

## Chickpea: Phytophthora Root Rot Management

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### Background

**Phytophthora root rot (PRR):** is a disease of chickpea caused by the fungus-like oomycete *Phytophthora medicaginis*, which is widespread in the cracking clay soils of northern New South Wales and southern Queensland. It can cause significant yield losses (Figure 1) in wetter than normal seasons or following periods of soil saturation in normal seasons. Lucerne, perennial and annual medics (*Medicago* species) and other leguminous plants including sulla (*Hedysarum* species) and sesbania (*Sesbania* species) can also host *P. medicaginis*.

**Waterlogging:** roots die from low oxygen levels.



Figure 1: Cultivated areas were killed by phytophthora. Only plants on top of contours survived.  
Photo: Mark Schwinghamer

**Phytophthora and waterlogging:** are induced by transient or prolonged soil saturation and surface water. They usually occur in low lying areas of paddocks, or where water accumulates such as on the low side of contour banks or in watercourses (Figure 2), or where the soil has been compacted or has hard pans.

However, under very wet conditions, entire paddocks can be affected.



Figure 2: Phytophthora in water course.  
Photo: Mark Schwinghamer

### Symptoms

Infection by *P. medicaginis* can occur at any growth stage, causing seed decay, pre- and post-emergence damping off, loss of lower leaves (Figure 3), and yellowing, wilting and death of older plants.



Figure 3: Severely affected plants (left) have no lateral roots and defoliation below tips of stems.

Photo: Joe Wessels

Symptoms are sometimes delayed if temperatures are cool and the soil is moist. Lateral roots and tap root die (Figure 4), or dark brown/black lesions often girdle the taproots. On young plants the lesions may extend up the stem for 10 mm or more above ground level (Figure 6).

Plants with phytophthora can be easily pulled from the soil. If conditions are mild, affected plants may partially recover by producing new roots from the upper part of the tap root (Figure 5).

Symptoms of waterlogging can be confused with those of phytophthora but differ in that:

- (i) Plants are most susceptible to waterlogging at flowering and early pod fill.
- (ii) Symptoms develop within 2 days of flooding compared to at least 7 days for phytophthora.
- (iii) Roots are not rotted and are not easily pulled from the soil at first.
- (iv) Plants often die too quickly for the lower leaves to drop off.

**Table 1:** Differences between phytophthora root rot and waterlogging

Phytophthora root rot	Waterlogging
<ul style="list-style-type: none"><li>• Organism kills roots</li><li>• Chickpea, medics, lucerne are hosts</li><li>• Occurs any time of year</li><li>• Symptoms onset after a week or more</li><li>• Lower leaves often yellow and fall off</li><li>• Roots always rotted and discoloured</li><li>• Plants easily pulled up and out</li><li>• Manage through paddock rotation and varietal choice</li></ul>	<ul style="list-style-type: none"><li>• Low oxygen kills roots</li><li>• No link with cropping history or weed control</li><li>• Usually occurs later in the year</li><li>• Symptoms onset quite rapid</li><li>• Plants die too fast for leaves to yellow or fall</li><li>• Initially roots not rotted or discoloured (tips black)</li><li>• Plants not easily pulled up initially</li><li>• Manage through paddock selection, no irrigation in reproductive phase</li></ul>



**Figure 4:** PRR affected plant (right) with lateral and tap root death.  
Photo: Mal Ryley



**Figure 5:** New roots forming from the top of the taproot (PRR).  
Photo: Mike Fuhlbohm



**Figure 6:** PRR basal lesions extending up the plant stem.  
Photo: Mal Ryley

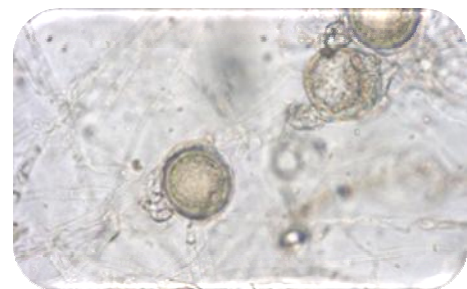
## Biology and epidemiology

*Phytophthora medicaginis* survives in soil mainly as thick-walled oospores (Figure 7), but some strains also survive as chlamydospores.

Oospores can survive in soil for at least 10 years. In saturated soil the exudates from the roots of chickpea and other hosts stimulate the oospores to germinate and produce lemon-shaped sporangia. Inside these sporangia, zoospores develop and are released into the soil and surface water, where they are carried by moving water and “swim” towards the roots and collars of chickpea plants.

Zoospores encyst on the root surfaces and germinate to produce hyphae that invade the roots. New sporangia develop from infected roots enabling further cycles of infection to occur. Later, oospores are formed in the infected roots.

Zoospores are only capable of “swimming” for a few millimetres, so long distance dispersal of *P. medicaginis* is by physical movement of soil and water infested with oospores, sporangia, zoospores and/or chlamydospores during floods and irrigation or by machinery.



**Figure 7:** *P. Medicaginis* oospores can survive in soil for up to 10 years.  
Photo: Gail Chiplin

## Management options for phytophthora root rot

Once a plant or crop is infected with phytophthora, there is nothing a grower can do.

There are no effective chemical sprays as there are for ascochyta and botrytis. Thus, phytophthora can only be managed by pre-sowing decisions and assessing risks for individual paddocks.

Development of the disease requires both the pathogen in the soil, and a period of soil saturation with water. Losses in a phytophthora-infested paddock may be minor if soil saturation does not occur.

The most effective control strategy is to not sow chickpeas in high-risk paddocks, which are those with a history of:

- Phytophthora noted in previous chickpea or lucerne crops.
- Lucerne or annual or perennial medics.
- Waterlogging or prone to flooding.

However, if you choose to sow chickpeas in high-risk paddocks, the following measures will reduce losses from phytophthora:

- Grow a chickpea variety with the highest level of resistance (Table 2). Particularly in medium risk situations, where medic, chickpea or lucerne crops have been grown in the past 5-6 years.
- Metalaxyl-based seed dressings. These are expensive and provide only 6-8 weeks protection. They can be applied with other seed treatments provided all label conditions are followed.

## Management options for waterlogging

- Avoid poorly drained paddocks and those prone to waterlogging
  - Do not flood irrigate after podding has commenced especially if the crop has been stressed.
- A rule of thumb is that if the crop has started podding and the soil has cracked do not irrigate.

Overhead irrigation is less likely to result in waterlogging but consult your agronomist.

**Table 2:** Resistance ratings<sup>#</sup> of some northern region varieties to *Ascochyta*, *Phytophthora* and *Botrytis*.

Variety	Ascochyta	Phytophthora	Botrytis
PBA HatTrick <sup>Ⓛ</sup>	MR/R	MR	S
Flipper <sup>Ⓛ</sup>	MR	MS	S
Yorker <sup>Ⓛ</sup>	MS/MR	MR	S
Howzat	S	MS	MS
Jimbour	S	MS/MR	S
Kyabra <sup>Ⓛ</sup>	S	MS	S
Moti <sup>Ⓛ</sup>	VS	MS	MS
Genesis <sup>™</sup> 090	R	VS	S
Genesis <sup>™</sup> 425	R	MS	S
Almaz	MS/MR	VS	S

<sup>#</sup> Resistance ratings are for low-moderate disease pressure situations.

In a season such as 2010 when repeated cycles of infection occur, even MR varieties can have yield-reducing levels of disease

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