

# Pathology challenges in avocado:

## Fruit diseases

Liz Dann, Lindy Coates, Luke  
Smith, Ken Pegg, Jan Dean,  
Tony Cooke

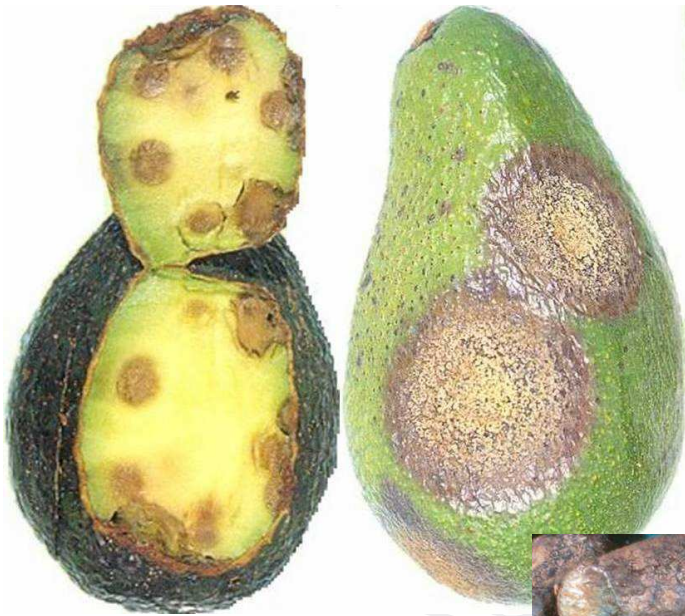


Queensland Government

## Topics covered

- Anthracnose, stem-end rot, pepper spot and sooty blotch
- Management of fruit diseases
  - Field practices and fungicide treatments
  - Postharvest practices and fungicides
- Rootstocks and nutrition
- Future management tools
- Integrated control

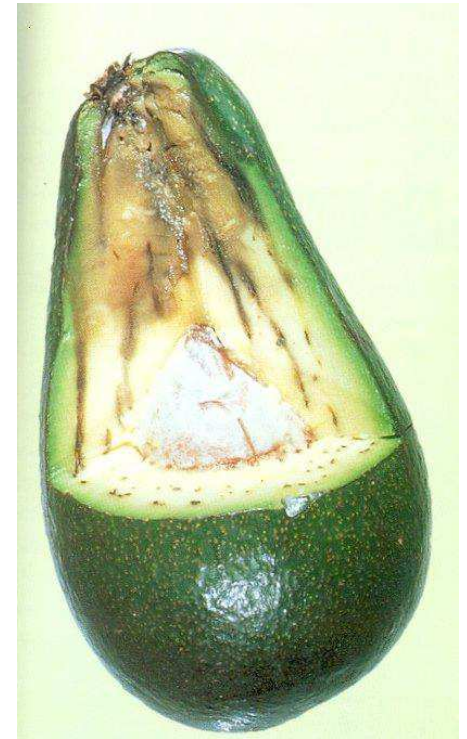
# Postharvest diseases



anthracnose



stem-end rot



## Field diseases



Pepper spot



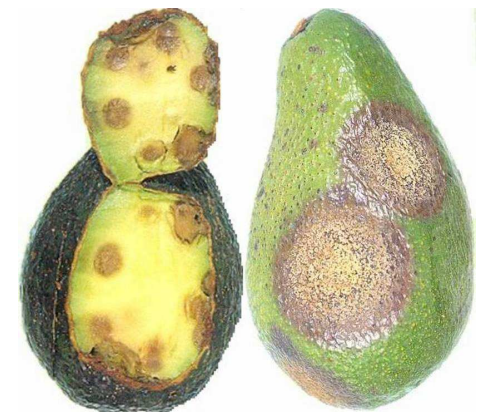
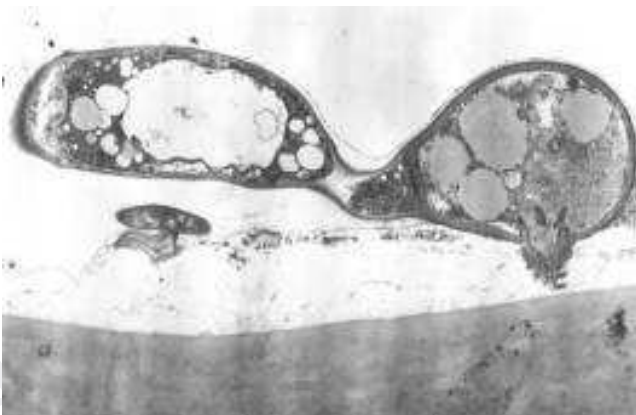
Sooty blotch

# Anthracnose (*Colletotrichum gloeosporioides*)

Infection occurs in field from fruit set to harvest

**dormant**  
→  
**period**

Symptoms develop during fruit ripening



## Stem-end rot (many fungi)

- *Botryosphaeria* spp
- *Lasiodiplodia theobromae*
- *Colletotrichum gloeosporioides*
- *Phomopsis perseae*
- *Thyronectria psuedotrichia*



Stem-end rot (SER) fungi colonise the stem tissue of avocado trees without causing disease

Symptoms develop during fruit ripening

## Stem-end rot

- SER more severe when trees are stressed
- Optimum irrigation and nutrition critical for control
- Higher incidence in immature fruit
- Incidence can be reduced by using field fungicides

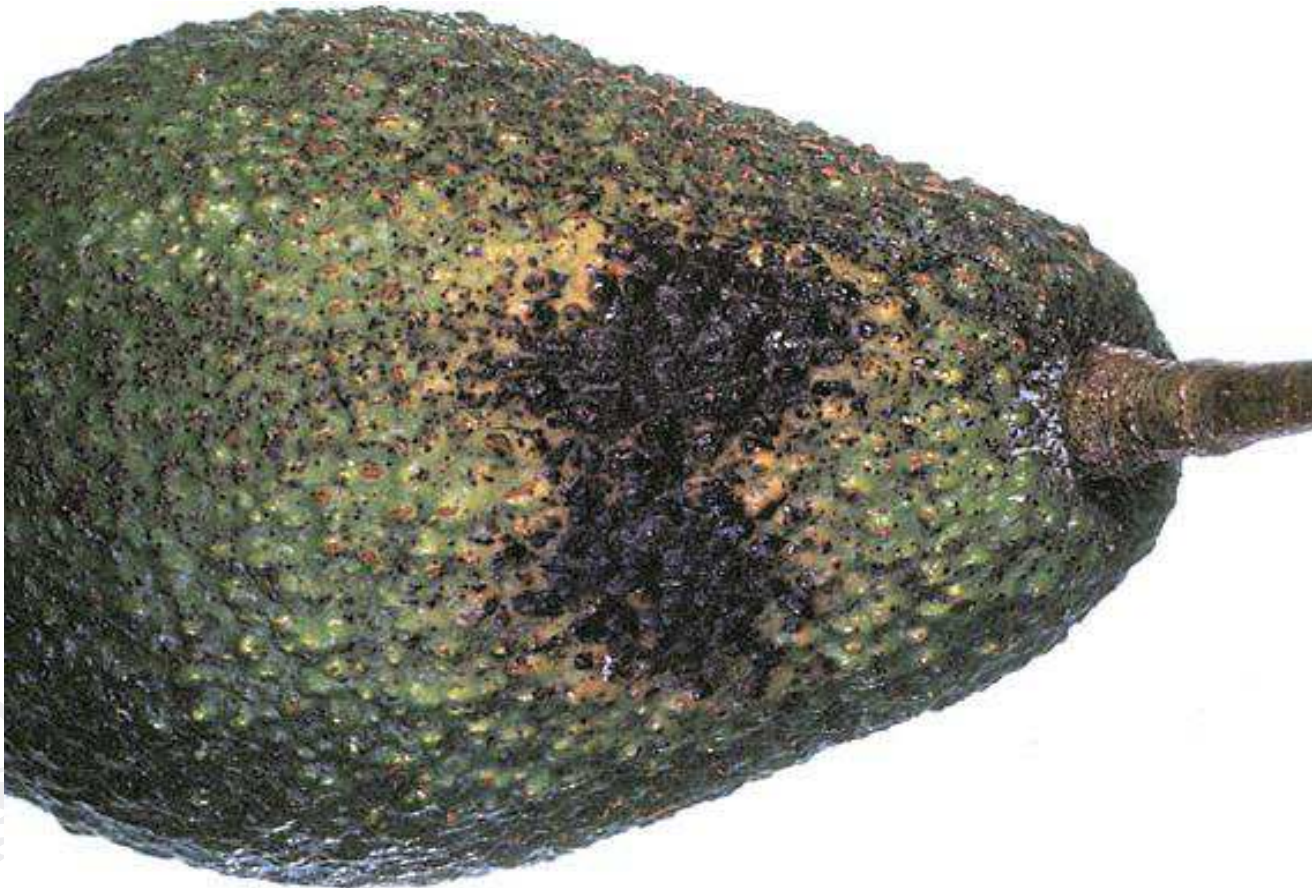
## Pepper spot (*Colletotrichum gloeosporioides*)

- Caused by the same fungus which causes anthracnose
- Correlation with tree stress due to:
  - abiotic factors (drought, sunburn/heat stress, poor irrigation management, no mulching)
  - biotic factors (Phytophthora)





# Pepper spot worsened by sunburn



# Sooty blotch

- Superficial blemish that can develop on fruit and twigs
- Active in wet weather
- Well controlled with copper spray program



# Management of fruit diseases

- Field
  - Registered fungicides eg. Copper, Amistar
  - Crop nutrition, especially Ca and N
  - Optimal irrigation
  - Variety/rootstock selection
  - Canopy management
  - Management of insect pests
  - Careful harvesting, avoiding skin damage, bruising

# Canopy management

- Good ventilation, rapid drying
- Lift skirts off ground
- Prune out dead branches before flowering



# Management of fruit diseases

- Postharvest
    - Keep fruit covered (out of sun) to prevent overheating
    - Remove field heat ASAP (pre-cool)
    - Handle fruit carefully, avoid bruising etc.
    - Registered fungicide (Sportak) before packing
    - Storage temperatures
      - green mature Hass, 4-5°C
      - ripening fruit >12°C
      - Near ripe 2-5°C
- Lower storage temps may cause chilling injury***
- Controlled ripening (ethylene)

## Chilling injury (“diffuse discoloration”)



## Copper fungicides

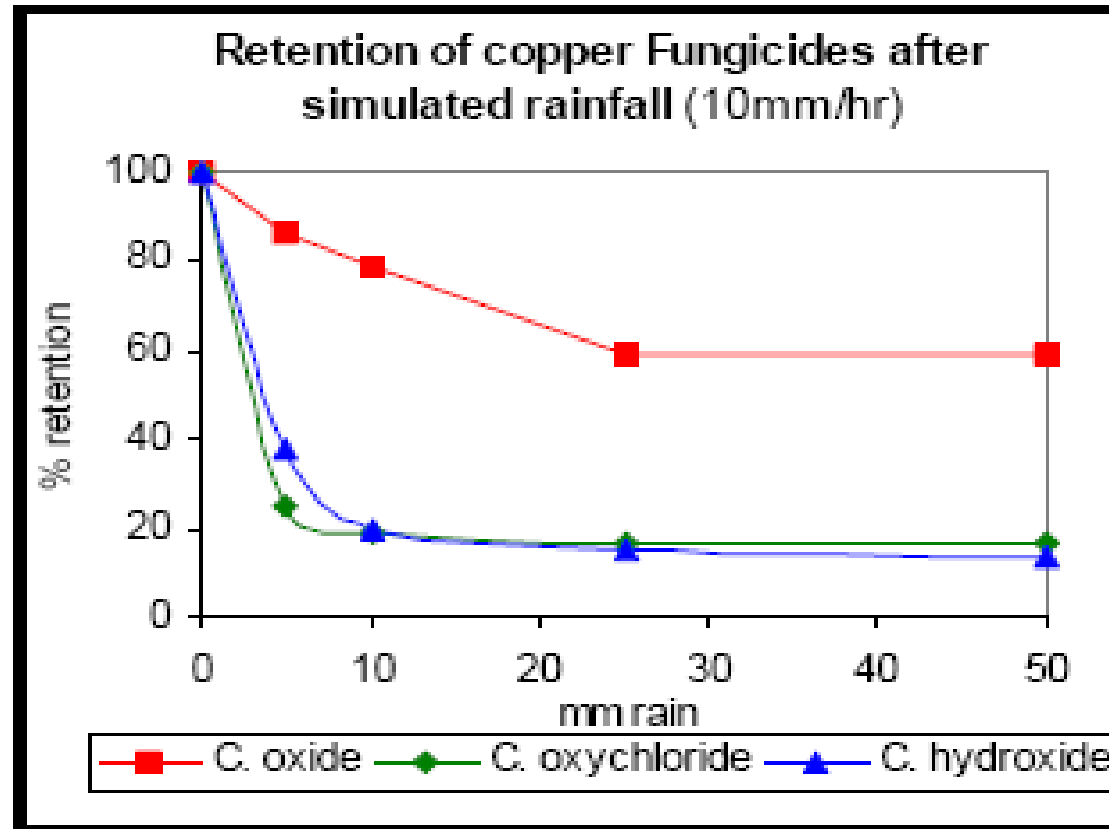
- Protectants – no “short-cuts” in copper spray program (every 28 days in fine weather, every 14 days if very wet)
- Must maintain protection from fruit set (pea size) to harvest
- Do not spray at flowering – can be phytotoxic
- If anthracnose and pepper spot a major problem, a “clean up” spray before flower bud break is OK
- Keep to recommended rates and monitor levels of copper in soil to avoid “**copper contaminated soils**”

## Keeping copper on the fruit

- Smaller particle size gives better rain fastness, coverage and longevity (red, copper oxide)
- Wind will blow off particles  $> 3\mu\text{m}$
- As fruit expands, copper is dislodged and fruit is not covered
  - Keep up the regular applications



# Copper retention



*Graph 1: Retention after simulated rainfall for 3 copper formulations (Centrilab, Holland).*

# Copper fungicides and foliar phosphonate application

- Use red copper (copper oxide/cuprous oxide) when spraying with phosphorus acid to reduce risk of toxicity
- Copper hydroxide (blue copper) is the worst to use with phosphorus acid, as the low pH makes it soluble (dissolves) and the cupric ions become phytotoxic
- Copper oxychloride (green copper) is intermediate
- Spray copper first, then phosphorus acid, **don't mix**

## Strobilurin fungicides

- Amistar® (registered for avocado)
- Cabrio® (not currently registered for avocado)
- Post-infection activity
- Can be applied after a very wet period
- Very effective when applied close to harvest (withholding period 7 days)
- Used with coppers in an anti-resistance strategy

***Follow label directions to avoid fungi becoming resistant to this group***

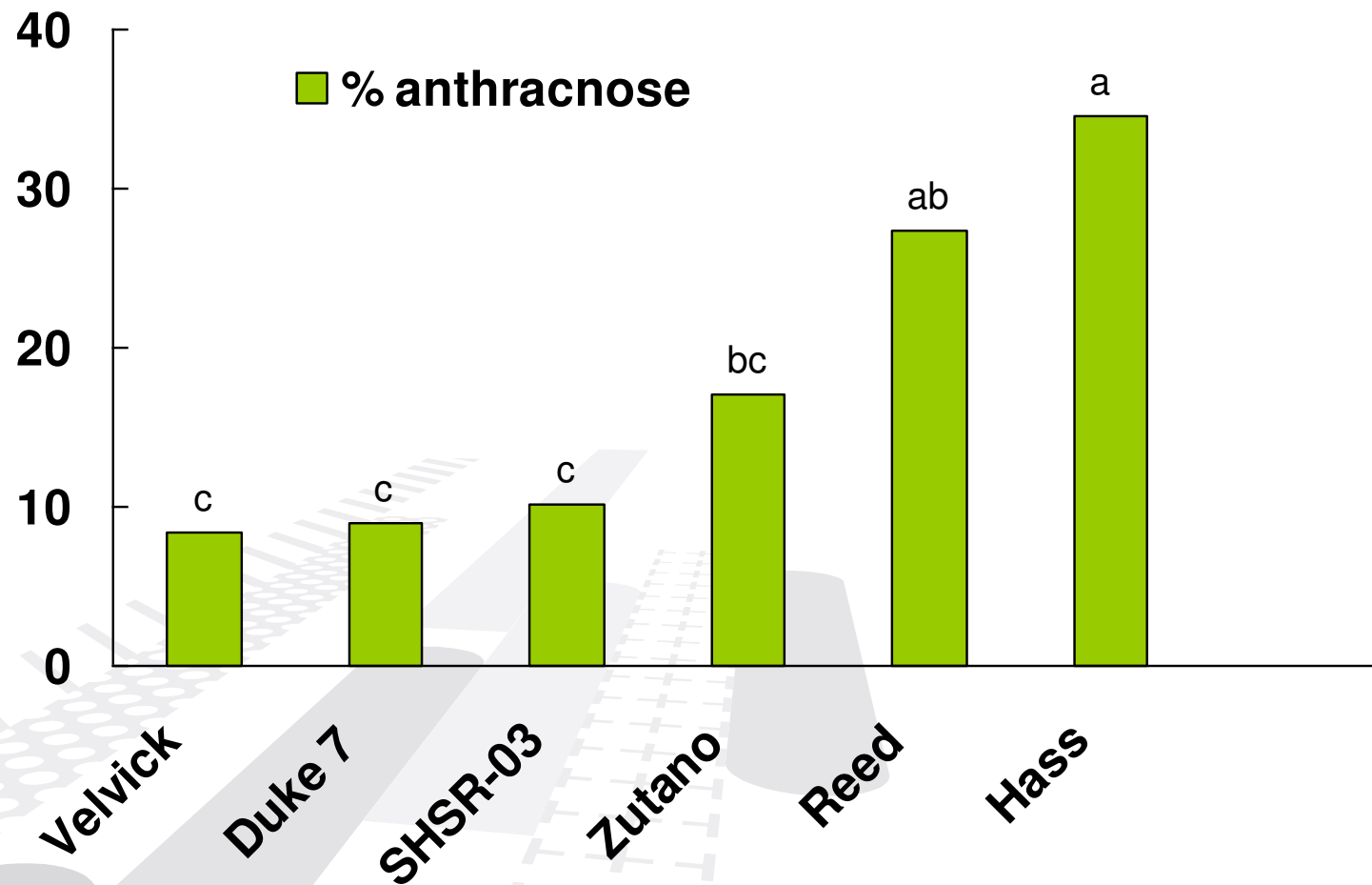
## Postharvest prochloraz fungicide

- Use prochloraz as a non-recirculated overhead spray on the packing line to control anthracnose
- Apply as soon as possible after harvest
  - best within 24h
- Must be used in conjunction with an effective field spray program
- MRL for EU is 5mg/kg

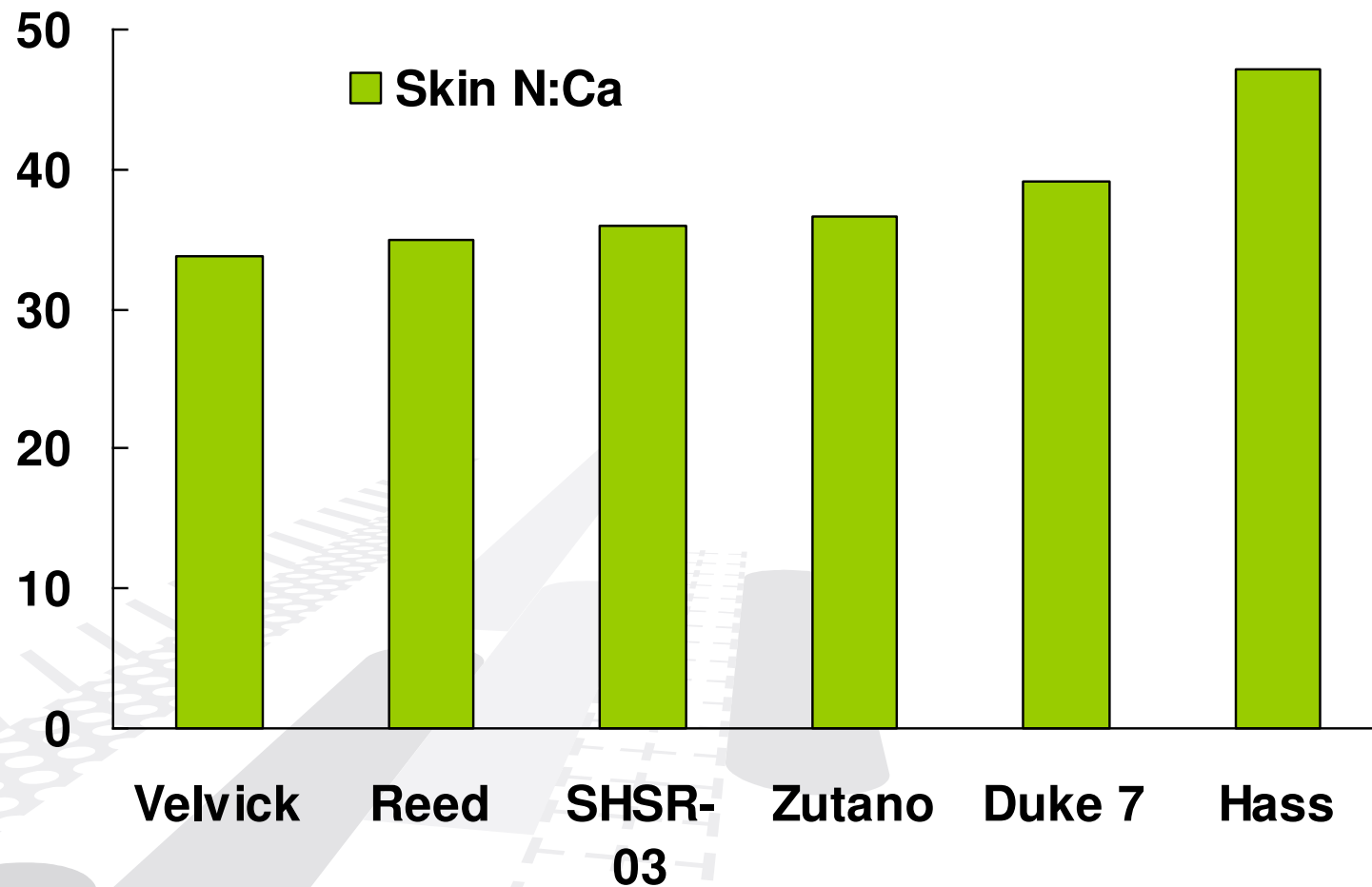
# Crop load, rootstock and nutrition affects fruit quality

- Evidence for higher quality fruit from trees with high crop loads (Trials 2007 & 2008)
- 'Hass' fruit quality consistently high (disease lower) from Velvick (West Indian) rootstock
- Further assessments continuing in AV08000 with Tony Whiley & Peter Hofman

# Effect of rootstock on anthracnose, Hampton 2008



## Effect of rootstock on fruit skin N:Ca ratio, Hampton 2008



## Correct nutrition (Ca and N) is critical

- increased shelf life and decreased disorders with improved calcium nutrition
- Ca levels in fruit difficult to manage
- Higher Ca in fruit from 'Velvick' than from 'Duke'
- High N can result in greater photosynthesis in leaves, outcompeting developing fruit for water and Ca and Mg
  - excessive N fertiliser can result in poorer quality fruit with more disease



## Correlations between disease, yield & nutrient balance – Hampton 2008

Variable 1	Variable 2	P	r (correlation coefficient)	Relationship
Anthracnose severity	Yield per tree	0.044	0.30	-
Anthracnose severity	Fruit skin N:Ca	0.011	0.39	+
Stem-end rot severity	Fruit skin N:Ca	0.013	0.38	+

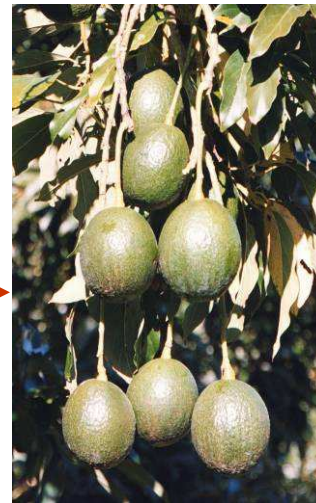
# Future management tools



## Future management tools

- Nutrient optimisation, N and Ca
- Improved formulations of fungicides – mancozeb?
- New products being tested – natural green® (calcium-based), Aminogro® (chitosan from prawn shells), EcoCarb (potassium bicarb.), biological controls, plant defence activators
  - “soft”, not fungicides, OK for organic etc.
- Controlled/modified atmosphere ripening

# Integrated control – the complete picture



**Tree husbandry**

- nutrition (N, Ca)
- canopy mgt
- mulching
- root health
- irrigation



**Strategic fungicides**

- protectants and post-infection
- phosphorus acid
- postharvest



**Careful harvest**

- maturity %DM
- wet weather



**Postharvest care**

- pre-cool
- cover fruit
- CA, ethylene

# Acknowledgements

Graham and Vivienne Anderson, Duranbah  
Harold Taylor, Duranbah  
Brendan and Liz Burton, Steven Lean, Hampton  
Graeme Thomas, Hampton  
Tony Whiley, Nambour  
David Peasley, Murwillumbah  
Peter Hofman and team, DPI&F Nambour (QICARP)



Project AV07000 is supported by Avocados Australia, QPIF and HAL. It is funded using avocado grower levies which are matched by the Australian Government through HAL

*Know-how for Horticulture™*

## Contact us!!

- Liz Dann
  - (07) 3896 9468
  - [Elizabeth.dann@deedi.qld.gov.au](mailto:Elizabeth.dann@deedi.qld.gov.au)
- Luke Smith
  - (07) 3896 9608
  - [Luke.smith@deedi.qld.gov.au](mailto:Luke.smith@deedi.qld.gov.au)

## Strict label instructions for strobilurin fungicides

- Necessary to avoid fungi becoming resistant to the group
- Used with coppers in an anti-resistance strategy
  - Do not start season with an Amistar®
  - No more than 3 Amistar® sprays per season
  - No more than 2 consecutive Amistar® sprays
  - No more than 1/3 of sprays to be Amistar®
  - Withholding period 7 days (3 days for mango)