



Phytophthora root rot of lupins

After several years of research, the cause of lupin sudden death has been identified as a root rot caused by the soil-borne fungus *Phytophthora*. Accordingly, the disease will now be known as Phytophthora root rot of lupins. Phytophthora root rot has not been previously recognised as a disease of lupins in Australia and only in very limited situations worldwide.

Importance

This newly recognised disease was first observed in NSW in 1993, when large areas of apparently healthy lupin crops suddenly died. Patches of plants within crops turned yellow and failed to produce any seed. Since that time this condition has been observed annually across southern NSW, with varying degrees of crop damage, ranging from scattered plants to total crop losses in some instances.



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Figure 1 Symptoms of root and basal stem rot compared with a healthy root system.

Symptoms

The sudden wilting and death of lupin plants within days during pod filling is indicative of this disease. Leaves suddenly turn yellow and drop, often within a 24 hour period, and a dark brown sunken lesion may extend from the base and often up one side of the stem. Infected plants

are found to have a rotted taproot when pulled out of the ground. The taproot is woody in appearance with little outer tissue remaining and with few, if any, lateral roots.

The pattern of distribution within a paddock can vary from single scattered plants to large areas of crop, often in low-lying areas of paddocks. Plants fail to fill pods or produce small seed.



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Figure 2 Above ground symptoms of yellowing and wilting

Conditions favouring disease

There are two essential prerequisites for disease development. Firstly, soil temperatures must be increasing and above approximately 15°C. This explains why the disease is not seen early in the season during the cooler winter months. Once temperatures rise, infection occurs, the taproot is subsequently rotted, and plants suddenly wilt and die. Often this occurs around early pod fill when plants are drawing upon soil water from deeper in the profile, but the infected root system cannot sustain the growing plant.

The second requirement is a period of flooding or waterlogging, although this appears to be unnecessary in close rotations where high levels of soil inoculum have had a chance to build up.

	Bulk density (g/cm ³)		
	<1.6 g/cm ³	1.6-1.7	>1.7
Hardpan	absent	likely	present
1996	15	46	38
1997	25	40	35
1998	26	32	42

Table 1. Percentage of farm sites with soils at certain bulk densities. Note : Soils with bulk density >1.6 g/cm³ are considered to have a hardpan problem.

Waterlogging is often directly linked to the presence of hardpans or plough-pans. These are compacted layers within the soil profile which can form just below the zone of cultivation as a result of many years of cultivation. They are often impenetrable to plant roots and water. If hard pans are present, perched water tables can occur during and following periods of heavy or prolonged rainfall, allowing root infection to occur.

Surveys carried out by NSW Agriculture in 1996, 1997 and 1998, found a large number of paddocks across southern NSW to have hardpans present, irrespective of soil type, cultivation practices or cropping rotation. Over 50% of the paddocks surveyed had a bulk density considered to have the potential to cause problems (see Table 1).

Experiments have shown that narrow-leafed lupins survive flooding for at least 8 days in the absence of *Phytophthora*, but die in a short period when *Phytophthora* is present.

A pot experiment with soil taken from a Temora trial site showed that large responses in growth were achieved by controlling *Phytophthora* with soil-incorporated metalaxyl fungicide. Untreated plants all died of root rot prior to or around pod set. The experiment further demonstrated that other soil fungi such as *Rhizoctonia* and *Pleiochaeta*, shown to be present but unaffected by metalaxyl, did not cause the root rot.

Distribution

Reports and surveys from previous seasons have shown *Phytophthora* root rot in lupins to be widely distributed in

central and southern NSW. It occurs on both albus and narrow-leaf lupins, especially in wet years.

Control

The most effective practice that can be recommended would be to avoid paddocks that are known to have a hardpan problem, since it appears that a period of waterlogging can be important for infection to occur. Hardpans can be identified by simply pushing a spade or shovel into the soil. A layer of resistance is felt where a hardpan is present.

Alternatively dig up some plants and observe the root growth. The regular occurrence of distorted taproots shaped like an 'L' indicate a hardpan. Consult your local agronomist to develop a strategy to manage them.

In addition, because the species and host range of *Phytophthora* is indefinite at this stage, it is not possible to recommend suitable crop rotations to minimise disease impact.

Further work

There still remains a lot of investigation to fully understand *Phytophthora* root rot of lupins. The causal organism still remains to be fully identified, and its variability understood. The potential host range, survival mechanisms, and spread of the pathogen once understood, will lead to more reliable management strategies being developed for adoption by growers. This could include crop rotation, and paddock management practices. Breeding for resistance could be possible, if sources of resistance can be found. This would become a breeding priority for the Australian Coordinated Lupin Improvement Program module, breeding narrow-leafed lupins for south eastern Australia, with screening being carried out at the Wagga Wagga Agricultural Institute.

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The information contained in this publication is based on knowledge and understanding at the time of writing in January 2002. However, because of advances in knowledge, users are reminded of the need to ensure that information upon which they rely is up-to-date and to check currency of the information with the appropriate officer of New South Wales Department of Agriculture or the user's independent adviser.

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