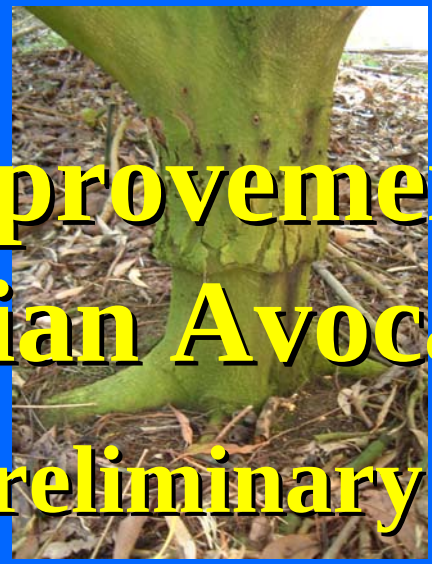
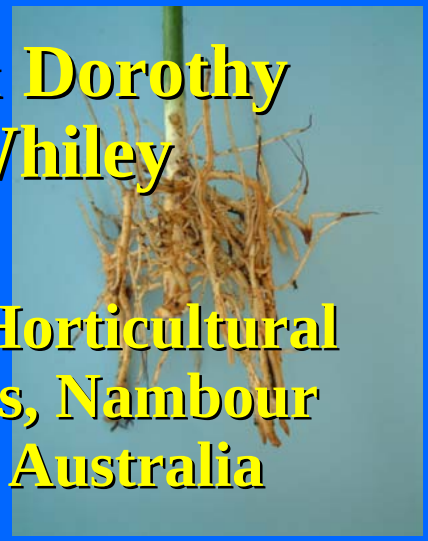
SESSION FOUR

Session Four
New germplasm and global breeding programmes

New Zealand and Australia Avocado Grower's Conference'05
20-22 September 2005
Tauranga, New Zealand

Rootstock Improvement for the Australian Avocado Industry - A Preliminary Report





Tony & Dorothy Whiley

Sunshine Horticultural Services, Nambour QLD Australia

SHS
Servicing Horticulture

Webber, 1926

“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”.

SHS
Servicing Horticulture

80 years of learning

1. Rootstock differences in salinity and alkalinity tolerance
2. Rootstock differences in mineral nutrient uptake
3. Rootstock differences in concentrations of antifungal compounds
4. Rootstock differences on fruit quality
5. Rootstock differences on alternate bearing

SHS
Servicing Horticulture

Phytophthora root rot tolerance

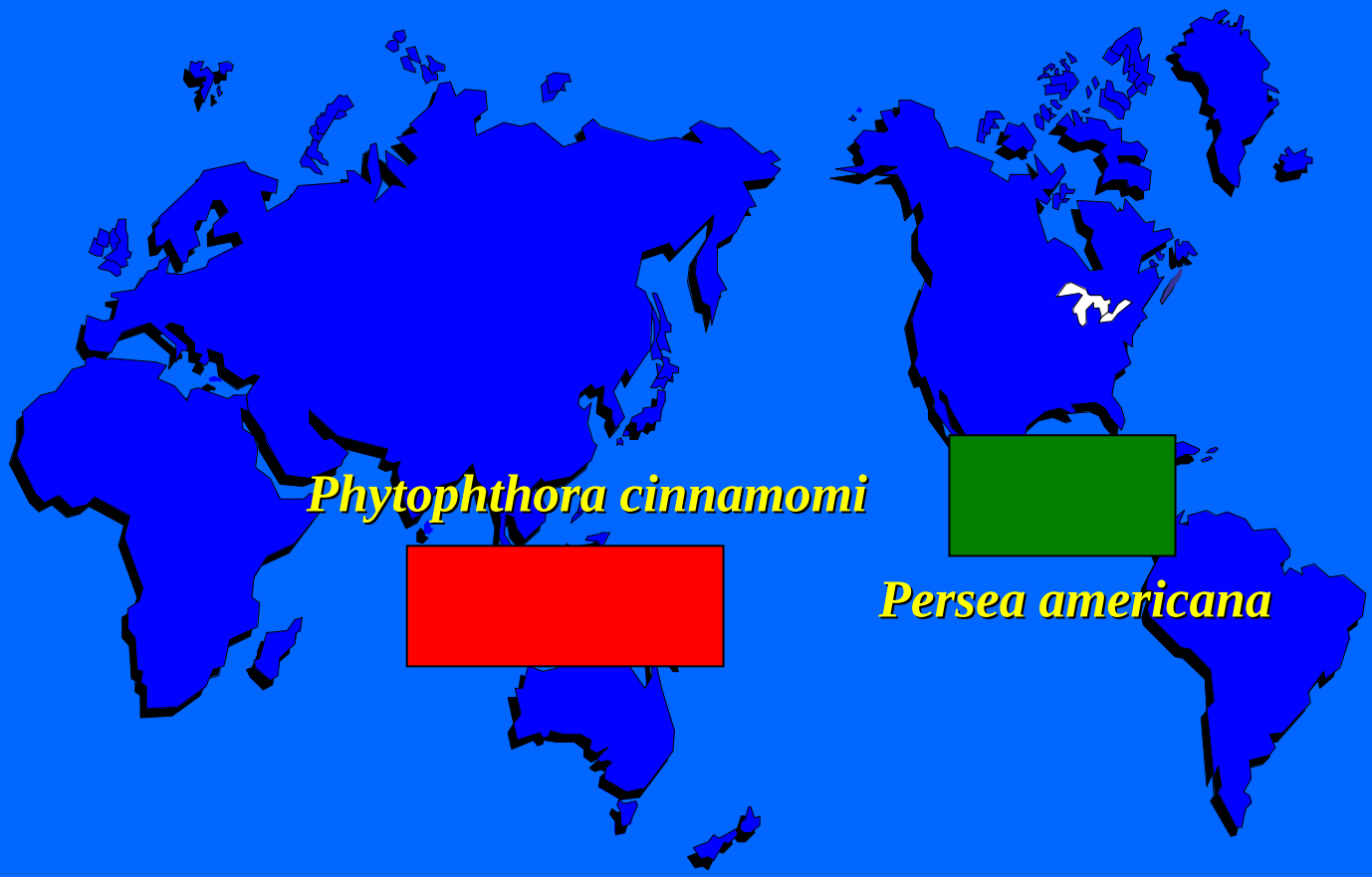
Fantasy or fact?

After 40+ years of investment we are no closer to having rootstocks with commercial resistance to P.c.

SHS

Servicing Horticulture

Different evolutionary centres



SHS
Servicing Horticulture

Botanical varieties = rootstock differences

SHS
Servicing
Horticulture

Botanical varieties = rootstock differences

Mexican Guatemalan West Indian

Salinity

Cold tolerance

Soil boron uptake/translocation

Anthracnose resistance

SHS
Servicing Horticulture

Horticultural vs Physiological Compatibility

Should we be worried?

Rootstock overgrowth

Scion overgrowth

SHS
Servicing Horticulture

Effect of graft union on roots

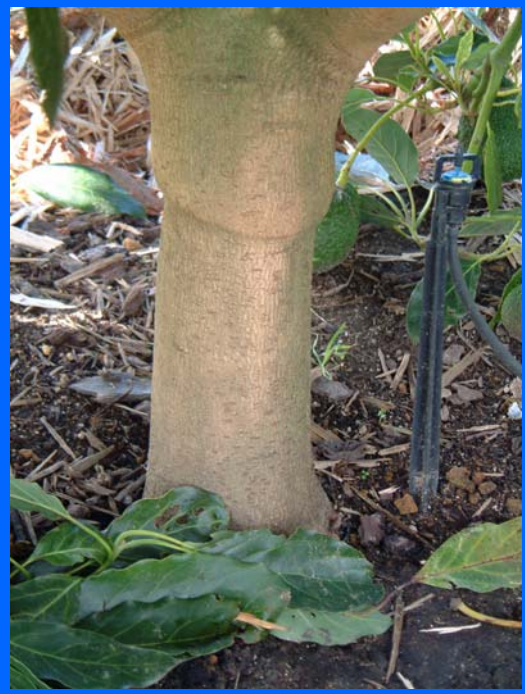
In most cases significant scion overgrowth results in strong alternate bearing

=

SHS
Servicing Horticulture

Scion overgrowth

‘Hass’ on ‘Mexicola’



‘Hass’ on ‘Zutano’

SHS
Servicing Horticulture

Rootstock challenges in Australia

Major differences in:

1. Climate
2. Soil types
3. Water quality

SHS
Servicing Horticulture

Test the effect of genetic diversity on:

1. Precocity
2. Sustainable yield
3. Fruit quality
4. Anthracnose resistance
5. Phytophthora tolerance

SHS
Servicing Horticulture

Genetic diversity

Mexican

'Barr Duke'
'Duke 7'
'SHS 1'
'P1'
'Toro Canyon'
'Thomas'

Guatemalan

'A8'
'SHS 2'
'Nabal'
'Peasley'
'Reed'
UC lines

WI

'Velvick'
'SHS 4'

Hybrids

'Zutano'

'A10'
'Edranol'
'Hass'
'SHS 3'

Hybrids

'Plowman' ?
'SHS 5'

SHS
Servicing Horticulture

Field experiments planted 04/05

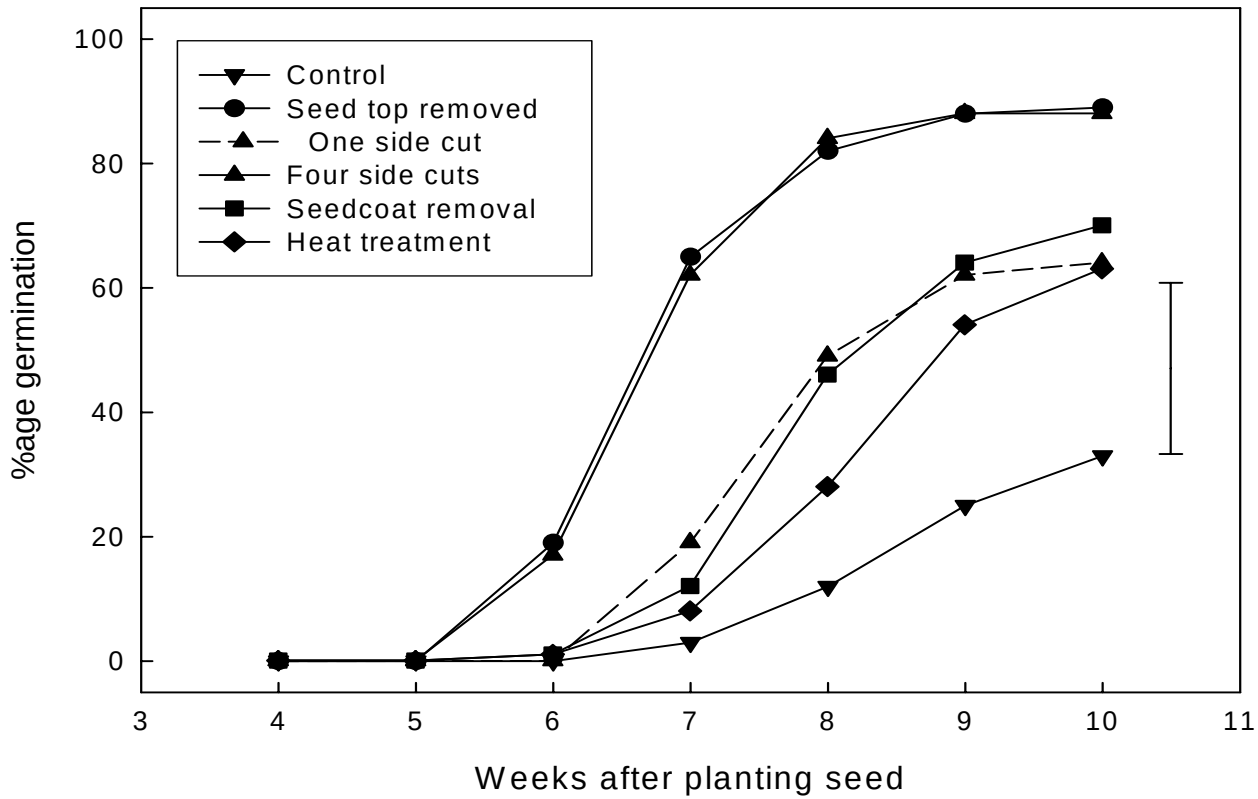
Seedling + cloned rootstocks – Hass & Shepard scions

Pemberton WA – Hass (180 trees)
Carabooda WA – Hass (90 trees)
Duranbah NSW – Hass (170 trees)
Hampton QLD – Hass (200 trees)
Childers QLD – Hass & Shepard (310 trees)
Walkamin QLD – Hass & Shepard (390 trees)

SHS
Servicing Horticulture

Other research - Propagation

Seed germination



SHS
Servicing Horticulture

Other research - Propagation

Cloning techniques

Mexican Guatemalan West Indian

Rooting difficulty

‘Duke 7’ **‘Velvick’**

SHS
Servicing Horticulture

Other research - Propagation

Cloning techniques - wounding

Front

Back

SHS
Servicing
Horticulture

Other research - Propagation

Cloning techniques - wounding

Collar of roots from 360° wound

SHS
Servicing
Horticulture

Other research - Propagation

Cloning techniques - wounding

Double wounding/bottom KIBA

SHS
Servicing
Horticulture

Other research - Anthracnose

SHS
Servicing Horticulture

Other research - Anthracnose

Highly susceptible (5) **Very resistant (0)**

SHS
Servicing Horticulture

Other research - Anthracnose

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]

SHS
Servicing Horticulture

Other research - Anthracnose

Eco-evolutionary connections to *Colletotrichum* tolerance?

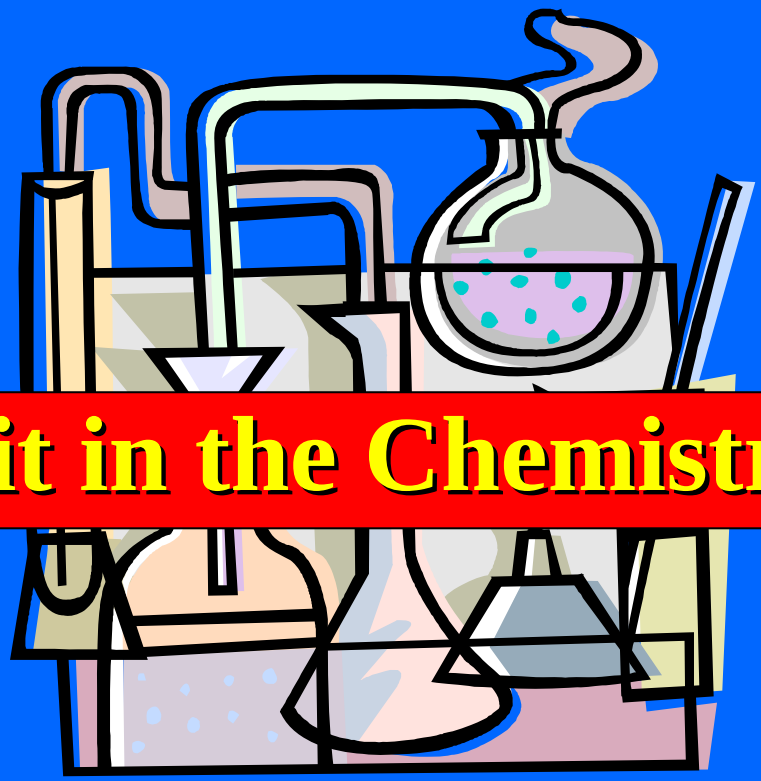
Mexican - 16°C, 786 mm

Guatemalan – 19.6°C, 1394 mm

West Indian - 28°C, 1137 mm

SHS
Servicing Horticulture

Susceptibility/resistance of botanical races to Anthracnose



Is it in the Chemistry?

SHS
Servicing Horticulture

Susceptibility of botanical races to Anthracnose

1. ‘Velvick’ has twice the leaf diene conc. of ‘Duke 6’ Coates *et al.* 2003

2. Higher concs. of phenolics in resistant rootstocks Whiley, unpub.

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

SHS
Servicing Horticulture

The Bunny test!

0	0	0	X E (S)
0 UT (S)	0	0	0
0	0	0 UT (S)	0
0	0	0	0
0	0	0	0
X PE (S)	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	X E (S)	0
0	X PE (S)	0	0
0	0	0 UT (S)	X E (S)
0	0	0	0
0 UT (S)	0	0	0 UT (S)
0	0	0	0
0	0	0	0
0	X UT (S)	0	0
0	0	X E (S)	0

3. No other Hass trees in this block were eaten

S = less than 0.75 m high
X = Duke 7 rootstock
0 = other rootstock

Data courtesy of G. Thomas

SHS
Servicing Horticulture

Conclusions

1. Scarification of avocado seed improves germination

2. There is significant potential to improve avocado yield, fruit quality and disease resistance through the selection of appropriate rootstocks

3. Rootstock attributes are strongly based on botanical races

SHS
Servicing Horticulture

Conclusions

4. There is a strong likelihood of rootstock chemistry playing an influential role in tree performance with more information required
5. Be suspicious of rootstocks that produce a significant scion overgrowth – they could be under-performing
6. Avoid Mexican race rootstocks or their hybrids in the summer-wet subtropics of Australia

SHS
Servicing Horticulture

Acknowledgements

Funding supporting this research is supplied by Avocados Australia Ltd through its levy program and matched by Horticulture Australia Limited. We thank QDPIF staff and those growers with rootstock experiments for their ongoing collaboration and assistance.

Avocados Australia

HAL
Know-how for Horticulture™

SHS
Servicing Horticulture


2005
PROFIT TOGETHER