Department of Agriculture
Farmnote
No. 15/2003
Replaces Number 24/97

Lupin anthracnose - identification and management

REVIEWED 2007

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Summary

Anthracnose is a serious disease of lupins, caused by the fungus *Colletotrichum gloeosporioides*. All species of lupins are affected, but generally albus lupin *(Lupinus albus)* and yellow lupin *(Lupinus luteus)* are more susceptible than narrow-leafed lupin *(Lupinus angustifolius)*. This strain of lupin anthracnose does not affect other broadacre crops.

Anthracnose is most common in the high rainfall zone of the northern agricultural region of Western Australia, partly because of the large populations of blue lupins *(Lupinus cosentinii)*, which are endemic in this region. Whilst potentially not as damaging in other regions of Western Australia, anthracnose has been found in most lupin producing areas of the state.

Management at a glance

€ Resistant varieties - Tanjil or Wonga

- Sow uninfected seed or seed with very low infection
- Apply thiram fungicide seed treatment
- Control or avoid adjacent blue lupins
- Rotation and paddock selection
- Avoid spreading disease with machinery

Fig 1. Anthracnose infected Myallie plants showing characteristic bending and twisting of stems

Symptoms

Anthracnose lesions can form on all above-ground parts of the lupin plant. The most distinctive symptom is the bending and twisting of stems with a lesion in the crook of the bend (Figures 1, 2 and 3). This is particularly noticeable when the crop is flowering (Figure 1). Stem lesions are usually dark brown and elongated up to about two centimetres in length. A pale pinkish (sometimes orange) spore mass develops within lesions (Figure 3).

The stem is often completely girdled by these lesions or weakened so that it breaks. Both the main stem and lateral branches can be affected and close inspection will often show similar symptoms on leaf petioles (Figure 2). Bean yellow mosaic virus can produce similar shepherds crook symptoms on stems, but they will not have the

Fig 2. Anthracnose infection of seedlings

A) Anthracnose lesion on cotyledons

B) Infected leaf petiole and characteristic stem bending

Fig 3. Anthracnose stem lesions with close-up of pink spore mass in crook of lesion

Fig 4. Anthracnose pod lesion on narrow leaf lupins

Fig 5. Anthracnose infected seed

associated lesion or production of spores (see Bulletin No. 4294 *Virus diseases of lupins* Agdex 161/633). Leaf lesions are not numerous but may be seen as beige spots with a dark brown border. Pods develop lesions similar to stems and are often twisted and distorted (Figure 4). Pod infections can result in complete loss of pods or production of infected seed. Infected seeds can be malformed, have brown lesions, fungal mycelium on the seed surface, or have an occasional pink spore mass (Figure 5). Seeds can also be anthracnose infected without any visible symptoms.

Infection cycle

Initial infection comes from fungal spores or mycelium carried on or in infected seed. The fungus can survive for up to two years on the seed and possibly longer under some conditions. Seedlings that emerge from infected seed may develop lesions on the root, hypocotyl, cotyledons, leaf petioles or stems (Figure 6).

After a few days, these lesions produce an abundance of spores, which are spread through the crop by rain-splash. The vast majority of spores spread only a few metres, but some can travel further when raindrop aerosols are blown by strong winds. Spread of more than 100 metres has been recorded with anecdotal evidence of spread of more than 500 metres. Spores can also be spread longer distances by farm machinery, animals and insects.

Despite being poorly adapted to surviving on stubble, small amounts of the fungus can survive over summer on infected stubble and spores can be splashed to re-infect seedling lupins. This contributes to disease build-up in regenerating stands of blue lupins. Rain decreases the viability of the fungus on stubble and it will not survive through the following winter and spring conditions.

Spores need a film of moisture on the plant surface for at least four hours to germinate and penetrate the tissue. More infection will result from longer periods of wetness. After penetration, the fungus colonises the plant tissue and develops a lesion within a few days. Warmer temperatures increase the rate of symptom development and spore production.

Disease risk and predisposing factors

Anthracnose infection can arise through sowing infected seed, spread from adjacent infected blue lupins or other infected crops. Disease spread is greatest in high rainfall areas with warmer temperatures, although the disease can develop in all lupin growing areas in Western Australia. The level of infected seed sown, climatic conditions, susceptibility of variety sown and proximity of other infected lupins all contribute to anthracnose risk (Table 1).

Flower heads and pods of all varieties (including resistant varieties) are more susceptible to infection than stems and lateral branches. Pod set can be severely reduced by infection on flower heads and pods;

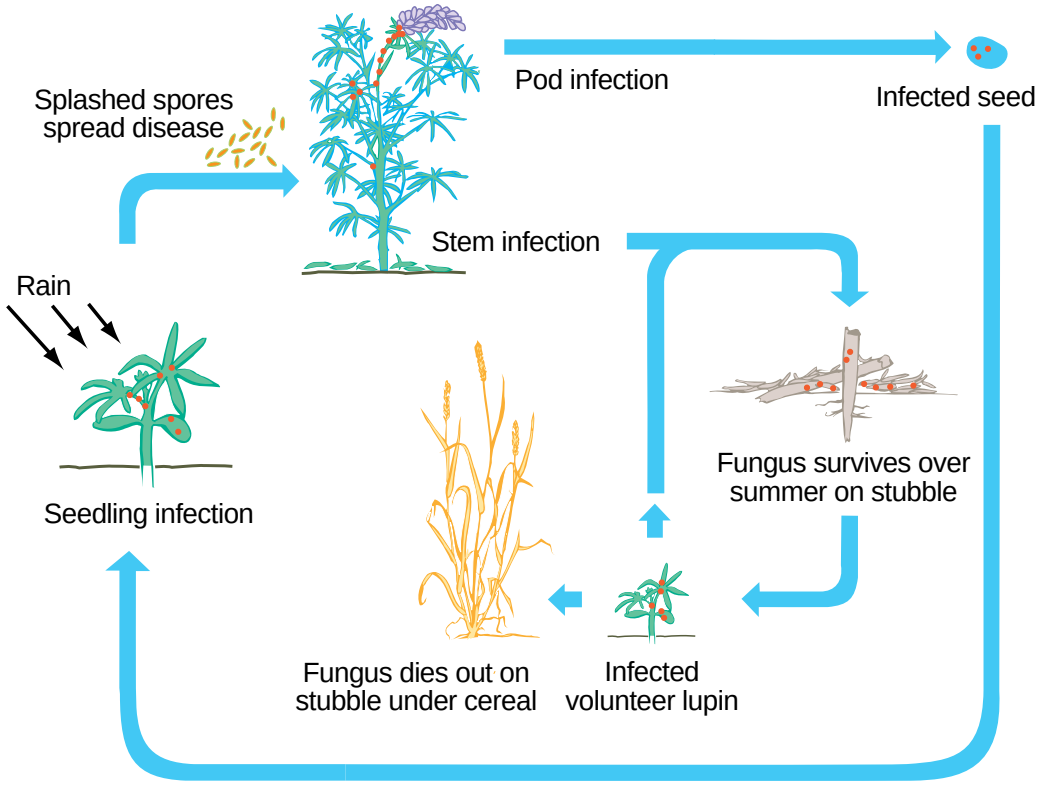

Fig 6. Life cycle of lupin anthracnose fungus

Table 1. Anthracnose risk in Western Australian Lupin zones

Lupin zone*	Overall risk	Risk factors		
		Blue lupins	Rainfall	Winter temperature
1. High rainfall - North	Very high	High	High	Warm
2. Medium rainfall - North	High - moderate	Medium	Medium	Warm
3. Low rainfall - North	Low	Low	Low	Warm
4. High rainfall - Central and Great Southern	Moderate	Very low	High - medium	Cool
5. Medium rainfall - Central	Moderate - low	Very low	Medium	Cool
6. Medium rainfall - Great Southern	Low	Very low	Medium	Cool
7. Low rainfall - East	Low	Very low	Low	Cool
8. South Coast	High - moderate	Very low	High	Cool

** See Figure 7*

consequently yield loss will be greatest where infection within a crop or adjacent blue lupins becomes severe before flowering.

Management

Key techniques for managing anthracnose are the use of resistant varieties and reducing the impact of seed infection through the use of clean seed and fungicide seed treatment. Use of fungicide sprays to control disease during the growing season is not recommended.

Varieties

There is a large range of variation in the resistance of narrow-leafed lupins to anthracnose (Table 2, Figures 8 and 9). The varieties Tanjil and Wonga are most resistant and are recommended for high-risk zones (lupin zones 1, 2 and 8). Susceptible varieties are not recommended in high risk zones, while they can be grown more safely in lower risk areas. The current yellow lupin and albus lupin varieties are very susceptible to anthracnose and should be grown only in low risk areas using completely clean seed.

Table 2. Resistance of lupin varieties

Variety	Resistance (0-9)
Kiev Mutant	1 Extremely susceptible
Wodjil, Unicrop	2 Very susceptible
Quilinock, Myallie, Tallerack	3 Susceptible
Belara, Merrit, Gungurru, Jindalee, Moonah	4 Moderately susceptible
Illyarrie, Yandee, Danja, Warrah	5 Intermediate
Kalya	6 Moderately resistant
Tanjil, Wonga	7 Resistant
-	8 Very resistant
-	9 Immune

Clean Seed

Growers should obtain seed that has the lowest risk of carrying anthracnose infection. Using totally clean seed is ideal, however under some circumstances a degree of seed infection can be tolerated with only minimal yield loss. The level of seed infection that can be tolerated is dependent on a series of factors:

Fig 7. Map of Lupin Zones

- the susceptibility of the variety sown;
- environment in which the seed will be sown (rainfall is most critical);
- use of fungicide seed treatment;
- proximity of other sources of infection (such as blue lupins or other infected crops).

In general, tolerance of seed infection is lower in susceptible varieties and in higher rainfall zones.

Details of predicted yield loss and critical seed infection thresholds across varieties and rainfall zones are available, with seed test results, from Agwest Plant Laboratories or on-line at http://www.agric.wa.gov.au.

Seed testing

To determine the suitability of seed for sowing, it should be tested for the presence of anthracnose infection. Seed testing is carried out with a DNA-based PCR test, which determines the quantity of infection in a seed sample. Test results should be compared to infection threshold and yield loss tables to determine the risk of yield loss. Seed testing services are available through Agwest Plant Laboratories.

Fungicide seed treatment

Fungicides with the active ingredient thiram (used at a rate of 100 g active ingredient per 100 kg seed) reduce seed transmission of anthracnose by around 75 per cent. These fungicides are available under various trade names. Seed treatment with thiram will reduce but not eliminate the transmission of disease by seed.

Thiram gives poor control of brown spot and should be used in conjunction with fungicides containing iprodione (such as Rovral®, Civet®) or procymidone (such as Sumisclex®, Fortress®) where protection from that disease is required (see Farmnote No. 5/96 *Brown spot and Pleiochaeta root rot of lupins* Agdex 161/633). Thiram is not compatible with rhizobium inoculum on seed.

Blue lupins

Blue lupins can be a major source of anthracnose infection. In areas with blue lupin pastures, only the most resistant varieties (Tanjil and Wonga) should be grown. Smaller patches of blue lupins (such as along raceways or fencelines) can also act as reservoirs of infection. These patches should be controlled if possible or resistant varieties should be used in these paddocks. A buffer of 250 metres between susceptible varieties and blue lupins (or other sources of infection) will significantly reduce the impact of anthracnose spread from these sources.

Seed storage

The viability of anthracnose infection in seed decreases over time. Storage of seed for 18 months can reduce seed infection by up to 95 per cent, with minimal effect on germination. This method cannot be guaranteed to eradicate infection.

Rotation and paddock selection

Do not sow lupins onto last year's lupin stubble. A break of one year with good control of volunteer lupins will reduce infection risk. Do not sow susceptible varieties directly beside blue lupin pastures or paddocks sown with infected seed. Paddocks downwind (during rain) have the greatest risk of anthracnose infection. Standing cereal stubble limits the splash of spores from infected seedlings, so sowing into standing cereal stubble will reduce the rate of disease spread to some extent.

On-farm biosecurity

Avoid spreading disease from infected to uninfected paddocks on vehicles or equipment. When spraying for weeds or insects, treat next year's seed paddock first. Harvest next year's seed paddock first, as infected seed can contaminate clean seed.

Disclaimer: Mention of trade names does not imply endorsement or preference of any company's product by the Department of Agriculture; any omission of trade names is unintentional. Recommendations were current at the time of printing.

Acknowledgments

The author acknowledges the following agencies for their support of anthracnose research: Grains Research and Development Corporation, Centre for Legumes in Mediterranean Agriculture, Co-operative Bulk Handling Ltd, Grain Pool of WA, and Grains Research Committee of Western Australia.

Further reading

Farmnote No. 5/96 Brown spot and Pleiochaeta root rot of lupins (Agdex 161/633).

Bulletin No. 4294 Virus diseases of lupins (Agdex 161/633).

Fig 8. Anthracnose damage on Kalya (moderately resistant)

Fig 9. Anthracnose damage on Myallie (susceptible), note significant stem infection and poor pod set

00983/07/03-2500-Advance Press

ISSN 0726-934X