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Farmnote

Brown spot and Pleiochaeta root rot of lupins

Reviewed September 07

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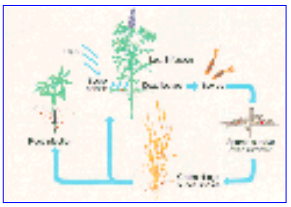

Figure 1. Infection cycle of the fungus Pleiochaeta setosa.

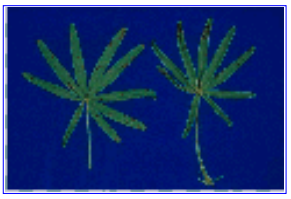

Figure 2. Brown spot infection on leaves.

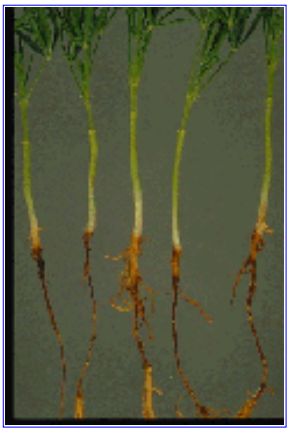

Figure 3. Pleiochaeta root rot - dark brown lesions on the tap and lateral roots.

Summary

This Farmnote outlines infection cycle, symptoms and regions of risk for brown spot and Pleiochaeta root rot in lupins. Presents a management package including rotation, stubble mulching, sowing date, tillage, depth of sowing, phosphorus nutrition, seeding machinery, seeding rate and suitable varieties.

Brown spot and Pleiochaeta root rot, caused by the fungus *Pleiochaeta setosa*, are responsible for the greatest disease losses to Western Australian lupin production. The effects are so important that they dictate rotational break and crop establishment methods over most of the State.

Infection cycle

During winter and spring large quantities of spores are produced by the fungus on dead, diseased leaves on the soil surface. These can be splashed by rain to cause more foliar disease within four to five days. Over summer, the spores persist and become incorporated into the top 10 cm of soil when the following cereal crop is sown. When the next lupins are sown, the spores germinate and infect seedling roots as well as being splashed upwards by rain droplets to infect leaves and stems (Figure 1).

Management at a glance

- right soil type
- right rotation
- cereal stubble mulch
- fungicide seed treatment
- direct drill to 5 cm sowing depth
- sow early at high seeding rate
- high phosphate nutrition
- care with herbicides
- the best variety - Myallie

Brown spot can develop in crops where paddocks are sown to lupins for the first time. Sufficient spores can be carried in soil or stubble blown from nearby lupin paddocks or as

Figure 4. Climatic risk of yield loss in lupins resulting from brown spot.

contamination with seed. However, there are never enough spores down the soil profile to cause Pleiochaeta root rot in a first-time paddock. Root rot in a first-time paddock is likely to be caused by *Rhizoctonia*.

In narrow-leafed lupin (*Lupinus angustifolius*) seed infection is rare and such seed is usually non-viable and of no consequence in disease carryover. However, the European white lupin (*L. albus*) is liable to develop seed-borne infections that can give rise to seedlings with diseased cotyledons.

Symptoms

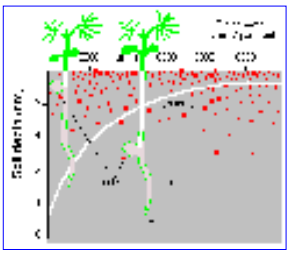

Figure 5. A typical Pleiochaeta spore profile in a direct drilled paddock. Tap roots of deeper sown plants escape higher spore numbers.

Infected cotyledons develop dark brown spots, then rapidly die and drop off. Leaves develop dark brown spots, often net-like in appearance, and often become distorted and reduced in size before prematurely dropping off (Figure 2).

Small brown flecks may be evident on the stems that occasionally develop into large cankers which kill the stem above the infection point. Pods may be flecked or develop large lesions, particularly those set closer to the ground.

Root infection causes dark brown lesions on the tap and lateral roots (Figure 3). Tap roots can rot away completely and the plant rapidly wilts and dies before it reaches the 4-leaf stage. Lateral roots may compensate for the loss of tap roots while surface soil moisture is adequate. However, the affected plants are outcompeted and die from moisture stress later in the season. The reduced stand densities lower the yield potential of the crop and plants with a partially rotted root system are less vigorous, with lower yields.

Disease risk and predisposing factors

The number of *Pleiochaeta* spores in the soil largely determines the severity of brown spot and root rot in a lupin crop. Climate and soil type also strongly influence the risk of getting severe brown spot (Figure 4).

In the northern wheatbelt, because of higher winter temperatures, lupins grow rapidly out of the susceptible seedling stage and develop tall dense stands which reduce rain-splash of spores from the soil onto the foliage. In colder areas, growth rates are slower and plants remain small with prolonged exposure to rain-splash at the most susceptible 0- to 4-leaf stage. They also take longer to grow away from disease on the lower leaves.

In the lower rainfall areas, crops are less able to compensate for early setbacks in vigour because of the shorter growing season and so early brown spot has a greater impact on grain yield.

Narrow-leafed lupins are best adapted to slightly acidic, deep loamy sands. They are less suited to growing on acidic wodjil soils, deep grey and white sands, shallow duplex and heavier soil types. On less favourable soils, plants remain shorter and exposed to rain splash for longer and do not finish as well, providing less opportunity to compensate for earlier disease.

Parts of paddocks liable to be waterlogged are much more likely to get brown spot.

Pleiochaeta root rot is mostly determined by the soil spore load and less influenced by climate and soil types. However, it is more severe in situations where the surface 10 cm of soil dries out shortly after seeding as can occur with early sowings.

The management package

Rotation

The *Pleiochaeta* spore numbers in the soil approximately halve every year under a non-lupin crop or pasture. Spore numbers are usually very high in paddocks sown to lupins the previous season so that double cropping lupins is never recommended. All risk factors should be considered when choosing a suitable rotation. Table 1 provides a guide.

Stubble mulching

Retaining cereal stubble as a mulch on the soil surface reduces the rain-splash of spores onto the foliage of the plant, reducing brown spot severity - the greater the stubble cover, the greater the disease control. A minimum of 20 per cent ground cover on the surface after the seeding operation is recommended.

Fungicide

Seed treatment with Rovral® or Sumisclex® is recommended for all except very low risk situations. It can dramatically reduce brown spot losses when disease is severe in the first four weeks after seeding. Fungicide seed treatment should be used in conjunction with stubble mulching for prolonged seasonal protection. A rate of 100 mL/100 kg of seed (25 per cent active ingredient) is the most economical for most situations.

Sowing date

Avoid late (June) sowings when temperatures are starting to fall and slower growth leads to greater seedling exposure to rain-splash and delayed canopy closure.

Tillage

Direct drilling is the best choice because lupins rarely show a response to cultivation and Pleiochaeta root rot infection is kept to a minimum. Using a disc plough to control weeds, reduce stubble or incorporate simazine before seeding lupins can markedly increase root rot. The disc plough inverts the soil and buries the band of concentrated spores deeper into the soil profile, making it impossible to sow below the spore band.

Spores buried by ploughing before the previous season's wheat crop will survive at depth and cause more root rot in the following lupin crop compared with direct drilling the wheat. Scarifying or deep ripping the previous wheat crop buries fewer spores than a disc and has little effect on subsequent lupin crops.

Depth of sowing

Plants sown shallow (2 cm or less) are very susceptible to root infection because the tap root has to grow through a band of concentrated spores near the soil surface (Figure 5). A sowing depth as close to 5 cm as possible is recommended. Hypocotyls are not infected by *Pleiochaeta*.

Phosphorus nutrition

Phosphorus deficient lupins are more susceptible to brown spot infection. Deficient crops are

shorter, less vigorous and have less canopy development exposing the upper foliage to infection by rain-splashed spores.

Deep-banding phosphate (4 to 6 cm directly below seed) is best on soils low in phosphate or that tie up phosphate. Deep-banding is essential when crops are grown on wide row spacings (see Farmnote 16/95).

Seeding machine

Select and modify seeding machinery to achieve accurate sowing depth. Tines give greater precision than culti-trash discs. Sowing on wide row spacing (360mm) with deep-banded phosphate and rotary trash harrows is a very robust system, providing good stubble handling and accurate seed placement.

Seeding rate

Keep seeding rates up to compensate for losses due to Pleiochaeta root rot. Thin stands are also more liable to rain-splash due to poor canopy closure.

Herbicides

Avoid application of post-emergent herbicides to crops badly stressed with brown spot. Delay application of grass selective herbicides as grasses can help protect seedlings from rain-splash.

Varieties

Myallie is significantly more resistant to brown spot than all previous varieties of narrow-leafed lupin. It is the best variety for the extreme risk area (Figure 4), but must be used with the rest of the management package. It does not have Pleiochaeta root rot resistance.

Some advanced breeding lines have better resistance to Pleiochaeta root rot and should be released soon.

Yorrel is the most susceptible variety and should not be grown in high disease risk situations.

Kiev Mutant (*L. albus*) is more susceptible to brown spot and Pleiochaeta root rot than the narrow-leafed lupin varieties if grown on sandplain soils. However, it tolerates disease better than narrow-leafed lupin on fertile loams. Esta, a new variety which is taller than Kiev Mutant, escapes late season pod infection and should be considered for higher rainfall areas.

Further reading

- Farmnote no. 16/95 'Lupin nutrition' (Agdex 161/10)

Table 1. Suggested number of years between lupin crops to avoid brown spot and Pleiochaeta root rot problems in Western Australia

	Number of years			
Soil type	**Zone 1. Eastern (low rainfall)**	**Zone 2. Central and Great Southern**	**Zone 3. North Central and south coast**	**Zone 4. Northern**
Good sandplain	1 to 2	1 to 2	1	1
Wodjil sandplain	3 to 4	2 to 3	2 to 3	2
Free-draining loams and gravels	2 to 3	2 to 3	2	1
Duplex	2 to 3	2	1 to 2	1

See Figure 4 for map of climate zones

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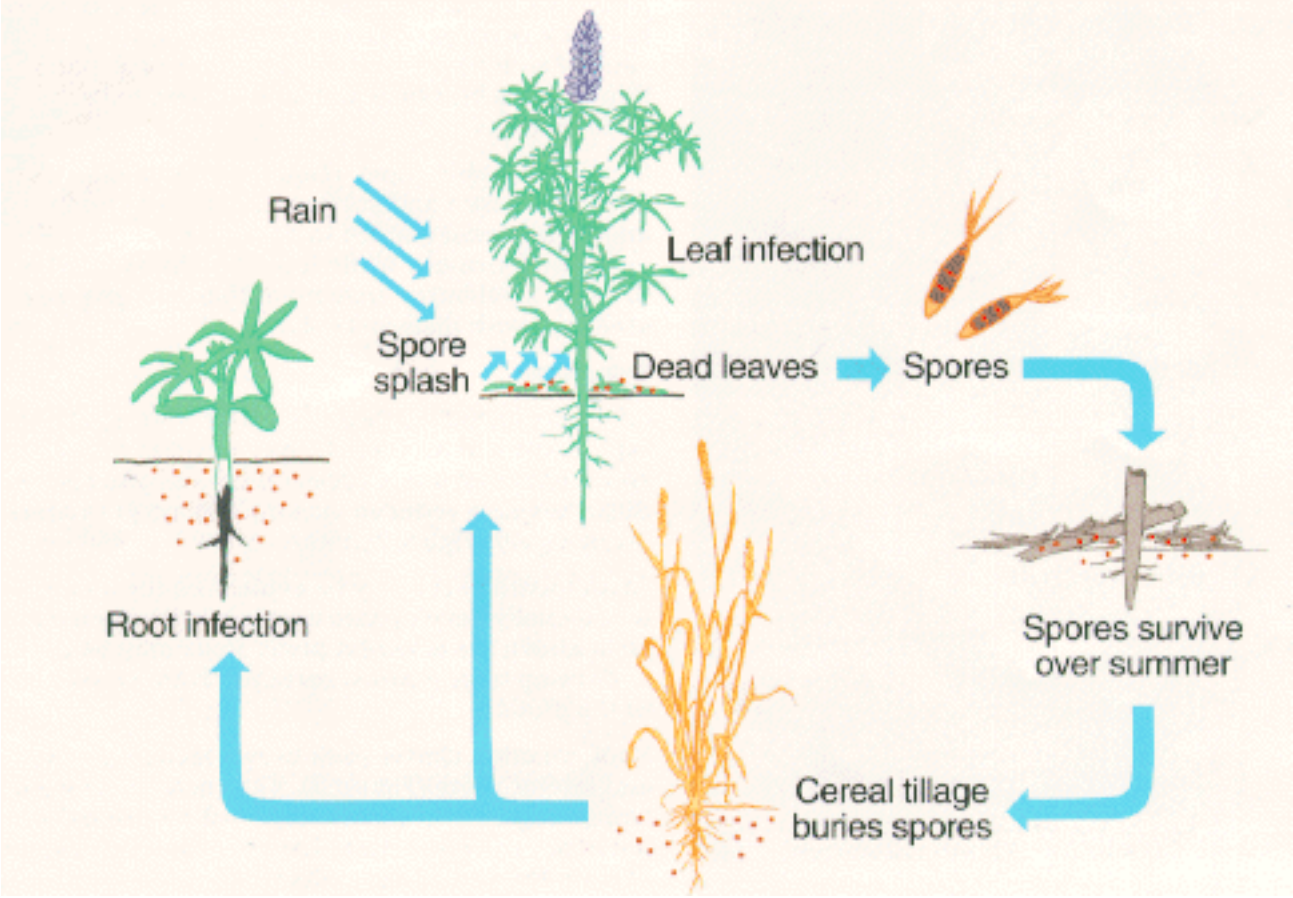

Figure 1. Infection cycle of the fungus Pleiochaeta setosa.

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Figure 2. Brown spot infection on leaves.

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Figure 3. Pleiochaeta root rot - dark brown lesions on the tap and lateral roots.

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Figure 4. Climatic risk of yield loss in lupins resulting from brown spot.

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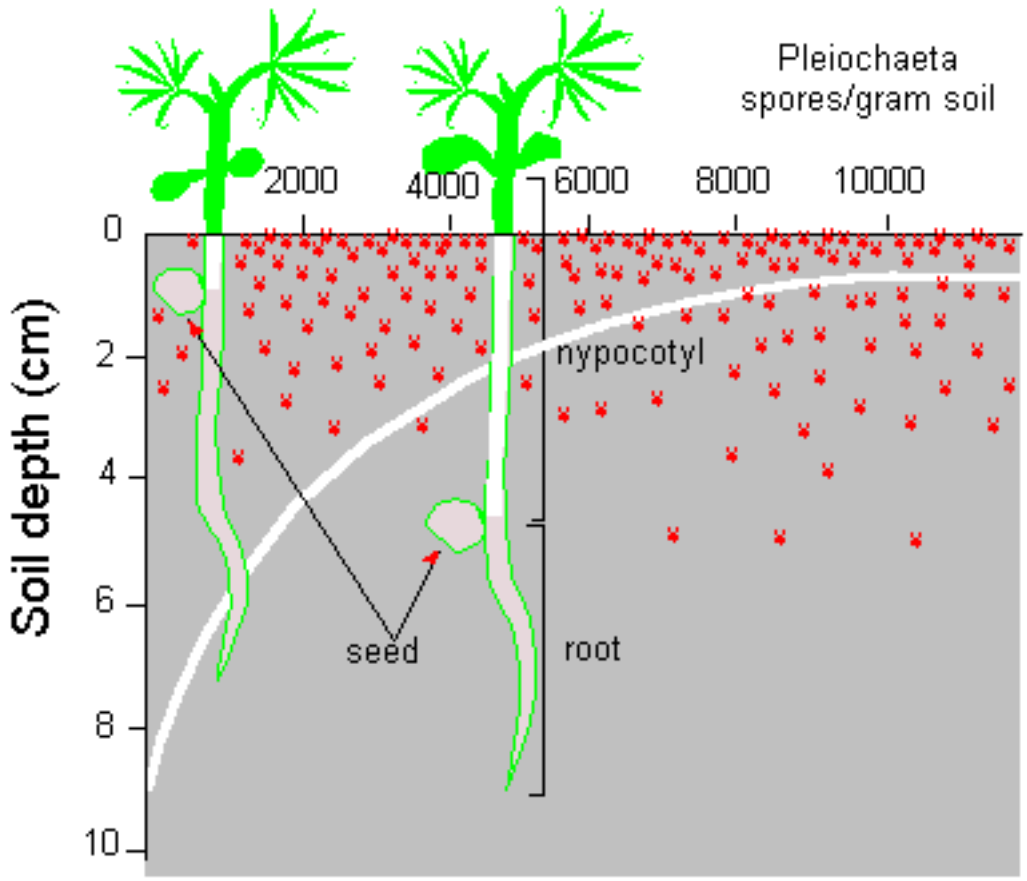

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