Integrated Control of Phytophthora

Control measures for discussion

K. G. Pegg
Soil Selection
- No. 1 priority
- Well drained
- Well aerated
- NB Ridging/mounding

Organic Amendments
- Mulching essential
- Cost-effective organics
- Manures/composts etc.
- Cover crops/green manures

P.c. Resistant/Tolerant Rootstocks
- 'Dusa', 'Duke 7', 'Bounty', 'Velvick'
- Disease-free nursery trees

Healthy Avocado Tree

Inorganic Nutrition
- Leaf and soil analysis
- Veg: Reprod balance (N)
- Ca²⁺ as a mild fungicide

Irrigation Management
- Beware of over-irrigation in sick trees
- Micro-jet, drip or pulse irrigation for better control

Chemical Control
- Young trees
  - Ridomil/Phosphonate paint
- Mature trees
  - Phosphorous acid
  - Injecting most effective

Minimize Plant Stress

Promote Root Health
Soil Selection-C1

- Drainage the most critical factor
- Without good drainage, all other controls will fail
Rootstocks-C2

• Tolerant rootstocks – many now available

• Still not adequate to cope with high Pc pressure without other control measures

• Scion overgrowth – some root starvation due to partial incompatibility – aggravates the Pc problem
Effect of graft union on roots
Irrigation-C3

Disease development can be modified by regulating irrigation
Inorganic Nutrition-C4

- Calcium is a mild fungicide, improves soil drainage and thereby aeration and increases resistance to Phytophthora
- Can be applied as sulphate (gypsum) – slow release of Ca$^{++}$
- Ammonium ion is toxic to Phytophthora and avocado feeder roots
- If applied to a mulch ammonium sources must be used sparingly
Manage summer growth flush

• A good summer growth flush is a major contributor to winter starch accumulation and promotes good root growth during autumn/winter

• Trees with good root growth better able to cope with Pc and flowering and fruit set in Spring

• Requires a high standard of general tree nutrition especially Nitrogen balance
Mulching-C5

- Woody mulch (C:N ratios 25-100:1)
- Provides oxygen rich environment for feeder roots
- High biological activity
- Enzymatic degradation
- Soil modification – low bulk density in surface soils
Ashburner System of Biological Control
Suppressive Soil

- Cation exchange capacity, exchangeable Ca, Mg, N and organic matter higher in suppressive than conducive avocado soils
- Total exchange capacity depends on organic matter as kaolinite has low CEC
- Suppressive avocado soil comparable with rainforest soil
- Disease suppression due to total physical, chemical and biological properties
- Suppression fails where drainage inadequate
Organic Matter + ANVAS trees

No organic matter
Infected nursery trees
Phosphonates-C6

Without phosphonates (injections/sprays) many avocado orchards would fail
Control  Dip 0.5% PO3  Dip 0.5% PO3 + high volume spray at 3 months
Phosphonates-C6

The effectiveness of phosphonate depends on sensitivity of the pathogen and the capacity of defense responses in the host.
## Pineapple Pc

<table>
<thead>
<tr>
<th>Pineapple cv.</th>
<th>Resistance/ Susceptibility</th>
<th>PO$_3$ rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Highly resistant Hypersensitive response</td>
<td>Not required</td>
</tr>
<tr>
<td>2</td>
<td>Restrict colonization Root regeneration</td>
<td>0.1%</td>
</tr>
<tr>
<td>3</td>
<td>Susceptible</td>
<td>0.25%</td>
</tr>
<tr>
<td>4</td>
<td>Highly susceptible</td>
<td>0.5%</td>
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</tbody>
</table>