



## Pacific Pests, Pathogens & Weeds - Fact Sheets

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### Avocado dieback (120)



Photo 1. Dieback of avocado, *Phytophthora cinnamomi*; note that this tree is losing its leaves, so that the fruit are exposed. The branches will rapidly die from the tips.

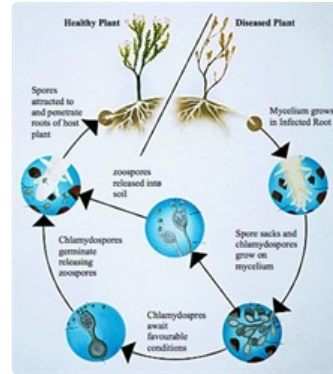


Diagram. Life cycle of *Phytophthora cinnamomi*, the cause of avocado dieback disease. Note that mycelium refers to the body or the cottony growth of the water mould. Zoospores have "tails" and can swim short distances through soil water; chlamydospores and oospores are long-term survival spores.

#### Common Name

Avocado dieback

#### Scientific Name

*Phytophthora cinnamomi*

#### Distribution

Worldwide. Asia, Africa, North, South, and Central America, the Caribbean, Europe, Oceania. It is recorded from Australia, Cook Islands, Fiji, Federated States of Micronesia, New Zealand, Papua New Guinea, and Samoa.

#### Hosts

Avocado and many other fruit and nut trees (macadamia), fruits (pineapple), ornamentals (roses, azaleas), plus wild species in the US (American chestnut, Shortleaf pine, Fraser fir), in Australia (*Banksia*, *Darwinia*, *Grevillea*, and jarrah, *Eucalyptus marginata*), and Europe (native chestnut and cork oak). More than 800 species are susceptible.

#### Symptoms & Life Cycle

Avocado dieback affects the small feeder roots of the tree. The pathogen causes a gradual decline of older trees or a quick death of those that are younger. The leaves become smaller than normal, green-yellow and brown at the tips; they may wilt during the heat of the day. Bare twigs and small branches appear as they fail to produce leaves, a symptom known as dieback (Photo 1). Fruit are small and progressively fewer as the disease advances. Dieback continues with ever more wilting and loss of leaves until the tree dies. In addition to the damage of the small roots, cankers may occur on the stem at or below soil level.

*Phytophthora cinnamomi*, the cause of avocado dieback, is not a fungus although much about its biology and life cycle is fungus-like. It belongs to the water moulds or oomycetes, which are related to algae. It has motile spores, called zoospores, produced within flask-shaped spores - sporangia (Diagram). The zoospores swim in the soil water and in this way find and infect the roots, until the whole root system is destroyed and the plant dies. During unfavourable conditions for *Phytophthora cinnamomi*, i.e., when there are no hosts to infect or soil conditions are too dry for spread, two types of thick-walled resting pores are formed: (i) 'chlamydospores', which are the more common, and (ii) 'oospores', which are produced when different strains mate. Both can survive for several years.

Temperature effects disease development. If the temperature is relatively low, i.e., less than 22°C, root growth slows and the disease is severe. If the temperature is relatively high, i.e., more than 27°C, avocado grows better than the water mould, and damage is less.

## Impact

*Phytophthora cinnamomi* is the leading cause of damage to avocado trees, and is commonly known as "root rot" by avocado farmers. Damaged trees generally die or become unproductive within 3-5 years. The disease is worse in heavy clay soils with poor drainage.

In 1974, a very wet year in eastern Australia, 50% of all avocado trees developed root rot caused by *Phytophthora cinnamomi*. However, the situation today is different, as growers use phosphonate fungicides to help manage the disease.

## Detection & inspection

Look for the foliage that becomes increasingly yellow and wilts during the hottest part of the day; look for the appearance of twig dieback. Dig up some of the roots, remove the soil by washing, and look for darkening or dead feeder roots.

## Management

### QUARANTINE

Most countries legislate to prevent the movement of untreated plants across their borders; however, it is also important to restrict the movement of plants, plant parts and soil **within** countries to prevent the further spread of serious diseases, such as *Phytophthora cinnamomi*. Plants from nurseries, in particular, have the potential to spread diseases, and the following should be done:

- Soil mixes should be steam-air pasteurised (30 minutes at 60°C).
- Water sources should be free from contamination by *Phytophthora cinnamomi*.
- Pots should be free from soil and sterilised before use by soaking in disinfectant.
- Plants brought into the nursery should be as cuttings or certified free from disease.
- Tools use in propagation practices should be washed free of soil after use, as should footwear.

### CULTURAL CONTROL

Cultural control methods offer the best chance of reducing avocado dieback. It is important to remember that the disease spreads by movement of infected planting material, contaminated tools, and water running over infested areas, so do the following:

- *Avoid introduction:* Take care not to introduce the disease into a new planting with contaminated plants, soil, tools, footwear, vehicles, or storm water; if purchasing from a nursery make sure that the nursery is using procedures detailed above under Quarantine.
- *Site selection:* Make sure that the area is well drained; avoid planting where waterlogging occurs. Dig holes, fill with water and check that the water drains away within an hour or so.
- *Organic matter:* At planting, and at other times, regardless whether the pathogen is present or not, add organic matter as mulches (but keep away from the base of the trees), manures or composted materials.
- *Hygiene:* Disinfect tools, machinery, especially tyres, and footwear regularly.
- *Replanting:* If trees die, remove as much of the root system as possible, and dispose by burning. If replanting, do **not** use the same hole but plant upslope from the dead one, add organic matter and ensure there is good drainage. A light liming may be beneficial.
- *Gypsum:* Apply 0.5-1 kg/m<sup>2</sup>. Gypsum promotes root growth, and increases disease resistance.

### RESISTANT VARIETIES

Tolerant rootstocks are available. The variety, Duke 7, was the first commercial rootstock to be used worldwide, after its discovery in 1975. Others are available with better *Phytophthora* tolerance, and growers should enquire as to what is available locally. It is important that the rootstocks are from clonal plants, not seedlings.

### CHEMICAL CONTROL

Apply fungicides containing potassium phosphonate as a spray or by injection. If trees are injected or sprayed, and there are no dieback symptoms, do it once a year when leaf flushes have greened and hardened, and root growth is strongest; this is at the end of autumn and the start of winter (May to June in the southern hemisphere). Only use foliar sprays if the trees have a full and healthy canopy of leaves. If that is not the case, use the trunk injection method. For trees showing dieback, a second injection should be applied in late spring/early

summer. *It is important to obtain advice from agriculture authorities on methods of application and timing.*

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Information from Gerlach WWP (1988) *Plant diseases of Western Samoa. Samoan German Crop Protection Project, Deutsche Gesellschaft für Technische Zusammenarbeit (GIZ) GmbH, Germany*. Photo 1 *Diseases of fruit crops in Australia* (2009). Editors, Tony Cooke, Denis Persley, Susan House. CSIRO Publishing. Diagram Rudman T (2005) *Interim Phytophthora cinnamomi management guidelines*. Nature Conservation Report 05/7, Biodiversity Conservation Branch, Department of Primary Industries, Water and Environment, Hobart.

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