Exporting Australian avocados:

Challenges, options and research

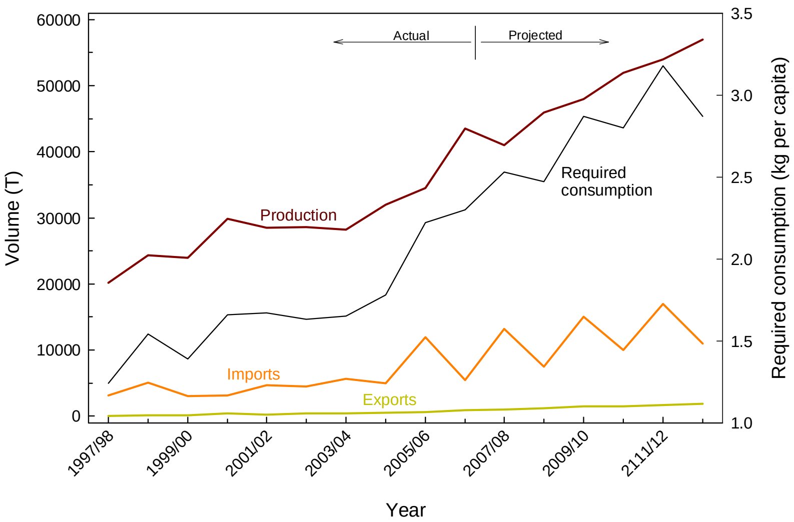
Peter Hofman and Roberto Marques

Queensland Primary Industries and Fisheries

Queensland Government

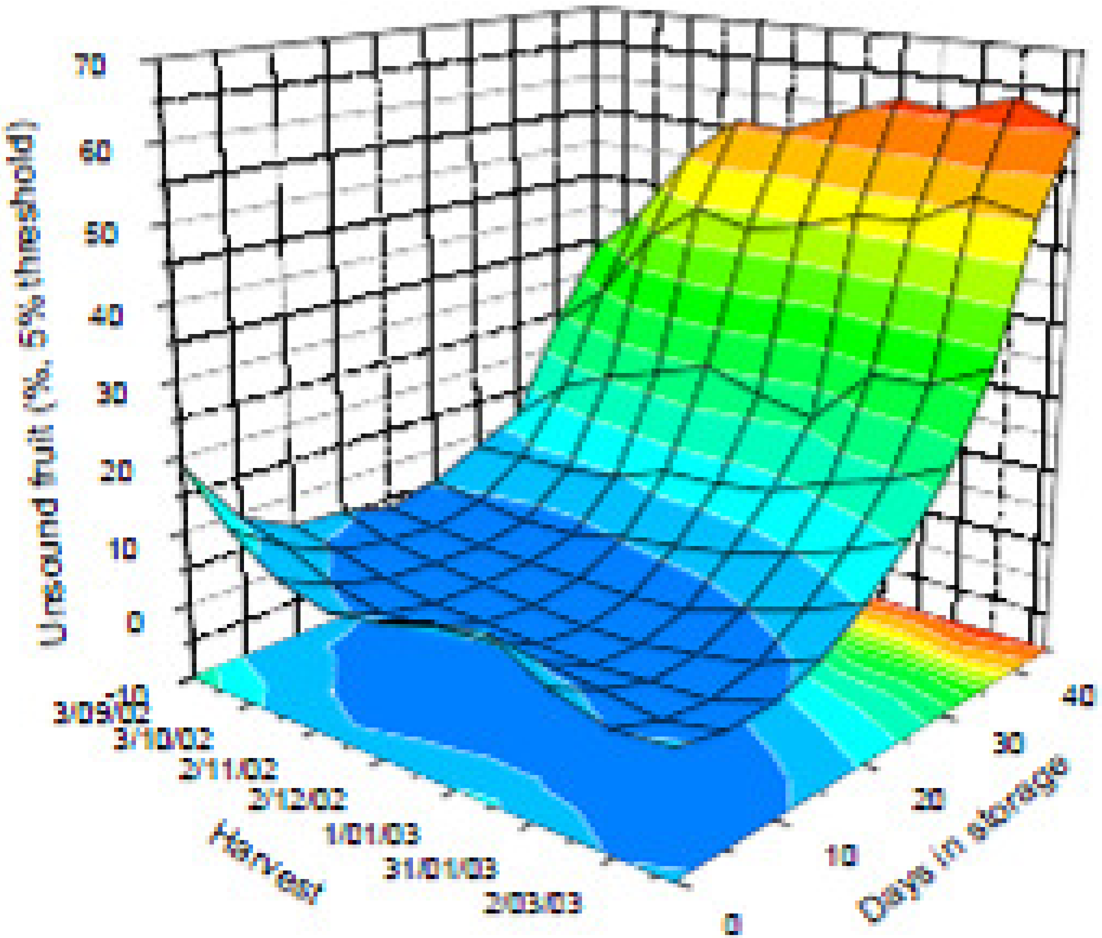
How to get there – the cost/quality balance!

- Air
  - Generally expensive
  - Maintains quality
- Sea
  - Cheaper
  - May compromise quality because of longer times (10-40 days)
- Combinations of air and sea
  - Intermediate cost and quality risks
  - Greater logistical challenges



Seafreight - the tyranny of time

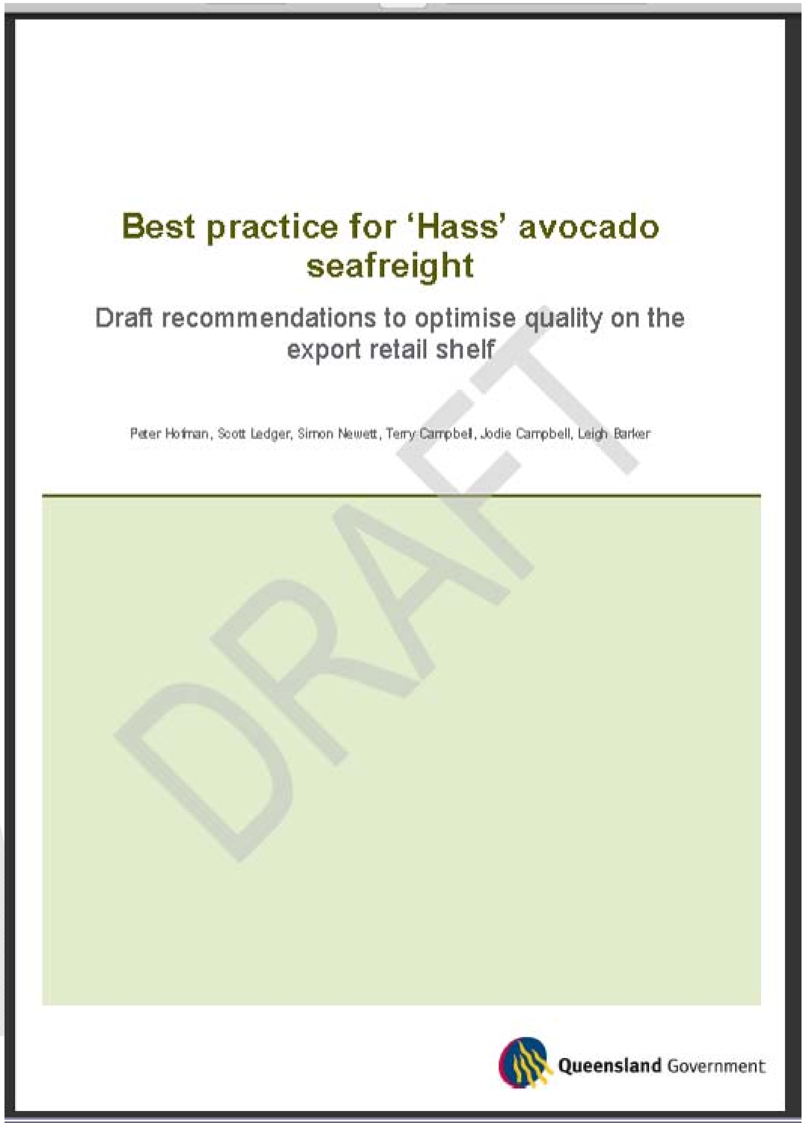
Cold storage at 4ºC



Dixon et al. (2003)

The need for best practice from field to fork

- Based on Hazard Analysis
  - Draft stage
  - Will be refined at end of season
  - Will be the basis for information guides/training material



Best practice for 'Hass' avocado seafreight

Draft recommendations to optimise quality on the export retail shelf

Peter Hofman, Scott Ledger, Simon Newett, Terry Campbell, Jodie Campbell, Leigh Barker

DRAFT

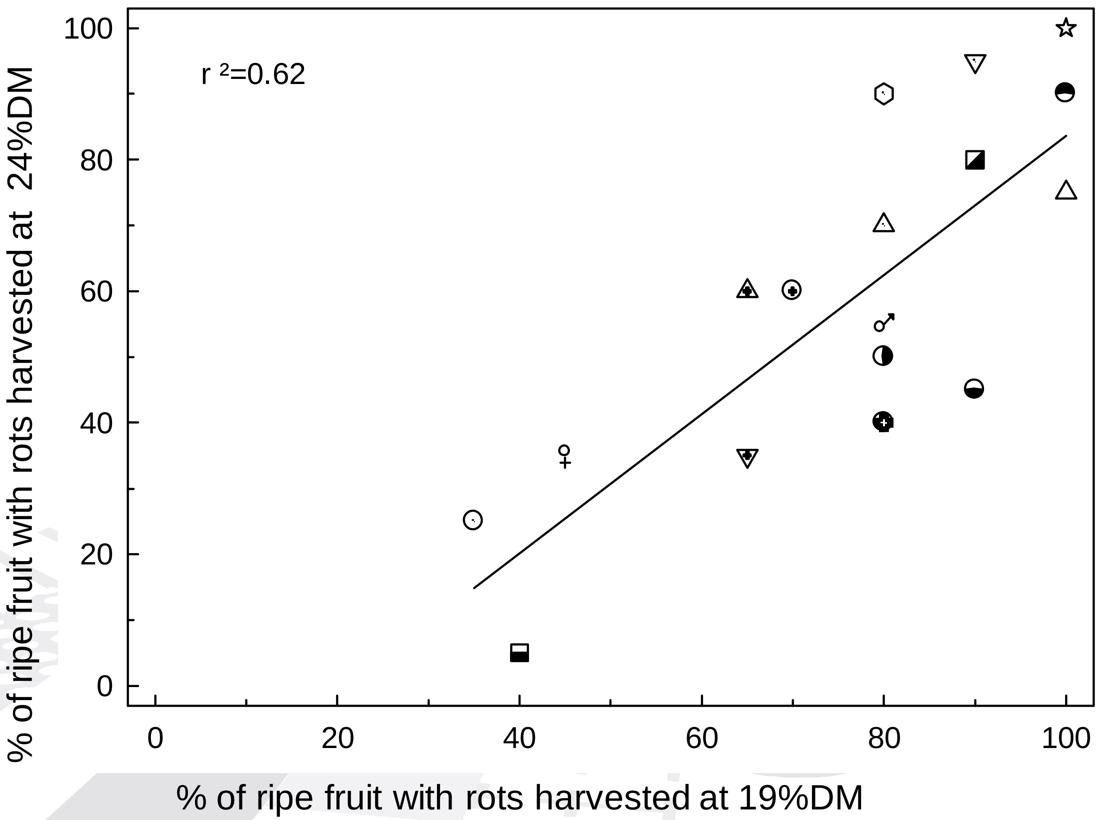
Queensland Government

Predicting outturn quality-which fruit to export

- Disease load in the orchard
  - Everett (2003) using leaf discs
- Fruit “robustness”
  - Nitrogen
  - Calcium
  - Iron
  - Maturity
  - C7 sugars?

Predicting outturn quality – the Avotest

- Harvest sample fruit weeks before shipping
- Combines inoculum load and fruit robustness



Le Lagadec et al. (2008)

Predicting using non-destructive means

- E.g. near infrared spectroscopy (NIRS)
- It can sort for dry matter/ moisture content in the lab
- Can NIRS sort for:
  - rots?
  - more even ripening? (Blakey 2009)
  - Poster by Burdon et al.

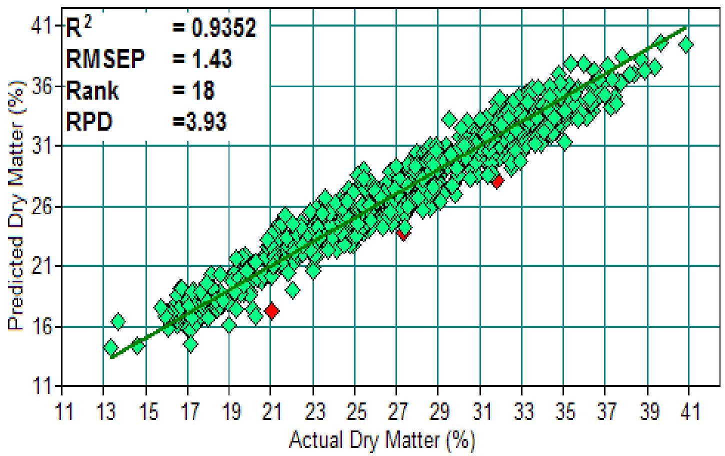


Figure 1. Validation set for all regions combined.

Wedding et al (2008)

In the container……………..the key variables

1. Temperature
2. Atmospheres

– Humidity
– Low oxygen and high carbon dioxide
  - Reduces respiration rate
  - Two main “control” systems
    - Controlled atmospheres – full active control
    - Modified atmospheres
      - Relies on fruit respiration and a “membrane” to restrict gas movement
      - MA packaging - plastic bags etc
      - Maxtend
      - The reefer container is the “membrane”

1. Temperature

- Can we store below 4-5ºC?
  - Risk –discrete patches
  - Benefits – less flesh defects
  - Conditioning before storage
    - 3-4 days at 4-6ºC
    - Eliminates discrete patches for 20-25 days at 1ºC
      - Good cold disinfestation treatment - in transit?
      - Also improves internal quality
    - Not sure about longer than 25 days
    - Not tested in combination with CA

Not conditioned

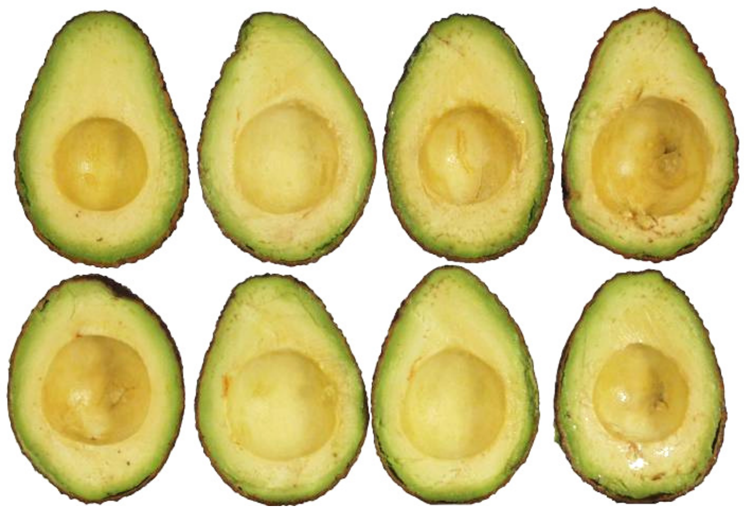
At removal from 1 ºC for 16 d

At ripe

Conditioned

At removal from 1 ºC for 16 d

At ripe



2. Atmospheres

- Humidity
  - Reduces fruit weight loss
  - Controlling water loss from harvest reduces risk of fruit “ripening” in store
    - Can reduce flesh defects
  - New containers have larger evaporator coils
    - Allows >90% RH

- Oxygen and carbon dioxide
  - Literature reports ranges of 2-4% O_2 and 4-6% CO_2
  - Recent static trial gave excellent results after 42 days

Controlled atmospheres

Without CA		With CA
	Grower 1	
	Grower 2	

Ways to “control” the atmospheres

Full control

- Nitrogen generator to flush out excess O_2
- Introduce air if O_2 gets too low
- Flush with air/nitrogen to reduce CO_2 buildup

- Recent improvements
  - CA system integrated into container
    - Increased cargo space
  - Smarter atmosphere control – AFAM+
    - Better use of air and generator gases
  - More powerful CA units
    - establish CA more quickly

Ways to “control” the atmospheres

Dynamic CA

- Determine best O_2 concentrations by measuring fruit behaviour during storage
- Adjust O_2 concentrations to just above damaging levels
- Currently only used for land storage in apples etc
- Promising results with avocados (Burdon *et al* 2007&8)

Ways to “control” the atmospheres

- “Hybrid system - Maxtend
  - Uses fruit respiration to reduce O_2 concentrations
  - Introduces air when O_2 concentration gets too low
  - Absorbs excess CO_2 using satchets
  - Similar performance to full CA, but can be cheaper

Include CO_2 absorber

Seal the container

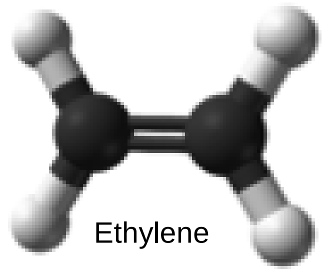
Flush with nitrogen

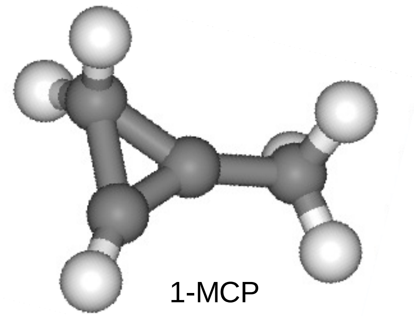
Install the Maxtend controller

SmartFresh^{SM}

SmartFresh

- 1-MCP
- Similar molecule to ethylene – but different enough
  - blocks ethylene from starting the ripening process
- Applied as a gas soon after harvest
  - Cool fruit
  - Treat with about 0.5 ppm for about 20 hours
  - Handle/store/seafreight as usual





Smartfresh - potential

- Internal quality often as good as with CA
- But:
  - variable ripening
  - Can get more disease with longer ripening
- Use only during mid-late maturity? (SA)
- Maybe sort with NIRS for even ripening

No SmartFresh

No SmartFresh

Other potential advances

- RFID
  - Tracking container movements
- In transit fruit behaviour monitoring
- Infrastructure improvements
  - Maintaining the cold chain
- Logistics scheduling
  - Reducing time from harvest to sale

Thanks to
QPIF
Sunfresh
AAL
HAL