



SOUTHERN

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GRAINS RESEARCH
& DEVELOPMENT
CORPORATION

LUPIN

SECTION 7

ROOT DISEASES AND NEMATODES

OVERVIEW | PLEIOCHAETA ROOT ROT | RHIZOCTONIA BARE PATCH
| PHYTOPHTHORA ROOT ROT | RHIZOCTONIA HYPOCOTYL ROT OR
RHIZOCTONIA ROOT ROT | MINOR ROOT DISEASES IN SOUTHERN REGION
LUPIN CROPS | NEMATODES

MORE INFORMATION

GRDC 'Grain and Legume Handbook': <https://grdc.com.au/grainlegumehandbook>

GRDC 'Fact Sheet – Plant Parasitic Nematodes': www.grdc.com.au/GRDC-FS-Plant-Parasitic-Nematodes-SW

Australian Pesticides and Veterinary Medicines Association: <http://apvma.gov.au/>

CropPro: http://www.croppro.com.au/crop_disease_manual/ch10.php

SARDI PREDICTA® B: http://pir.sa.gov.au/research/services/molecular_diagnostics/predicta_b

DPIRD-GRDC MyCrop and MyCropApp: <https://grdc.com.au/apps>

DPIRD Diagnostic Laboratory Services (DDLS)-Plant Pathology: <https://www.agric.wa.gov.au/ddls-seed-testing-and-certification>

Root diseases and nematodes

7.1 Overview

Incidence of root and hypocotyl diseases in lupin crops has declined in the past 20 years, but remains an issue for some southern region growers to manage.

Root rot occurs in most narrow leaved lupin paddocks but, in most areas, it typically has only a small impact on crop development and major yield losses are uncommon.

In paddocks where high levels of root rot occur, plant establishment and seedling vigour can be affected.

Pleiochaeta setosa and *Rhizoctonia solani* are the major pathogens causing root or hypocotyl infection of lupin plants.

Hypocotyl rot risk is higher with legume-pasture rotations and can typically be found on most soil types.

When a root disease is present in a crop, little can be done to manage it in that cropping season.

It is, therefore, vital to correctly identify the cause for appropriate management before sowing the next lupin crop.

Correct identification can be made by assessing in-crop symptoms and the root and hypocotyl of affected plants.

Poor emergence, patches in crops, uneven and stunted growth, yellowing of plants and wilting or death under water stress – particularly at flowering and grain fill – can indicate the presence of root disorders.

But these above-ground symptoms are difficult to diagnose, as many biotic and abiotic disorders can have similar above ground expression.

Soil testing and monitoring, through the South Australian Research and Development Institute's (SARDI) PREDICTA® B sampling service or Department of Primary Industries and Regional Development (DPIRD) – formerly Department of Agriculture and Food Western Australia (DAFWA) – Diagnostic Laboratory Services (DDLS)-Plant Pathology, can help correctly diagnose, monitor and manage root and hypocotyl diseases and nematodes in lupin crops. For more information go to http://pir.sa.gov.au/research/services/molecular_diagnostics/predicta_b and <https://www.agric.wa.gov.au/ddls-seed-testing-and-certification>.

Lupin can be an excellent management tool for reducing some nematode species, but is highly susceptible to damage from others.

This reiterates the importance of correct species identification for rotation planning to manage root disease and nematode issues.



i MORE INFORMATION

Agriculture Victoria ‘Brown Leaf Spot and Root Rot of Lupins’:
<http://agriculture.vic.gov.au/agriculture/pests-diseases-and-weeds/plant-diseases/grains-pulses-and-cereals/brown-leaf-spot-and-root-rot-of-lupins>

DPIRD-GRDC MyCrop: <https://www.agric.wa.gov.au/mycrop/diagnosing-leiochaeta-root-rot-narrow-leafed-lupins>

DPIRD ‘Lupin Root Diseases’:
<https://www.agric.wa.gov.au/lupins/lupin-root-diseases-diagnosis-and-management>

7.2 Pleiochaeta root rot (*Pleiochaeta setosa*)



Figure 1: *Pleiochaeta* root rot infection on lupin stems.

(SOURCE: GRDC Grain Legume Handbook)

- Rarely leads to major crop losses (except in some situations where lupin is sown after lupin on very infertile sands)
- Minimum tillage and deep ripping can reduce disease incidence
- Rotations with non-host crops can reduce spore concentrations in soil.

Pleiochaeta root rot is caused by the fungus *Pleiochaeta setosa* that also causes Brown leaf spot of lupin.

Spores are produced on fallen Brown spot-infected leaves and become incorporated into the top few centimetres of soil, where these can persist during summer and across several years.

The spores germinate in the next lupin crop and infect the plant roots of seedlings, causing pleiochaeta root rot.

Spores that have survived on the soil surface can also be splashed upwards by rain droplets and infect leaves and stems, causing brown leaf spot. This continues the disease cycle.

Pleiochaeta root rot creates lesions on roots, but rarely leads to major crop losses where reduced tillage and extended lupin rotations are used.

Incidence can be higher in paddocks with close lupin rotations and where seeding operations place spores in the root zone.

Disease severity and yield impact is determined by the number and distribution of spores in the soil. A high number of spores distributed close to the seed can cause severe disease.

In-crop symptoms of pleiochaeta root rot include wilted, weak or dying seedlings that can be scattered in the paddock or on particular soil types.

Infection produces dark brown lesions on the tap and lateral roots, leading to stripping of the outer layer of the root. In severe cases there is complete rotting of the root.

Taproots are susceptible for about six to eight weeks after germination. But new lateral roots are susceptible during emergence of the crop and are often pruned-off.

FEEDBACK

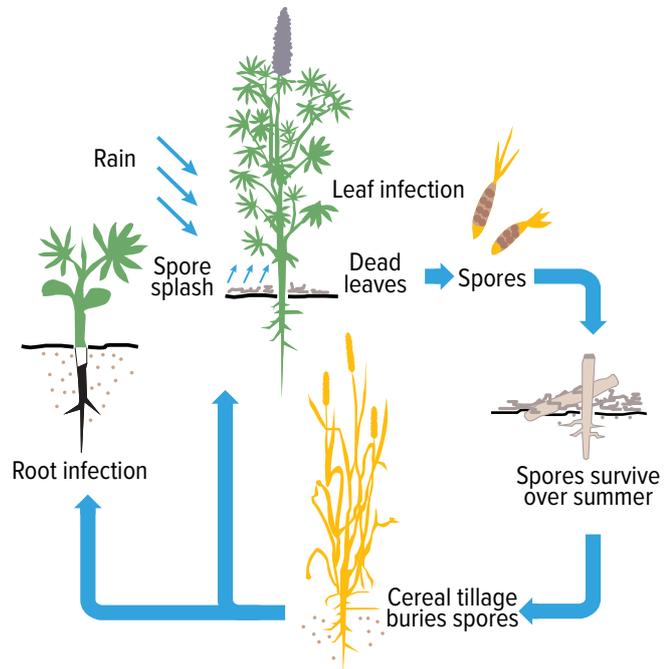


Figure 2: *Pleiochaeta* root rot spore profile in a direct drilled paddock.

(SOURCE: DPIRD)

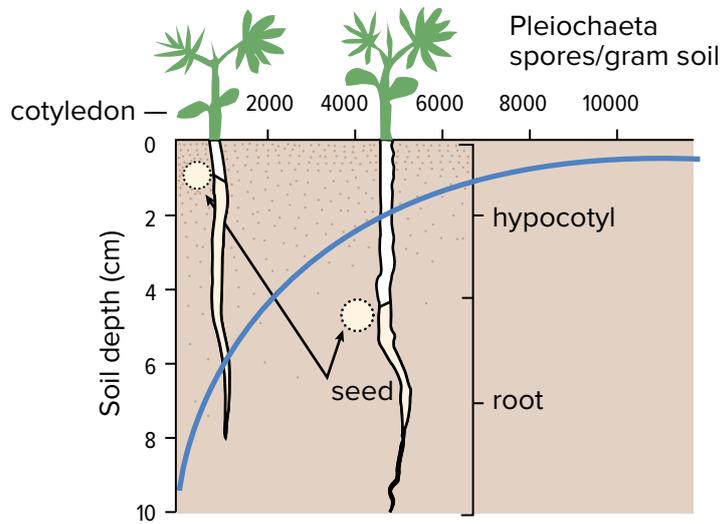


Figure 3: Infection cycle of *Pleiochaeta* root rot.

(SOURCE: DPIRD)

Management of pleiochaeta root rot

- » Use reduced or minimum tillage
- » Variety tolerance and choice is important
- » Deep tillage spading or mouldboard ploughing can suppress disease severity
- » Rotate lupin with non-host crops (such as cereals, canola, pasture).
- » Control brown leaf spot in preceding lupin crops
- » No fungicide treatments are registered for in-crop use.¹

Minimum or reduced tillage sowing systems have been shown to reduce the incorporation of pleiochaeta root rot spores into the rooting zone of the soil profile.

Rotating lupin with non-host crops, such as cereals, canola or pasture, can lower the concentration of soil-borne spores.

Controlling Brown leaf spot in preceding lupin crops can also reduce the amount of spores returned to soil.²

Fungicide seed treatments containing the Group 2 actives iprodione or procymidone (used to control Brown leaf spot in the southern region) do not tend to provide consistent control of pleiochaeta root rot.

There are no registered fungicide treatments to use in-crop.

MORE INFORMATION

DPIRD-GRDC MyCrop: <https://www.agric.wa.gov.au/mycrop/diagnosing-rhizoctonia-bare-patch-grain-legumes-0>

SARDI 'PREDICTA® B': http://pir.sa.gov.au/research/services/molecular_diagnostics/predicta_b

7.3 Rhizoctonia bare patch (*Rhizoctonia solani* AG8)

- Occurs on most soil types
- Affects lupin and most other crops and pastures
- Rotations tend not to break the disease cycle
- All commercial lupin varieties equally susceptible
- Affected paddocks have distinct patches of stunted or dying crops three to six weeks after sowing
- Yields are severely depleted in patch areas
- Some tillage systems can reduce disease incidence
- Seed or in-furrow fungicides are not registered for use in lupin crops.

Rhizoctonia bare patch is caused by the fungus *Rhizoctonia solani* (AG8) and has a wide plant host range, making rotation with cereals, canola or other pulses mostly ineffective in suppressing disease incidence in lupin crops.

But research and grower experience in South Australia and Western Australia have found grass-free canola and pulse crops and pastures can help to reduce inoculum levels in soil to benefit subsequent crops.

Rhizoctonia bare patch is found in most soil types, especially in sandplain areas, and affects all commercially available lupin varieties.

The fungus colonises either living plant tissue or dead organic material, allowing it to survive across years.

After autumn rain, it grows rapidly to infect young seedlings and distinct patches of stunted or dying plants are visible in the crop three to six weeks after sowing.

Long-term trials show rhizoctonia bare patch can also attack crops throughout the growing season.³

¹ DPIRD-GRDC (2016) MyCrop diagnostic tool – Diagnosing pleiochaeta root rot in narrow-leaved lupins, www.agric.wa.gov.au/mycrop/diagnosing-pleiochaeta-root-rot-narrow-leaved-lupins

² DPIRD-GRDC (2016) MyCrop diagnostic tool – Diagnosing pleiochaeta root rot in narrow-leaved lupins, www.agric.wa.gov.au/mycrop/diagnosing-pleiochaeta-root-rot-narrow-leaved-lupins

³ McKay, A (2006) Fungicide Control of Rhizoctonia Part B Syngenta, SARDI, University of SA, CSIRO Adelaide, DAFWA, http://projects.grdc.com.au/projects.php?action=view_project&project_id=653

FEEDBACK

Yield losses from this root disease in lupin crops are typically proportional to the area of paddocks affected by patches, which can range from 0.5 to five metres in diameter and produce virtually no grain.⁴

The tap and lateral roots of affected plants are 'pinched off' by dark brown lesions, often having a spear-tipped appearance. As the season progresses, damaged plants often die.

Management of rhizoctonia bare patch

- » Use deep cultivation at sowing with a narrow tyne 10-15 cm below seed
- » Deep ripping to 25-30 cm immediately prior to sowing can suppress disease
- » Ensure good crop nutrition
- » Avoid herbicide damage to roots
- » No fungicide seed dressing or foliar products are registered for use in lupin
- » Rotation and variety selection will not provide total control.⁵

Deep cultivation at sowing with a narrow tyne 10-15 cm below the seed, or deep ripping to 25-30 cm prior to sowing, have been shown to be the most effective methods for reducing lupin crop damage caused by rhizoctonia root rot.⁶

Cultivation with knife-point soil openers can disturb fungal growth in the soil and encourage better root growth, compared to disc sowing systems.

It is recommended to sow at the optimal time, to ensure good crop growth with adequate plant nutrition and avoid herbicide damage to roots to reduce disease impact.

Research has shown control of the 'green bridge' of weeds and crop volunteers between crops and ensuring good weed control in-crop can also help to reduce crop losses.⁷

Crop rotation and variety selection will not totally control rhizoctonia root rot and there are no registered fungicide seed dressings or foliar actives for use in lupin crops.

4 DPIRD-GRDC (2016) MyCrop Diagnostic Tool – Diagnosing rhizoctonia bare patch in grain legumes, <https://www.agric.wa.gov.au/mycrop/diagnosing-rhizoctonia-bare-patch-grain-legumes-0>

5 DPIRD-GRDC (2016) MyCrop Diagnostic Tool – Diagnosing rhizoctonia bare patch in grain legumes, <https://www.agric.wa.gov.au/mycrop/diagnosing-rhizoctonia-bare-patch-grain-legumes-0>

6 DPIRD-GRDC (2016) MyCrop Diagnostic Tool – Diagnosing rhizoctonia bare patch in grain legumes, <https://www.agric.wa.gov.au/mycrop/diagnosing-rhizoctonia-bare-patch-grain-legumes-0>

7 GRDC (2016) Tips and Tactics – Rhizoctonia – Western Region, www.grdc.com.au/TT-Rhizoctonia

FEEDBACK

i MORE INFORMATION

CropPro 'Phytophthora Root Rot of Lupins': http://www.croppro.com.au/crop_disease_manual/ch09s04.php

GRDC 'The watch outs for pulse diseases in 2017': <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/02/the-watch-outs-for-pulse-diseases-in-2017>

NSWDPI 'Phytophthora root rot of lupins': http://archive.dpi.nsw.gov.au/_data/assets/pdf_file/0019/157411/pulse-point-17.pdf

7.4 Phytophthora root rot (*Phytophthora spp*, *P. cryptogea*)



Figure 4: *Phytophthora* root rot can cause significant lupin losses in susceptible areas in some seasons, with damage in control plots of chickpea with no chemical protection shown here at a NSW trial site in 2017.

(SOURCE: GRDC)

- Warm soil and waterlogging are conducive to disease
- Leaves turn yellow and die, typically within 24 hours
- Plants wilt and die during pod filling
- Symptoms include a rotted woody taproot with few lateral roots
- There is no known resistance in lupin.

Phytophthora root rot (caused by the organism *Phytophthora spp* in narrow leafed lupin and *P. cryptogea* in albus lupin) has been a significant disease of lupin crops in north eastern VIC and southern NSW. It was widespread in these regions in 2016 on the back of above average rainfall in late winter and early spring and has also been found to cause premature wilting in lupin crops on the SA Lower Eyre Peninsula in some seasons.⁸

This disease tends to strike pulse crops in areas prone to waterlogging, from periods of as short as eight hours, in low lying paddocks and in soils prone to hardpans (which can develop perched water tables).⁹

The phytophthora root rot pathogen infects lupin roots and is typically expressed in spring, when plants prematurely die often around pod filling. As the soil starts to dry out, the infected and damaged root system can no longer support the plant and this leads to premature death.¹⁰

8 Lindbeck, K (NSW Department of Primary Industries, Wagga Wagga Agricultural Institute, Wagga Wagga, NSW), Moore, K (NSWDPI Agricultural Institute, Calala, NSW), Richards, M & O'Connor, G (NSWDPI Agricultural Institute, Wagga Wagga, NSW) (2017), The watch outs for pulse diseases in 2017, <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/02/the-watch-outs-for-pulse-diseases-in-2017>

9 Lindbeck, K (NSW Department of Primary Industries, Wagga Wagga Agricultural Institute, Wagga Wagga, NSW), Moore, K (NSWDPI Agricultural Institute, Calala, NSW), Richards, M & O'Connor, G (NSWDPI Agricultural Institute, Wagga Wagga, NSW) (2017), The watch outs for pulse diseases in 2017, <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/02/the-watch-outs-for-pulse-diseases-in-2017>

10 Lindbeck, K (NSW Department of Primary Industries, Wagga Wagga Agricultural Institute, Wagga Wagga, NSW), Moore, K (NSWDPI Agricultural Institute, Calala, NSW), Richards, M & O'Connor, G (NSWDPI Agricultural Institute, Wagga Wagga, NSW) (2017), The watch outs for pulse diseases in 2017, <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/02/the-watch-outs-for-pulse-diseases-in-2017>



In-crop symptoms include leaves that suddenly turn yellow and drop, often within a 24 hour period. A dark, 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 if any outer tissue remaining and few, if any, lateral roots.¹¹

The pattern of distribution in a crop can vary from single scattered plants to large areas of a paddock, often in low lying areas. Plants tend to fail to fill pods or produce small seed.¹²

The fungus causing phytophthora root rot survives in the soil and becomes established when a new crop is sown. To date it is not known what other hosts carry this fungal pathogen between lupin crops.¹³

There appear to be several essential prerequisites for this disease to develop, including soil temperatures of above 15°C. This explains why symptoms in the paddock often do not appear until early spring as soil temperatures rise.¹⁴

A period of waterlogging also appears to be required for root infection to occur. Trials have found narrow leaved lupin can survive flooding for at least eight days in the absence of phytophthora root rot, but die within a short period when the pathogen is present.¹⁵

Management of phytophthora root rot

- In susceptible areas avoid sowing lupin in paddocks prone to waterlogging
- Avoid sowing into soils with a hardpan problem.

Disease management for phytophthora root rot is difficult because of the extended period of survival of the fungus in the soil. Methods to minimise the occurrence of the disease include crop rotation and avoiding paddocks with a known waterlogging or hardpan problem.¹⁶

Hardpans can be identified by 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 or adviser to develop a strategy to manage them.¹⁷

As the species and host range of phytophthora root rot is indefinite at this stage, it is not possible to recommend suitable crop rotations to minimise disease impact.¹⁸

11 CropPro (2017), Phytophthora Root Rot of Lupins, http://www.croppro.com.au/crop_disease_manual/ch09s04.php

12 CropPro (2017), Phytophthora Root Rot of Lupins, http://www.croppro.com.au/crop_disease_manual/ch09s04.php

13 CropPro (2017), Phytophthora Root Rot of Lupins, http://www.croppro.com.au/crop_disease_manual/ch09s04.php

14 CropPro (2017), Phytophthora Root Rot of Lupins, http://www.croppro.com.au/crop_disease_manual/ch09s04.php

15 CropPro (2017), Phytophthora Root Rot of Lupins, http://www.croppro.com.au/crop_disease_manual/ch09s04.php

16 Lindbeck, K (NSW Department of Primary Industries, Wagga Wagga Agricultural Institute, Wagga Wagga, NSW), Moore, K (NSWDPI Agricultural Institute, Calala, NSW), Richards, M & O'Connor, G (NSWDPI Agricultural Institute, Wagga Wagga, NSW) (2017), The watch outs for pulse diseases in 2017, <https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/02/the-watch-outs-for-pulse-diseases-in-2017>

17 Carpenter, D. NSW DPI, Pulse Point Phytophthora root rot of lupins, http://archive.dpi.nsw.gov.au/_data/assets/pdf_file/0019/157411/pulse-point-17.pdf

18 Carpenter, D. NSW DPI, Pulse Point Phytophthora root rot of lupins, http://archive.dpi.nsw.gov.au/_data/assets/pdf_file/0019/157411/pulse-point-17.pdf

FEEDBACK

i MORE INFORMATION

DPIRD-GRDC MyCrop: <https://www.agric.wa.gov.au/mycrop/diagnosing-rhizoctonia-hypocotyl-rot-narrow-leafed-lupins>

DPIRD ‘Lupin Root Disease’: <https://www.agric.wa.gov.au/lupins/lupin-root-diseases-diagnosis-and-management>

7.5 Rhizoctonia hypocotyl rot, or rhizoctonia root rot (*Rhizoctonia solani*)



Figure 5: *Rhizoctonia* can cause reddish-brown sunken lesions on the below ground portion of the stem of crops – as illustrated in this wheat plant.

(SOURCE: GRDC)

- Affects all lupin varieties and most other crop and pasture legumes
- Incidence is relatively low
- Affected crops can have poor plant establishment
- Rotation with non-legumes can break disease cycles
- Cultivation practices are ineffective.

Rhizoctonia hypocotyl rot, or root rot, is caused by the soil-borne ZG3, ZG4 and ZG6 strains of the fungus *Rhizoctonia solani*.

These pathogens are related to the strains causing rhizoctonia bare patch and affect all lupin varieties and most other crops and pasture legumes.

Incidence of hypocotyl rot in the southern region is typically relatively low, but can occur in most soil types and reduces plant establishment in affected crops.

The bulk of fungal inoculum is found in the top 5 cm of soil, where it can survive for at least two years in remnant organic matter.

With the onset of opening rains, the fungus grows and infects susceptible seedlings. It is more active in warm soil and tends to be more prevalent in early sown crops.

FEEDBACK

Risks of infection are highest in lupin crops following a legume pasture phase as a result of disease build-up and the capacity of fast-germinating pasture seedlings to host infection prior to lupins germinating.

When a root disease such as hypocotyl rot is present, very little can be done to manage it during that cropping season.

It is, therefore, advised to correctly identify the cause with soil sampling to allow appropriate management before sowing the next lupin crop.

Above ground symptoms of rhizoctonia hypocotyl rot in lupin crops include clumps of poor emergence, uneven and stunted plant growth, wilting or death.

It is the most easily diagnosed of all lupin root diseases, causing reddish-brown sunken lesions on the hypocotyl (below ground portion of the stem).

From emergence until about eight-leaf stage, infected seedlings wilt and die as lesions grow and rot through the hypocotyl.

Infected plants that survive past the eight to 10-leaf stage often remain stunted and are less productive than healthy plants.¹⁹

Management of rhizoctonia hypocotyl rot

- » Avoid lupin rotations after legume pasture
- » Shallower sowing can reduce hypocotyl exposure to the fungus
- » Avoid sowing very early into warm soil in high risk paddocks
- » Higher sowing rates may compensate for establishment losses.

Crop rotation can be useful to break the rhizoctonia hypocotyl root rot cycle and, in high-risk areas, it may be beneficial to not sow consecutive lupin sequences or lupin after a legume pasture.

Shallower sowing can reduce exposure of the hypocotyl to the fungal inoculum and it is advised that sowing very early into warm soil in paddocks with known disease risk should be avoided.

Increasing sowing rate by 10-25 percent can help to compensate for establishment losses in high risk paddocks.²⁰

¹⁹ DPIRD-GRDC (2016) MyCrop Diagnostic Tool – Diagnosing rhizoctonia hypocotyl rot in narrow-leaved lupins, <https://www.agric.wa.gov.au/mycrop/diagnosing-rhizoctonia-hypocotyl-rot-narrow-leaved-lupins>

²⁰ DPIRD-GRDC (2016) MyCrop Diagnostic Tool – Diagnosing rhizoctonia hypocotyl rot in narrow-leaved lupins, <https://www.agric.wa.gov.au/mycrop/diagnosing-rhizoctonia-hypocotyl-rot-narrow-leaved-lupins>

FEEDBACK

i MORE INFORMATION

DPIRD-GRDC MyCrop: <https://www.agric.wa.gov.au/lupin-diagnostic-tool>

GRDC 'Grain Legume Handbook': <https://grdc.com.au/grainlegumehandbook>

7.6 Minor root diseases in southern region lupin crops

Table 1: Summary of minor root diseases of lupin in the southern region.²¹

Disease	
Charcoal rot (<i>Macrophomina phaseolina</i>)	
Risks	Moisture-stressed crops; survives in soil for multiple years.
Symptoms	Premature senescence of individual plants or patches in-crop. Stems and taproots have ash-grey discoloration (when split open) due to masses of tiny black microsclerotia embedded in the tissue.
Management	Does not typically reduce crop yields.
Useful resources	DPIRD-GRDC MyCrop: https://www.agric.wa.gov.au/lupins/lupin-root-diseases-diagnosis-and-management
Pythium root rot	
Risks	Most soil types, especially shallow duplex soils and other soils prone to sub-soil saturation.
Symptoms	Roots develop a black rot; hypocotyls develop water-soaked lesions. Infection can kill emerging seedlings or create weak and stunted plants that wilt at the start of stem elongation.
Management	Avoid sowing lupin in waterlogging-prone soils; crop rotations.
Useful resources	GRDC Fact Sheet 'Root disease', https://grdc.com.au/uploads/documents/GRDC_FS_Pythium.pdf and DAFWA Lupin disease hub, https://www.agric.wa.gov.au/lupins/lupin-root-diseases-diagnosis-and-management
Abiotic root damage	
Risks	Various soil structures and properties.
Symptoms	Impermeable hardpans and duplex soils can cause damaged or bent taproots and poorly developed root systems. Waterlogging can result in soft discolored roots, poorly developed root systems and yellowing of plants. Chemical damage from triazine or sulfonylurea herbicides or poor fertiliser placement can cause rotting, pruning or reduced development of roots.
Management	
Useful resources	DPIRD-GRDC MyCrop: https://www.agric.wa.gov.au/lupins/lupin-root-diseases-diagnosis-and-management

²¹ DPIRD-GRDC (2016) MyCrop Diagnostic Tool – Lupins, <https://www.agric.wa.gov.au/lupin-diagnostic-tool>

i MORE INFORMATION

GRDC 'Tips and Tactics – Root Lesion Nematodes': <https://grdc.com.au/Resources/Factsheets/2015/03/Root-Lesion-Nematodes>

GRDC 'Fact Sheet – Plant Parasitic Nematodes' (Southern Region): <https://grdc.com.au/Resources/Bookshop/2010/10/Plant-Parasitic-Nematodes-Fact-Sheet-Southern-Western-Region>

GRDC 'Paddock Practices – Managing Root Lesion Nematodes Pre-sowing': <https://grdc.com.au/Media-Centre/Media-News/West/2016/03/Managing-root-lesion-nematodes-presowing>

7.7 Nematodes



Figure 6: Root lesion nematodes are worm-like microscopic endoparasites that feed on plant roots and can cause patches in crops.

(SOURCE: DPIRD)

- Lupin crops can help reduce the Root lesion nematodes (RLN) *P. neglectus* and *P. thornei*
- The RLN *P. penetrans* and *P. crenatus* have a very low presence
- Lupin is very susceptible to *P. penetrans*
- There are no in-crop options to control nematodes
- Crop rotation can help reduce crop damage
- Rotation is influenced by species of nematode present in soil
- Soil and/or plant root testing will identify species and levels of nematodes.

Root lesion nematodes (RLN) are the main nematode species that affect all southern region crops, including lupin, and incidence is increasing where intensive cropping occurs.

These worm-like microscopic endoparasites feed on plant roots.

The main RLN species found in the southern region are *Pratylenchus neglectus* and *P. thornei*.

Lupin crops are an excellent management tool for helping to reduce *P. neglectus* and *P. thornei* burdens in paddocks, but are very susceptible to damage from *P. penetrans*. Testing by SARDI in 2016 found minimal risk of incidence of *P. Penetrans* in SA and low levels of risk of incidence from 2016 samples taken from northern VIC and southern NSW.²²

This reiterates the importance of correctly diagnosing the RLN species in paddocks with soil testing using accredited laboratories.

Correct RLN identification will also help the grains industry characterise nematode distribution and gather further resistance information for crop types and varieties grown in the southern region.

Such research is vital because no chemicals are available to economically control nematodes in broadacre cropping systems. Incidence of RLN in the southern region and maps identifying medium and high risk areas 2016 PREDICTA® B tests can be found on the SARDI website at: http://pir.sa.gov.au/__data/assets/image/0003/293142/Australia_P_penetrans_map_2016.jpg

22 SARDI (2017), Disease Risk Map, P. Penetrans, http://pir.sa.gov.au/__data/assets/image/0003/293142/Australia_P_penetrans_map_2016.jpg

FEEDBACK

i MORE INFORMATION

SARDI 'PREDICTA® B': http://pir.sa.gov.au/research/services/molecular_diagnostics/predicta_b

DPIRD Diagnostic Laboratory Services (DDLs)–Plant Pathology: <https://www.agric.wa.gov.au/ddls-seed-testing-and-certification>

In-crop symptoms of nematodes are often indistinct, difficult to identify and commonly mistaken for nutrient deficiencies, soil limiting factors or presence of rhizoctonia.

Big patches, or uneven waves of crop growth, may be evident in paddocks. Up close, plants are often smaller, look chlorotic (yellowing), have reduced tillering, wilt easily and may be dying-off.

If nematodes are present, roots may be stunted, lack lateral roots and may have brown lesions from nematode pruning.

Testing to identify nematodes

A pre-sowing soil test using PREDICTA® B, offered by accredited advisers through SARDI, can diagnose *P. neglectus* and *P. thornei*, along with Cereal cyst nematode (*Heterodera avenae*). Soil testing and in-crop plant root testing for nematode diagnosis can also be carried out by DPIRD's Diagnostic Laboratory Services (DDLs)-Plant Pathology.

Soil sampling guidelines include:

- » Dig soil to a depth of 0-10 cm
- » Take samples in the crop row, close to roots
- » Sample at six to 12 locations towards the margins of poor growth areas
- » Place all samples in a bucket and mix gently
- » Remove a 500 g sample from the bucket and put in plastic bag
- » Collect a second sample from a healthy crop area
- » Include paddock history and notes on each sample to send to the laboratory.

Plant sampling guidelines include:

- » Collect plants from several locations towards the margins of poor crop growth
- » Use a trowel/shovel to keep root systems intact
- » Retain the soil ball to protect roots in transit to the laboratory.²³

Management of nematodes

- » No in-crop options can stop nematode damage
- » Diagnose and monitor species and concentration levels using soil and root testing
- » Avoid growing lupin where *P. penetrans* is present
- » Maintain healthy soils and adequate crop nutrition.

Planning crop rotations with resistant varieties, or non-host break crops and pastures, can help inhibit nematode reproduction/build-up (resistance) and potentially boost crop yields to non-limiting levels under RLN pressure (tolerance).

If there are high or very high RLN levels in a paddock (more than 10 nematodes/mL of soil or more than 10,000 nematodes/gram dry root – severity score three and four) – it is recommended to grow a moderately resistant (MR) or resistant (R) crop for one to two cropping seasons.²⁴

Lupin shows good resistance for *P. neglectus* and *P. quasitereoides* and can be grown where these are present to help break nematode cycles.

But lupin is susceptible to *P. penetrans* and it is advisable to avoid planting them where this nematode is present.

Maintaining healthy soils and good crop nutrition, especially at crop establishment, can also help to reduce the long-term impact of nematodes on lupin production.

23 Collins, S (2014), Know your nematodes and set up a crop defence system in 2015, GRDC, <https://grdc.com.au/Media-Centre/Media-News/West/2014/07/Know-your-nematodes-and-set-up-a-crop-defence-system-in-2014>

24 Collins, S (2014), Know your nematodes and set up a crop defence system in 2015, GRDC, <https://grdc.com.au/Media-Centre/Media-News/West/2014/07/Know-your-nematodes-and-set-up-a-crop-defence-system-in-2014>