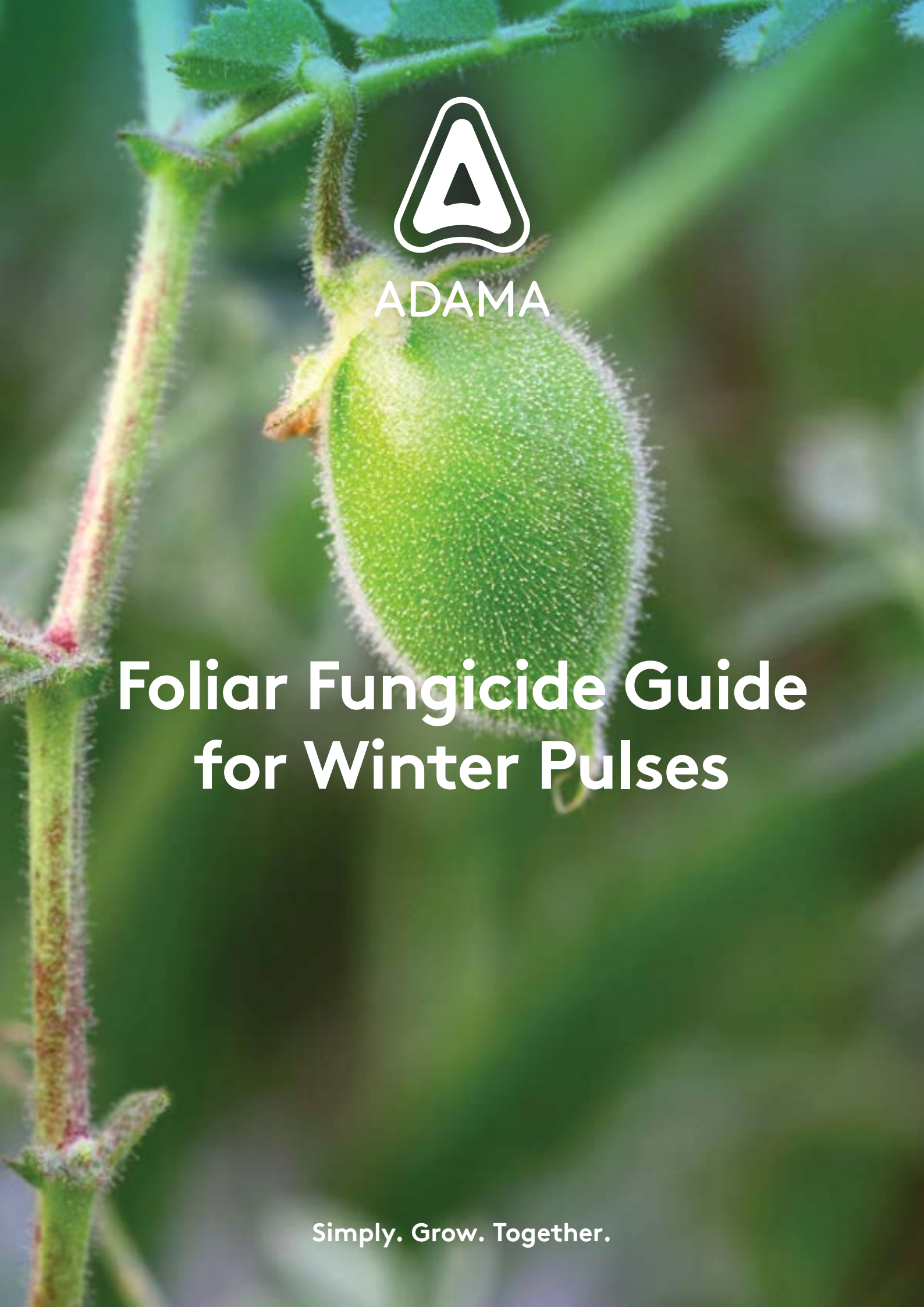


ADAMA

Foliar Fungicide Guide for Winter Pulses

Simply. Grow. Together.

Foliar Diseases in Winter Pulses

The signficance of foliar diseases in Winter Pulses

A range of winter pulse crops are grown in Australia, most of which can be significantly affected by foliar diseases. The impact of foliar diseases is influenced by several key factors including location, rainfall, pre-existing disease inoculum levels, varietal tolerance, disease status of neighbouring crops and type of fungicide program employed.

The impact diseases will have on pulse crops based on the above factors can range from complete yield loss, if not well managed, to negligible affect where best practice tactics are employed. Multi-pronged approaches to managing diseases is always preferred. This guide aims to assist with the management decisions associated with pulse diseases with a particular focus on correct choice and maximising the effectiveness of foliar fungicides.

How do foliar disease outbreaks occur?

There are three factors that must be present for a foliar disease outbreak:

- A viable inoculum source
- A susceptible variety
- Favourable weather conditions.

Viable inoculum source

The inoculum (fungal spores) that initiates a disease epidemic is called the inoculum source. The primary inoculum source will depend upon the disease and its ability to survive on either a living host (e.g. Botrytis Grey Mould) or on dead plant material such as stubble (e.g. Ascochyta Blight). Volunteers and infected stubble host diseases and provide an inoculum source to initiate new infections in subsequent crops.

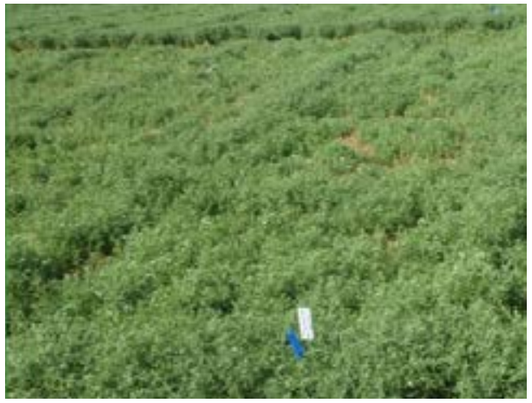
A susceptible variety

Variety selection can help growers manage the risk of losses from foliar diseases. It can also help tailor fungicide applications according to the yield potential and level of disease risk ***(Table 1)***. No pulse crops or varieties are immune to disease and fungicide application may be required under severe disease pressure. Growers and agronomists should be aware that sensitivity shifts to diseases can occur quickly within varieties.

Volunteers should be controlled by mid-March: and ideally earlier to reduce disease inoculum by the time of crop emergence

Variety Resistance Classification			
Rating	**Alpha Code**	**Numeric Code**	**Management Option Description**
Resistant	R	9	Disease may be found but will be at such a level that no economic management is required, even in instances of high disease pressure.
Resistant – Moderately Resistant	R-MR	8	Disease may be observed but no economic management decisions will be required. Preventative sprays not necessary but disease should be monitored. Management of seed quality may be required.
Moderately Resistant	MR	7	
Moderately Resistant – Moderately Susceptible	MR-MS	6	In the presence of inoculum and in seasons conducive to disease, the disease will be seen more readily when inspecting the crop. If the disease appears early in the season then an economic management decision (preventative spray) may be appropriate. Later occurrence of the disease may not require any action. Management of seed quality will be required.
Moderately Susceptible	MS	5	
Moderately Susceptible – Susceptible	MS-S	4	
Susceptible	S	3	The disease will be easily found in the crop. Management decisions will be required to reduce yield loss and will most probably be economic to do so. Management of seed quality will be required.
Susceptible – Very Susceptible	S-VS	2	Do not grow this variety if the disease in question is a regular occurrence or risk. The variety in question can be a complete loss if sown and no disease management is applied.
Very Susceptible	VS	1	

Table 1. Variety classifications are available from agency websites



Untreated

Favourable weather conditions

Pathogens have temperature and leaf wetness requirements for spore germination, infection and sporulation. At a suitable temperature and leaf wetness, spores germinate and infect the plant.

Once diseases have started to develop, the rate at which they progress depends upon the thermal requirements for each disease. Thermal time maps the accumulation of average daily temperatures across time and can be a useful way to assess likely disease progression and latent period.

What can I do to manage foliar diseases?

Growers have a range of options available to manage foliar diseases including:

- Reducing inoculum sources
- Choosing suitable varieties
- Applying seed dressings
- Applying foliar fungicides.

Reducing inoculum sources

Inoculum sources can be reduced by:

- Controlling 'Green Bridge' volunteers
- Rotating crops
- Managing stubble.

Veritas 750 mL/ha

Volunteers should be controlled by mid-March to ensure spores produced on these plants are not viable by the time of crop emergence. Rotating crops to avoid planting back into infected stubble is also especially important for diseases such as Ascochyta Blight.

Seed Dressing Fungicides

Seed dressing fungicides are a useful tool that can be employed by pulse growers to control/suppress certain foliar diseases in addition to a range of soil and root diseases (Table 9). For example, Fairgro Opti seed dressing will control seed born Botrytis and Aschochyta Blight infections that can reduce crop establishment as well as offering protection against airborne Aschochyta Blight infections. The benefit of seed treatment will depend on disease conditions and risk factors, however, in lentils and chickpeas it is the foundation of good crop establishment and disease management programs.

For lentils and chickpeas, seed treatment is the foundation of good disease management

Chickpea Crop

Foliar Diseases of Pulse crops

Chickpeas

Several foliar diseases commonly affect chickpeas and if not adequately managed can cause significant or total loss of yield. The two most damaging are Ascochyta Blight and Botrytis Grey Mould, although other less important foliar diseases, such as Sclerotinia and certain viruses can also infect chickpea crops.

Ascochyta Blight *(Ascochyta rabiei)*

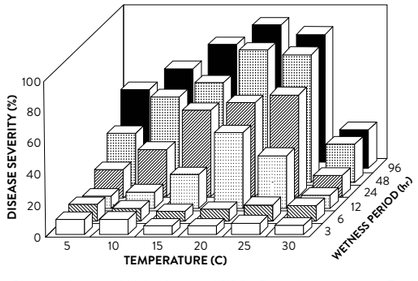
Ascochyta Blight is the most prevalent and damaging foliar disease in chickpeas. The Ascochyta Blight fungus can infect all above ground parts of the plant and is most prevalent in cool, cloudy and humid conditions. Figure 1 below demonstrates how extended periods of leaf wetness can significantly increase the speed of disease development and severity of Ascochyta infection.

Ascochyta Blight affected chickpea plant (photo: J.Leys).

Ascochyta Blight is endemic in all growing regions and there is no economic threshold for Ascochyta. Management strategies should be aimed at preventing the occurrence of disease and limiting its spread.

Initial crop infection is due to the introduction of either infected planting seed or from movement of infected trash by wind, machinery or animals. Spores of the fungus can survive for a short time on skin, clothing and machinery. Later in-crop infection spread occurs when inoculum is moved higher in the canopy or to surrounding plants by wind or rain splash during wet weather. Aschochyta Blight can develop under a very broad temperature range (5 - 30 °C) and therefore it requires a season long management process.

Figure 1. Effect of leaf wetness and temperature on Ascochyta Blight



Trapero-Casas, A. and W.J. Kaiser, 1992. Development of Didymella rabiei, the teleomorph of Ascochyta rabiei, on chickpea straw.

Ascochyta Blight in chickpeas is best managed through crop rotation, hygiene, seed treatment, growing varieties with improved resistance and prophylactic use of effective fungicides like Veritas and Cavalry Weatherguard. (Refer to tables 5 to 8).

Botrytis Grey Mould (BGM) *(Botrytis cinerea)*

BGM in chickpeas is caused by the fungus ***Botrytis cinerea*** and is a significant disease of several other types of pulse crops including lentils. In addition to being a serious disease of chickpeas, BGM will infect and invade dying and dead plant tissue. With its wide host range and its saprophytic capacity, inoculum of BGM is rarely limiting and if conditions favour infection and disease development, BGM infections will occur.

The first symptom of BGM infection in a chickpea crop is usually drooping branches. If several plants are infected, these may appear as yellow patches in the crop where grey 'fuzz' also develops under high humidity on flowers, pods, stems and on dead leaves and petioles.

BGM will develop most prolifically where the average daily temperature is 15°C or higher and is therefore typically a disease that occurs later in the season on chickpea crops.

When BGM infected seed is sown, seedling blight can occur soon after crop emergence. To reduce risk from infected seed, Adama recommends treating all chickpea planting seed with Fairgro Opti seed treatment fungicide.

Botrytis Grey Mould (Botrytis cinerea) affected chickpea plant (photo: Anon 2017)

Where early infections are left unchecked, masses of spores can be produced which spread onto surrounding plants by wind and rain splash to create greater levels of infection.

Adama recommends spraying a systemic + protectant fungicide like Veritas prior to major rainfall (≥10 mm) events and when conditions favour disease outbreak (generally later in the season).

Other Chickpea Diseases

Other diseases can affect the foliage of chickpeas such as Sclerotinia ***(S. sclerotiorum*** and ***S. minor)*** and certain viruses vectored by insect pests such as Bean Leafroll Virus (BLRV), Beet Western Yellows Virus (BWYV), Subterranean Clover Red Leaf Virus (SCRLV) and Subterranean Clover Stunt Virus (SCSV). These diseases are generally of less significance compared to Aschocyta Blight and Botrytis Grey Mould.

Faba Beans

The key foliar diseases affecting faba bean crops are Chocolate Spot, Ascochyta Blight and Cercospora Leaf Spot. Other disease such as Rust can also become a problem in some seasons. All these diseases can be effectively controlled to prevent them causing significant yield loss. Adama recommends an integrated approach where multiple tactics including effective fungicides are utilised to achieve the best overall outcome.

Chocolate Spot *(Botrytis fabae)*

Chocolate Spot infections are favoured by warm (15 - 25°C) and humid conditions (over 70 % relative humidity) that extend for 4 - 5 days or more. Under these conditions the disease can spread rapidly within a crop. Disease epidemics typically develop later in the season during flowering and after canopy closure. Yield loss due to Chocolate Spot results from pod abortion and loss of green leaf area to support grain fill.

Chocolate Spot symptoms appear initially as pin head lesions on one side of the leaf but can expand significantly turning the plant black and completely destroying the foliage if not controlled with fungicide.

Chocolate Spot - Occurs at 15 - 25°C. Initially pin head spots on one side of leaf.Can completely destroy Faba Bean crops if not controlled (photo: J.Leys).

Ascochyta Blight *(Ascochyta fabae)*

Ascochyta Blight infections in faba beans are worse in environments with prolonged wet and cool (5 - 15°C) conditions. Where conditions are favourable the disease can develop early in the growing season and continue to be an issue right throughout the life of the crop. In situations where significant disease is present, stem infections can also cause serious crop lodging. In addition to negatively affecting yield and stand-ability of the crop, pod infection with Ascochyta Blight can cause seed staining and subsequent quality downgrades.

Visible symptoms include dark leaf spots that become grey and elongated with age and the pale centre of the lesions may have tiny black fruiting bodies (pycnidia).

Cercospora *(Cercospora zonata)*

Like Ascochyta Blight, Cercospera develops early in the season during wet and cold conditions, but is generally less damaging to the crop. The disease can also develop later in the season, and if uncontrolled, can still cause significant leaf damage. Veritas is registered for control of Cercospera at 300 ml/ha.

Cercospora in faba beans presents as large dark brown circular lesions with ringed margins that expand irregularly. This photo also shows some small brown Chocolate Spot lesions. (photo: J.Leys)

Rust *(Uromyces viciae-fabae)*

Rust can occur from mid spring onwards and is favoured by warm temperatures (above 20°C). Rust infection can occur following 6 hours of leaf wetness and therefore does not require extended wet periods. Veritas is registered for control of Cercospera at 300 ml/ha.

Lentils

The main foliar diseases of lentils in Australia are Ascochyta Blight and Botrytis Grey Mould, although other diseases such as viruses can at times become an issue.

Ascochyta Blight *(Aschochyta lentis)*

Ascochyta Blight is a significant disease of lentils in Australia, generally impacting the crop earlier in the season when conditions are cooler. Most current varieties are unlikely to suffer large yield losses due to Ascochyta Blight, however, the disease does infect lentil pods and seed, causing a discolouration of grain that will significantly reduce the marketability and value of affected grain. Fungicides should ideally be applied prior to rain events and prior to the canopy fully closing over. If wet weather persists, multiple sprays may be required to manage this disease.

Botrytis Grey Mould (BGM) *(Botrytis fabae* and *Botrytis cinerea)*

BGM can infect all parts of the lentil foliage and disease progression is favoured by warm (15 –25°C), humid conditions (RH over 80 %) for 4 – 5 days. Yield losses due to BGM arise from infection of lower stems and leaves, which can spread and lead to stem and plant death, and the eventual formation of dead patches within crops which produce small or no seed at all. Under ideal disease conditions, BGM can cause total crop destruction.

BGM has a diverse host range and is generally always present on pulse crop residues. Host crops include faba bean, vetch, chickpea, field pea and lucerne.

Foliar fungicides should ideally be applied just prior to canopy closure to prevent BGM establishing.

Botrytis Grey Mould affected lentil plant. (photo: Agriculture Victoria)

Other Lentil Diseases

The majority of Australian lentil crops have background levels of viral infection; however, significant crop symptoms are not common. The key virus diseases affecting lentils are Cucumber Mosaic Virus (CMV), Alfalfa Mosaic Virus (AMV) and Beet Western Yellow Virus (BWYV). In the rare cases where damaging viral infections occur it is generally in association with prolonged, high aphid numbers early in the crop.

To avoid virus outbreaks growers should avoid planting in close proximity to a substantial virus reservoir (e.g. lucerne and summer weeds) and manage vector numbers such as aphids through insecticide application.

Field Peas

The main foliar diseases of Field Peas in Australia are Ascochyta Blight, Powdery Mildew, Downy Mildew and Bacterial Blight.

Ascochyta Blight *(Mycosphaerella pinodes, Phoma medicaginis, Ascochyta pisi, Phoma koolunga)*

Also known as 'Blackspot', Ascochyta Blight is the most important disease of field peas. Paddock selection, sowing time and seed treatment are key to minimising yield losses from this disease. Seed treatment with a product like Fairgro Opti (containing thiram plus thiabendazole) will help to minimise the establishment of disease. Early sown peas (May) and those sown next to pea stubble are more likely to benefit from seed treatment. Foliar fungicides program can be effective to control later infections, a two spray program should ideally be targeted at 6-8 nodes and again at early flowering.

Downy Mildew *(Peronospora viciae)*

Downy Mildew can pose a risk to field peas at crop emergence if the disease has occurred in the paddock previously. Downy Mildew can be effectively prevented with seed treatment products containing metalaxyl (like Apron* XL). Foliar treatment can improve yields significantly in susceptible varieties, but will have little benefit in resistant varieties.

Grey Mould *(Botrytis cinerea)*

Can develop on old flowers and then spread to other plant parts. Veritas is registered for control. Seed can be infected and cause seedling loss when sown for the next crop.

Powdery Mildew *(Erysiphe polygoni)*

Varieties with good levels of resistance to Powdery Mildew are available and these will generally require no fungicide treatment for control. For susceptible varieties or in high risk scenarios a foliar fungicide containing tebuconazole (like Orius) will adequately control Powdery Mildew. Disease will normally occur in moist conditions in early spring.

Field Pea with no disease (photo: J.Leys)
**Registered Trademark*

Bacterial Blight *(Pseudomonas syringae pv pisi, & pv syringae)*

Field peas can occasionally be impacted by Bacterial Blight. No seed treatment is effective for the control of Bacterial Blight of field, however some copper based foliar fungicide sprays are registered. Use of tolerant varieties is recommended, particularly in high risk areas.

Lupins

Lupins can be affected by several foliar disease strains although the two most common ones are Brown Spot and Anthracnose.

Brown Spot *(Pleiochaeta setosa)*

Brown Spot is the most commonly occurring disease of lupins in Australia and can infect lupins at all stages of growth. Infection of lupin seedlings early in the crops growth has the greatest potential to impact yield.

Iprodione or procymidone seed treatment fungicides can dramatically reduce early Brown Spot infections and should be considered where other risk factors are present such as proximity to previously infected lupin stubble

Lupin Brown Spot (photo: Agriculture Victoria)

Anthracnose *(Colletotrichum lupini)*

Anthracnose is a foliar disease of lupins spread by infected seed and rain-splashed spores from infected plants. All lupin species can be affected but generally narrow-leafed lupins are less susceptible. Symptoms range from bending and twisting of stems to stem lesions that are dark brown with a pale pinkish-orange spore mass within the lesion. Anthracnose is favoured by warm wet conditions therefore the greatest risk of disease is in higher rainfall areas. The disease can be managed by choosing resistant varieties, planting clean un-infected seed, foliar applications of mancozeb or through use of thiram based seed treatments.

Other Foliar Diseases of Lupins

Other foliar diseases of lesser significance affecting lupins are Grey Mould (*Botrytis cinereal*), Phomopsis Stem and Pod Blight ***(Diaporthe toxica)***, Sclerotinia Stem Rot ***(Sclerotinia sclerotiorum)***, Cucumber Mosaic Virus (CMV) and Bean Yellow Mosaic Virus (BYMV). These diseases rarely require any intervention or specific management strategies in lupins.

Foliar Fungicide options for Winter Pulses

Chickpea foliar fungicide ratings

Product	Active	Rate	FRAC Group	Type of Activity	Chickpeas	
					Botrytis	Ascochyta
Veritas®	Tebuconazole 200 g/L + Azoxystrobin 12 g/L	1 L	3,11	Xylem systemic	****	****
Cavalry® Weatherguard	Chlorothalonil 720 g/L	2 L	M5	Contact protectant	**	****
Aviator* Xpro	Prothioconazole 150 g/L + Bixafen 75 g/L	600 mL	3, 7	Xylem systemic	-	****
Howzat®	Carbendazim 500 g/L	500 mL	1	Xylem systemic	***1/2	**
Mancozeb	Mancozeb 750 g/kg	2.2 kg	M3	Contact protectant	**	***
Polyram*	Metiram 700 g/kg	2.2 kg	M3	Contact protectant	**	***
Captan®	Captan 800 g/kg	1.25 kg	M4	Contact protectant	*	***

Table 2.

Lentil foliar fungicide ratings

Product	Active	Rate	FRAC Group	Type of Activity	Lentils	
					Botrytis	Ascochyta
Veritas®	Tebuconazole 200 g/L + Azoxystrobin 12 g/L	1 L	3,11	Xylem systemic	****	****
Cavalry® Weatherguard	Chlorothalonil 720 g/L	2 L	M5	Contact protectant	**	****
Howzat®	Carbendazim 500 g/L	500 mL	1	Xylem systemic	***1/2	**
Mancozeb	Mancozeb 750 g/kg	2.2 kg	M3	Contact protectant	**	***
Polyram*	Metiram 700 g/kg	2.2 kg	M3	Contact protectant	**	***
Sporex®	Procymidone 500 g/L	500 mL	2	Limited systemic	****	-
Captan®	Captan 800 g/kg	1.25 kg	M4	Contact protectant	*	**
Aviator* Xpro	Prothioconazole 150 g/L + Bixafen 75 g/L	600 mL	3, 7	Xylem systemic	****	****

Faba bean foliar fungicide ratings

Product	Active	Rate	FRAC Group	Type of Activity	Faba Beans			
					Chocolat	Ascochyta	Rust	Cercospora
Veritas®	Tebuconazole 200 g/L + Azoxystrobin 12 g/L	1 L	3,11	Xylem systemic	****	****	****	****
Cavalry® Weatherguard	Chlorothalonil 720 g/L	2 L	M5	Contact protectant	**	****	**	*
Howzat®	Carbendazim 500 g/L	500 mL	1	Xylem systemic	***1/2	**	*	*
Orius®	Tebuconazole	145 mL	3	Xylem systemic	*	*	***	***
Mancozeb	Mancozeb 750 g/kg	2.2 kg	M3	Contact protectant	**	***	***	*
Polyram*	Metiram 700 g/kg	2.2 kg	M3	Contact protectant	**	***	***	*
Sporex®	Procymidone 500 g/L	500 mL	2	Limited systemic	****	*	*	*
Aviator* Xpro	Prothioconazole 150 g/L + Bixafen 75 g/L	600 mL	3, 7	Xylem systemic	****	****	****	****

Table 4.

****	Excellent control
***	Good control
**	Moderate control
*	Low control
-	No data

**Registered Trademarks.*

Matching the right product to the pathogen at the right timing provides a greater likelihood of getting a profitable return on investment.

Applying Foliar Fungicides

Factors to consider before applying foliar fungicides include:

- Disease pressure – dependent on variety, weather events and inoculum source
- Visual symptoms – monitor the crop for infection levels
- Seed dressing/in-furrow application
- Crop growth stage – apply fungicides to protect plant parts that contribute most to yield
- Yield potential – in low disease + low yielding crops, fewer sprays are needed. In moderate to heavy disease + higher yielding crops, multiple fungicide inputs are often required.

What is the objective of applying a foliar fungicide?

The main goal of a foliar fungicide application is to increase profitability. Fungicides do not generally increase yield, but they protect the yield potential of a given crop by maintaining the green vegetative area (including leaves, stems and seed pods). Foliar diseases reduce the green area of the plant and its ability to produce energy (via photosynthesis), particularly during key growth stages such as pod fill.

Getting the best result from fungicide applications

There are a number of key considerations when applying fungicides, including:

- Timing of application
- Product selection
- Rate selection.

Timing of application

Timing of application of foliar fungicides is the most important consideration for effective disease control.

Key points to consider with fungicide timing are:

- Applying fungicides to prevent the disease from becoming established. Do not rely on curative ability.
- Application at critical growth stages – 6-8 leaf, canopy closure flowering and pod formation depending on the crop and variety.
- Multiple applications may be required as fungicides cannot protect leaves that haven't emerged at the time of spraying
- High disease pressure/susceptible variety = earlier spraying + multiple sprays
- Applying fungicides to prevent the disease from becoming established. Do not rely on curative ability.

Product selection

The key foliar fungicide options available for use in chickpeas, lentils and faba beans are listed in tables 2, 3 and 4 along with important criteria such as their FRAC (Fungicide Resistance Action Committee) resistance group, type of activity within the plant and the relative strength against the key foliar diseases. The choice of fungicide to apply will depend on:

- The disease/s present
- Severity of disease pressure
- Crop growth stage
- Yield potential
- Resistance management
- Likelihood of livestock grazing.

Fungicides differ in their disease spectrum and efficacy. Matching the right product to the pathogen at the right timing provides a greater likelihood of getting a profitable return on investment.

Rate Selection

Changing the application rate of foliar fungicides will alter the efficacy, disease spectrum and length of residual control. Growers may choose to apply lower rates under lower disease pressure and/or when multiple applications are planned in a spray program. If higher rates are to be used, growers must ensure they do not exceed the maximum number of sprays permitted for the season or the maximum combined product rate allowable per hectare as directed by the label/permit i.e. Howzat and Veritas. This is to ensure there are not excessive residues in the grain or hay, as well as ensuring fungicide resistance management is considered.

Changing the application rate of foliar fungicides will alter the efficacy, disease spectrum and length of residual control.

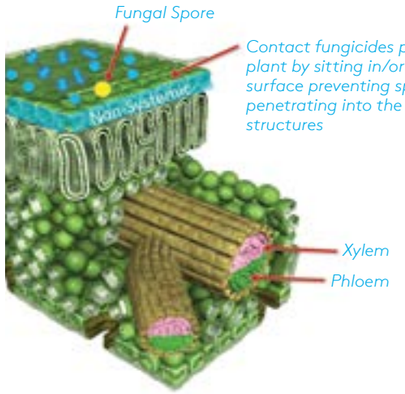
Fungicide Uptake and Movement

Fungicide uptake and movement within the plant can vary greatly between active ingredients. Understanding these differences can help with decisions on ideal application method and timing. With non-systemic products like Cavalry Weatherguard where the active ingredient primarily sits on/or just under the leaf surface, thorough coverage and early timing prior to the movement of the disease inside the leaf is essential.

Fungicides such as Veritas move acropetally in the xylem with the transpirational movement of water within the leaves. However, like non-systemic fungicides growth dilution occurs and fungicides must be reapplied to protect foliage if conditions continue to favour infection.

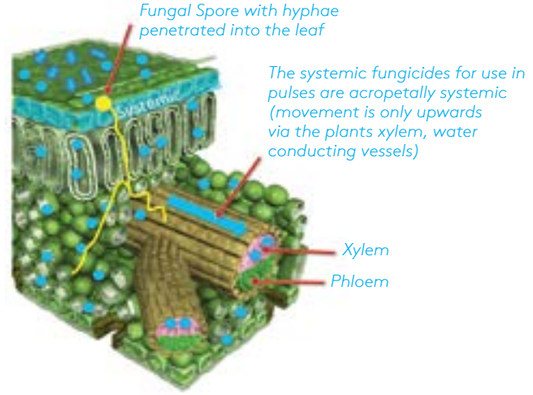
Figure 2. Fungicide movement within the leaf

Non-Systemic (Contact)



Cavalry Weatherguard, Captan, Manzozeb and Copper are examples of non-systemic fungicides

Systemic



Veritas, Howzat and Orius are examples of systemic fungicides

Resistance Management

With limited fungicide modes of action available, it is important to manage the risk of resistance developing. Resistance is the heritable loss of sensitivity to a fungicide, resulting in less efficacy in the field. Some fungicide modes of action are inherently more prone to the development of resistance.

To reduce the selection pressure on fungicides, it is recommended that growers use a spray program that incorporates a range of different mode of action groups and rotate between these different groups. Mixtures of modes of action can also assist with resistance management, where permitted.

CropLife Australia recommends growers follow their resistance strategies like the one below for managing BGM in pulse crops:

1. DO NOT apply more than two Group 1, 2, 3+11, M3 or M4 sprays in one season (including seed treatment).
2. DO NOT apply more than two consecutive Group 1 or M3 sprays, including from season to season and seed treatments. The final foliar spray of the previous season should be considered when planning which fungicide group to use in seed treatments and the first foliar application.

It is advisable to rotate groups between seasons.

To see the fungicide MOA Group for each fungicide refer to (Tables 2, 3 ,4 ,9 and 10).

For pulse diseases where established resistance management guidelines do not exist, CropLife recommends the use of fungicides from any given activity group (excluding Group M) be limited to a maximum of one third of the total number of fungicide applications. The use of consecutive applications of fungicides from the same activity group should also be limited by alternating between products from different activity groups. The use of Group M fungicides is not included in this limitation as these fungicides carry an inherently low risk for fungicide resistance.

For the latest advice on fungicide resistance management strategies visit the CropLife Fungicide Resistance Management Strategies page at https://www.croplife.org.au/resources/programs/resistance-management/fungicide-resistance-management-strategies1/

Foliar Fungicide programs

Table 5. High rainfall no livestock

	Chickpeas	Lentils	Faba Beans
Sowing	**Fairgro Opti Seed dressing**		
6-8 WAS	Cavalry Weatherguard		Mancozeb/Orius
Canopy Closure	Veritas	Veritas	Veritas
Flowering	Cavalry Weatherguard	Cavalry Weatherguard	Cavalry Weatherguard
Mid/ Late Flowering	Howzat/ Cavalry Weatherguard	Howzat/ Cavalry Weatherguard	Howzat/ Cavalry Weatherguard
Podding	Mancozeb/ Howzat	Mancozeb/ Howzat	Veritas

Table 6. High rainfall with livestock

	Chickpeas	Lentils	Faba Beans
Sowing	**Fairgro Opti Seed dressing**		
6-8 WAS	Mancozeb		Mancozeb/Orius
Canopy Closure	Veritas	Veritas	Veritas
Flowering	Mancozeb/ Howzat	Mancozeb/ Howzat	Mancozeb/ Howzat
Mid/ Late Flowering	Veritas	Veritas	Veritas
Podding	Mancozeb/ Howzat	Mancozeb/ Howzat	Mancozeb/ Howzat

Table 7. Low/Med rainfall no livestock

	Chickpeas	Lentils	Faba Beans
Sowing	**Fairgro Opti Seed dressing**		
6-8 WAS	Mancozeb		Mancozeb/Orius
Canopy Closure	Veritas	Veritas	Veritas
Flowering	Cavalry Weatherguard	Cavalry Weatherguard	Cavalry Weatherguard
Podding	Veritas	Howzat	Howzat

These fungicide programs are suggestions only. Adama recommends consulting an agronomist to accurately assess individual program requirements. Programs are separated by livestock and no livestock based on Cavalry Weatherguard having significant ESI (export slaughter interval requirements) and the preference to avoid its use where livestock may be grazed on pulse stubbles or failed crops.

In higher rainfall environments under high disease pressure, multiple applications of systemic fungicides will often be required to protect yield potential.

Table 8. Low/Med rainfall with livestock

	Chickpeas	Lentils	Faba Beans
Sowing	**Fairgro Opti Seed dressing**		
6-8 WAS	Mancozeb		Mancozeb/Orius
Canopy Closure	Veritas	Veritas	Veritas
Flowering	Mancozeb/ Howzat	Howzat	Howzat
Podding	Veritas	Mancozeb/ Howzat	Mancozeb/ Howzat

ADAMA Pulse Fungicide Range

Veritas®

Veritas® is a broad-spectrum foliar fungicide for use in chickpeas, lentils, faba beans, broad beans, vetch, lupins and field peas. The unique strobilurin + DMI combination in Veritas provides both outstanding protectant and systemic activity. Application of Veritas prior to disease infection will significantly reduce the establishment of foliar diseases later in the crop.

Strobilurin component:

- Inhibits spore germination and host penetration during the early stages of fungal vegetative growth
- Extended residual activity while also exhibiting excellent systemic movement within the leaf (acropetal movement)

DMI component:

- Rapidly absorbed into leaves and transported acropetally, providing more uniform protection throughout the leaf
- Active on the vegetative mycelia of the fungi with limited direct activity on spores.

The dual combination of a strobilurin + DMI in Veritas ensures infections are targeted from the time of spore germination on the leaf surface through to fungal development within leaves. Therefore, growers applying Veritas as a preventative treatment prior to spore germination will maximise their disease control.

Cavalry® Weatherguard

Cavalry® Weatherguard is a high quality formulation of chlorothalonil designed to display excellent sticking qualities, rainfastness and provide broad spectrum disease control.

Unsprayed faba bean plant infected with Chocolate Spot (Botrytis fabae)

- Cavalry Weatherguard provides long lasting protection from a range of pulse diseases even in prolonged wet conditions
- Cavalry Weatherguard adheres strongly to leaves and other plant tissue when dry and meets the highest market standard for chlorothalonil rainfastness and length of protection
- The chlorothalonil in Cavalry Weatherguard is a member of the multi-site activity group giving it a low risk to fungal disease resistance development
- As a protectant fungicide, Cavalry Weatherguard must be applied prior to disease infection to achieve maximum control and with no systemic activity. Thorough spray coverage at the time of application is essential.

Howzat®

Howzat® is a highly effective suspension concentrate (SC) formulation of carbendazim with both protective and systemic activity. For pulse crops its primary use is for Botrytis diseases.

- Howzat has a systemic mode of action being transported acropetally within the plant.
- Howzat acts by inhibiting development of the fungal germ tubes, the formation of appressoria, and the growth of mycelia
- The carbendazim in Howzat is a member of the Group 1 benzimidazole fungicide group and with no other members of this group available for use in pulse crops it remains a valuable tool for resistance management.

Faba bean plant sprayed with Veritas 1 L/ha

Photos from a faba bean disease control trial at Westmere, Vic in 2016

Captan

Adama Captan is designed to have the correct amount of surfactant to ensure optimum coverage of the plant while minimising foaming.

- Adama are developing Captan with a pulse registration and its available under a permit* at present.
- Captan is a member of the M4 multi-site activity group of fungicides giving it a low risk to fungal disease resistance development
- As a protectant fungicide, Captan must be applied prior to disease infection to achieve maximum control and since it has no systemic activity, thorough spray coverage at the time of application is essential.

**APVMA permit No. PER81406 allows the use of Captan in chickpeas and lentils for Ascochyta Blight, Chocolate spot, and BGM until 30th September 2023.*

Fairgro® Opti

Fairgro® Opti is a highly effective seed treatment fungicide for control of seedborne foliar diseases and seedling root pathogens of peas, chickpeas, lentils, faba beans and vetch. Fairgro Opti contains the active ingredients thiram and thiabendazole which combine to provide both protectant and systemic activity against key pulse diseases, in the soil and on the foliage.

- In combination with foliar fungicides, Fairgro Opti is a highly effective tool for managing ascochyta in a range of pulse crops
- Highly effective against botrytis seed rot and seedling root rots (*Pythium* spp. and *Fusarium* spp.)
- Excellent option for application to seed whe re suspected diseases contamination is present
- Easy to use formulation.

Efficacy of Veritas in lentils, PBA Hurricane XT (Swan Hill, VIC 2016) Reference Figure 2

Untreated

Orius 145mL/ha + Mancozeb 1Kg/ha

Veritas 1 L/ha + Mancozeb 1Kg/ha

Untreated

Orius 145mL/ha + Mancozeb 1Kg/ha

Veritas 1 L/ha + Mancozeb 1Kg/ha

Efficacy of Veritas in lentils, Bolt (Longerenong, VIC 2017) Reference Figure 1

Untreated

Veritas 750 mL/ha

Field Trials in Lentils

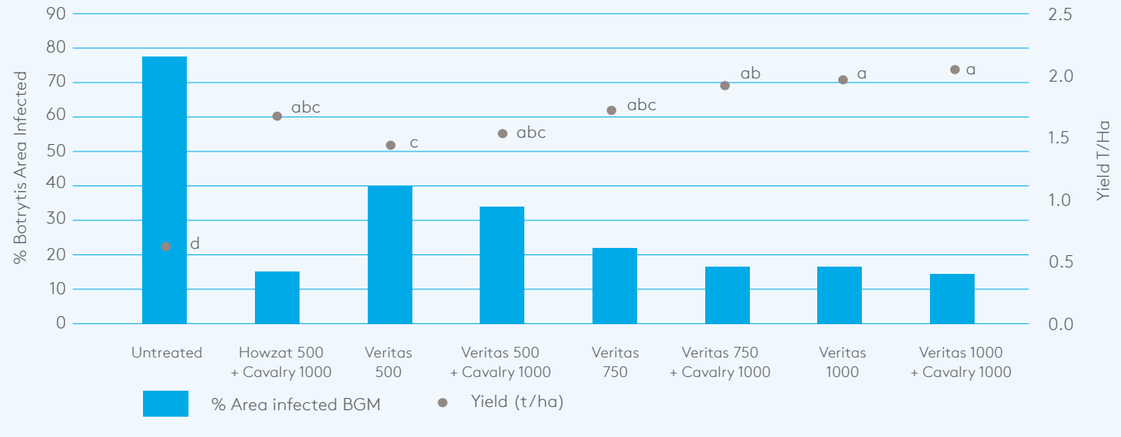


Figure 1: Efficacy of Veritas for the control of Botrytis and yield assesment in lentils (Longerenong, VIC 2017)

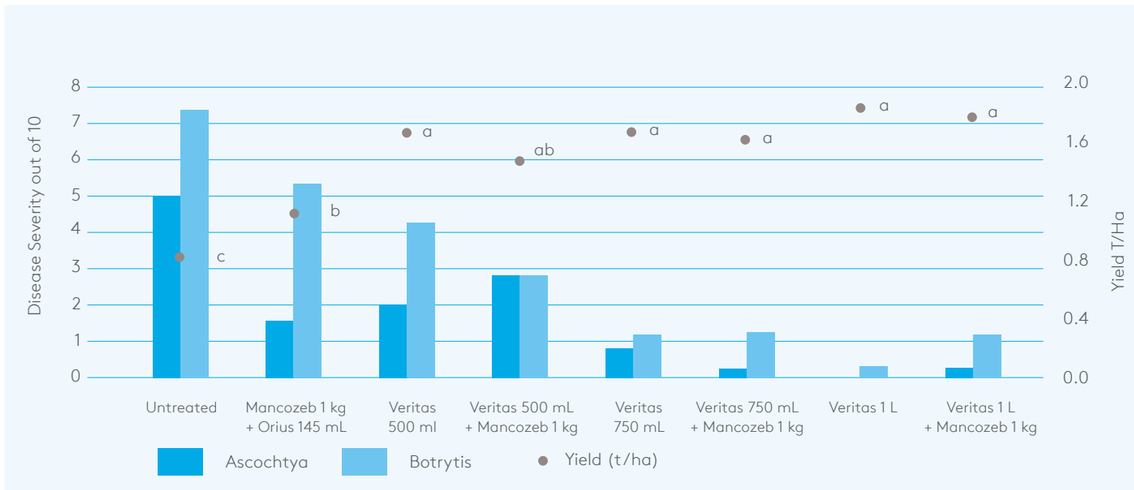


Figure 2: Efficacy of Veritas for the control of Ascochyta and Botrytis in lentils with yield assessment (Swan Hill, VIC 2016)

Pulse Fungicide Details

Table 9. Seed Treatments

Product	Active ingredients	Fungicide MOA Group	Rate per 100 kg/seed						Rate per 100 kg/seed							
			Chickpeas				Vetch		Lentils		Faba Beans	Field Peas		Lupins		
			Phytophera	Ascochyta (seed borne)	Botrytis (seed borne)	Damping Off (Seedling Root Rots)	Seedling Root Rots (Fusarium spp., Pythium spp.)		Ascochyya (seed borne)	Damping Off (Seedling Root Rots)	Damping Off (Seedling Root Rots)	Downy Mildew	Damping Off (Seedling Root Rots)	Brown Leaf Spot	Rhizoctonia Hypocotyl Rot	Anthracnose (seed borne)
Apron* XL	metalaxyl-M 350 g/L	Group 4	75 mL	-	-	-			-	-	-	75 mL	75 mL	-	-	-
Fairgro® Opti	thiram 360 g/L + thiabendazole 200 g/L	Group 1 + Group M3	-	200 mL	200 mL	200 mL	200 mL		200 mL	200 mL	200 mL	-	200 mL	-	-	-
Rovral* Liquid Seed Treatment	iprodione 250 g/L	Group 2	-	-	-	-			-	-	-	-	-	100 to 500 mL	100 to 400 mL	-
Sporex®	procymidone 500 g/L	Group 2	-	-	-	-			-	-	-	-	-	50#, 100 or 200 mL	-	-
Thiraflo*	thiram 600 g/L	Group M3	-	200 mL	200 mL	-			-	-	-	-	-	-	-	170 to 200 mL

 # = 50 mL per 100 kg of seed in WA only

Table 10. Foliar Fungicides

Product	Active ingredients	Fungicide MOA Group	Rate per hectare									Rate per hectare					Withholding Periods						Rainfast	Aerial use allowed	Activity Type
			Chickpeas		Lentils		Faba Beans				Lupins	Vetch		Field Peas												
			Botrytis spp.	Ascochyta	Botrytis	Ascochyta	Chocolate Spot	Ascochyta	Rust	Cecospera	Botrytis	Botrytis spp.		Powdery Mildew	Downy Mildew	Blackspot (Ascochyta)	Botrytis	Chickpeas	Lentils	Faba Beans	Lupins	Vetch	Field Peas			
Aviator* Xpro	prothioconazole 150 g/L + bixafen 75 g/L	Group 3 + Group 7	-	400 to 600 mL	400 to 600 mL	400 to 600 mL	600 mL	400 to 600 mL	600 mL	400 to 600 mL	-	-		-	-	400 to 600 mL	-	G 5 weeks Latest Late Flowering ESI 7 days	G 5 weeks Latest early Flowering ESI 7 days	G 5 weeks Latest early Flowering ESI 7 days	-	-	G 5 weeks Latest early Flowering ESI 7 days	-	Yes	Systemic
Captan®	captan 800 g/kg	Group M4	1.25 kg^	1.25 kg^	1.25 kg^	1.25 kg^	-	-	-	-	-	-		-	-	-	-	G 14 days H 14 days ESI 7 days	G 14 days H 14 days ESI 7 days	-	-	-	-	When spray is dry	Yes	Non systemic
Cavalry® Weatherguard	chlorothalonil 720 g/L	Group M5	-	1.0 to 2.0 kg	1 to 2 L	1 to 2 L	1.4 to 2.3 L	-	1.4 to 2.3 L	-	-	-		-	-	-	-	G 14 days H 14 days ESI 63 days	G 14 days H 14 days ESI 63 days	G 14 days H 14 days ESI 63 days	-	-	-	When spray is dry	Yes	Non systemic
Howzat®	carbendazim 500 g/L	Group 1	500 mL	-	500 mL	-	500 mL	-	-	-	-	500 mL		-	-	-	-	G 4 weeks H 4 weeks	G 4 weeks H 4 weeks	G 4 weeks H 4 weeks	-	G 4 weeks H 4 weeks	-	2 hours	No	Systemic
Mancozeb (various)	mancozeb 750 g/kg	Group M3	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg		1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	-	G 14 days H 4 weeks	G 14 days H 4 weeks	G 14 days H 4 weeks	G 14 days H 4 weeks	G 14 days H 4 weeks	G 14 days H 4 weeks	24 hours	Yes	Non systemic
Orius®	tebuconazole 430 g/L	Group 3	-	-	-	-	-	-	145 mL£	145 mL£	-	-		145 mL	-	-	-	-	-	G 14 days H 21 days	-	-	G 3 days H 3 days	When spray is dry	Yes	Systemic
Polyram*	metiram 700 g/kg	Goup M3	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	-	1.0 to 2.2 kg		1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	1.0 to 2.2 kg	G 21 days H 6 weeks	G 21 days H 6 weeks	G 21 days H 6 weeks	-	-	G 21 days H 6 weeks	-	-	Non systemic
Sporex®	procymidone 500 g/L	Group 2	-	-	500 mL	-	500 mL	-	-	-	-	-		-	-	-	-	-	G 21 days H 21 days	H 9 days	-	-	-	4 hours	Yes	Systemic
Veritas®	azoxystrobin 120 g/L + tebuconazole 200 g/L	Group 11 + Group 3	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L	0.75 to 1.0 L		-	-	-	0.75 to 1.0 L	G 4 Weeks H 4 Weeks	G 4 Weeks H 4 Weeks	G 4 Weeks H 4 Weeks	G 4 Weeks H 4 Weeks	G 4 Weeks H 4 Weeks	G 4 Weeks H 4 Weeks	2 hours	Yes	Systemic

^ = For use under permit No. PER81406. Expires 30th September 2023
£ = For use under permit No. PER13752. Expires 30th June 2024
G = Grazing Withholding Period, H = Harvest Withholding Period, ESI = Export Slaughter Interval
- = Not applicable or information not available
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Innovation Centre

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