Preliminary Results from Avocado Rootstock Research in Australian

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Avocados Australia

HAL Know-how for Horticulture™

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Queensland Government Department of Primary Industries and Fisheries

- Webber (1926) observed “no factor of the avocado industry is more important than rootstocks, and there is no problem that we know less about, or which requires a longer time to solve.”

- Over time we have learnt about rootstock effects on salinity, alkalinity tolerance and nutrient uptake

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- **Most effort has been invested in searching for *Phytophthora* root rot resistance – the most serious disease of avocado trees**

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Phytophthora root rot – a New Encounter Disease

No evolutionary history between host and pathogen

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- Useful commercial Pc tolerance exists
- Combine Pc tolerance with responsiveness to phosphonate
- Combine Pc tolerance with productivity

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Horticultural vs Physiological Graft Compatibility

Three botanical races – Mexican
Guatemalan
West Indian

Horticultural graft compatibility

Physiological graft incompatibility

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Effect of Graft Union on Root Growth

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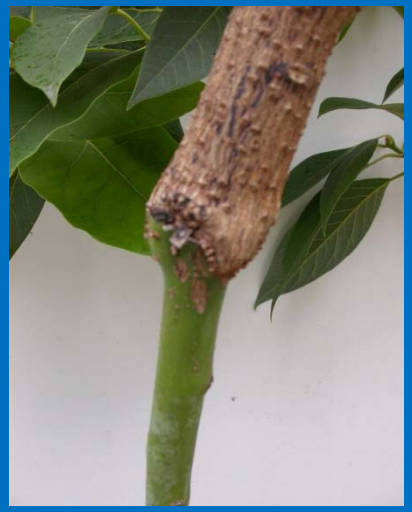

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Rootstock Influence on Tree Physiology

- 'Velvick' has twice the leaf diene conc. of 'Duke 6' and is translocated to the Hass scion Coates *et al.* 2003

- Rootstocks change mineral nutrition profiles in fruit Coates *et al.* 2003

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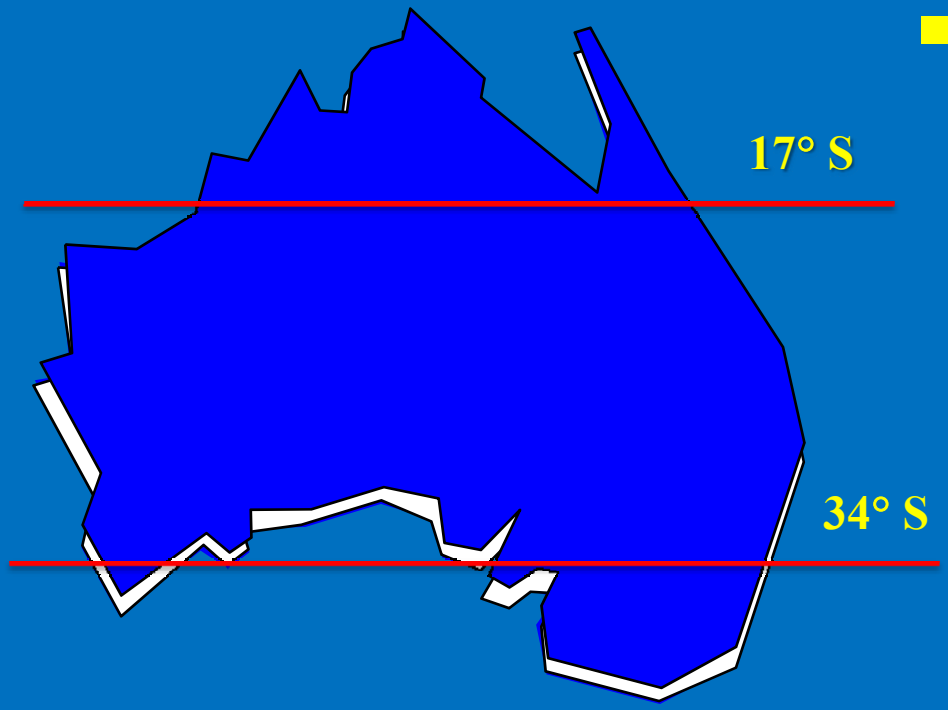
Project Opportunities



- Greatest environmental diversity
  - Climate
  - Soil
  - Water (quality)
- Large genetic pool

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Project Objectives

- Evaluate rootstocks from the three botanical races grafted to Hass and Shepard

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Genetic diversity

Mexican

'Barr Duke'
'Duke 7'
'SHSR - 01'
'P1'
'Toro Canyon'
'Thomas'

Guatemalan

'A8'
'SHSR - 02'
'SHSR - 04'
'Nabal'
'Peasley'
'Reed

WI

'Velvick'
'Gema'
'Maoz'
'SHSR - 06'

Hybrids

'A10'
'SHSR – 03'
'Zutano'

Hybrids

'Plowman'
'SHSR - 05'

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Project Objectives

- Evaluate rootstocks from the three botanical races grafted to Hass and Shepard
- Evaluate both seedling and clonally propagated rootstocks from the same maternal source

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Seedling vs. Clonal Rootstocks

- High relative cost of nursery trees on cloned rootstocks
- Strong evidence required to shift industry to cloned material

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Project Objectives

- Evaluate rootstocks from the three botanical races grafted to Hass and Shepard
- Evaluate both seedling and clonally propagated rootstocks from the same maternal source
- **Identify and evaluate superior rootstocks for consistent high yield and root rot tolerance**

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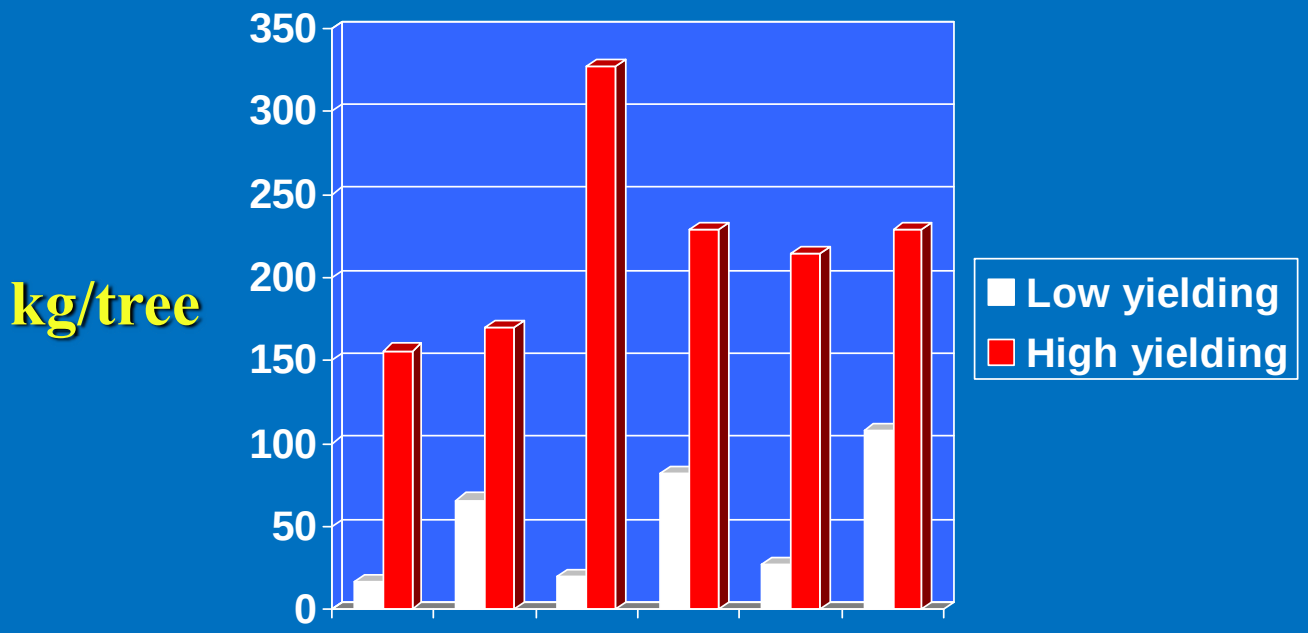
Project Objectives

- Identify and evaluate superior rootstocks for consistent high yield and root rot tolerance



Source: Thomas (1997) Aust. Avocado Conf. Proc.

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Project Objectives

- Evaluate the effect of rootstock on postharvest disease development in fruit

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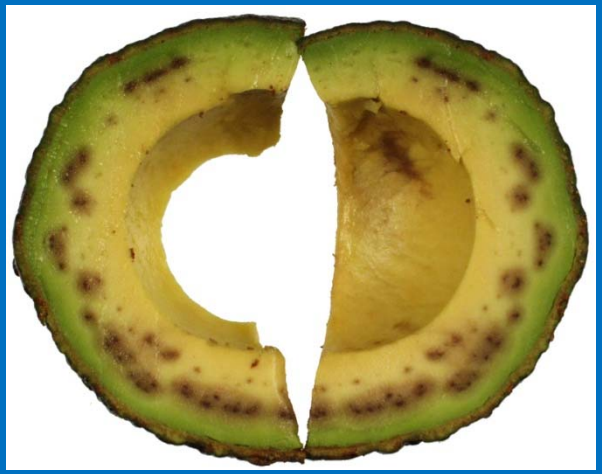
Project Objectives

- Evaluate the effect of rootstock on postharvest disease development in fruit

- Evaluate the effect of rootstock on postharvest storage and physiological fruit disorders



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Results

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Collection of Growth Data

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Yield and Production Efficiency

Hass at Walkamin 2007

Rootstock (seedling)	Yield (kg/tree)	Yield efficiency (kg/m^3)
A8	2.42	0.70
A10	3.00	0.72
Barr Duke	**4.23**	0.66
Duke 7	**3.98**	**1.52**
SHSR-01	3.36	0.44
Nabal	2.43	0.68
Reed	**4.40**	**5.04**
SHSR-03	3.49	0.53
Velvick	**6.24**	0.59
Zutano	4.84	0.91

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Yield and Production Efficiency

Hass at Walkamin 2007

Rootstock (clonal)	Yield (kg/tree)	Yield efficiency (kg/m^3)
A8	0.89	0.34
A10	0.62	0.24
Barr Duke	0.41	0.23
Duke 7	**2.89**	**1.07**
Hass	0.26	0.29
Nabal	0.00	0.00
Reed	0.00	0.00
Thomas	**2.00**	0.62
Velvick	**2.79**	**1.03**
Zutano	0.61	0.19

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Results

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Anthracnose Tolerance by Race

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Anthracnose Tolerance by Race

Highly susceptible (5) Very resistant (0)

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Anthracnose Tolerance by Race

Botanical variety x resistance

Rst	Race	Rating	Rst	Race	Rating
B. Duke	M	5^{b}	Hass	G x M	2^{a}
Duke 7	M	5^{b}	SHS 2	G x M	2^{a}
Parida	M	5^{b}	A8	G	1^{a}
SHS 1	M	5^{b}	SHS 3	G	0^{a}
Thomas	M	5^{b}	Nabal	G	0^{a}
T Canyon	M	5^{b}	Reed	G	1^{a}
Zutano	M x G	4^{b}	Plowman	G x WI	0^{a}
A10	G x M	2^{a}	SHS 4	WI x M	1^{a}
Edranol	G x M	3^{ab}	Velvick	WI	0^{a}

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Rootstock Effects on Postharvest Anthracnose

Clonal Rootstocks		% Marketable Fruit
Duke 7	M	27.7 b
Hass	GxM	21.5 b
SHSR - 03	GxM	36.3 b
Velvick	WI	70.6 a

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Evaluation of Phytophthora Root rot Tolerance

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Protocols for Establishing Trees in High-pressure Disease Site

- Drench nursery bags prior to planting with 8% phosphonate solution
- Treat tree sites with Ridomil® granules prior to planting
- Apply 20% phosphonate + 2% Pulse® to trunk bark every 8 weeks

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Rootstock Performance Under High Pc Pressure

Rootstock	Mean health rating (1yr)
GE (clone) AUS	2.0[d]
Hass (clone) USA	2.1[cd]
Dusa (clone) SA	3.5[bcd]
Velvick (clone) AUS	4.0[bcd]
Velvick (seedling) AUS	4.3[abcd]
Duke 7 (clone) USA	4.4[abcd]
Latas (clone) SA	5.0[a]
Reed (seedling) USA	6.8[a]

Rating scale 0-10 where 0=healthy and 10=dead

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One-year-old cloned Hass - on its own roots

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One-year-old cloned GE Rootstock Grafted to Hass

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Performance of Merensky clones (Dusa and Latas) may have been compromised by *Cylindrocladium* which was isolated from roots

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Mean Trunk Canker Ratings From Shepard Trees Grafted to Different Rootstocks

Barr Duke	2.2^{a}	M
Duke 7	2.0^{ab}	M
Thomas	1.8^{ab}	M
Shepard	1.2^{abc}	M x G
Zutano	0.7^{bc}	M x G
A10	0.0^{c}	G x M
Nabal	0.0^{c}	G
Smerdon	0.0^{c}	G x M
Velvick	0.0^{c}	WI

LSD (0.05) ≤ 1.4

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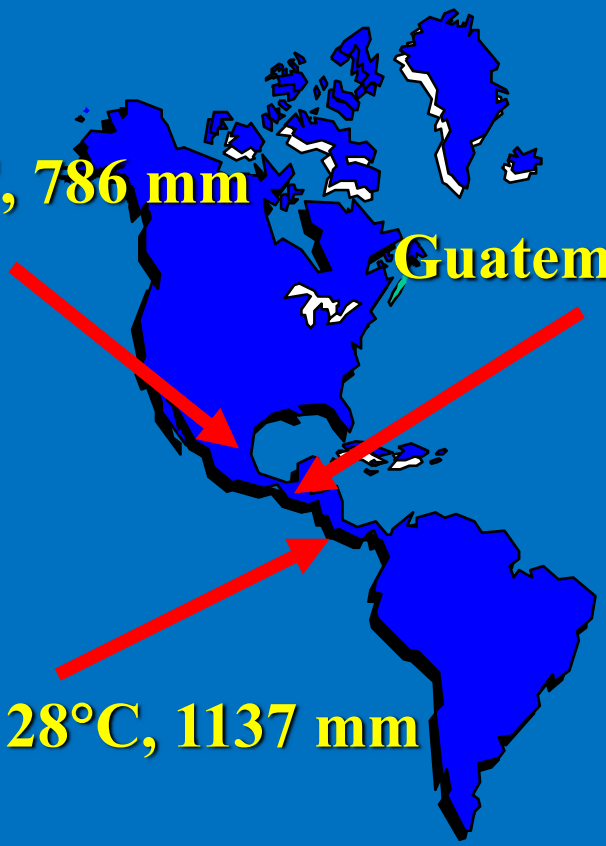
Eco-evolutionary Reasons for Development of Disease Tolerance Mechanisms



Mexican - 16°C, 786 mm

Guatemalan – 19.6°C, 1394 mm

West Indian - 28°C, 1137 mm

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Source: The Avocado – Botany, Production and Uses (2001)

Conclusions

- **Differences between races in susceptibility of leaves to anthracnose**

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Conclusions

- Differences between races in susceptibility of leaves to anthracnose
- Possible differences between races when used as rootstocks on postharvest anthracnose in fruit

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Conclusions

- Differences between races in susceptibility of leaves to anthracnose
- Possible differences between races when used as rootstocks on postharvest anthracnose in fruit
- **Differences between races when used as rootstocks on susceptibility to Phytophthora trunk canker**

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Acknowledgements

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Department of Primary Industries and Fisheries

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