AMCOR FIBRE PACKAGING

AUSTRALASIA

SESSION SIX

Session Six
Postharvest quality, outturn

New Zealand and Australia Avocado Grower's Conference'05
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Tauranga, New Zealand

Avocado Postharvest Quality – An Overview

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Limitations to avocado postharvest handling

- Preharvest Factors
- Postharvest Factors
  - Fruit maturity and quality
  - Storage duration
  - Stage of ripeness

Susceptibility to low storage temperatures

External Chilling Injury

Internal Chilling Injury

Postharvest Diseases

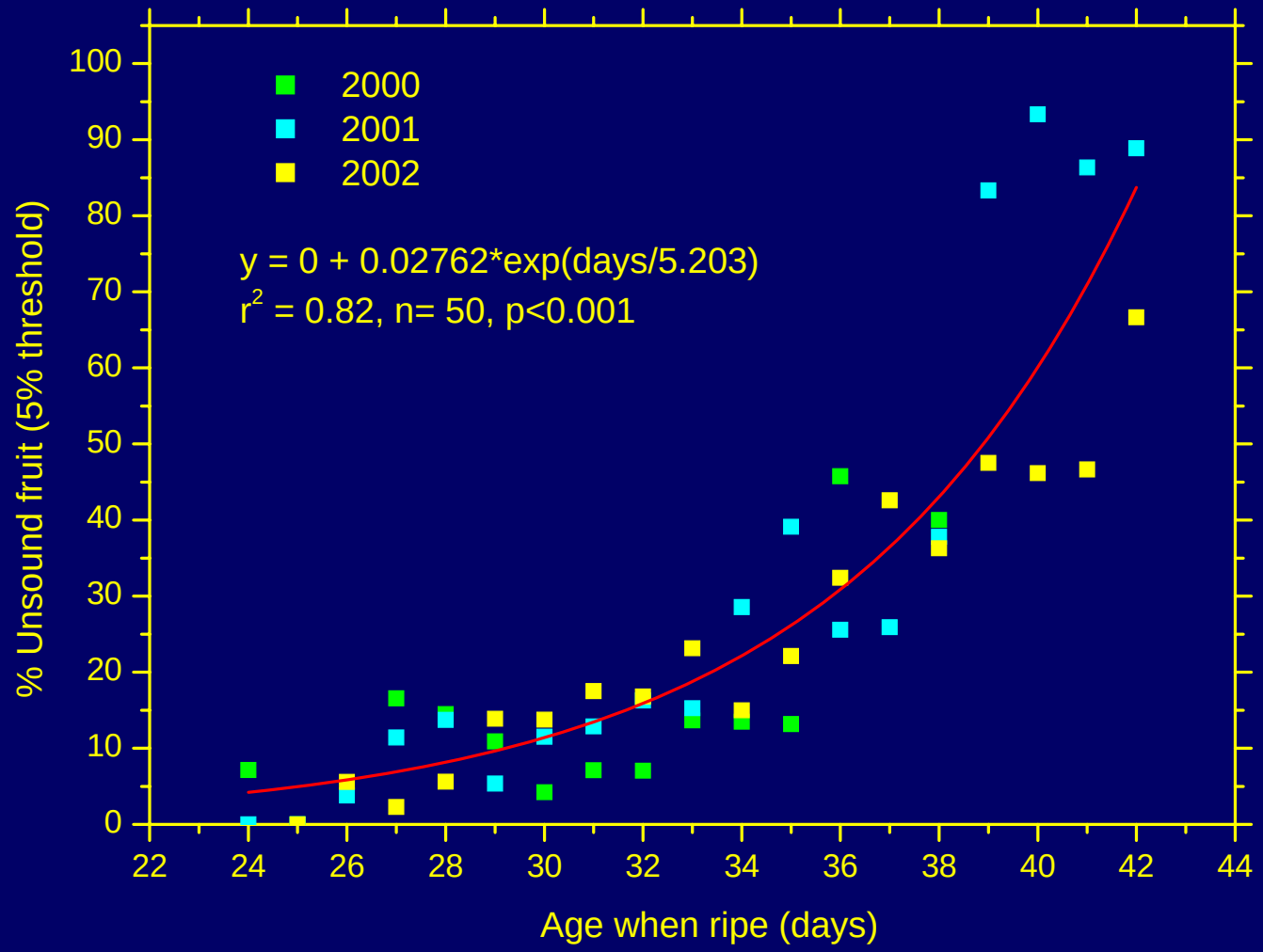
Stem End Rot

Anthracnose
Body Rot

Alternaria
Stem End Rot

Dothiorella
Stem End Rot

Relationship between fruit age and unsound fruit



Dixon, Pak and Cutting

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

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? Is there a difference between growing areas?
- Product Uniformity
- Ability to predict when ready to eat
- Freedom from defects
- Eating quality

Preharvest factors influencing fruit quality

Preharvest Factors

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

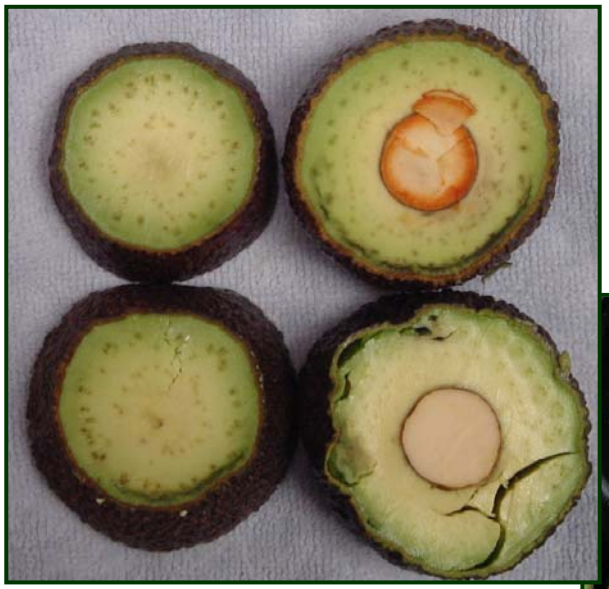
These factors are interactive and influence each other

How preharvest factors may influence fruit quality

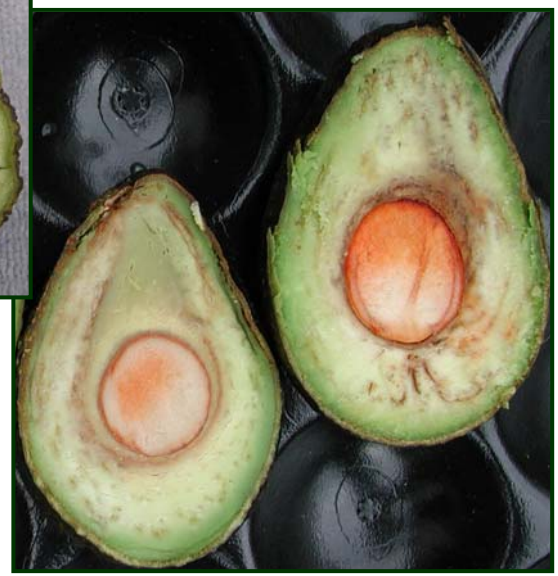
- Development and maturation
- Physical effects on quality and packout
- Susceptibility to physiological and pathological breakdown

Climate and environment

- Temperature
- Wind
- Rainfall
- Fruit position on tree



Freeze Damage
= Cold Stress

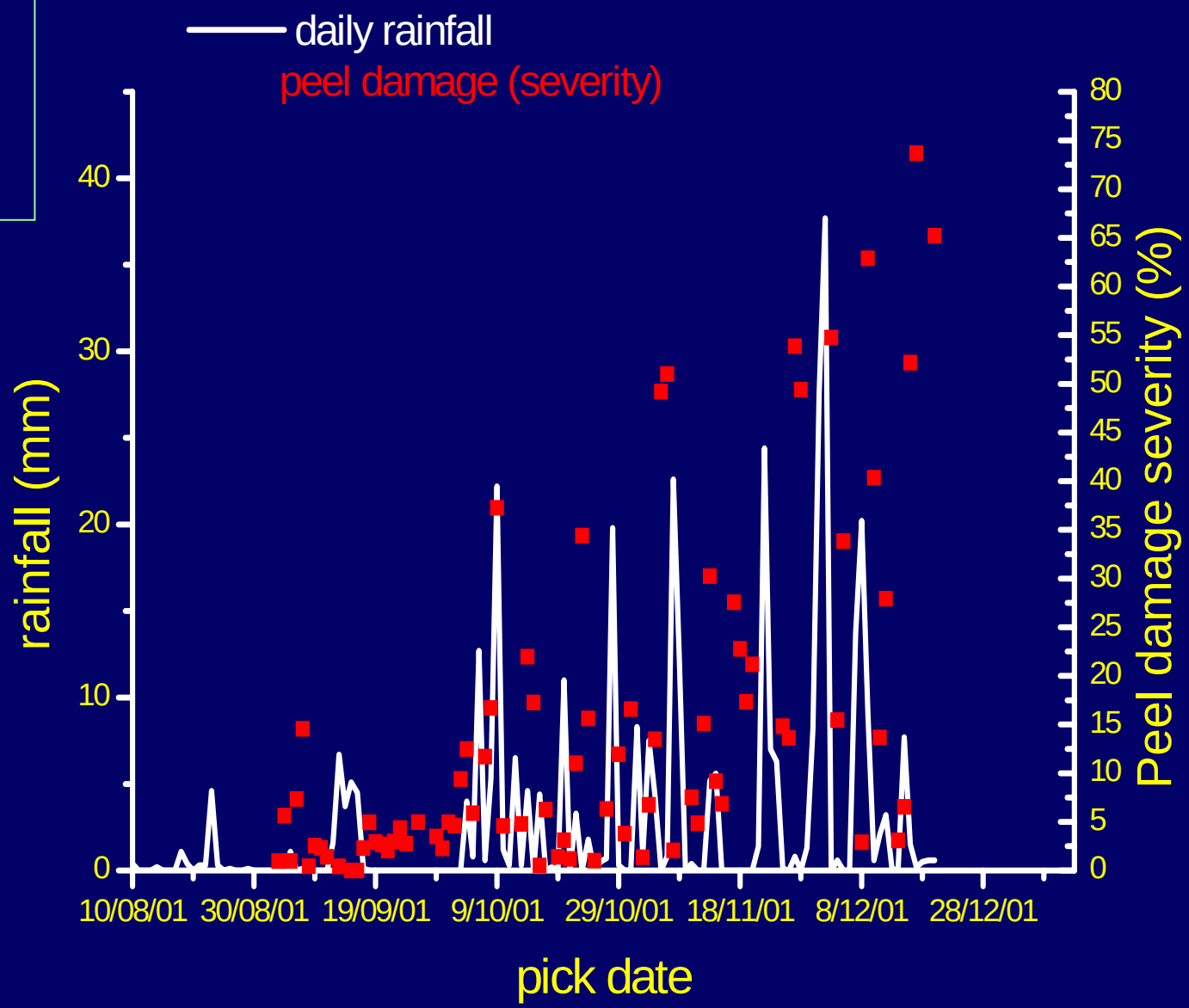


Beware of discoloured stems

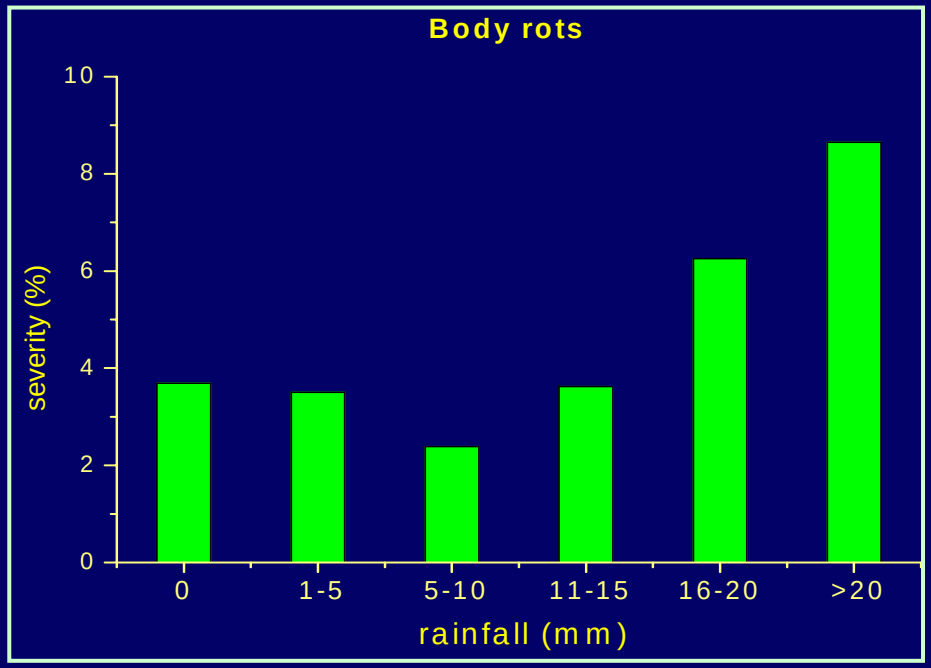
Can see increased decay and low temperature damage after storage

Effects could last for several weeks/months

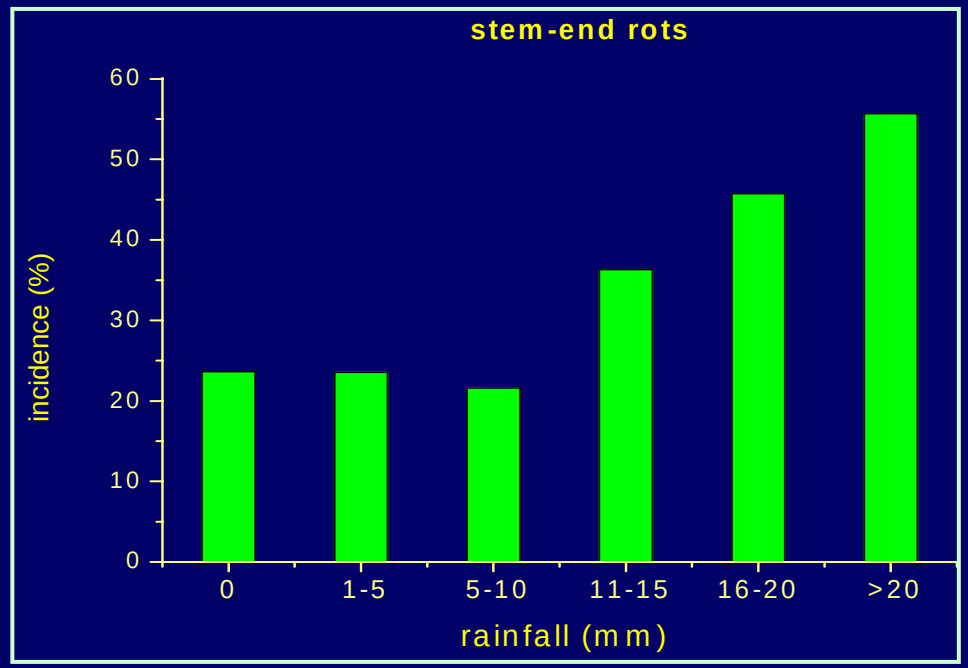
Relationship between rainfall and peel damage



Dixon, Mandemaker, Pak and Cutting



Influence of rainfall prior to harvest on Decay

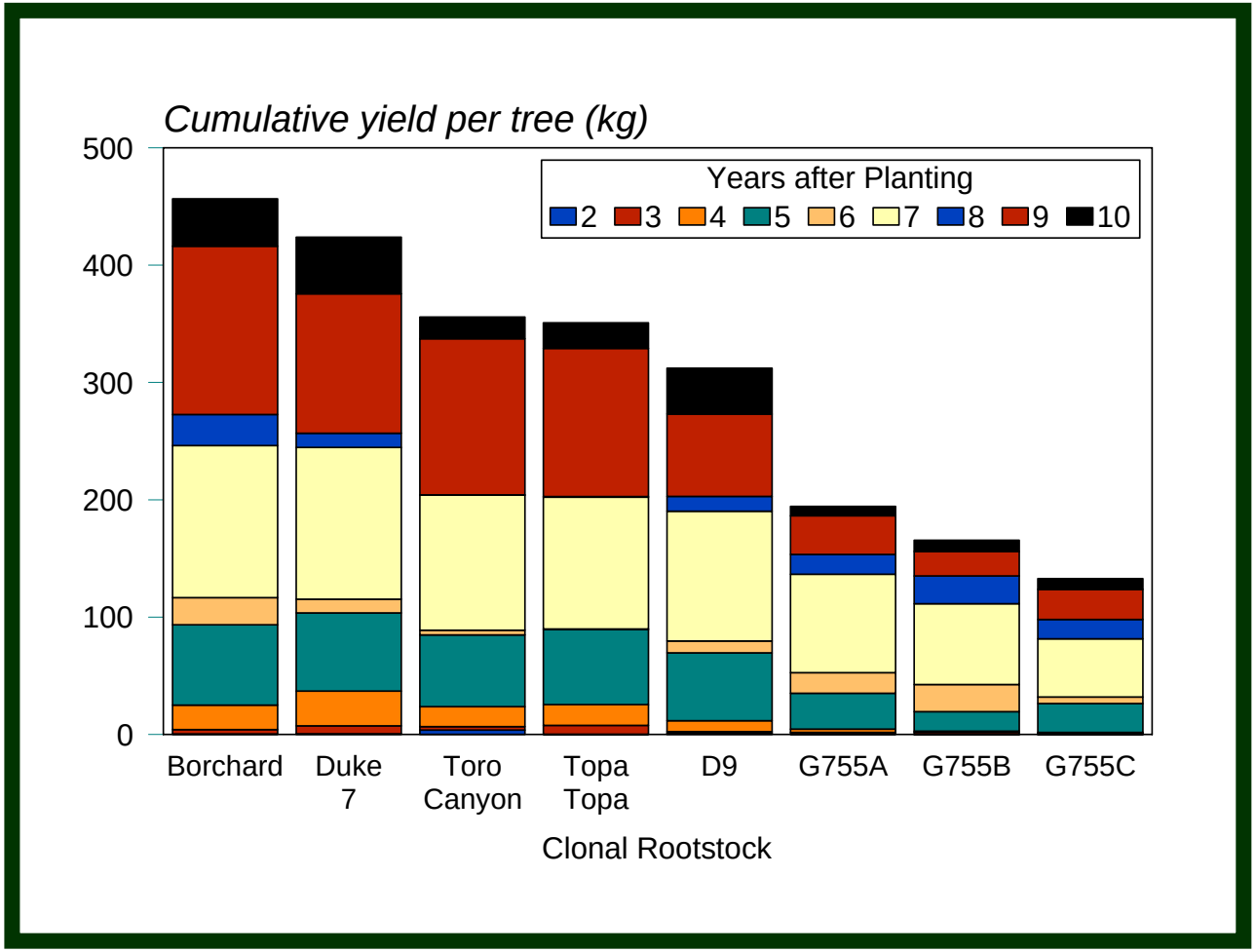


Dixon, Mandemaker, Pak and Cutting

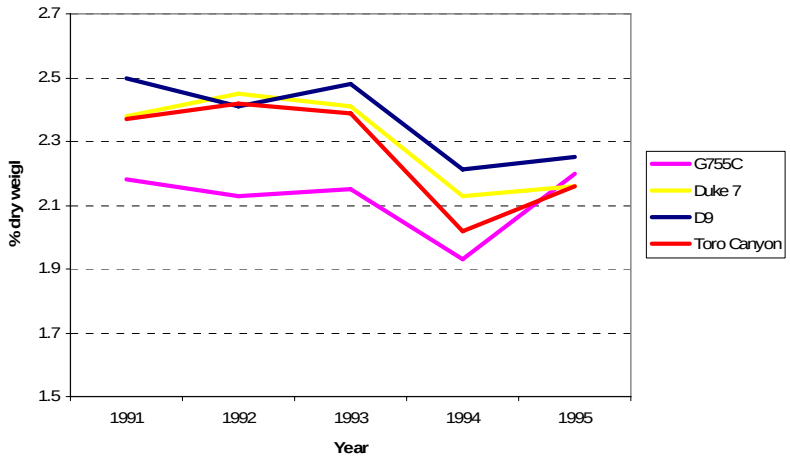
Rootstock and Variety Interactions

Clonal Rootstocks

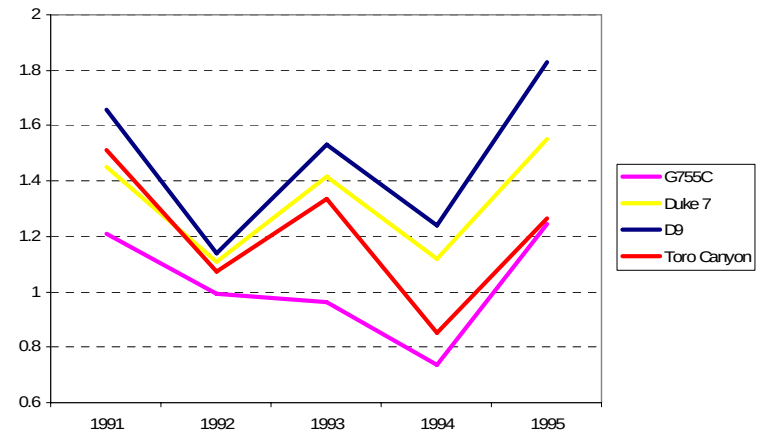
- Enhanced yield possible
- Control of root rot



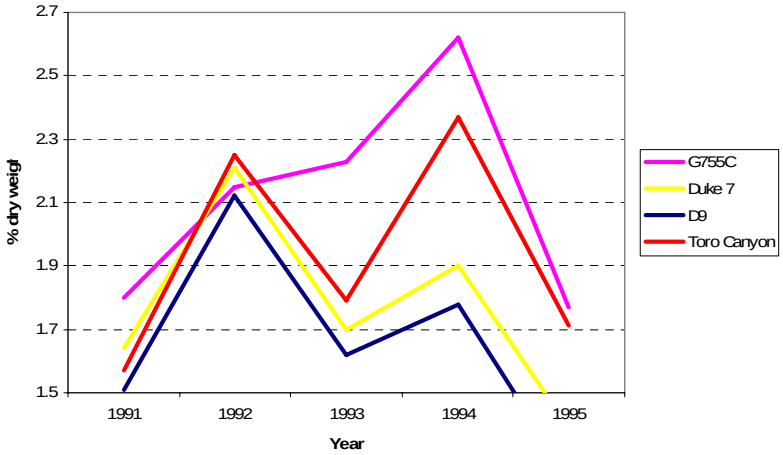
Nitrogen



Nitrogen:Calcium Ratio



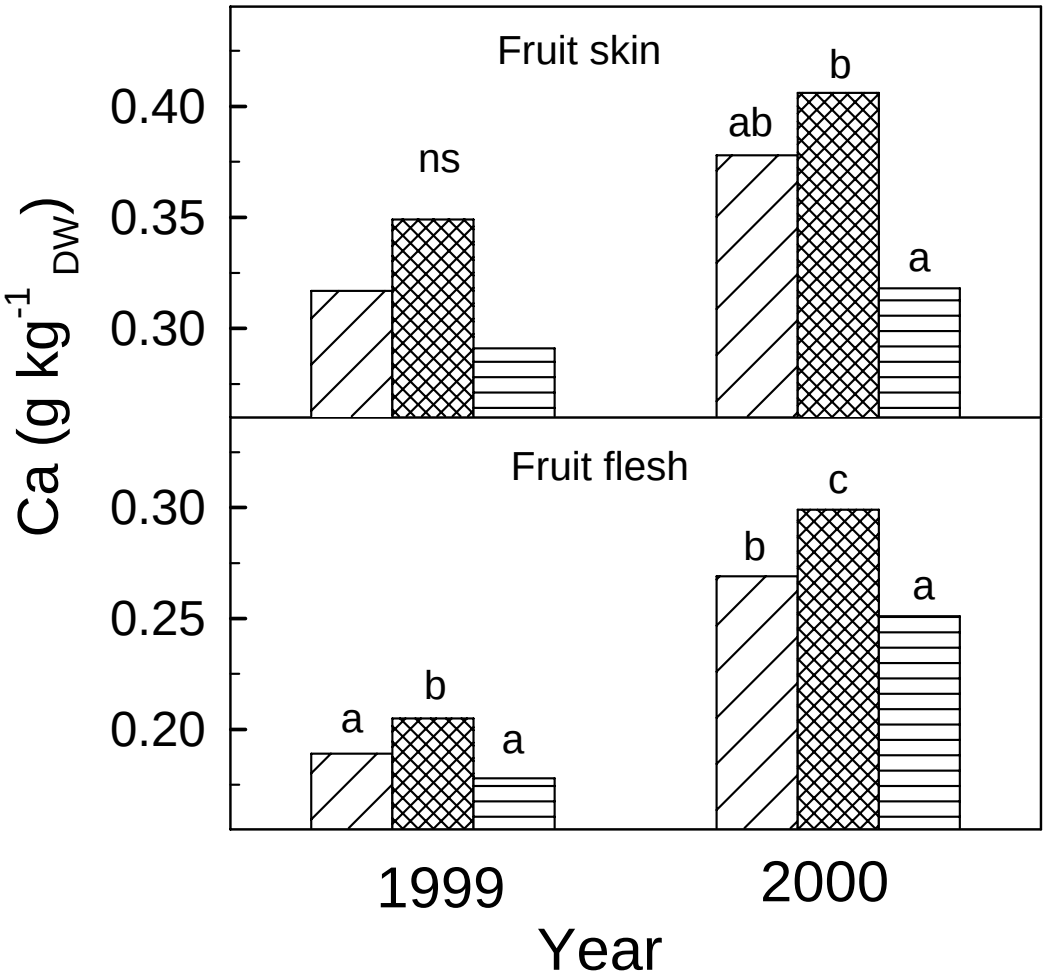
Calcium



Rootstock can influence nutrient composition

Leaf analysis results

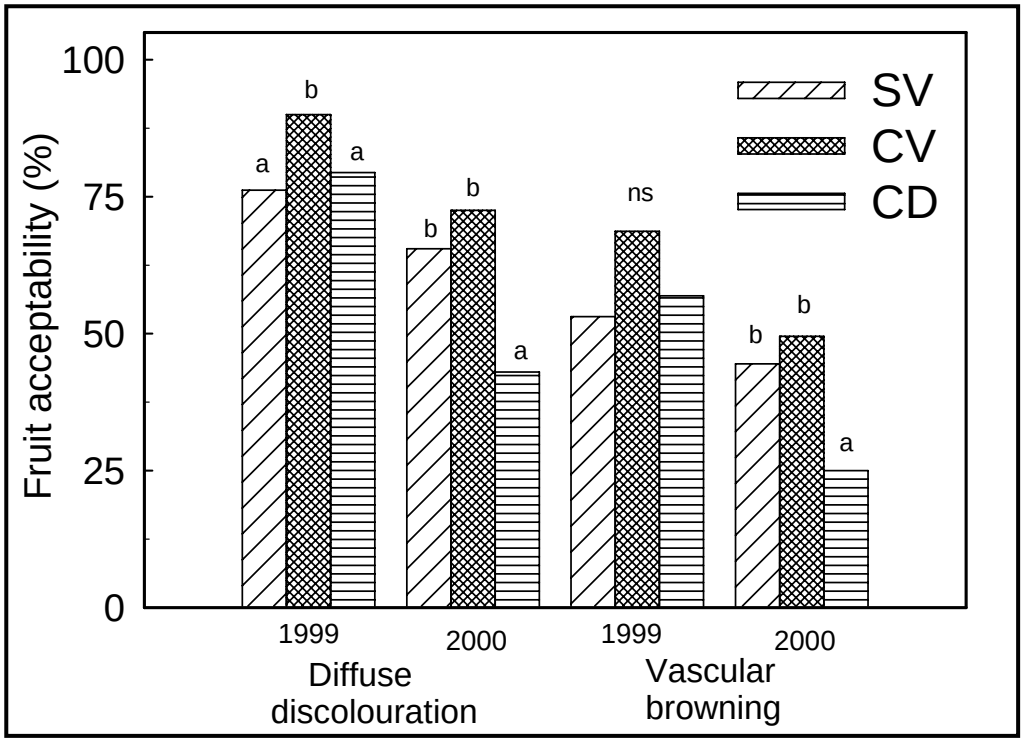
Rootstock and Variety Interactions



Seedling Velvick
Clonal Velvick
Clonal Duke 7

Rootstock influences Calcium levels in the fruit

Rootstock and Variety Interactions

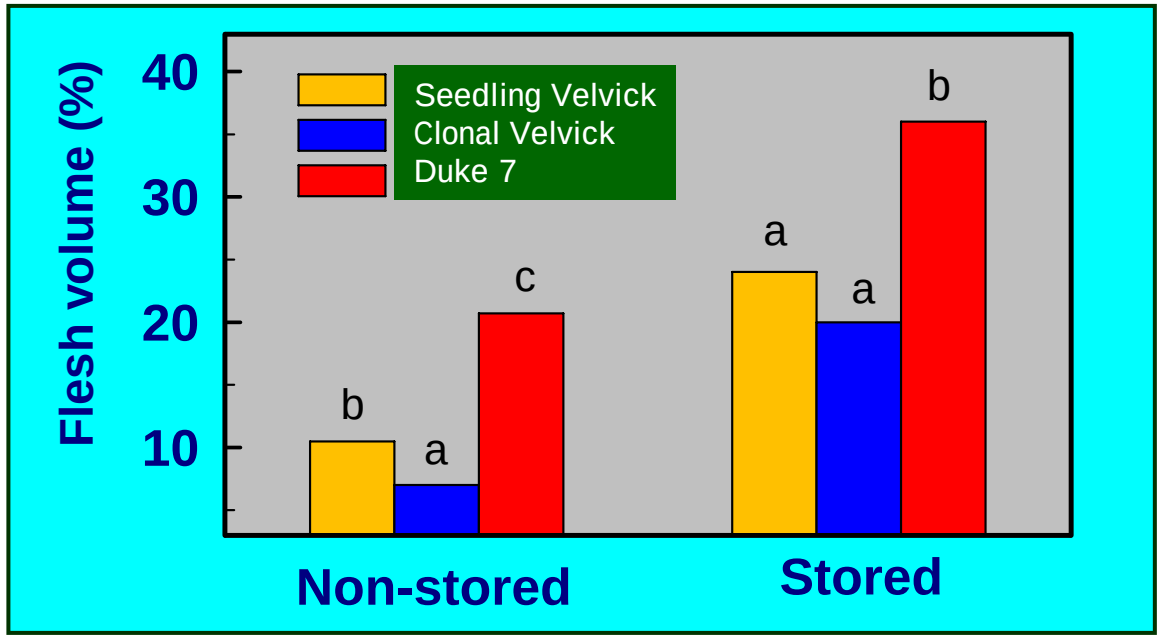


Results from Australia
20 yr-old trees

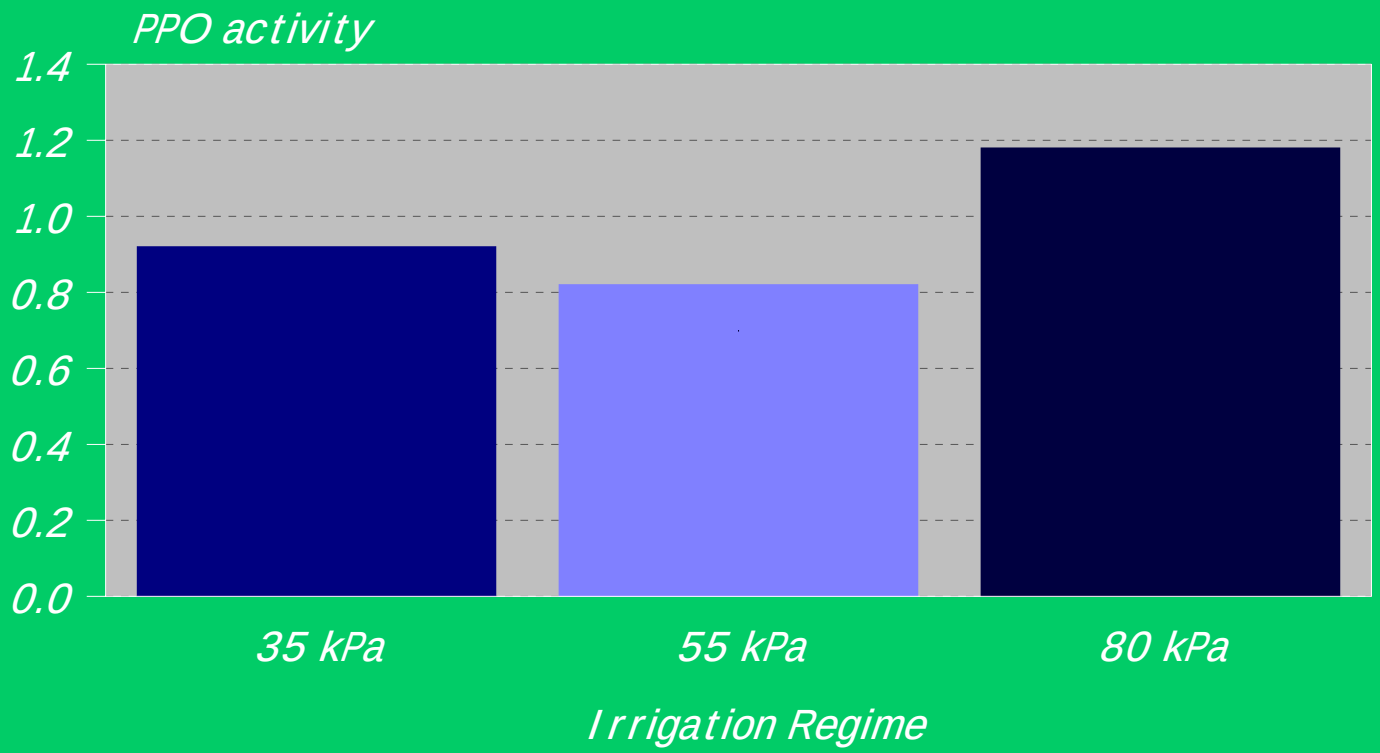
4 wks @ 5C

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



J.P. Bower, 1988

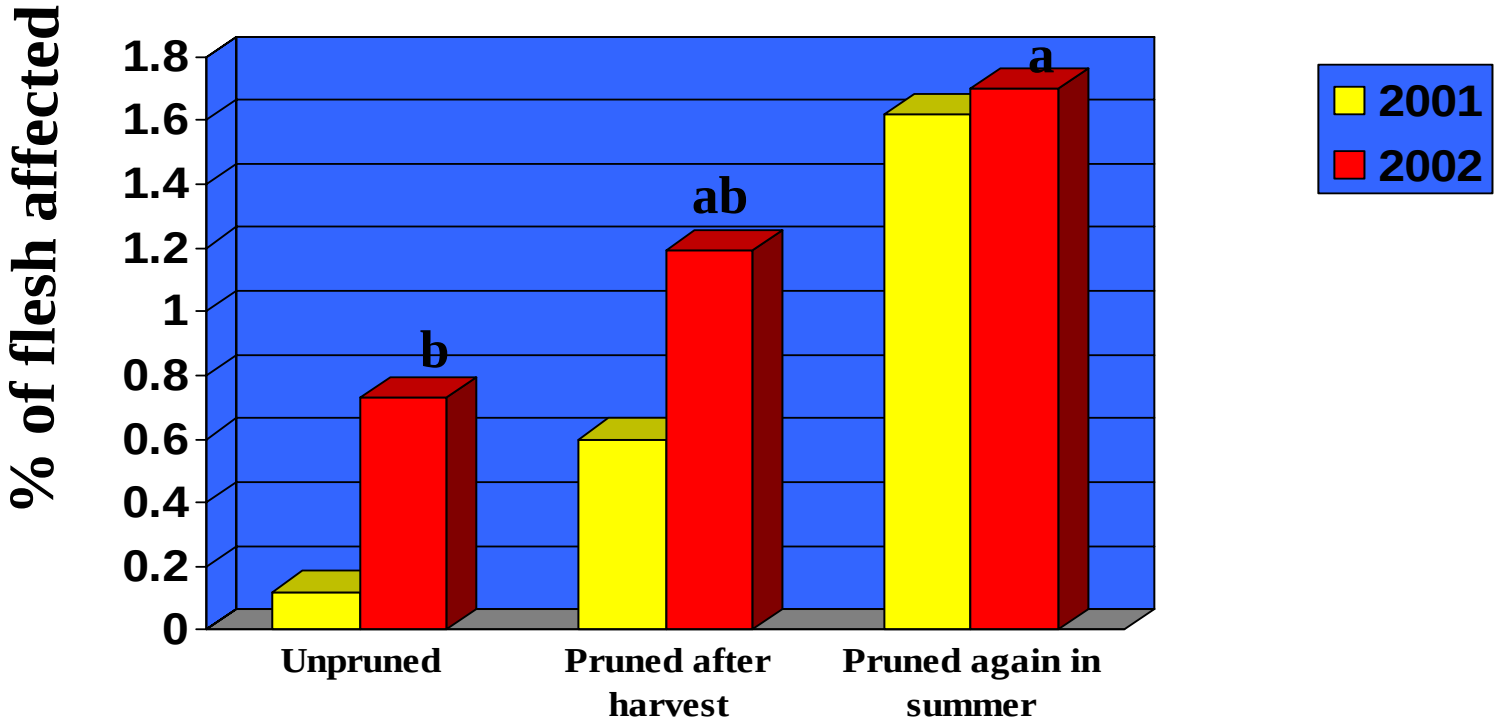
Irrigation effects on fruit quality

Increased browning potential following storage = mesocarp discoloration

Canopy Management /Pruning

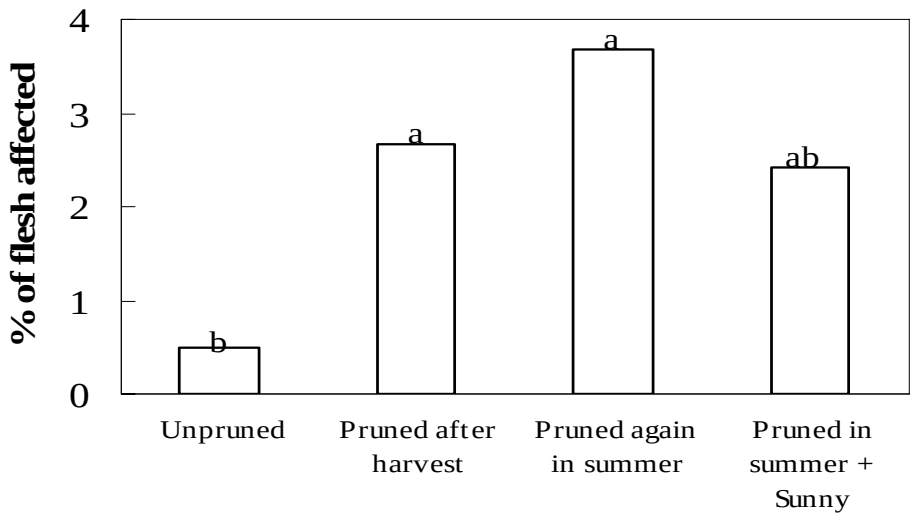
May have an effect on fruit quality

Aim at fruit requirements not wood



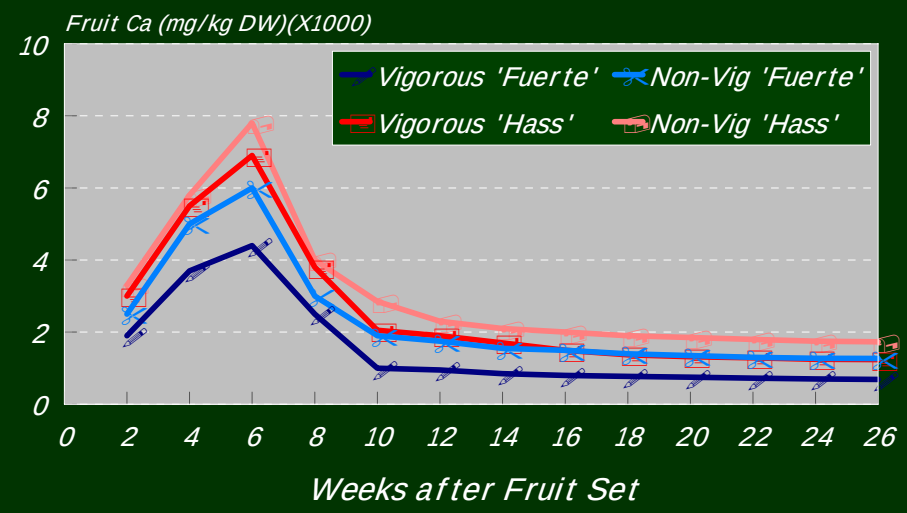
Increased vegetative vigor from pruning can result in increased decay and physiological disorders

Diffuse discoloration



Leonardi, Whiley, Hofman

Avocado Seasonal Calcium Concentration



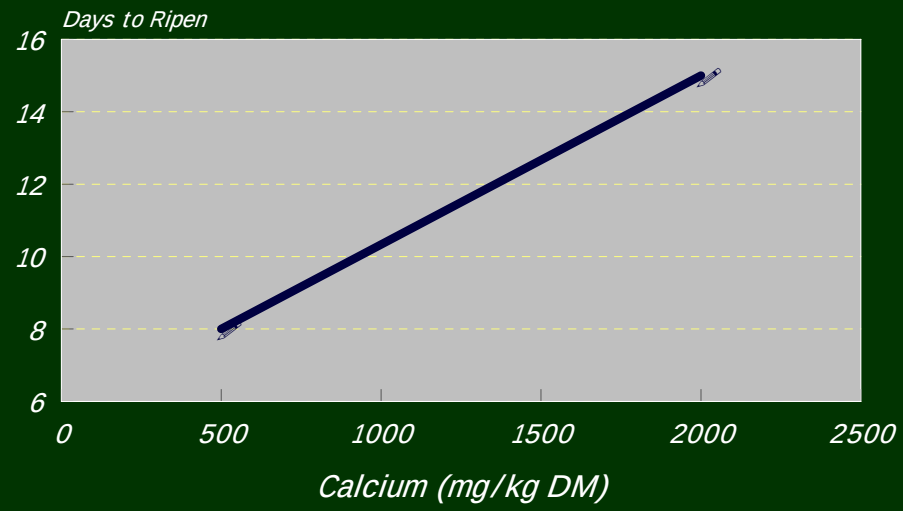
G.W. Witney et al., 1990

Tree vigor influences calcium levels in the fruit

Calcium affects the rate of ripening

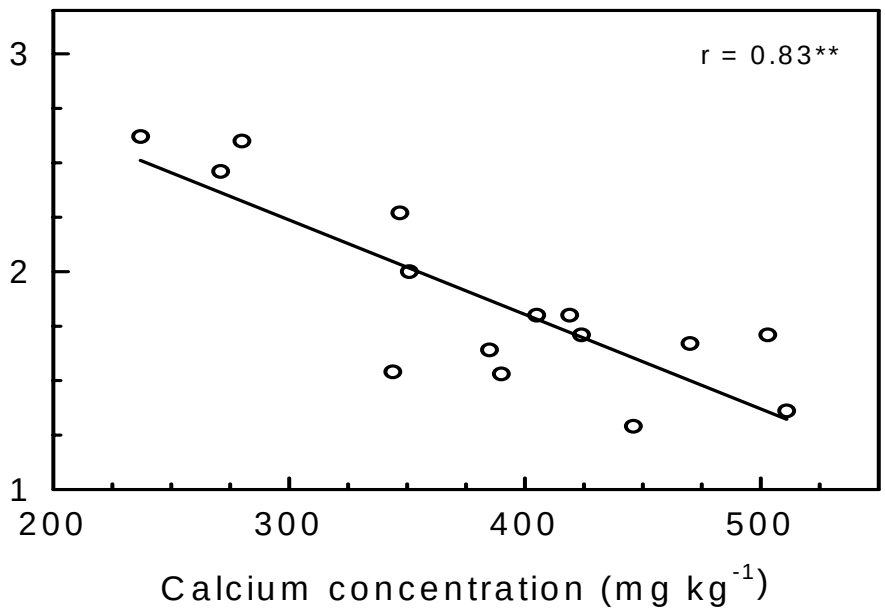
Regression of Days to Fruit Ripening and Calcium Concentration

$y = 0.0056x + 4.856, \quad r = 0.92^{**}$

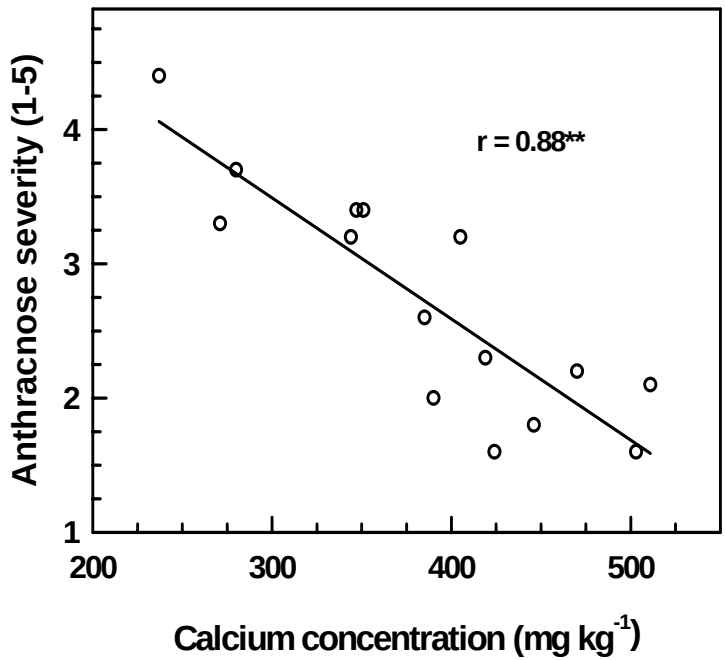


Witney et al., 1990

Diffuse discoloration (1-5)



Calcium fruit levels influences susceptibility to physiological problems and decay



Hofman, Vuthapanich, Whiley, Klieber, Simmons 2001

PRE-HARVEST GROWING CONDITIONS WILL INFLUENCE POSTHARVEST QUALITY

INTERACTION BETWEEN

* orchard temperatures and rainfall
  mainly external defects/decay
* vegetative growth/nutrient balance
  external and internal defects

EXTENT OF PROBLEMS INFLUENCED BY

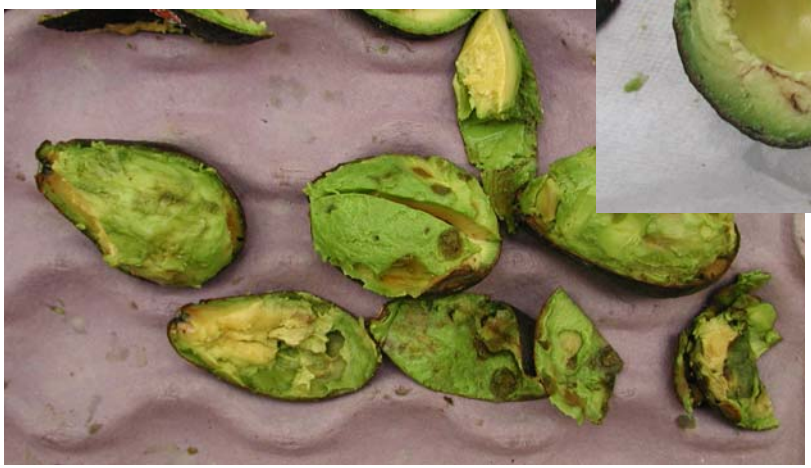
* water stress
* rootstock
* canopy management strategies

Harvesting Operations

- Minimum Maturity Standards
- Harvesting Methods
- Delay between field and packer
- Harvesting conditions

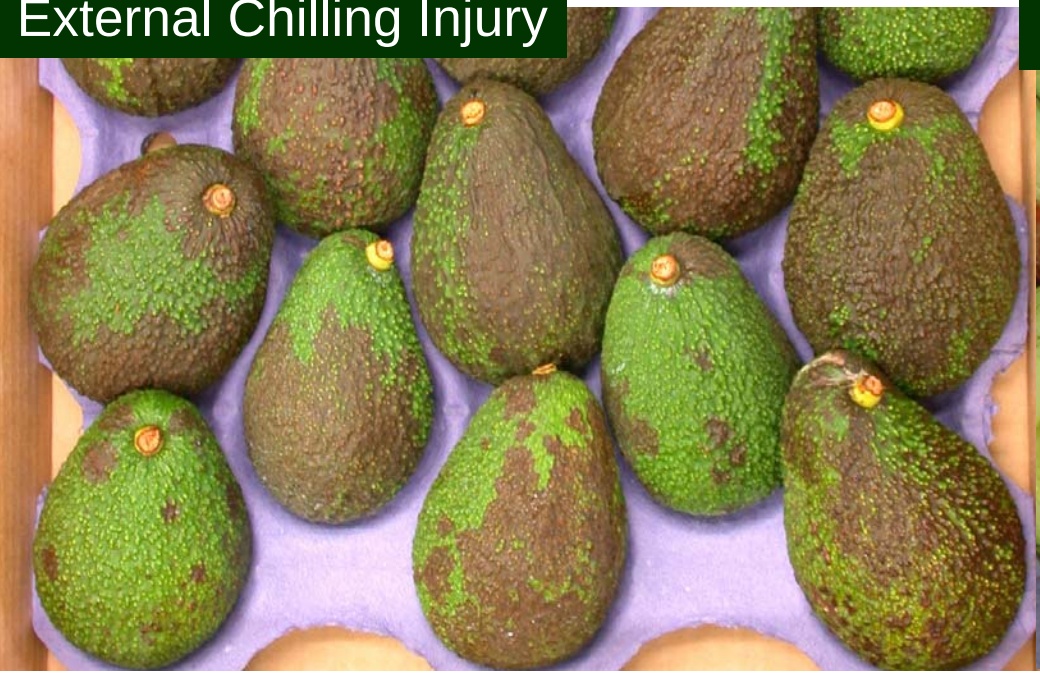
Fruit quality to consumers is limited by harvest maturity:

- 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

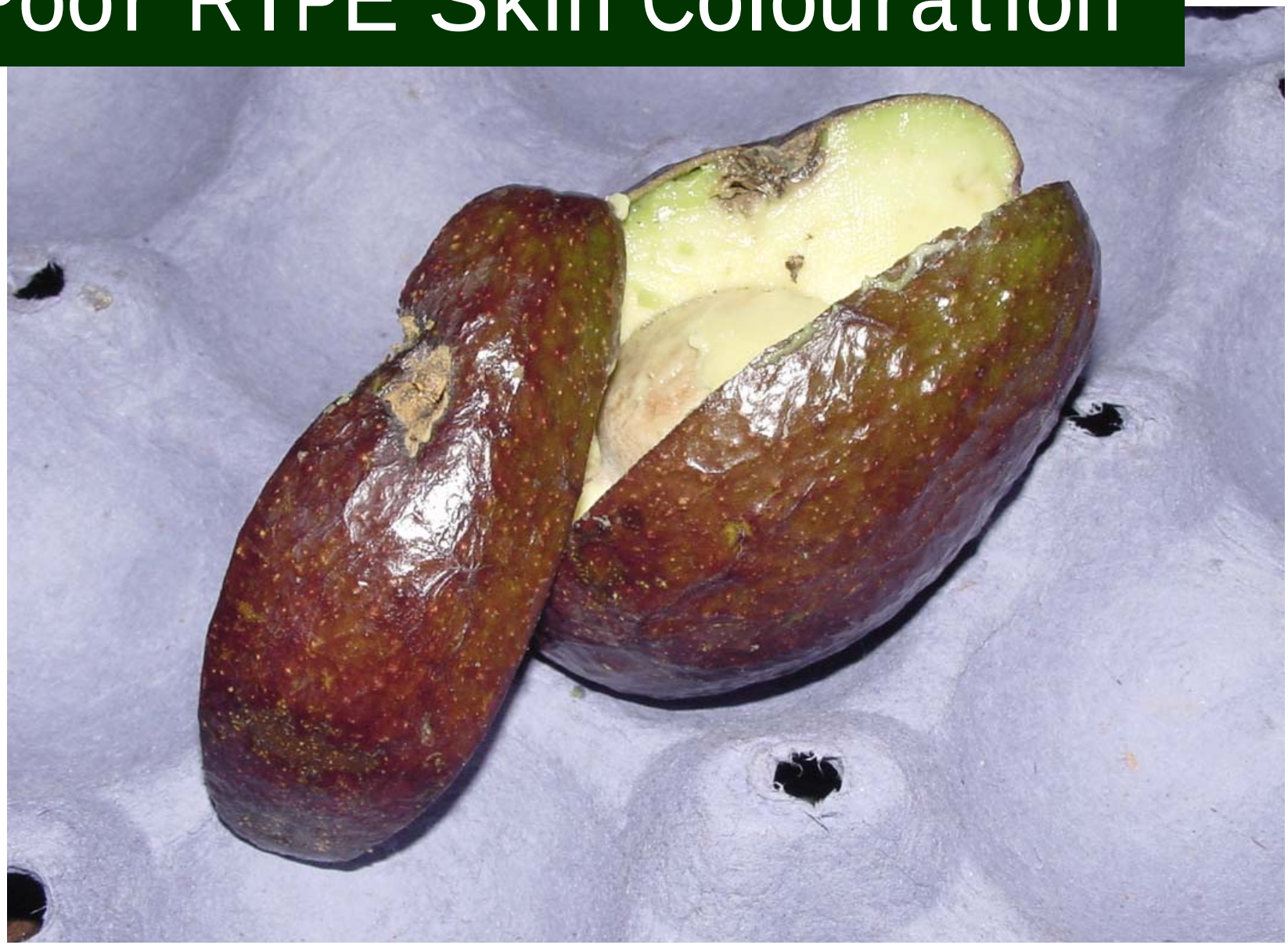
Checkerboarding = Ripening Variability

Difficult to predict time of ripeness; worse with low maturity

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

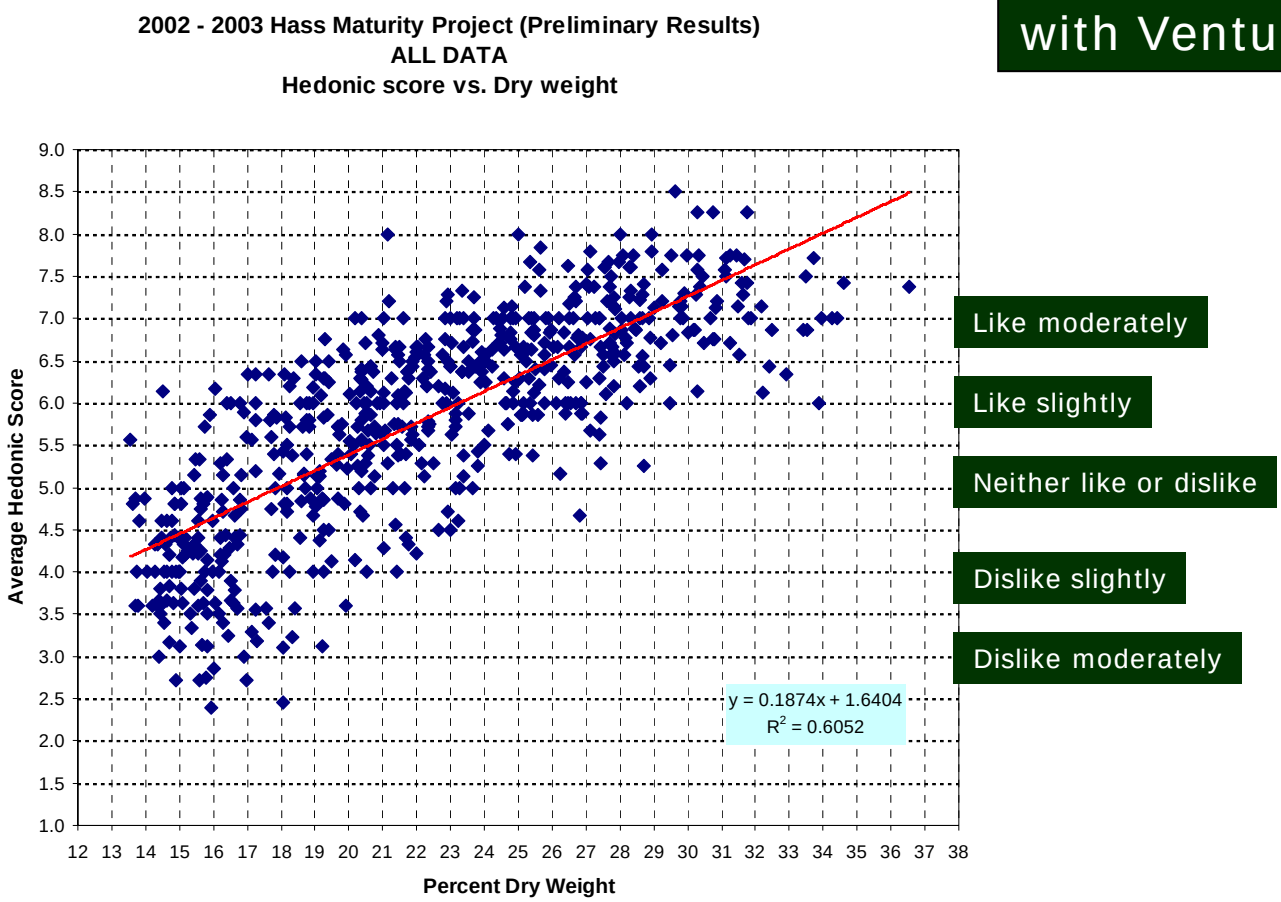
RESULT:
Lack of ripe uniformity means more loss at point of purchase

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%

Physical damage and chilling

Skin spotting
(Nodule damage)

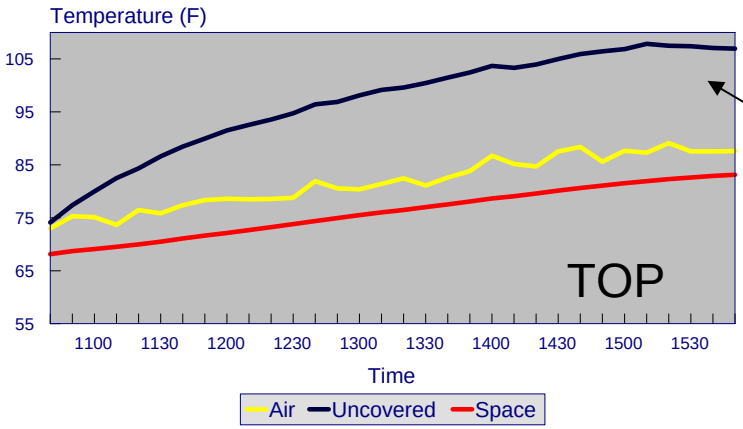
Discrete patches
(chilling damage)

Physical damage and chilling

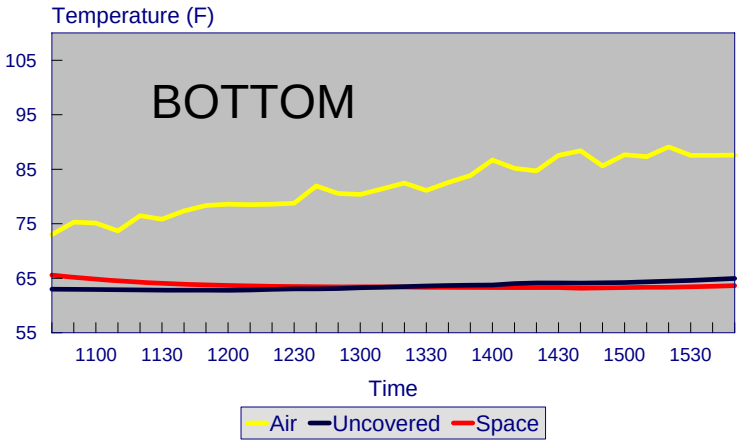
The importance of temperature management when harvesting

From the grove onward

Protecting the fruit after harvest from high temperature has implications in the market place



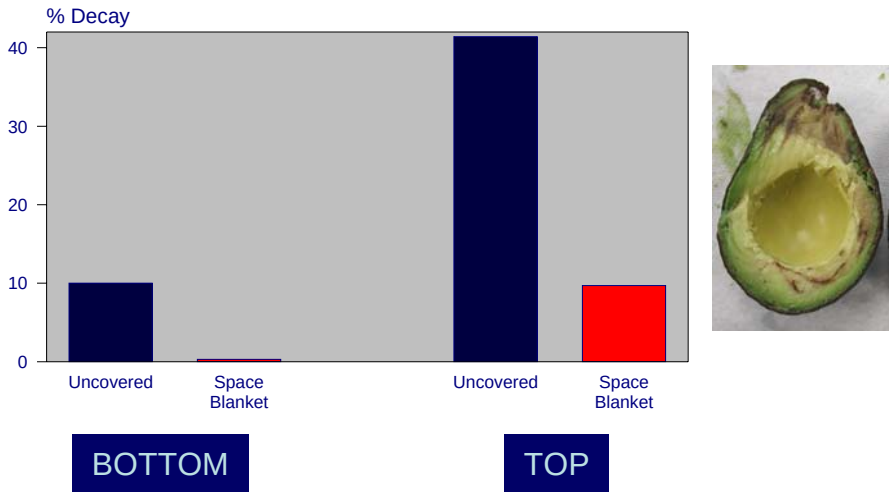
During the course of the day, fruit in the TOP 12” of the bin with no protection can reach temperatures in EXCESS of 35C whereas covered bins or those held in the shade can maintain temperatures close to ambient

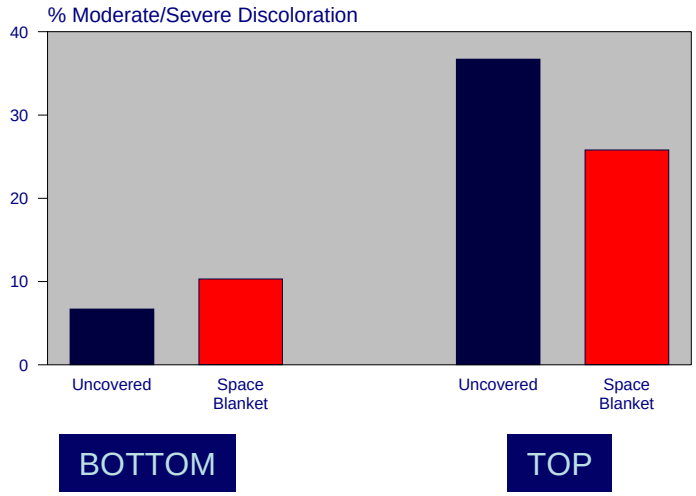


Fruit at the BOTTOM of the bin stay cool during the day

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

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





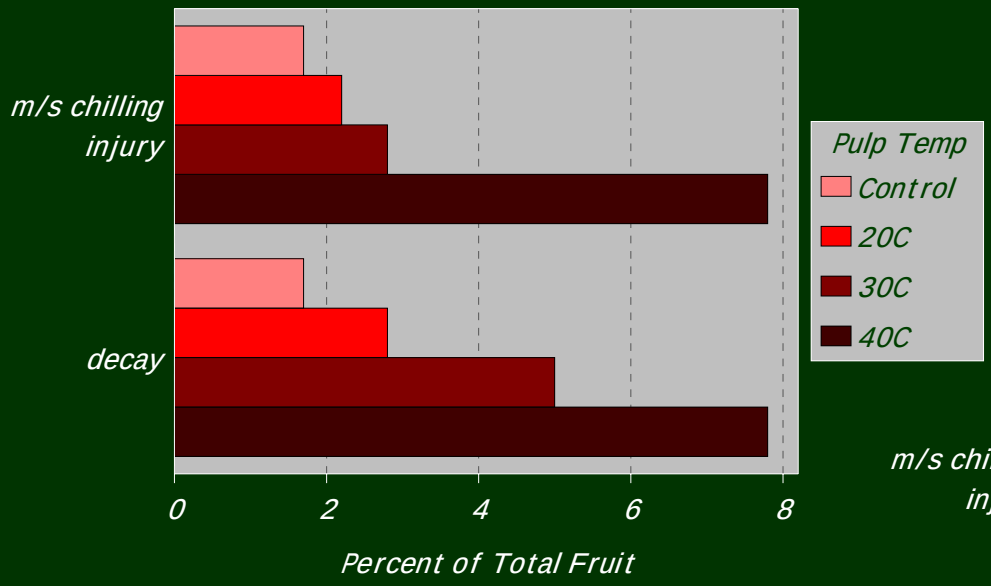
Fruit from the BOTTOM of the bin (lower temperatures) had lower decay and less chilling injury after storage at 5C and ripening.

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.

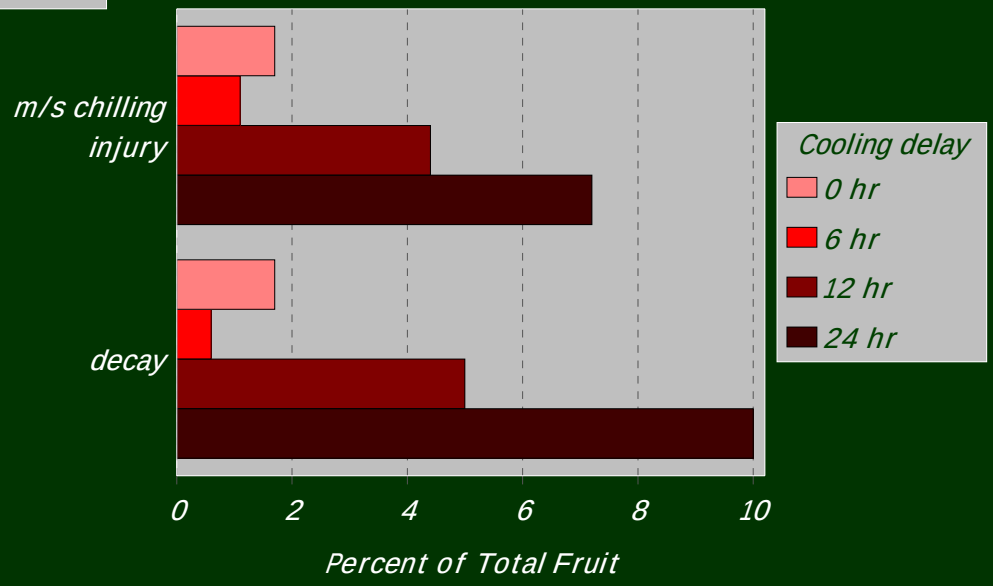
Source: Arpaia, M. L., 1994; storage was for 6 weeks at 5C.

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



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; 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

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

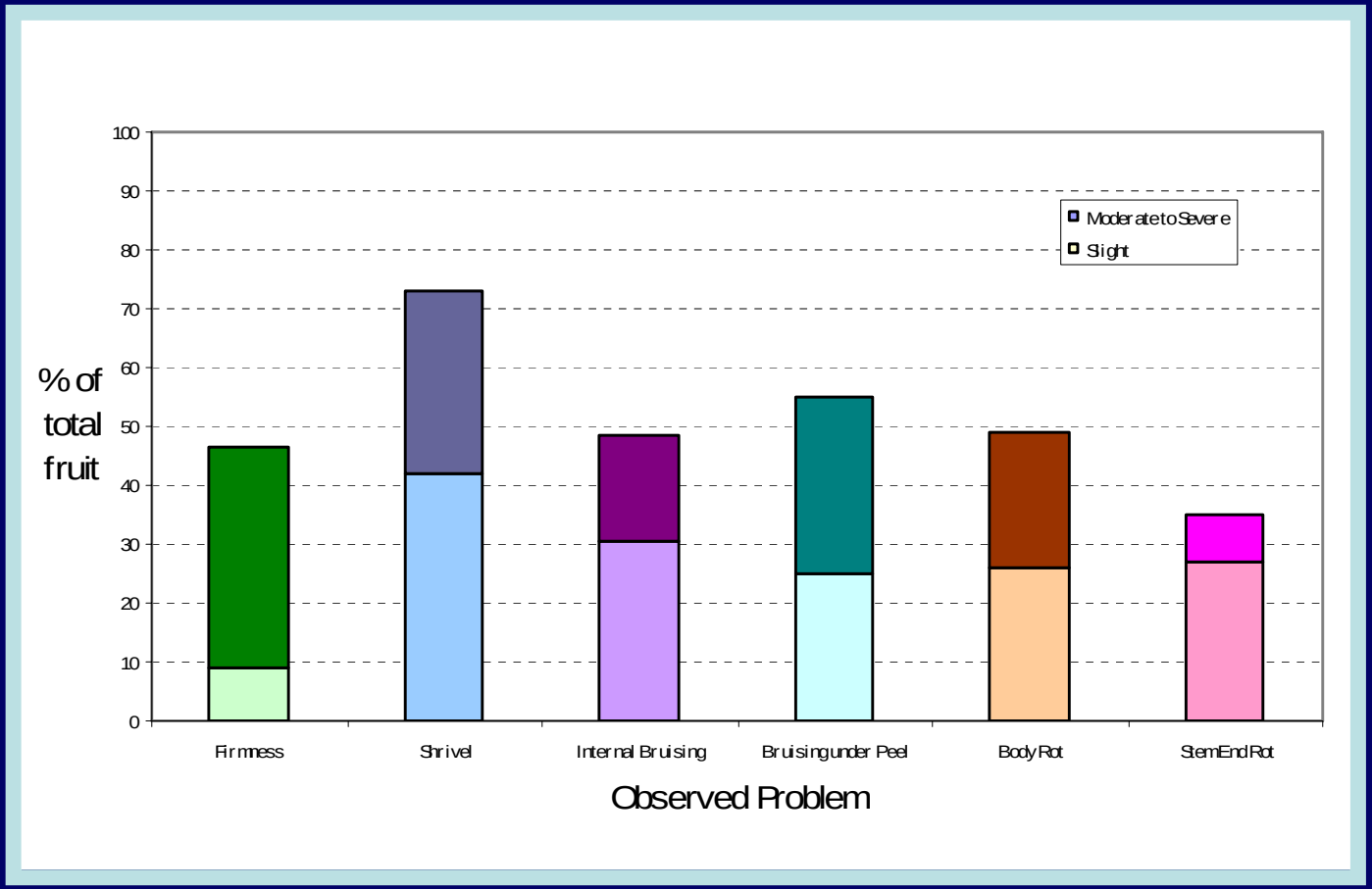
Example of a stem end rot

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

The link between the preharvest environment and fruit quality

BOTTOM LINE:
Quality does NOT improve after harvest

- Nutritional management – N, Ca relationships
- Rootstocks/pollinizers – what is their influence?
- Stress – Cold, Salinity, Irrigation management
- Canopy management – managing light and tree vigor

- Fruit handling prior to the packhouse

All contribute to fruit quality; interact w/ each other
Important to consider fruit maturity as well

Thank you!


2005
PROFIT TOGETHER