57765DW - 0.0008DW^2$
where DW = Dry weight
 $R^2 = 0.867^{***}$



Maturity work in Chile

Relationship to dry matter and oil has been established

$$Y = 53.4838 - (0.5767x)$$

Y = % oil

x = % Humidity

9% oil dry matter equivalent = 22.9%

8% oil dry matter equivalent = 21.1%

Dry matter testing of Chilean fruit after arrival in CA - 2003



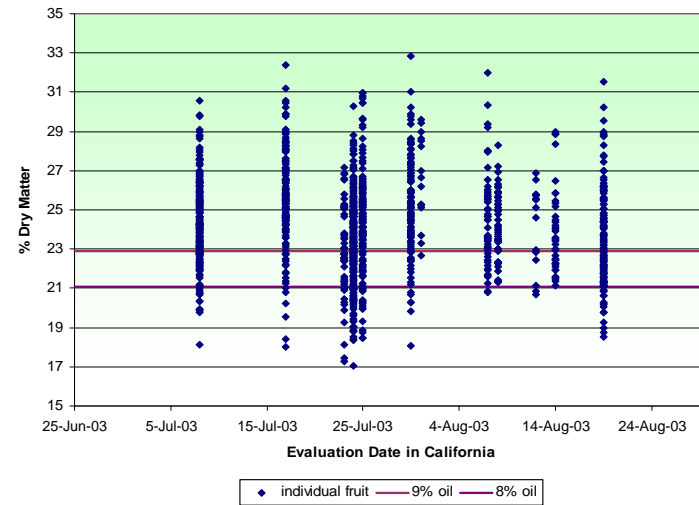
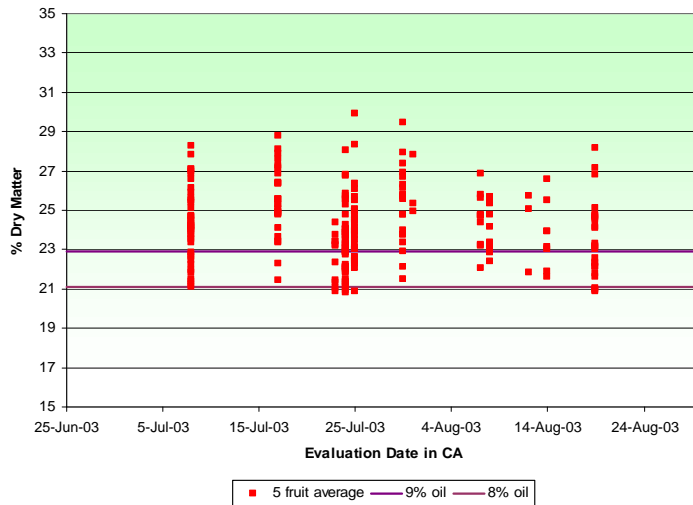
Testing conducted by Avocado Inspection Program, CDFA
upon arrival in California (early July to late August)

Results to be presented are from

- 1175 individual fruit

- 235 “average” samples of 5 fruit

Average and Individual Fruit Dry Matter Values



For **5-fruit average** samples 3.4% of samples were BELOW 8% and 26.3% of samples were BELOW 9% oil equivalent

For **individual fruit** samples 9.7% of samples were BELOW 8% and 30.7% of samples were BELOW 9% oil equivalent

Minimum measured – 17.1%; Maximum measured – 32.9%

Need to ask – what are the consequences of having nearly 1/3 of fruit arriving in CA below the Chilean standard for maturity

Source: Associated Marketing
Special report to CAC 11/01 – 7/02

- *Product satisfaction held at 81% of purchasing.....*
- *Early months of the crop year (N-J) may furnish the market with a highly disproportionate share of annual buyers...This surely suggests the special importance of marketing quality product during the early months of the season*
- *Avocados held high repeat rate – buyers highly concentrated (22% of households account for 46% of purchases*

Consumer Satisfaction

Overall satisfaction – 81%

HOWEVER, from November to January 2000-01, satisfaction claims were *below* the annual average and among the lowest of the year.

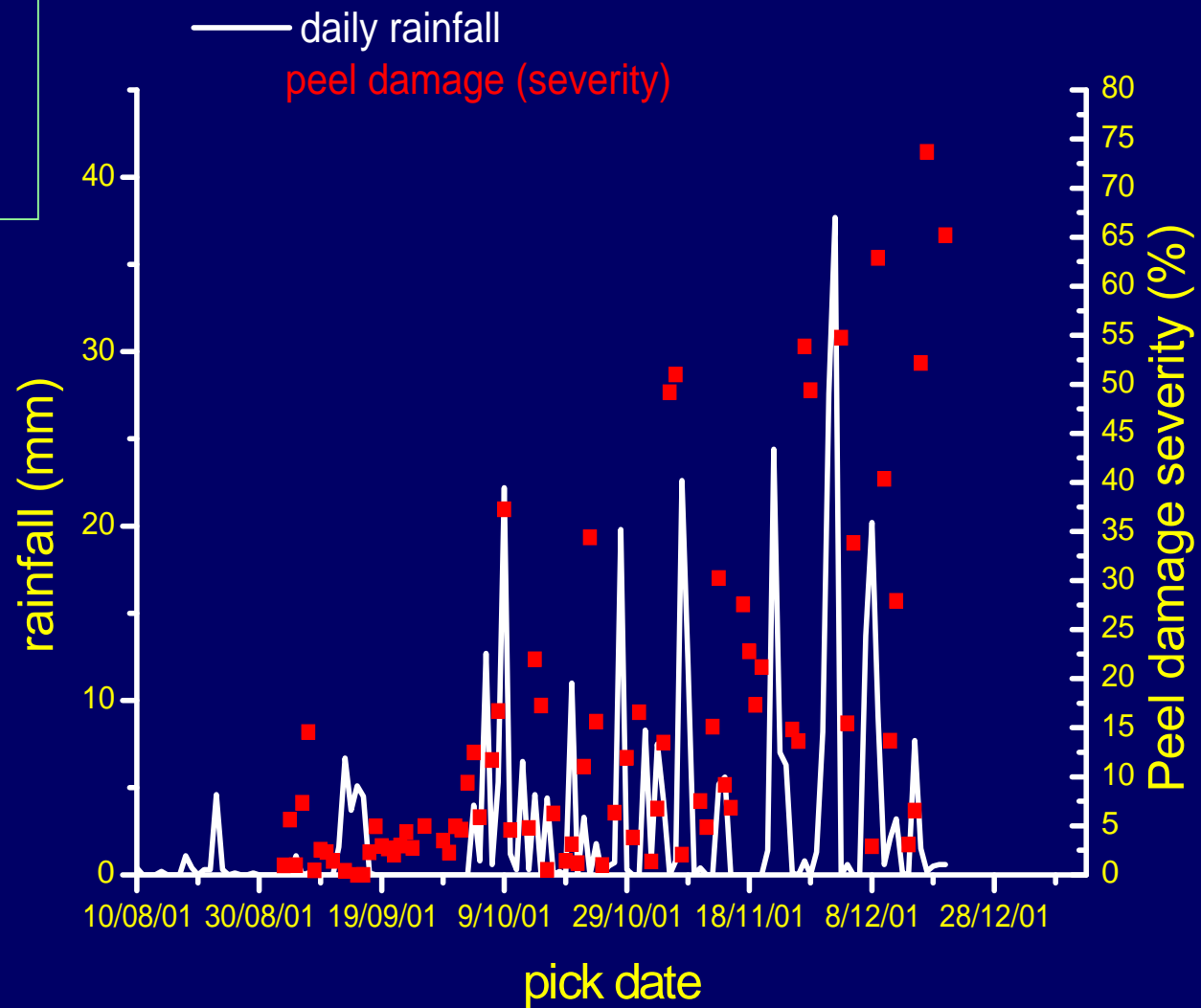
This strongly suggests the importance of *early season avocado quality* if high repeat performance may be expected to follow.

Too, it suggests the need for *increased product identification* designed to convey a consistent quality and upon which the consumer may learn to rely.

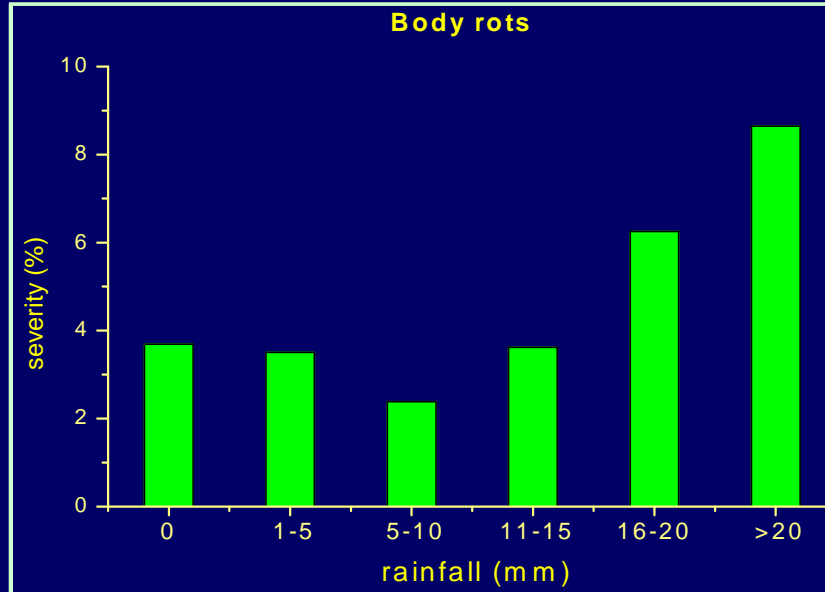
Things to consider:

- At retail level, fruit from all exporters are mixed together – loss of identity
- Increasing importance of discount, club stores
- Importance of maintaining Food Service (currently 30% of CA fruit)
- Consumer satisfaction results
 - Repeat buyers
 - “Expectations” of the consumer

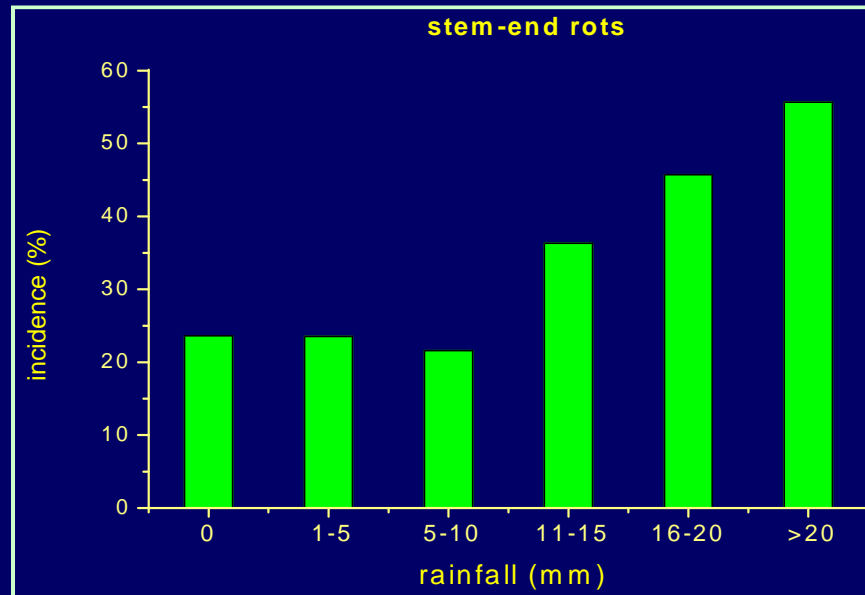
Relationship between rainfall and peel damage



Dixon, Mandemaker, Pak and Cutting



**Influence of rainfall
prior to harvest on
Decay**

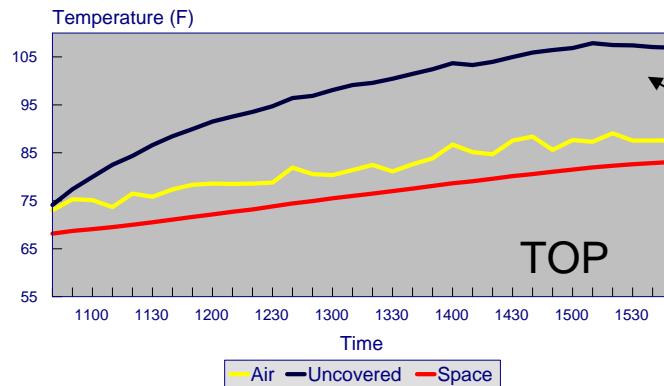


Dixon, Mandemaker, Pak and Cutting

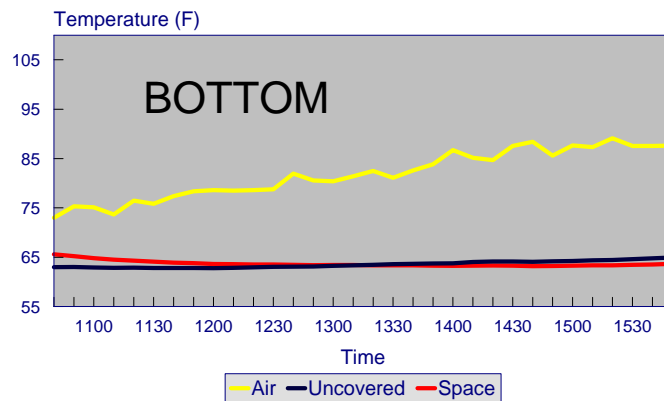
The importance of temperature management when harvesting

From the grove onward

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 35C 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 5C 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 5C.

Considerations in the grove

- Keep fruit in a cool place, out of the sun
- Handle the fruit gently
- 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; HACCP considerations

Packer/Exporter Inputs

Fruit age – time to ship

Cooling

Ethylene exclusion

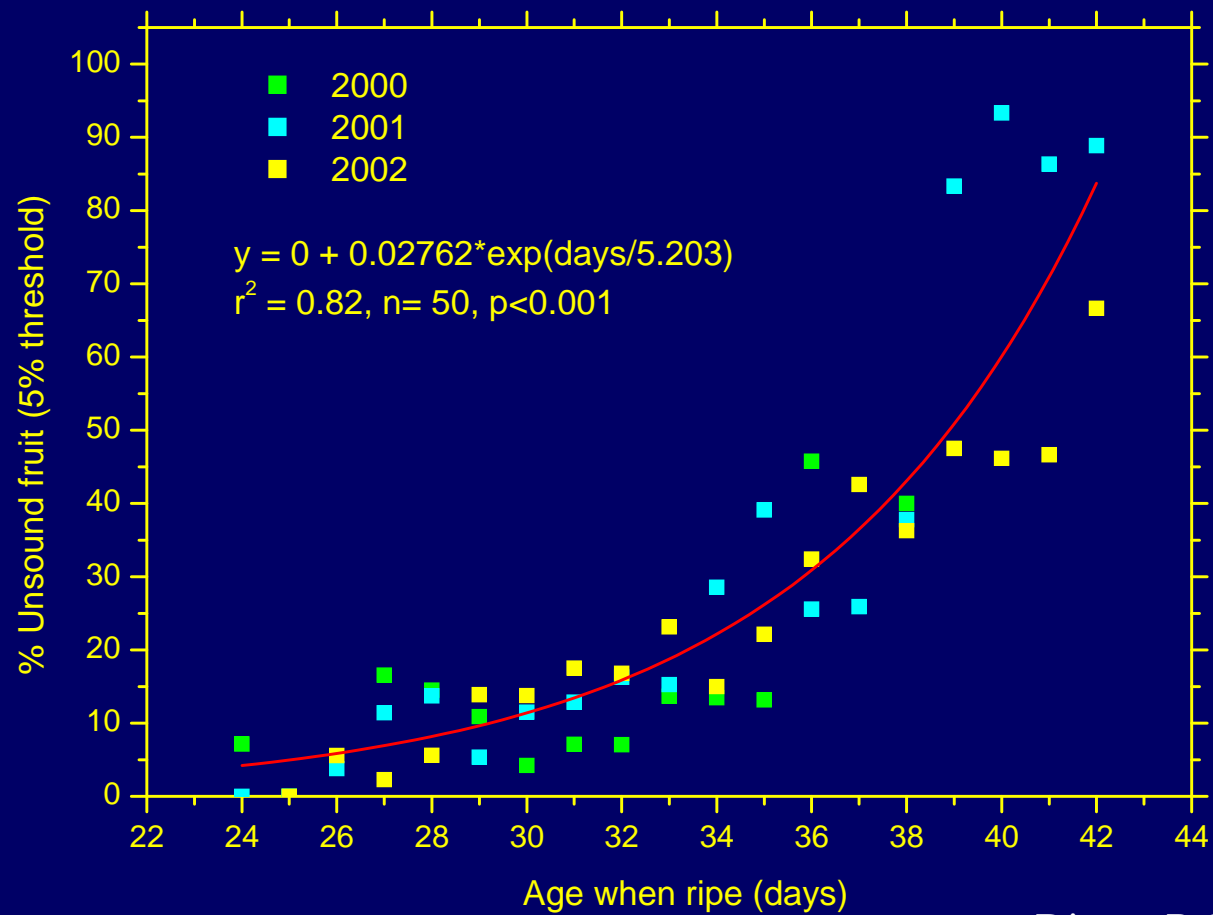
Controlled Atmosphere

1-MCP

Avocado Storage and Transit

- California fruit marketed within 1 – 2 weeks of harvest; storage at 5C
- US imports arrivals vary in time after harvest:
 - <10 days (Mexico)
 - 12 – 21 days (Chile)
 - approximately 28 days (New Zealand)
- Fruit quality has been mixed on longer transit times.....
- 1-MCP ????????????

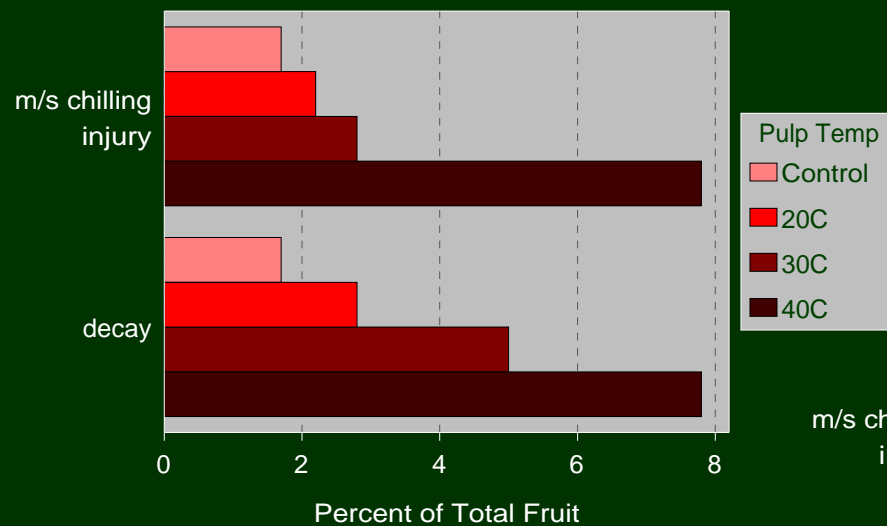
Relationship between fruit age and unsound fruit



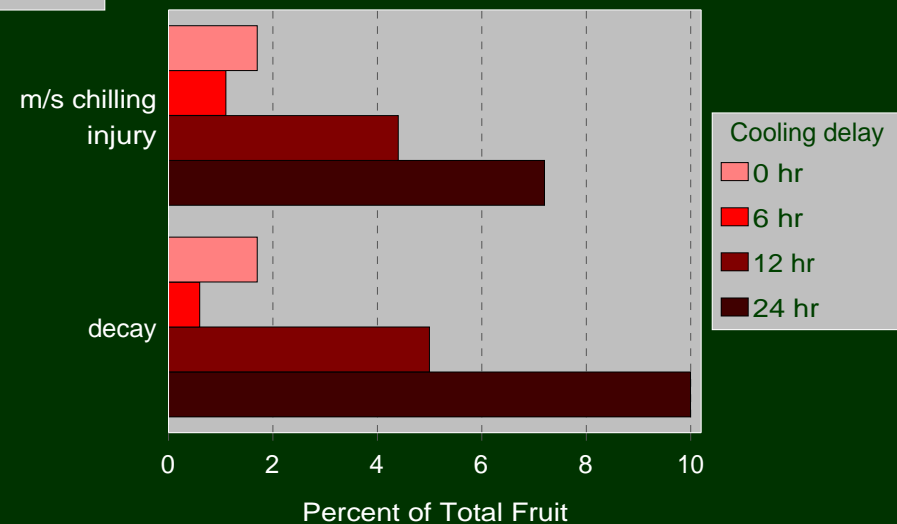
Dixon, Pak and Cutting

Short Duration High Temperature Effects on 'Hass' Fruit Storage and Quality (Arpaia, 1994)

Pulp temperature effects during delayed cooling on fruit quality following 4 weeks at 5C



Delayed cooling effects on fruit quality following 4 weeks at 5C



Physical damage and chilling

Lentical damage



External chilling



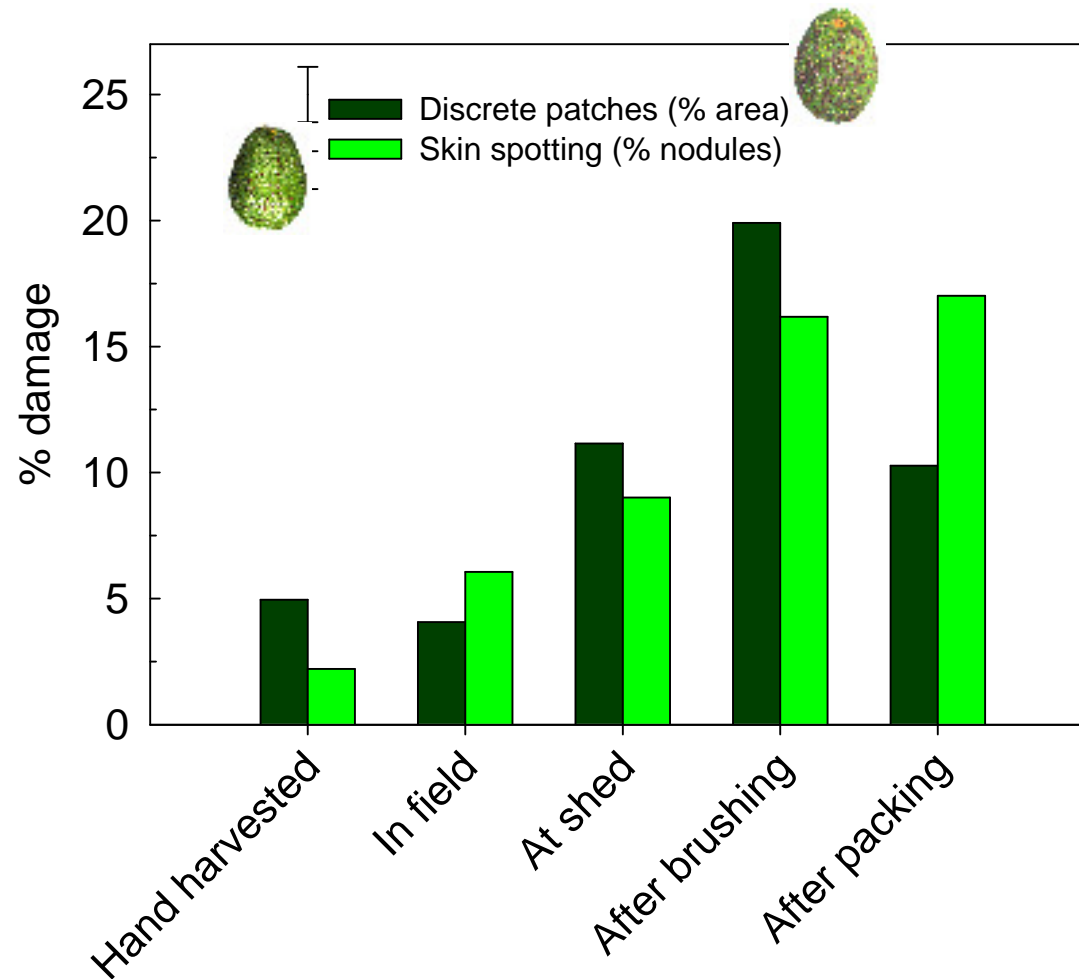
Source: Cutting, Dixon, Pak

Physical damage and chilling



Source: Cutting, Dixon, Pak

Physical damage and chilling



Source: Cutting, Dixon, Pak

Ethylene - hastens deterioration

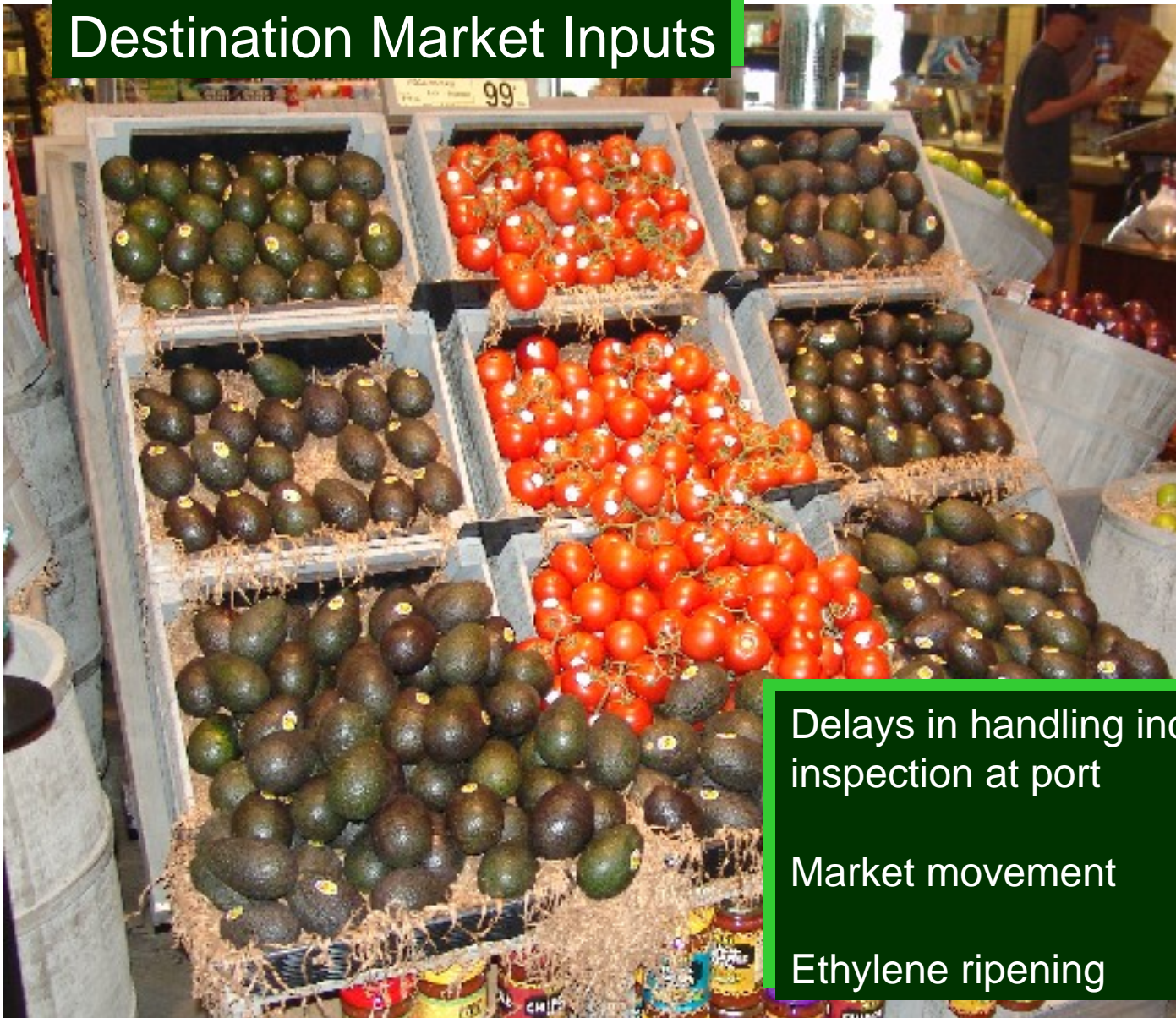
Ethylene contamination
Softening
Physiological disorders

Use of CA
High CO₂ counteracts ethylene
Slows softening

Use of 1-MCP
Can slow softening
Development of disorders
Risks – overdose fruit; ripening



Destination Market Inputs



Delays in handling including inspection at port

Market movement

Ethylene ripening

Market Fruit Quality Surveys



Conducted in collaboration with CAC Merchandising Staff



Example of fruit shriveling



Example of an overripe fruit with stem end rot, body rot and internal bruising

Example of a stem end rot



Example of body rots





- A. Fruit with no bruising under the peel.
- B. Fruit which is very overripe and is exhibiting bruising under the peel.

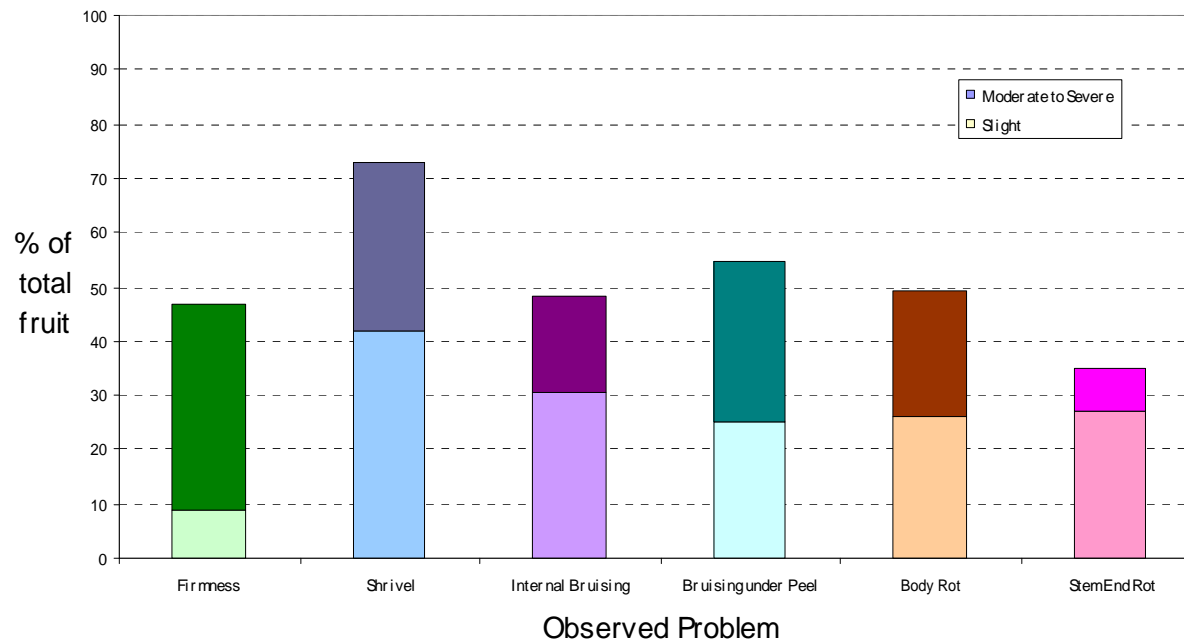


- A. Very ripe fruit compressed by other fruit on display.
- B. Example of internal bruising.



- C. Very ripe fruit showing severe internal damage.

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



Market Survey, 2005

Solving problems at the marketplace

- Ethylene treatment of fruit increasing and becoming an important tool to make the avocado more consumer friendly
- Consequence of handling ripe fruit – MORE Physical damage
- A problem NO MATTER the source – an opportunity to work with other industries
- Coordination with HAB?



Limitations to avocado postharvest handling

- Fruit maturity and quality at time of ripeness
- Time after harvest (fruit age)
- Stage of ripeness – more difficult to handle “ripe” fruit

Looking to the future

- Greater international coordination
- New varieties with improved attributes
- Better orchard management
- New postharvest technologies to assist in maintaining fruit quality

The continuum

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Thank you for your
attention