



# Sclerotinia management for narrowleaf lupin crops in Western Australian farming systems DAW2104-002RTX

: Project result summary to date for 2021 and 2022 research results.

## Key messages:

- Commercial crop surveillance in 2021 and 2022 has found sclerotinia in lupin caused by *Sclerotinia sclerotiorum* distributed across the WA wheatbelt but the potential for significant yield impact appears greatest in the medium and high rainfall zones of the Kwinana North and Geraldton port zones where infection occurs earlier in the season and generally at higher incidence.
- Research has shown that foliar fungicide application for control of canopy sclerotinia in lupin provided an average yield response of 11% in trials conducted in the Geraldton port zone in 2021-22, generally where sclerotinia incidence was significant (ie 30% or more plants infected).
- Foliar fungicide applied at a vulnerable crop stage (e.g., crop flowering – early pod emergence on the main spike) that precedes or coincides with favourable weather conditions for the sclerotinia pathogen is more likely to be profitable. A wet spring and presence of other diseases will increase the chances of obtaining a yield response from fungicide application for canopy sclerotinia.
- Foliar fungicide application, targeted at canopy infection, generally does not provide any reduction in incidence of ground level (basal) sclerotinia infection or yield losses associated with it.
- Albus lupin does not have the extensive canopy cover or consistent under canopy humidity that narrowleaf lupin has however, a yield response to fungicide is more likely due to vulnerability to anthracnose infection (highly damaging) which fungicide application at flowering / podding can also reduce.
- Sclerotinia risk is higher in lupin crops grown in paddocks that have: a previous history of the disease, high plant density, heavy soil type, early canopy closure and good yield potential and in seasons where weather is favourable for disease spread. A GRDC Lupin sclerotinia disease risk assessment guide has been compiled for the Western region to help growers prioritise which paddocks and which growing seasons disease management may be required.

## The project

The 4-year project (2021-2024 growing seasons) is an investment of the Grains Research and Development Corporation (GRDC) and Department of Primary Industries and Regional Development (DPIRD) with DPIRD research being conducted in Geraldton, Northam and Albany assisted by subcontractors the Mingenew-Irwin group (MIG) and Centre for Crop and Disease Management (CCDM). Research activities include field surveys, controlled environment and laboratory experiments, small plot field trials and large grower-scale field trials.

## Aims:

- Gather data on the distribution and economic/disease impact from sclerotinia stem rot (SSR) in commercial lupin crops.
- Expand understanding on the epidemiology and the infection process of sclerotinia in lupin in the canopy and at ground level (basal).
- Better understanding of how cultural practices influence disease development (eg. crop rotation, row spacing, plant density and sowing time) and the effectiveness and optimum timing of fungicides for management of both canopy and basal sclerotinia infection.

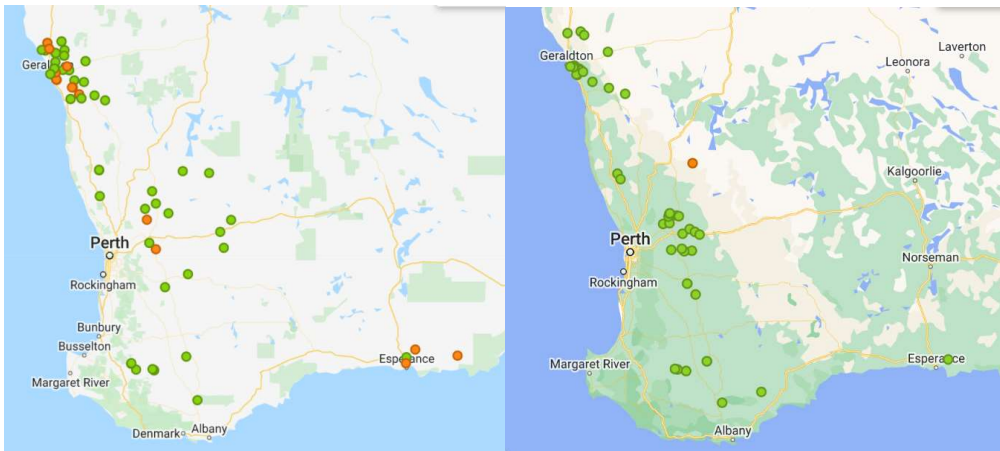
## Distribution and severity of sclerotinia in lupin in WA

Historically sclerotinia in lupin was an issue in the Geraldton port zone only but, with more canola being grown across the WA wheatbelt, the disease is now found in many areas and appears to be becoming a more regular issue. Regional disease surveillance has found sclerotinia in lupin is generally a problem in wetter growing seasons in areas where lupins are grown in close rotation with canola that has previously been infected with sclerotinia.

### 2021 and 2022 commercial crop surveillance conducted by DPIRD

Annual disease surveillance of commercial lupin crops was conducted in 2021 and 2022 across all the port zones as part of the endemic disease survey (Figure 1). This involved surveying 51 lupin crops in 2021 and 49 lupin crops in 2022. In each crop 25 plants were assessed for disease incidence and severity. All crops were narrow leaf lupin except for a very small proportion of the Geraldton port zone crops being Albus lupin. This was a joint effort by the Disease surveillance project and the Lupin Sclerotinia project and results are presented in Tables 1 and 2. with results of prevalence presented in Tables 1 and 2.

The 2021 and 2022 growing seasons were both characterized by an early start (late March/early April), dense crops with early canopy closure in most areas and above average rainfall in late winter in most parts of WA where lupins are grown. In 2022, a warm dry period in May/June delayed the commencement of the sclerotinia disease cycle (at least in the north) but all port zones had a long soft spring and above average yields.



**Figure 1.** Locations of lupin crops surveyed as part of both the Disease surveillance project and Lupin Sclerotinia project activities in 2021 (left) and 2022 (right) shown in orange or green. Please ignore different marker colours which do not symbolise anything relevant to this report.

Incidence of sclerotinia infection was high in the Geraldton port zone in both 2021 and 2022 where canopy infection was found in the majority of lupin paddocks surveyed while basal sclerotinia was very high in 2021 but halved in 2022. In 2022, incidence within paddocks and severity was lower than in 2021 with many lupin crops having branch infection rather than main pod infection

minimizing impacts to yield. In the Albany port zone, prevalence of canopy infection between surveyed crops was similar in both years (~70%) however basal infection was higher in 2022. Incidence of infection in the south within paddocks was consistently low and did not reach yield limiting levels in 2021 or 2022.

Lupin sclerotinia infection (both canopy and basal) was found to be at significantly higher incidence across the Kwinana port zone in 2022 than in 2021. In 2022 in Kwinana south 67% of paddocks surveyed had sclerotinia (canopy and/or basal) whereas in 2021 no southern paddocks had infection. In Kwinana north 92% of paddocks surveyed had sclerotinia in 2022, whereas in 2021 it was 60%. In Kwinana east 100% of paddocks surveyed in 2022 had sclerotinia whereas in 2021 it was only 17%.

Temperature differences in winter between the north and south of the WA wheatbelt appeared to be an important driver for the sclerotinia infection process in 2021 and in 2022. In both growing seasons, moisture and humidity were not lacking for the most part in all port zones, so it was evident that if conditions are too cold (<16°C) in winter, which is what occurred in the Albany port zone, infection will be delayed. In cooler southern regions infection only occurred at low incidence within paddocks and late in the season (late spring) often when crop flowering is finishing. In comparison, the north continues to be more prone to epidemics, infection earlier in the growing season (winter- spring) and higher incidence and severity within infected crops. So while the prevalence of Sclerotinia in southern regions is significant, the potential for significant yield impact appears greatest in the medium and high rainfall zones of the Kwinana North and Geraldton port zones. This is now an established issue for lupin (and potentially other legumes) as the disease inoculum (sclerotia) distribution in soil continues to intensify.

Infection with *Sclerotinia sclerotiorum* was the most common disease recorded in lupin surveys in Geraldton and Kwinana port zones. In the Albany port zone, other lupin diseases were more common than sclerotinia including bean yellow mosaic virus (BYMV), brown spot and botrytis grey mould (BGM). Across all port zones, Phomopsis infection was more common in 2022 than 2021 due to the widespread wet extended spring. Anthracnose was common in albus lupin surveyed in Geraldton port zone.

**Table 1.** Prevalence of lupin paddocks infected by sclerotinia (basal, canopy or either type) in each WA port zone in 2021 and 2022 when surveyed by DPIRD staff through Disease Surveillance and Lupin Sclerotinia Projects.

Port Zone (# of crops surveyed in 2021, 2022)	Percentage of surveyed lupin crops infected with sclerotinia (%)					
	2021			2022		
	Basal	Canopy	Total	Basal	Canopy	Total
<b>Kwinana (15, 24)</b>	13	20	27	38	75	88
<b>Albany (10, 8)</b>	10	70	80	17	67	67
<b>Geraldton (22, 15)</b>	90	95	100	40	87	93
<b>Esperance (4, 2)</b>	25	25	50	50	50	50
<b>Across all port zones (51, 49)</b>	47	63	71	22	44	53

**Table 2.** Average incidence of infected lupin plants within infected paddocks in each port zone surveyed in 2021 and 2022 by DPIRD staff through Disease Surveillance and Lupin Sclerotinia Projects.

Port Zone	Incidence of sclerotinia infected plants within infected paddocks (%)			
	2021		2022	
	Basal	Canopy	Basal	Canopy
Kwinana	8	24	1	7
Albany	4	4	1	4
Geraldton	11	41	3	26
Esperance	8	4	4	2

## Field trial research in 2021 and 2022 by DPIRD

### *Weather and canopy conditions and the infection process*

Lupin sclerotinia development is highly dependent on seasonal weather conditions, maybe even more than canola sclerotinia, and only develops to significant levels in years where there is sufficient rainfall across the growing season. Favourable rainfall, humidity and temperature conditions are required at all stages of the disease lifecycle for it to initiate, persist and spread. Infection can develop extremely rapidly within weeks under favorable weather conditions and can be difficult to manage with foliar fungicides when high disease pressure present.

In 2022, only 5 of the 15 field trials conducted by the project, had sclerotinia at moderate to high levels (canopy sclerotinia >30% incidence plants infected) and all were in the Geraldton port zone (Table 4). This is significantly fewer than in 2021, when 7 out of 10 field trials conducted had moderate to high levels of infection (Table 3). This disease is sporadic and although much of the 2022 growing season appeared favourable weather wise, it was a crucial dry period in autumn that likely led to delayed sclerotinia infection in the Geraldton and Kwinana port zones. Years of below average rainfall or where dry periods occur during crucial parts of the disease cycle (such as autumn and spring) will limit or prevent development and spread of sclerotinia in lupin if crop flowering does not overlap with ascospore release.

Field trials and monitoring sites conducted in this project in 2021 and 2022 have confirmed that sclerotinia infection in lupin is favoured in dense crops with history of sclerotinia, early closed canopies that are protected from wind and on loamy soil types that allow humidity levels to build up from ongoing soil moisture.

### *Yield impact and fungicide timing of canopy sclerotinia*

In lupin trial work conducted in this project and recent years, infection on the main spike and pods including branch pods was the most common part of the plant infected (rather than stems) and is likely to be the main cause of yield loss from the disease in lupin. This is why fungicide application in lupin needs to focus on protecting the pods rather than the stems (as is the case in canola) so fungicide application from 100% bloom to early pod emergence is likely to be most effective.

Field trials have found that yield responses are variable and are not guaranteed (Tables 3 and 4) making decisions on value of management in each cropping situation challenging.

In DPIRD field trials conducted in the Geraldton or Kwinana port zones in 2021 and 2022, a single foliar fungicide application gave a yield response in six out of 14 trials (three out of six trials in 2021; three out of eight trials in 2022) where sclerotinia was the dominant disease. Yield increases generally ranged from 4-23% (average of 11%) compared to the untreated plots. In general, the yield responses were found in trials that had 30% or more plants infected with sclerotinia and greater responses were found where other diseases such as anthracnose, phomopsis or brown spot were also present. In 2022, where there was a particularly soft finish to the season, a greater yield response was found when fungicide was applied relatively late (at flowering/podding of branches)

as it provided protection into spring when sclerotinia was most active. Otherwise, a single fungicide application timed to protect emerging main spike pods is often the best management practice to consider each season. Sclerote contamination in grain was significantly reduced by fungicide application only in three out of fourteen trials conducted in 2021 and 2022. Sclerote contamination of grain is highly variable and is effected by several factors (such as harvest height, harvester fan speed etc) so to date there is no clear correlation with disease incidence.

In 2021 and 2022 cool (<16°C) temperatures in winter in the Albany port zone delayed infection until late spring, too late to significantly impact yield. In both years, disease incidence was minimal, fungicides did not significantly reduce sclerotinia symptoms and provided no yield or grain quality benefit.

#### *Basal sclerotinia*

In 2021 and 2022, basal (ground level) sclerotinia was first observed from mid-August in Geraldton trials when the plants were generally at pod emergence on main spike leaf drop had commenced. Further research is needed to understand if basal infection is growth stage dependent or solely determined by seasonal weather and environmental conditions (eg if it requires leaf litter on the ground to spread mycelium so only occurs after leaf drop has occurred). Yield impact from basal infection is not yet understood and will depend on when in the season and what growth stage it occurs at. Research by the project is continuing to understand the infection process, yield impact and if anything can be done with fungicides to interrupt the infection process.

In the majority of trials conducted in 2021 and 2022, foliar fungicide application did not reduce ground level sclerotinia (basal infection). This corroborates findings of DPIRD trials conducted in 2016 and 2021 and findings by NSW DPI field research. Research results to date indicate that any significant reduction in basal infection should be seen as an unexpected bonus to fungicides reducing canopy infection and not be relied upon as a rule. Ground level sclerotinia infection is often at and below ground level so foliar fungicides applied at or after canopy closure are unlikely to be effective at managing this type of infection once it is present.

#### *Agronomic strategies – Time of sowing, crop rotation and crop density*

Time of sowing, crop density (sowing rate), soil type, and crop rotation history are all significant factors in determining risk of sclerotinia infection in lupin crops. Field trials sown in Geraldton in 2021 and 2022 found that early sown crops (early April) had more consistent high humidity throughout the growing season and higher incidence of sclerotinia infection than later sown crops. Research conducted in 2021 and 2022 is continuing to investigate the effect of

- crop density including row spacing and seeding rate on sclerotinia incidence and yield impact
- crop sequences (rotation) for building up sclerotia burden left behind in the soil and the impact on the next crop.

**Table 3.** Yield results (t/ha) of seven trials conducted in the Geraldton port zone (GPZ) in 2021 for this project. Sclerotia contamination of grain was significantly reduced by foliar fungicide application at two of the sites (Morawa and Geraldton).

	Morawa Narrow-leaf	Geraldton Narrow-leaf (TOS2)	Georgina Albus	Alma Narrow-leaf	Mingenew Narrow-leaf	Chapman Valley Narrow-leaf	Northamp- ton Albus
Untreated	2.5	3.0	2.0	1.5	2.1	2.78	0.4
Foliar fungicide applied at late flower /early pod emergence on main spike	2.6	3.6	1.9 -2.1	1.5	2.1	3.03	0.8
LSD (10%)	0.09	0.445	ns	ns	ns	0.247	0.158
% Yield response above untreated	4%	23%				9%	100%
% Maximum canopy incidence in untreated	85%	34%	61%	100%	<1%	7%	58%
Comments	Fungicide significantly reduced sclerotia in grain	Fungicide significantly reduced sclerotia in grain	Late sown crop, fungicide applied in late Aug	Early sown crop, fungicide applied in early July	Trace of sclerotinia	Trace of sclerotinia	High sclero incidence but also severe anthracnos e

**Table 4.** Yield results (t/ha) of nine fungicide application trials conducted in 2022 for this project. Some trials are not shown as disease incidence was too low (2 in Albany port zone, 2 in Geraldton port zone). Sclerotia contamination of grain was significantly reduced by foliar fungicide application one site (Bolgart).

	Yield (t/ha)								
	Narngulu	Narngulu	Narngulu	Narngulu	Bootenal	Bootenal	Moonyoonooka	Morawa	Bolgart
	NLL (opportunistic trial, sown late April) Small plot	NLL (TOS1-13/4) Small plot	NLL (TOS2-11/5) Small plot	Albus (TOS1&2) Small plot	Albus Sown late May Grower trial	NLL Sown late May Grower trial	NLL Sown 10 May Opportunistic within grower paddock	NLL Grower trial Sown 13 April	NLL Grower trial
Untreated	6.0	5.3	5.3	4, 4.2	0.8	2.8	2.8	4	3.5
Fungicide spray at early pod emergence on main spike	5.9-6.1	5.5	5.4	3.9, 4.4	1.2	3	2.8	4.6	3.5-3.9
LSD (10%)	NS	Ns	Ns	Ns	0.3	0.17	Ns	0.06	NS
% Yield response above untreated					50	7	11	15	
% Maximum canopy incidence in untreated	8	7	4	TOS1 15% TOS2 3%	39	30	39	37	18
Comments		Double spray (early pod MS +3 wks) gave 8% yield response		Low sclero, low anthracnose	Low sclero, severe anthracnose	Low sclero and phomopsis	High sclero, salvage late spray gave 11% yield response, also had Phomopsis and BGM	Moderate sclero +moderate pleiochaeta (brown spot stem+pod)  Fungicide was applied at a late growth stage when pods were forming on second order branches	

For more information on sclerotinia in lupin refer to DPIRD's [Understanding and managing sclerotinia stem rot in lupin](#) webpage.

Refer to GRDC factsheet [Lupin Sclerotinia Disease risk assessment guide](#) produced by the Lupin sclerotinia project.

### Important Disclaimer

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