2° SEMINARIO INTERNACIONAL DE PALTOS

29 • 30 DE SEPTIEMBRE
1° DE OCTUBRE • 2004

Relación entre pre y post cosecha de la palta

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SOCIEDAD GARDIAZABAL Y MAGDAHL LTDA.

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

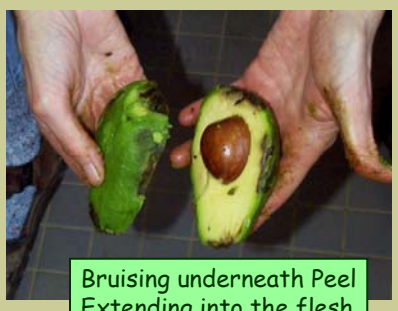
Alternaria
Stem End Rot

Dothiorella
Stem End Rot

Different symptoms of internal bruising

Internal Bruising

Bruising underneath Peel



Bruising underneath Peel
Extending into the flesh

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

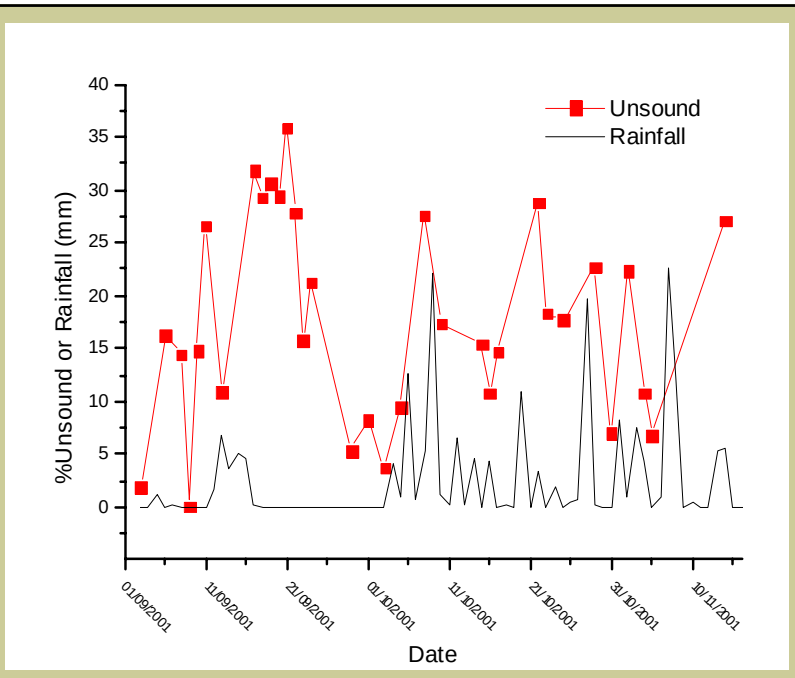
- Temperature
- Wind
- Rainfall
- Air quality
- Fruit position on tree

Freeze Damage
= Cold Stress

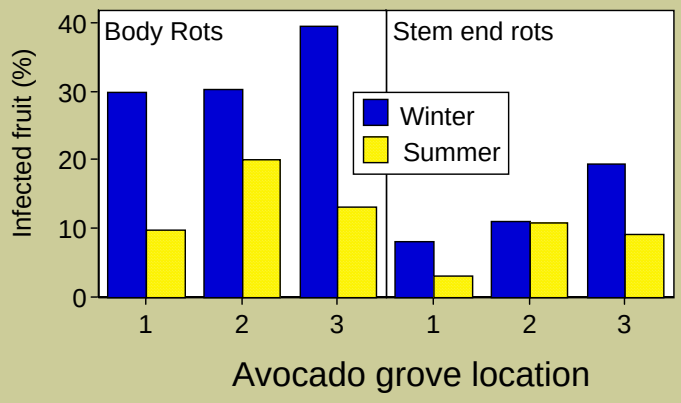
Beware of discoloured stems

Can see increased decay and low temperature damage after storage

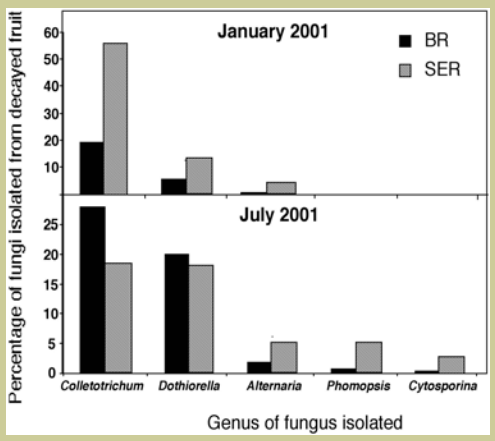
Effects could last for several weeks/months



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

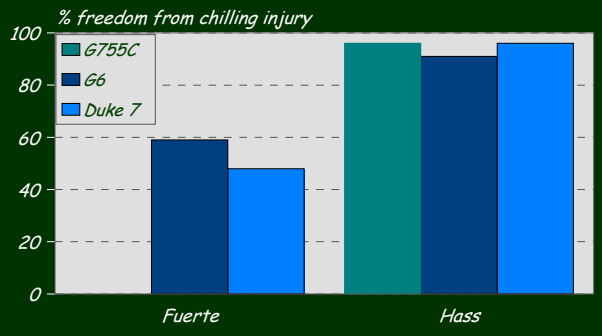


Things to ponder

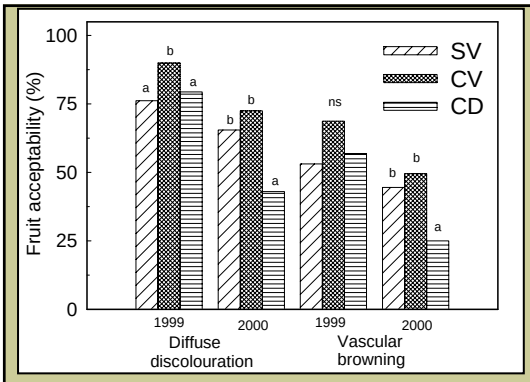
- Should freeze damaged fruit go into the market stream?
- Should you be tempted to pick up fruit from the ground?
- Should you pick after rain?

Rootstock and Variety Interactions

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



Kohne and Kohne, 1992 (unpublished)



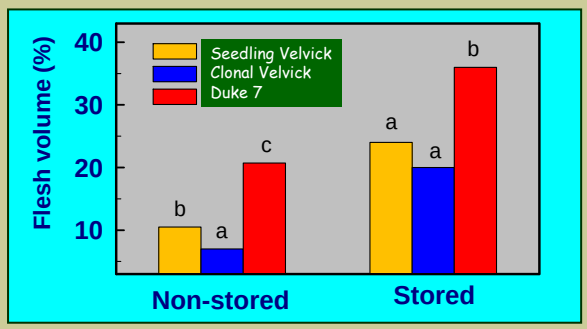
Rootstock and Variety Interactions

Results from Australia
20 yr-old trees

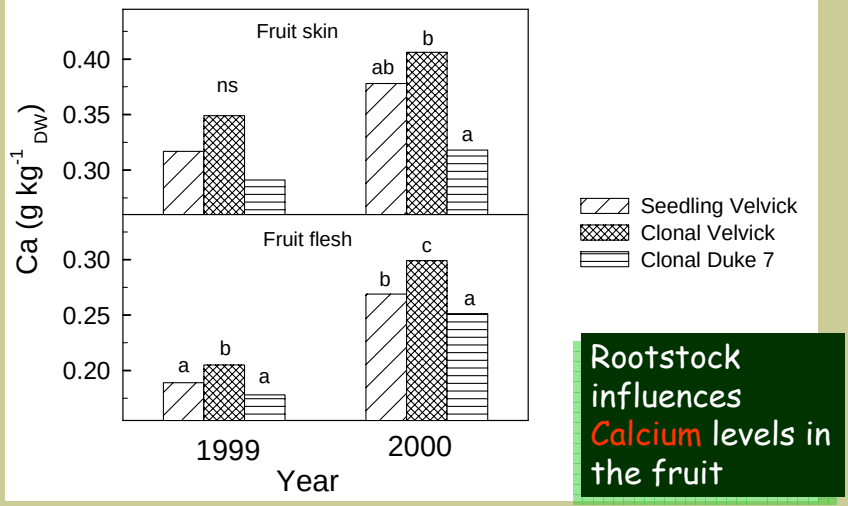
4 wks @ 5C

Rootstocks affect 'Hass' avocado fruit rots and physiological disorders

Marques, Hofman 2002

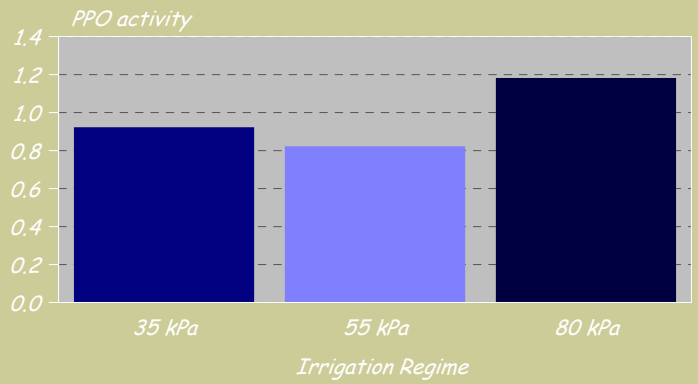


Rootstock and Variety Interactions



Rootstock influences Calcium levels in the fruit

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

Effects of tree vigor on fruit quality

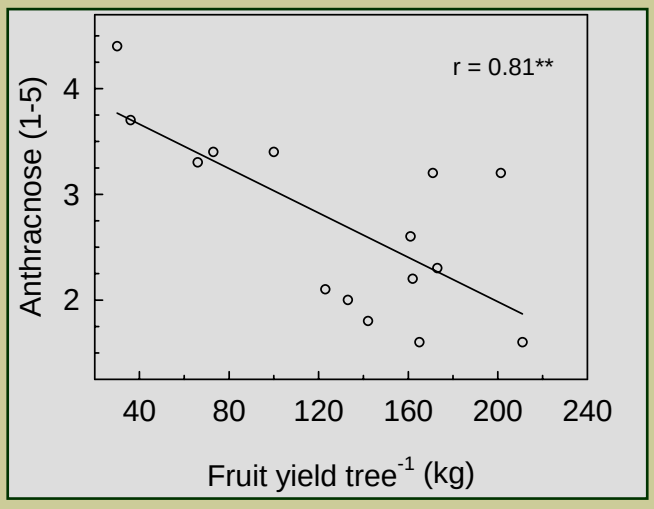
Individual tree yield records were maintained

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 5.5C
- Low yielding trees had lower pulp calcium, zinc and manganese

D. Smith, 1992 (unpublished RSA)

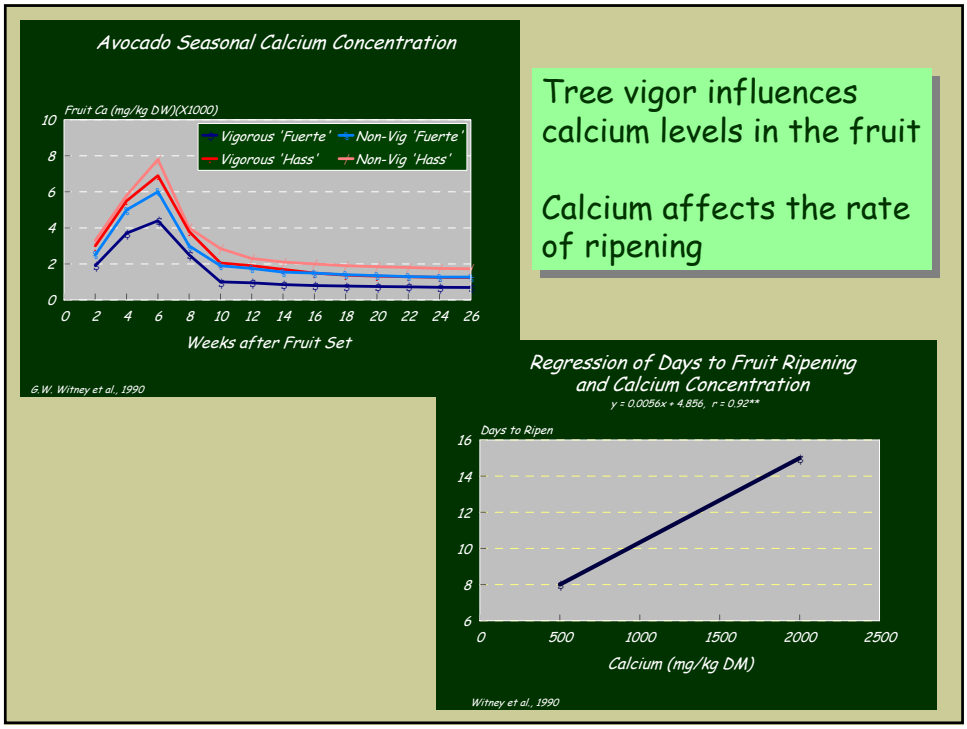
Tree yield and fruit rots (Australia)



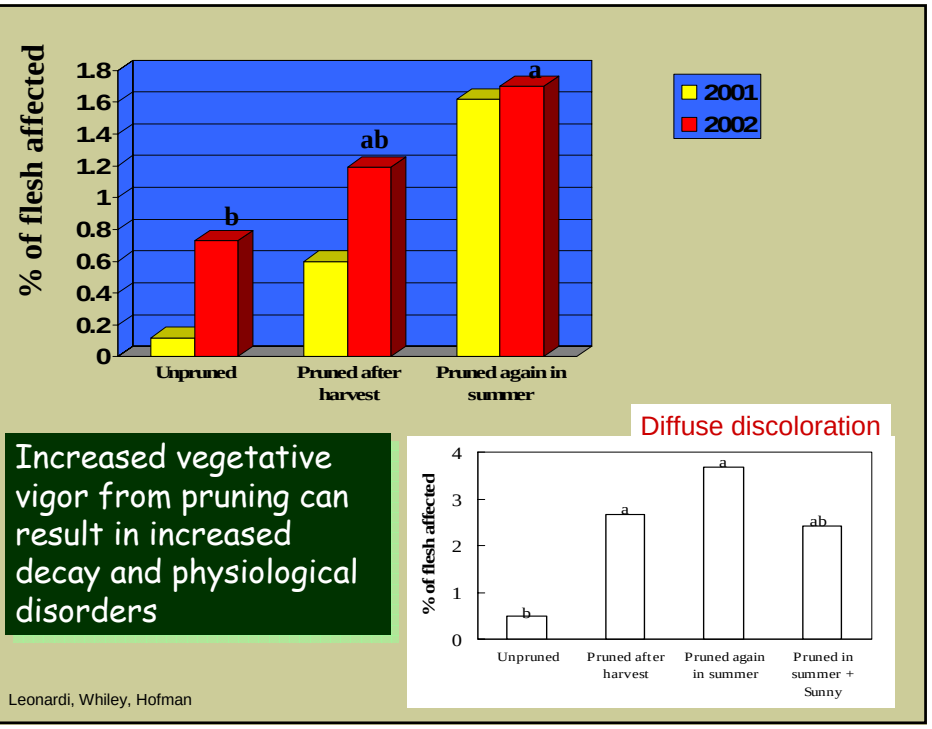
Higher yield for same size tree may also reduce postharvest decay

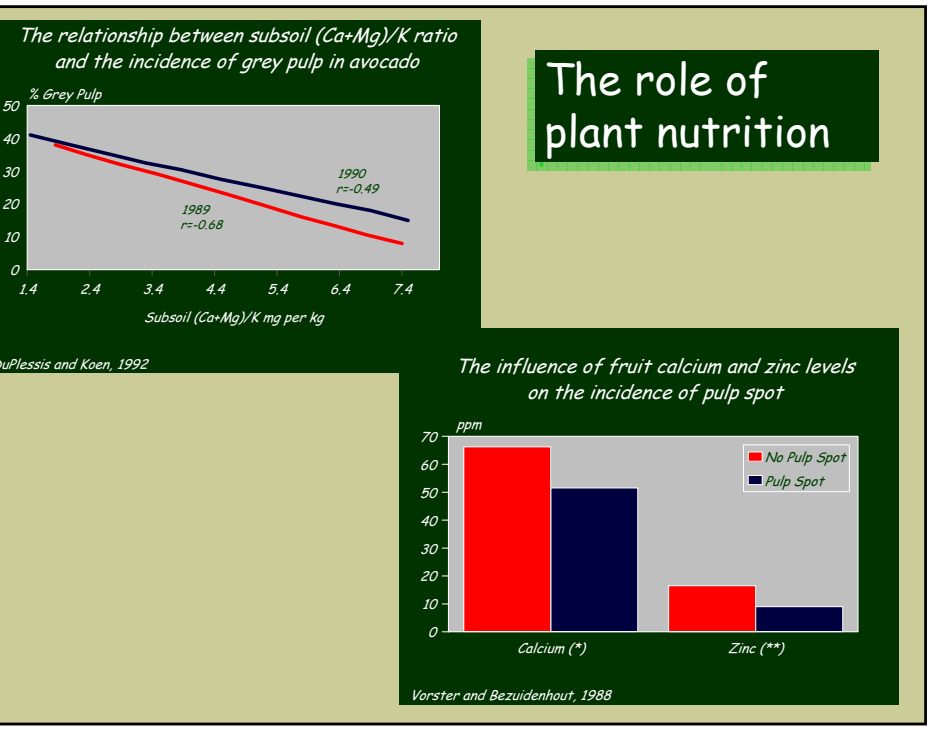
Associated with smaller fruit and higher fruit Calcium

Hofman, Vuthapanich, Whiley, Klieber, Simmons 2001


Avocado Seasonal Calcium Concentration
Fruit Ca (mg/kg DW)(X1000)
Vigorous 'Fuerte'
Non-Vig 'Fuerte'
Vigorous 'Hass'
Non-Vig 'Hass'
Weeks after Fruit Set
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, r = 0.92**
Days to Ripen
Calcium (mg/kg DM)
Witney et al., 1990

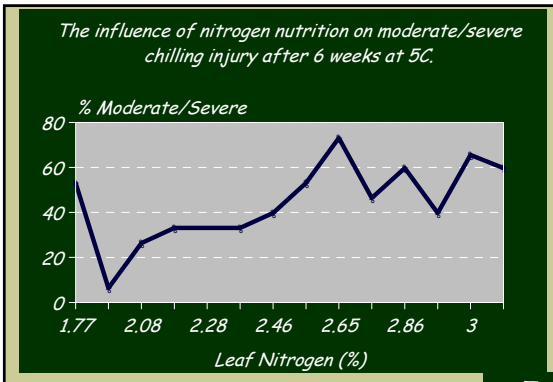

Canopy Management/Pruning
May have an effect on fruit quality
Aim at fruit requirements not wood

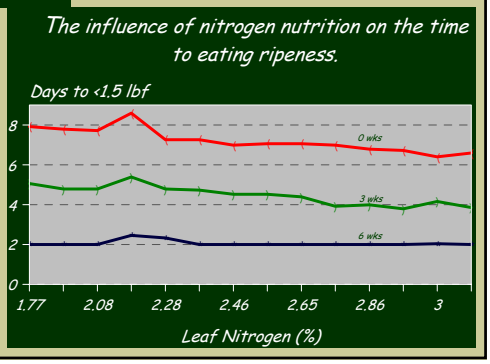

% of flesh affected
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
b
ab
a
2001
2002
Unpruned
Pruned after harvest
Pruned again in summer
Increased vegetative vigor from pruning can result in increased decay and physiological disorders
Diffuse discoloration
% of flesh affected
4
3
2
1
0
b
a
a
ab
Unpruned
Pruned after harvest
Pruned again in summer
Pruned in summer + Sunny
Leonardi, Whiley, Hofman


The relationship between subsoil (Ca+Mg)/K ratio and the incidence of grey pulp in avocado
% Grey Pulp
50
40
30
20
10
0
1990
r=-0.49
1989
r=-0.68
1.4
2.4
3.4
4.4
5.4
6.4
7.4
Subsoil (Ca+Mg)/K mg per kg
DuPlessis and Koen, 1992
The role of plant nutrition
The influence of fruit calcium and zinc levels on the incidence of pulp spot
ppm
70
60
50
40
30
20
10
0
No Pulp Spot
Pulp Spot
Calcium (*)
Zinc (**)
Vorster and Bezuidenhout, 1988

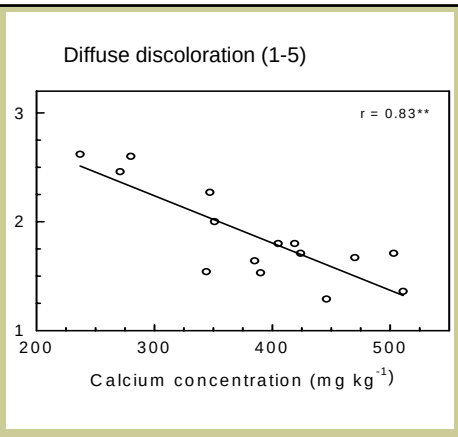
HIGH NITROGEN

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

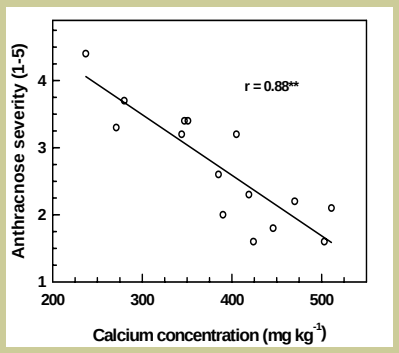




The role of Nitrogen on 'Hass' fruit quality



Calcium fruit levels influences susceptibility to physiological problems and decay



Hofman, Vuthapanich, Whiley, Klieber, Simmons 2001

Flesh minerals and diffuse discolouration

Year	Holding conditions	r value		
		Ca	Mg	K
1994	7°C, 3 wks	-0.07	-0.13	0.55 *
1995	7°C, 5 wks	0.30	0.31	0.06
	2°C, 5 wks	-0.83 **	-0.75 **	0.51 *

Hofman, Vuthapanich, Whiley, Klieber, Simmons 2001

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

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

Mature

- *Good quality when ripe*
- *Longest postharvest life*

Overmature

- *Poor flavor*
- *More Physiological disorders, decay*

Immature Fruit Quality Problems

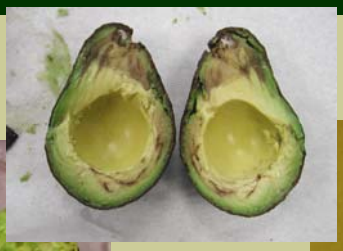
Physiological disorders accentuated with low maturity fruit

External Chilling Injury

Flesh Discoloration

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



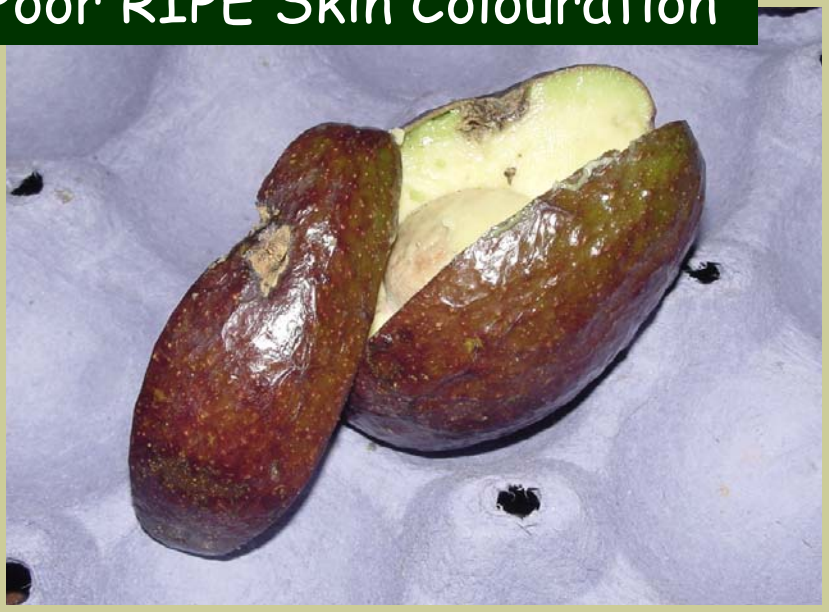
Checkerboarding = Ripening Variability

Difficult to predict time of ripeness

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

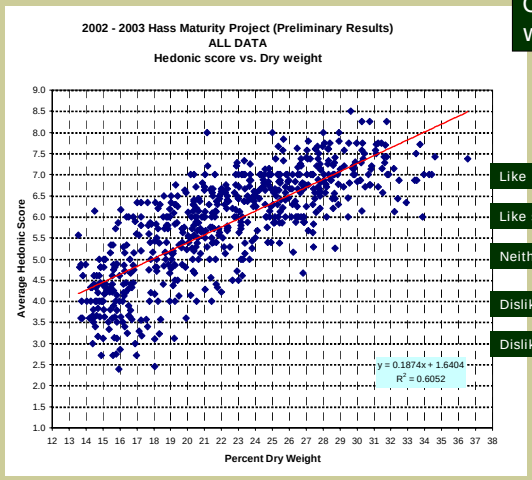
RESULT:
Lack of ripe uniformity means more loss at point of purchase

Poor RIPE Skin Colouration



TASTE

California 2002-03 results with Ventura Co. Hass fruit



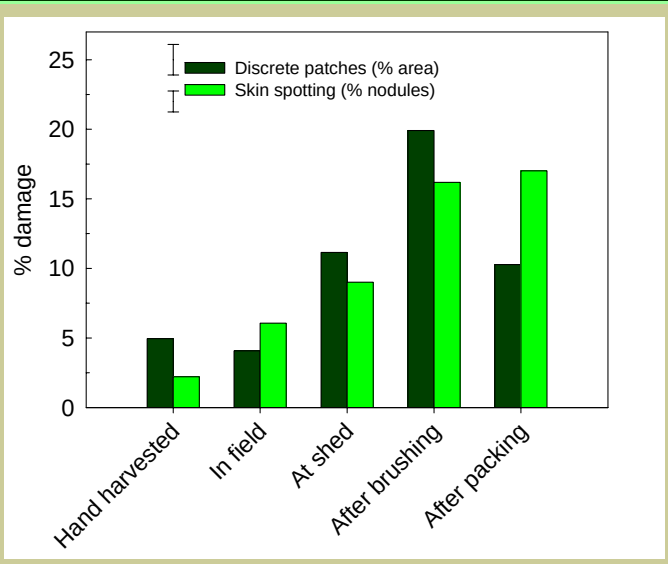
Clearly at lower DW values, acceptability of fruit is marginal

Data suggest that for a score of 6 the CA dry matter will be approximately 23%

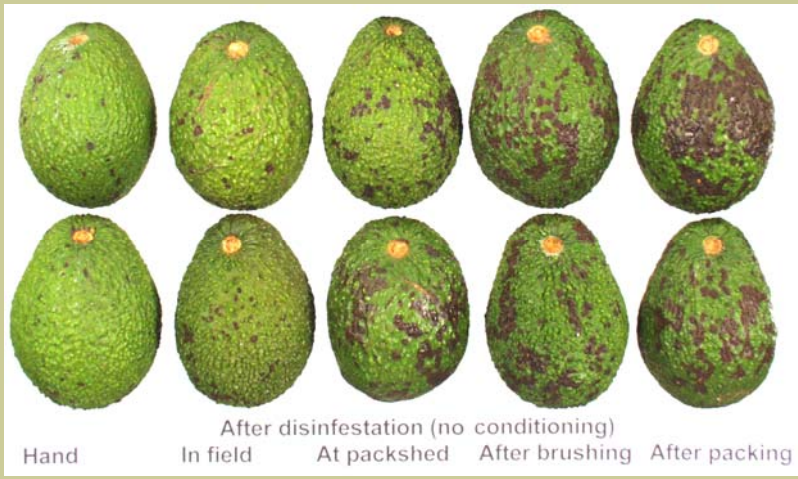
Skin spotting
(Nodule damage)

Discrete patches
(chilling damage)

Physical damage and chilling

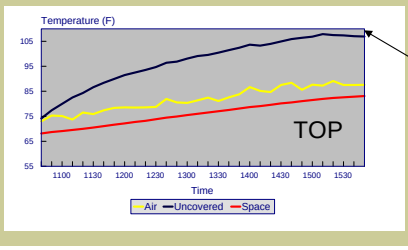


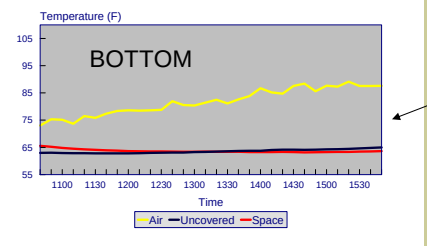
Physical damage and chilling



The importance of temperature management when harvesting

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



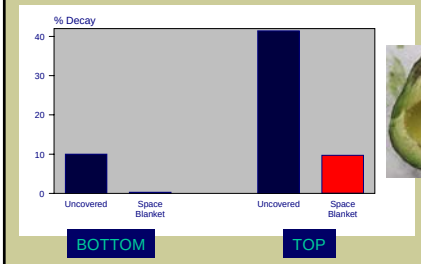


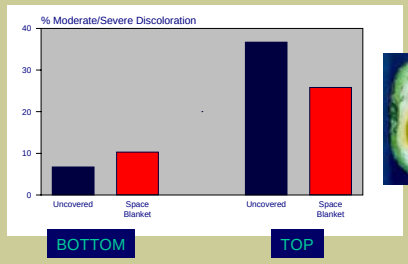
During the course of the day, fruit in the TOP 12" of the bin with no protection can reach temperatures in EXCESS of 100 F whereas covered bins or those held in the shade can maintain temperatures close to ambient

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