AFREN WEBINAR:
Pulse / mungbean seasonal update

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Fran Lopez Ruiz
CCDM

Josh Fanning
AgVic

Levente Kiss
Centre for Crop Health

Friday 6 September 2024

Australian Fungicide Resistance Extension Network

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Regionally specific resources and training to help growers and advisors understand the status, risks and management of fungicide resistance in Australian grains.

Develop and deliver:

- Fungicide resistance management guide
- Workshops, info sessions & webinars
- Factsheets, updates & email alerts

afren.com.au

afren@curtin.edu.au

@theGRDC

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Housekeeping

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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- To ask a question:
  - Go to the Q&A window in the bottom of your screen.
  - Click on Q&A, open the window and enter your question.
  - Your question will then be posted ready to be answered. You can also tick “send anonymously” if you don’t want your name attached to your question.

Why do we have a problem?

How does fungicide resistance develop?

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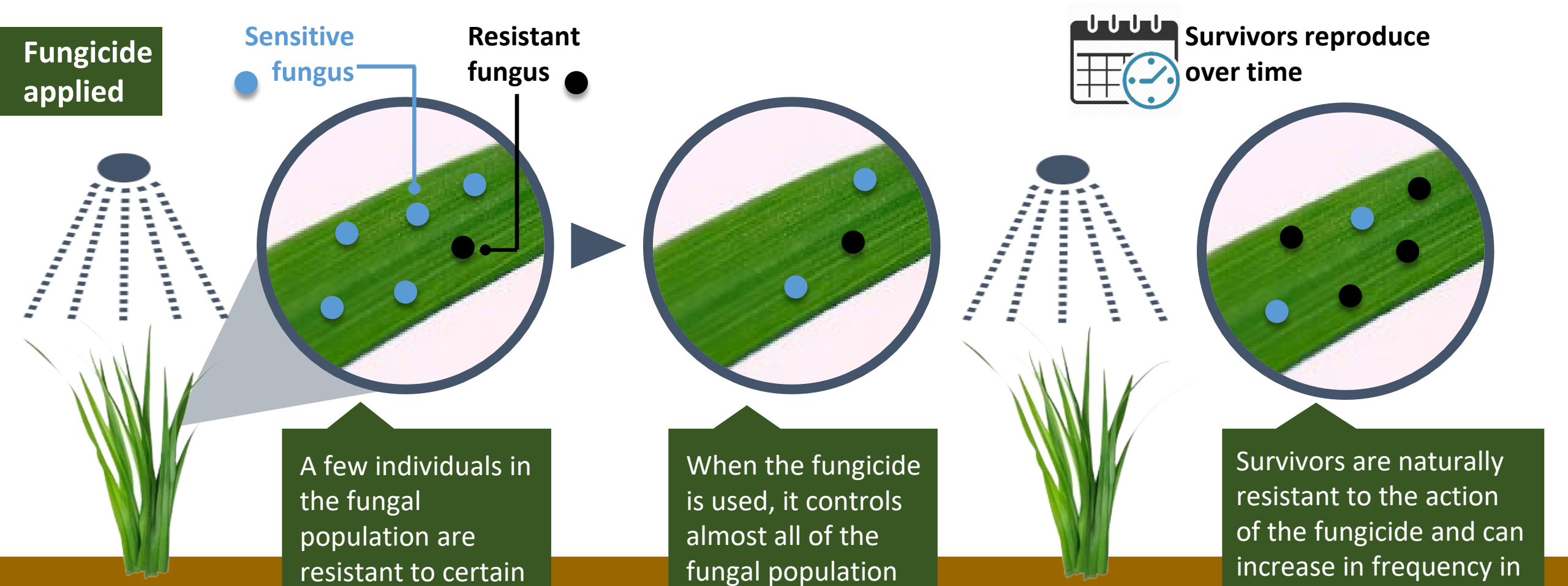

Modified from CropLife Australia Fungicide Resistance Management Fact Sheet - https://www.croplife.org.au/resources/programs/resistance-management/fact-sheet-fungicide-resistance/

Other factors that drive fungicide control failure

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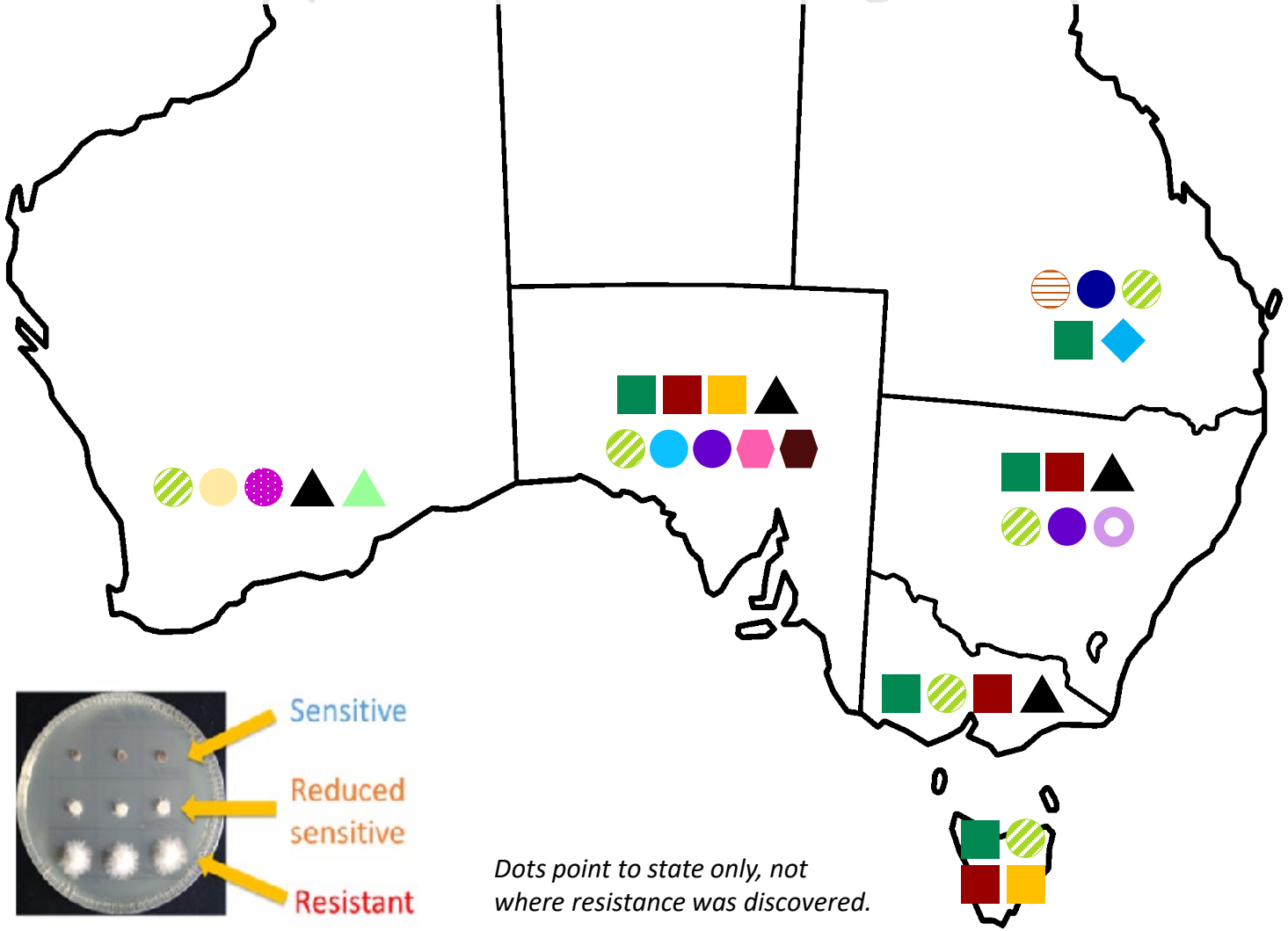
- Conducive season
- Wrong timing/product/coverage
- Poor IDM
- Lack of genetic resistance
- Mode of Action overuse = Resistance

Fungicide Resistance in Australian Grain Crops

Distribution of resistant (R), reduced sensitivity (RS, resistance below the threshold of field failure), and laboratory resistant detections (L) in fungal pathogens to fungicides with distinct modes of action across Australia.

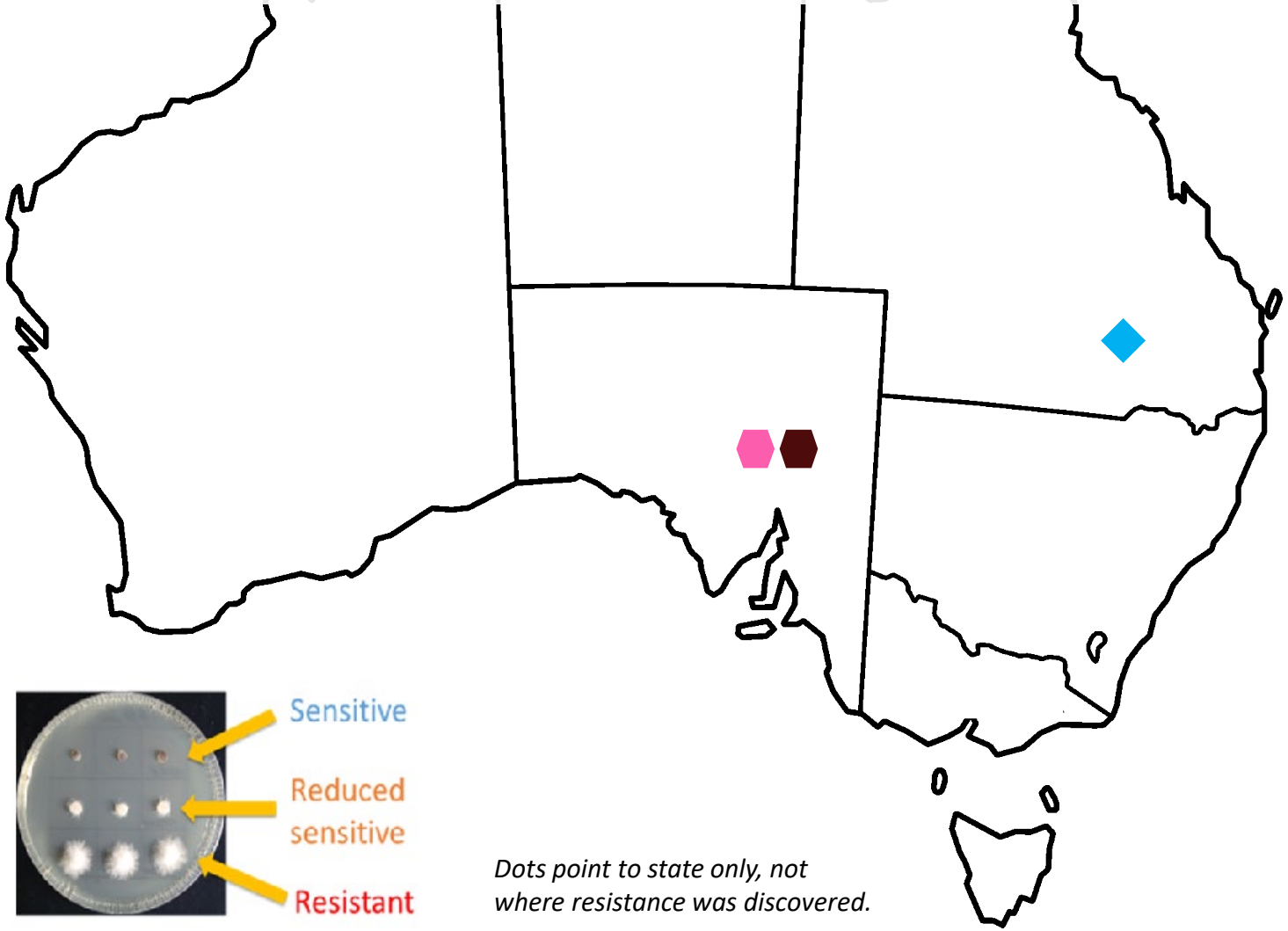


Dots point to state only, not where resistance was discovered.

Wheat powdery mildew	**R** - Group 11 QoI; Group 3 DMI
Septoria tritici blotch	**RS** - Group 3 DMI
Septoria tritici blotch	**L mutation R** - Group 11 QoI
Barley powdery mildew	**R, RS** - Group 3 DMI; **L - mutations**
Barley net form of net blotch	**R** - Group 3 DMI; **L mutations R, RS** - Group 7 SDHI
Barley net form of net blotch	**L mutations R, RS** - Group 7 SDHI
Barley net form of net blotch	**R, RS** - Group 3 DMI; **R** - Group 7 SDHI; **L mutations RS** - Group 11 QoI
Barley net form of net blotch	**R, RS** - Group 3 DMI; **R** - Group 7 SDHI
Barley spot form net blotch	**L mutations R, RS** - Group 3 DMI; **L mutations R, RS** - Group 7 SDHI
Barley spot form net blotch	**RS** - Group 3 DMI
Barley spot form net blotch	**R, RS** - Group 3 DMI; **R, RS** - Group 7 SDHI
Blackleg of canola	**RS** - Group 3 DMI
Blackleg of canola	**L mutations R** - Group 2
Botrytis grey mould of chickpea	**L mutation R** - Group 1 (MBC)
Ascochyta blight of lentil	**L mutation R** - Group 1 (MBC)
Mung bean powdery mildew	**RS** - Group 3 DMI; **L mutations R** - Group 11 QoI

Fungicide Resistance in Australian Grain Crops

Distribution of resistant (R), reduced sensitivity (RS, resistance below the threshold of field failure), and laboratory resistant detections (L) in fungal pathogens to fungicides with distinct modes of action across Australia.



Dots point to state only, not where resistance was discovered.

⬢	Botrytis grey mould of chickpea	**L mutation R** - Group 1 (MBC)
⬢	Ascochyta blight of lentil	**L mutation R** - Group 1 (MBC)
◆	Mung bean powdery mildew	**RS** - Group 3 DMI; **L mutations R** - Group 11 Qol

Pulse Disease Management

Joshua Fanning

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Centre for Crop and Disease Management

Curtin University

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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Pulse Pathologists

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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State	Pathologists - Diagnostics
Qld	Lisa Kelly (QDAF) Levente Kiss (USQ)
NSW	Joop van Leur (DPIRD) Sean Bithell (DPIRD) Kurt Lindbeck (DPIRD)
Vic	Joshua Fanning (AgVic) Chloe Findlay (AgVic) Dharushana Thanabalasingam (AgVic) Luise Fanning (AgVic)
SA	Rohan Kimber (SARDI) Mohsen Khani (SARDI)
WA	Geoff Thomas (DPIRD) Jean Galloway (DPIRD) Lars Kamphuis team (Curtin Uni)

Brief Overview

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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- Disease Basics
- Common Diseases
- Integrated Disease Management
- Fungicide Resistance Management

The Disease Triangle

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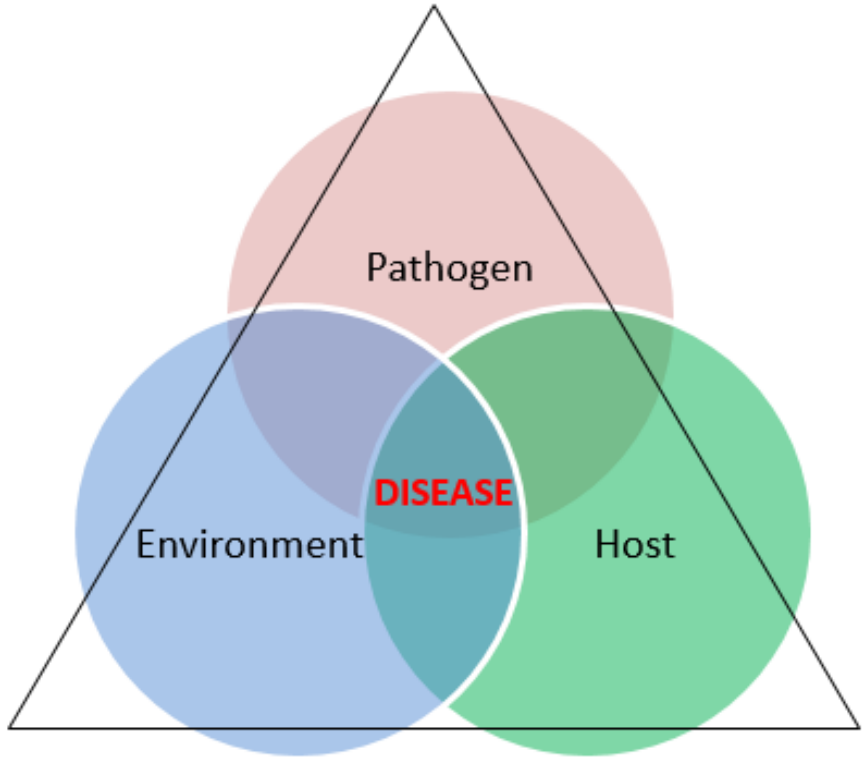
Survival structures
Infection Cycle
Dispersal
Reproduction



Temperature
Humidity
Rainfall
Fog
Soil moisture

Varietal resistance
Canopy structure
Growth stage

Fungicide Resistance Management

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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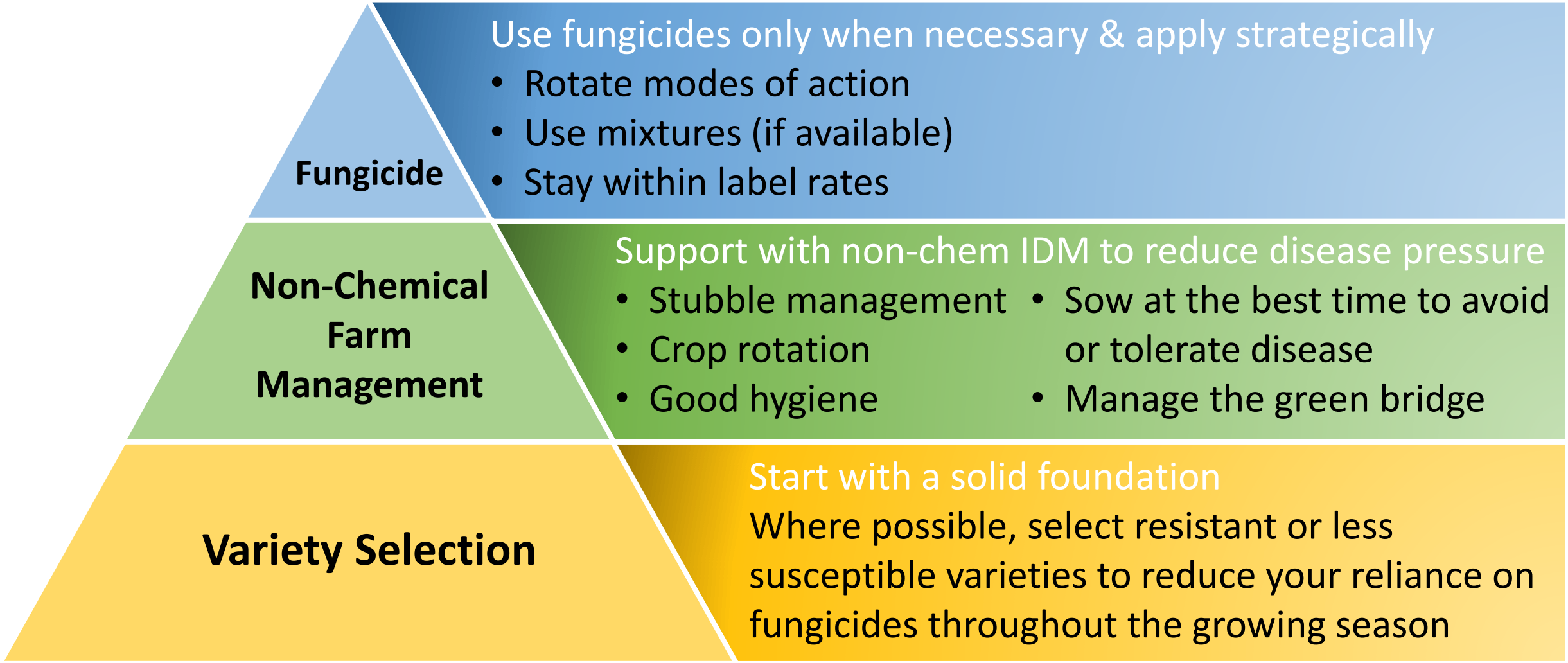

Correct Disease Identification

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- Is it Disease?
- Virus
- Abiotic?
- Water stress
- Nutrition
- Herbicide

Soil-borne Diseases

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- Fusarium spp.
- Didymella spp.
- Root Lesion Nematode
- Pythium
- Rhizoctonia
- Phytophthora spp.

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Common Pulse Diseases

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Lentil	Chickpea	Field Pea	Vetch	Lupin	Faba Bean
Botrytis grey mould					Chocolate Spot
Sclerotinia white mould					
Ascochyta blight	Ascochyta blight	Ascochyta blight	Ascochyta blight	-	Ascochyta blight
Stemphylium blight		Bacterial Blight		Brown leaf spot	Cercospora
Powdery Mildew					

Ascochyta Blight

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Ascochyta Blight

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Crop	Pathogen
Lentil	*Ascochyta lentis*
Faba bean	*Ascochyta fabae*
Chickpea	*Ascochyta rabiei*
Vetch	*Ascochyta viciae-villosae*
Field Pea	*Didymella pinodes* (synonym: *Mycosphaerella pinodes*), *Phoma medicaginis* var. *pinodella* *Phoma koolunga* *Didymella pisi*

Ascochyta Blight

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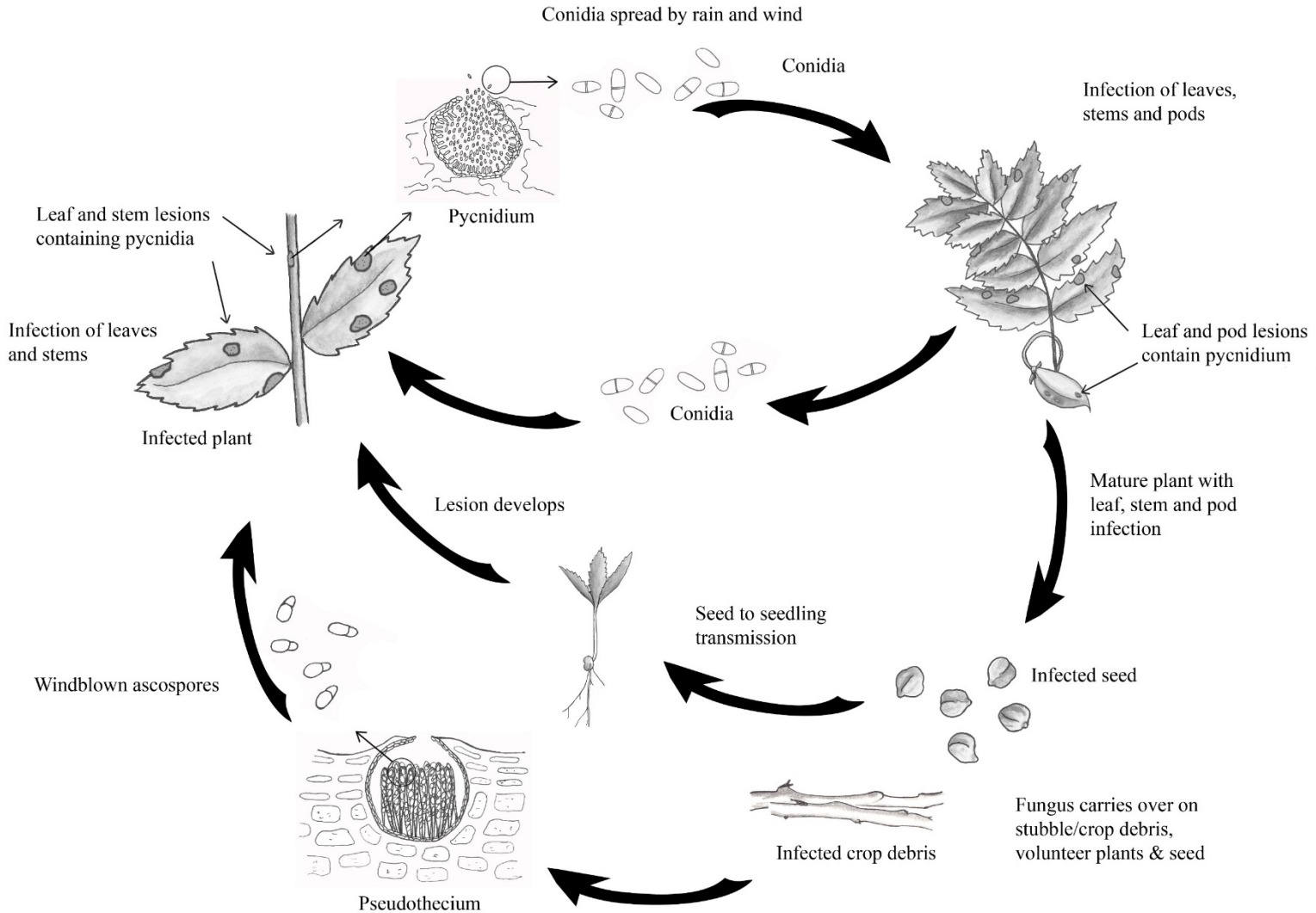

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Chickpea Yield Losses

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Location	Year	Genesis090 (MS)	PBA Striker (S)
Curyo Low Rainfall Zone	2019	48%	
	2020	64%	96%
Horsham Medium Rainfall Zone	2018	53%	
	2019	62%	74%
	2020	38%	81%
Nhill Medium Rainfall Zone	2020	57%	90%

Field Pea Yield Losses

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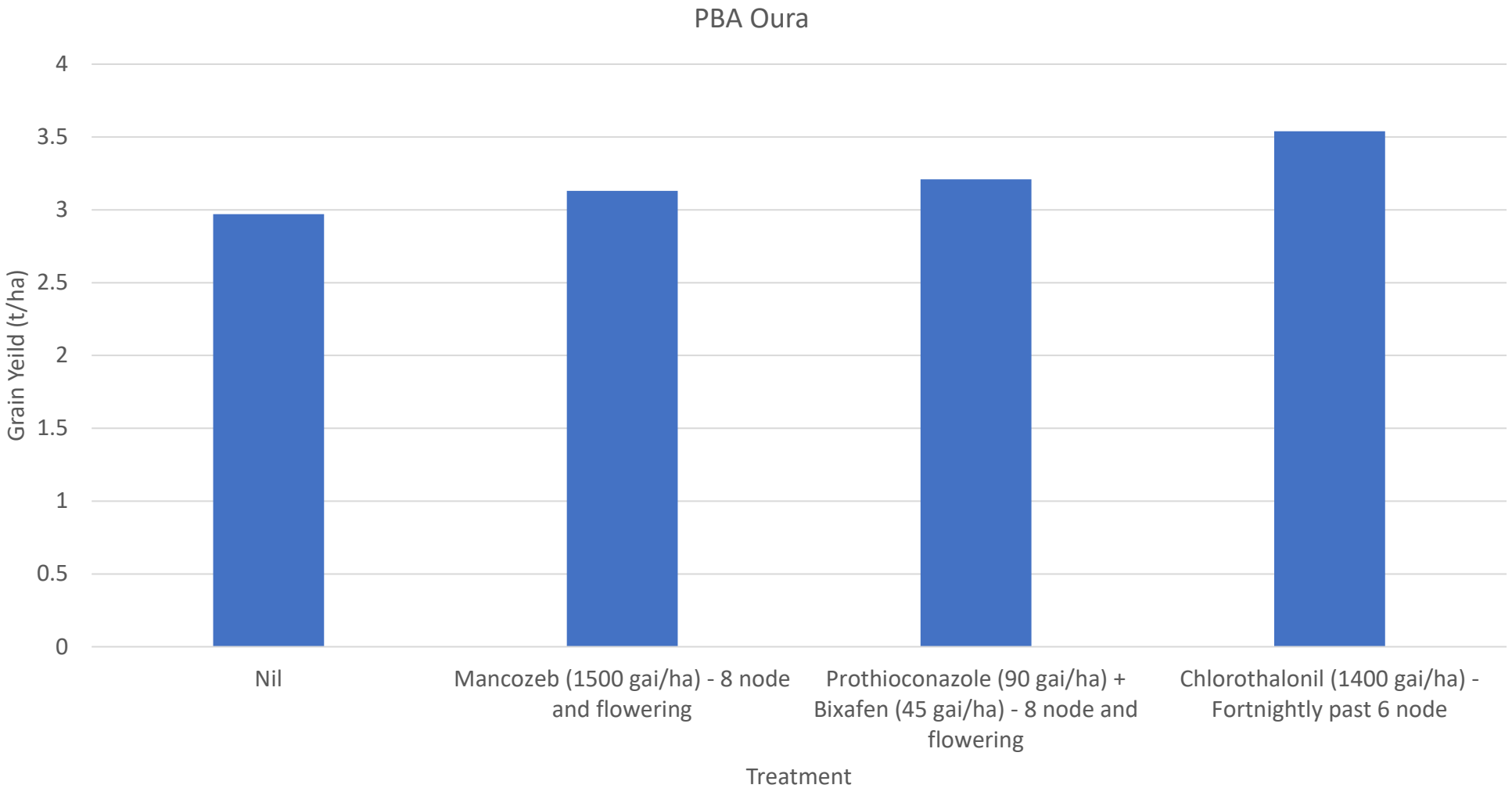

Government of South Australia
Department of Primary Industries and Regions

SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

Ascochyta blight Management

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- Choose more resistant varieties
- Keep in mind value of the crop and potential yield losses
- Plant away from last year's stubble
  - Recommendation is 500m
- Blackspot manager for Field Peas
  - Available through DIPIRD (WA Ag Department)

Ascochyta blight Management

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- Fungicides
  - Be mindful of the fungicide mode of action
    - Systemic vs protectant
    - Foliage not been sprayed is unprotected
  - Chickpeas
    - Ensure spraying before the rain, each rainfall event
    - Spray fortnightly when leaf wetness is common

Botrytis Grey Mould

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Chocolate Spot

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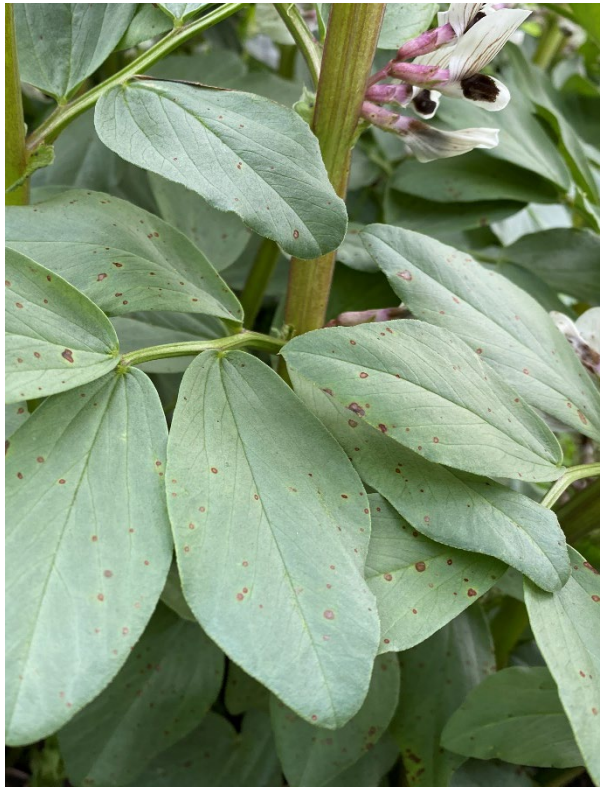

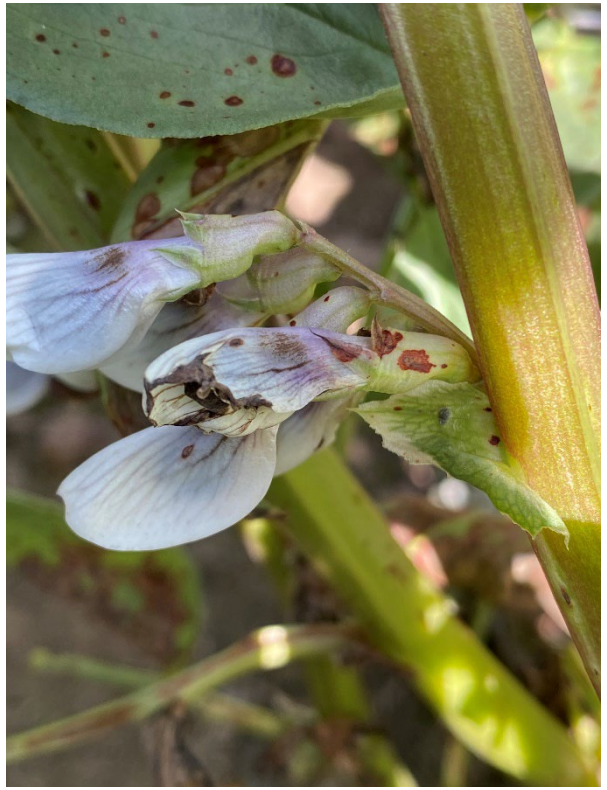

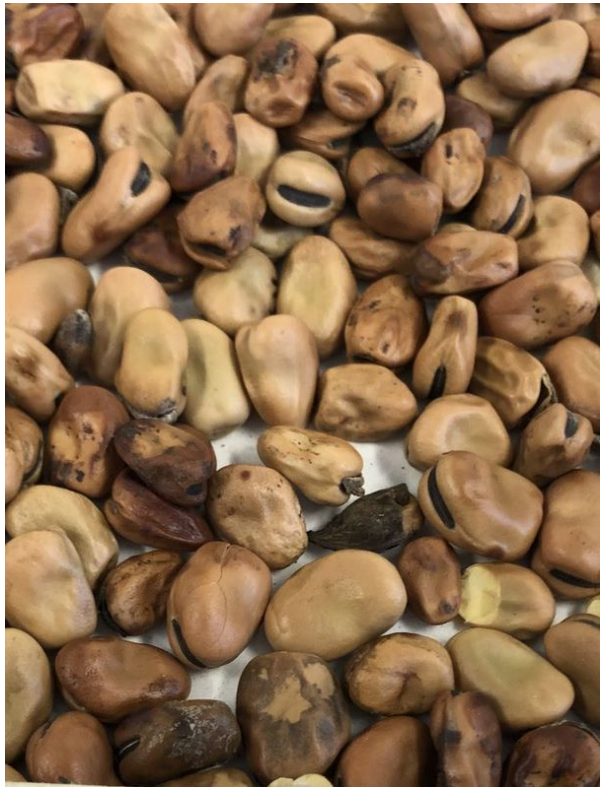

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Botrytis Grey Mould

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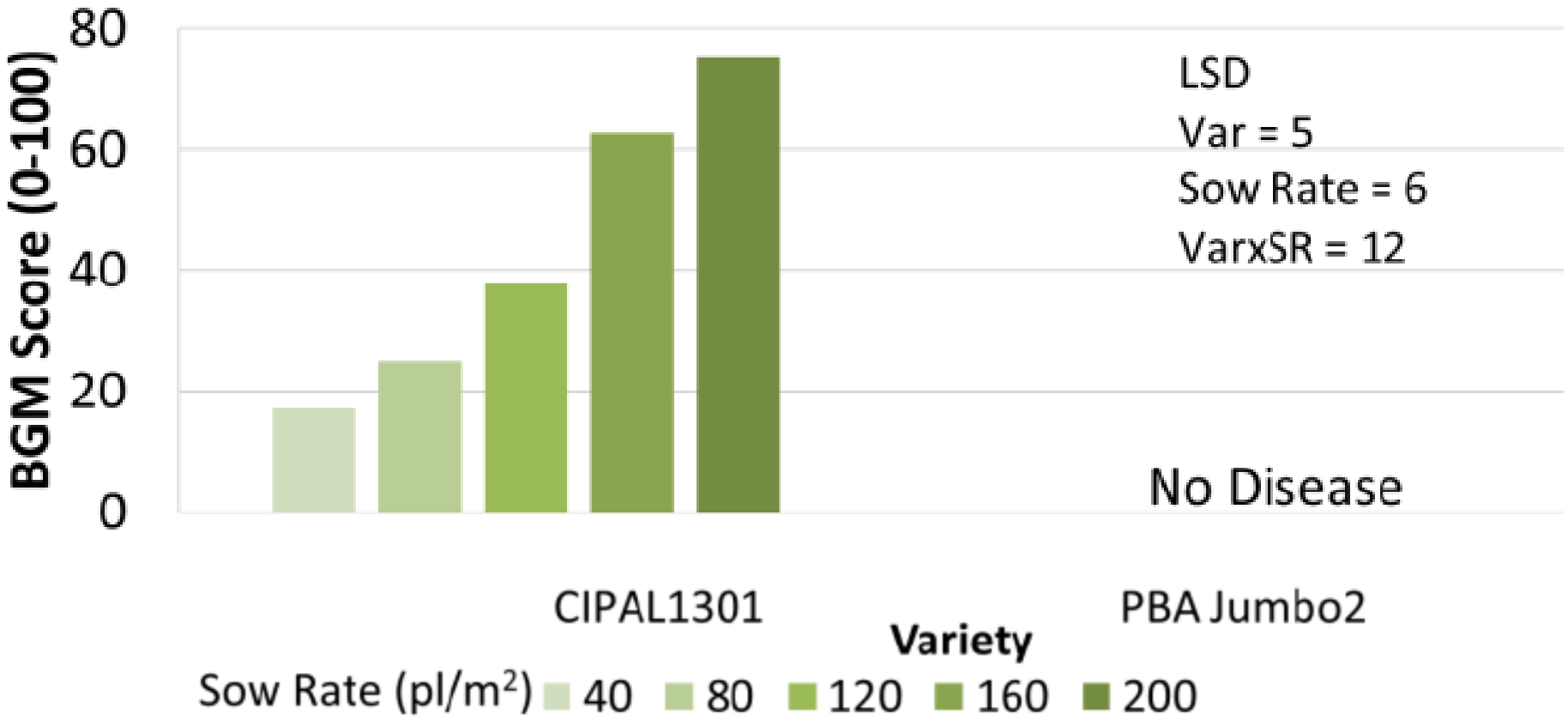
Crop	Disease	Pathogen
Lentil	Botrytis grey mould (BGM)	*Botrytis cinerea* *Botrytis fabae*
Chickpea		*Botrytis cinerea*
Vetch	Botrytis grey mould (BGM) Chocolate Spot	*Botrytis cinerea* *Botrytis fabae*
Faba bean	Chocolate Spot	

Sowing Density



Varietal Resistance

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2020 – Lake Linlithgow – No fungicides – 29/09/2020

PBA Amberley
2.75 t/ha

PBA Samira
1.27 t/ha

PBA Bendoc
0.62 t/ha

Fiesta
0.72 t/ha

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2020 – Lake Linlithgow - Economics

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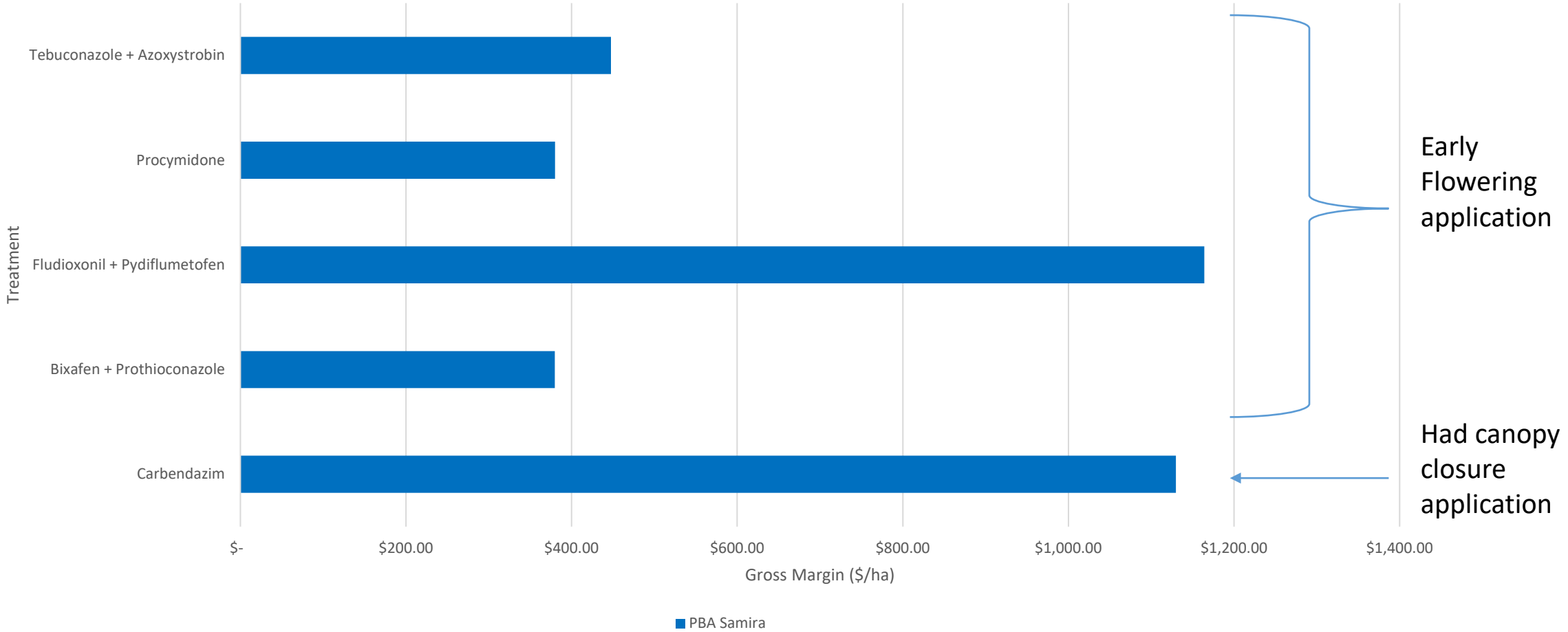

All treatments except untreated had a tebuconazole at 4 node stage

Significant interaction between treatment and variety

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Botrytis Management

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- Agronomy is just as important as varietal resistance
- Choose a more resistant variety
- Fungicides are essential
  - Be proactive and keep on top of disease – it is aggressive
  - There are some good options for rotation of fungicides
- Environment is key

Sclerotinia White Mould

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Sclerotinia White Mould

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- Pathogens
  - *Sclerotinia Sclerotiorum*
  - *Sclerotinia minor*
  - *Sclerotinia trifoliorum*
- Crops
  - Most broadleaf
  - Lentil, Chickpea, Field pea, Vetch, Canola

Sclerotinia White Mould

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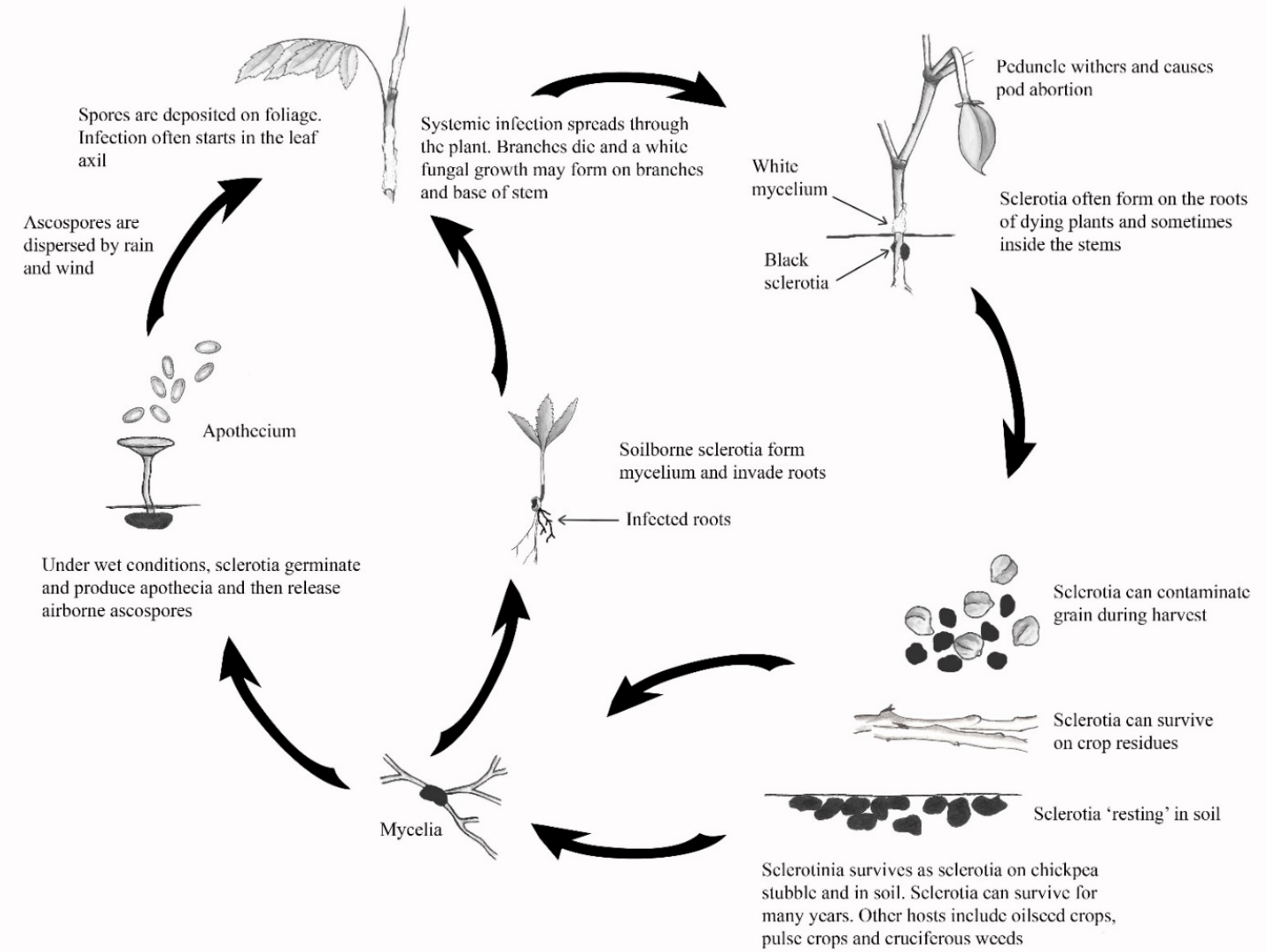

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Integrated Disease Management

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- Sow Clean Seed
- Crop rotations
- Choose resistant varieties
- Monitor for disease
- Understand the seasonal risk
- Optimise the fungicide strategy – Follow the product label
- Spray before rainfall events
- Remember plant growth post spray is unprotected
- Sprays are preventative not curative
- Protect the seed

Varietal Resistance

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Pulse Disease Guide 2024

Joshua Fanning, Chloe Findlay, Dharushana Thanabalasingam - Pulse Pathologists February 2024

2023 in review

The 2023 season had variable severity for pulse diseases across Victoria. Early Ascochyta blight was observed in lentils which required fungicides to prevent yield losses. Severe disease occurred where lentils were grown in close rotations. Proactive disease management and below average spring rainfall meant that disease was of isolated concern across most of Victoria. Low levels of disease were still present in many paddocks, which will contribute to the carryover of disease into the 2024 season.

2024 pulse disease management

There is a risk of disease carryover into the 2024 season from infected seed and stubble of crops that had disease during 2023. To minimise the risk of disease during 2024, a proactive integrated disease management strategy will be required. This should include:

- avoiding susceptible varieties where possible
- avoiding planting pulse crops into or adjacent to paddocks where there was disease during 2023,
- sowing healthy vigorous seed,
- using fungicidal seed dressings where applicable,
- implementing a fungicide management plan.

Summer rainfall and the growth of weeds will increase the risk of soil-borne diseases including root lesion nematodes and Pythium. A PREDICTA®B test will identify paddocks at risk from some important soil-borne diseases of pulses.

There have been no major disease rating changes for most pulses for 2024.

Beans: Chocolate spot was observed at very low disease severity in Victoria during 2023. It is important to avoid susceptible varieties where Chocolate spot is common or a high risk. Minimising disease early in the season will reduce the inoculum load later in the season. Reliance on fungicides is not recommended and cannot provide adequate control in a susceptible variety in a high-risk season and/or environment.

Chickpeas: Disease was not of major importance during 2023 in chickpeas due to proactive management. Currently, there is limited varietal resistance to Ascochyta blight but breeding lines with improved resistance are expected in coming years. A moderately susceptible (MS) variety in an average season should require minimal fungicide applications in low rainfall zones. In the medium to high rainfall zones, it is likely multiple fungicide applications will be required to prevent Ascochyta blight.

Lentils: Ascochyta blight was severe early in the season causing seedling death or stem breakages, and fungicides were required to minimise yield losses. This occurred in paddocks where lentils were grown on a tight rotation, therefore, avoiding tight rotations will minimise disease risk. Sclerotinia white mould (SWM) was not observed during 2023, with conditions not conducive to the disease. However, it is important to monitor paddocks with a history of SWM as the sclerotia (fruiting bodies/survival structures) can survive many seasons. Botrytis grey mould (BGM) was observed at very low levels towards the end of the season, due to dry and mild Spring conditions.

Vetch: BGM and Ascochyta blight are the main causes of yield loss in vetch. BGM in Vetch is caused by the same pathogens that cause BGM in lentil and Chocolate spot in faba bean. Therefore, avoid growing vetch, lentil or faba bean in close rotations or in adjacent paddocks where disease was observed in 2023. The disease management strategy should be matched to the crop's end use (hay, fodder, grain, and manure).

Field peas: Bacterial blight is the most significant threat to field pea production. There are no in-crop control options, so where possible avoid susceptible varieties, paddocks prone to frost, residual herbicides, or planting into pea stubble.

Lupins: Minimal disease was observed in lupins in 2023. Avoid growing lupins in rotation with other pulses and canola to avoid SWM. Monitor crops for disease to ensure disease severity remains low.

Seed quality: The quality of seed and the potential for diseases infecting seed is often neglected. Disease (e.g., BGM and SWM) carryover may be through infected seed or sclerotia contamination in seed lots. Seed infection can not only carry the disease between seasons but reduce plant establishment. Testing seed for germination, vigour, and seed-borne diseases before sowing will ensure good plant establishment. Testing can be completed by specialist laboratories (see back page). Seed treatments are effective at suppressing many fungal diseases; however, seed treatments don't combine well with rhizobium used for inoculation. Read labels for compatibilities.

If you see something different, or high levels of disease in any crop, please send a sample to Agriculture Victoria. If you suspect an exotic pest or disease contact CropSafe or the Emergency Plant Pest Hotline (see back page).

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GRDC NATIONAL VARIETY TRIALS

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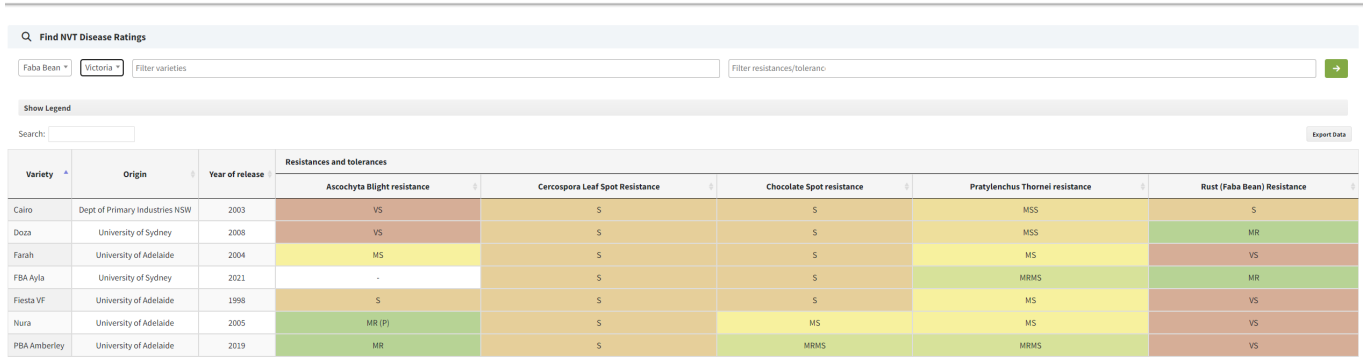
https://nvt.grdc.com.au/nvt-disease-ratings



Find NVT Disease Ratings

Faba Bean | Victoria | Filter varieties | Filter resistances/toleranc

Show Legend

Search: | Export Data

Variety	Origin	Year of release	Resistances and tolerances				
			Ascochyta Blight resistance	Cercospora Leaf Spot Resistance	Chocolate Spot resistance	Pratylenchus Thornei resistance	Rust (Faba Bean) Resistance
Cairo	Dept of Primary Industries NSW	2003	VS	S	S	MSS	S
Doza	University of Sydney	2008	VS	S	S	MSS	MR
Farah	University of Adelaide	2004	MS	S	S	MS	VS
FBA Ayla	University of Sydney	2021	-	S	S	MRMS	MR
Fiesta VF	University of Adelaide	1998	S	S	S	MS	VS
Nura	University of Adelaide	2005	MR (P)	S	MS	MS	VS
PBA Amberley	University of Adelaide	2019	MR	S	MRMS	MRMS	VS

Fungicide Options

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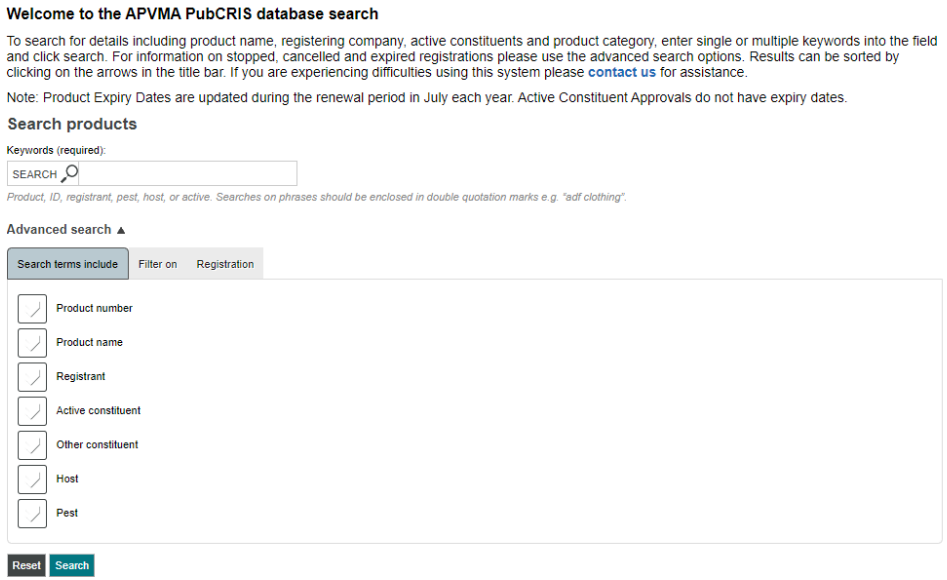

https://www.apvma.gov.au/

Fungicide Options

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Active (Product)	Group	Max Sprays/crop	Last Spray at growth Stage	Crops
Copper	M1			Faba bean, Field Pea
Mancozeb	M3			Chickpea, Lentil, Faba bean, Field Pea, Vetch, Lupin
Metiram	M3			Chickpea, Lentil, Faba bean, Field Pea, Vetch
Thiram	M3		Seed Treatment	Chickpea, Lupin
Chlorothalonil	M5			Chickpea, Faba bean, Lentil, Field Pea
Thiram + Thiabendazole	M3 + 1		Seed Treatment	Chickpea, Lentil, Faba bean, Field Pea, Vetch
Carbendazim	1	2		Chickpea, Lentil, Faba bean, Vetch
Procymidone	2	2		Faba bean, Lentil
Tebuconazole	3 DMI			Faba bean, Field Pea
Metalaxyl	4		Seed Treatment	Chickpea, Field Pea
Boscalid	7	2		Lentil
Bixafen + Prothioconazole (Aviator XPro)	7 SDHI + 3 DMI	2	BBCH60/61 BBCH69	Chickpea, Lentil, Faba bean, Field Pea Lupin (Sclerotinia)
Tebuconazole + Azoxystrobin (Veritas Opti)	11 QoI + 3 DMI	2		Chickpea, Faba bean, Lentil, Field Pea, Vetch, Lupin
Azoxystrobin + Cyproconazole (Amistar Xtra)	11 QoI + 3 DMI	2	BBCH75	Chickpea, Faba bean, Field Pea, Lentil
Pydiflumetofen + fludioxonil (Miravis Star)	7 SDHI + 12 PP	2	BBCH69	Pulse Crops

Fungicide Resistance Management

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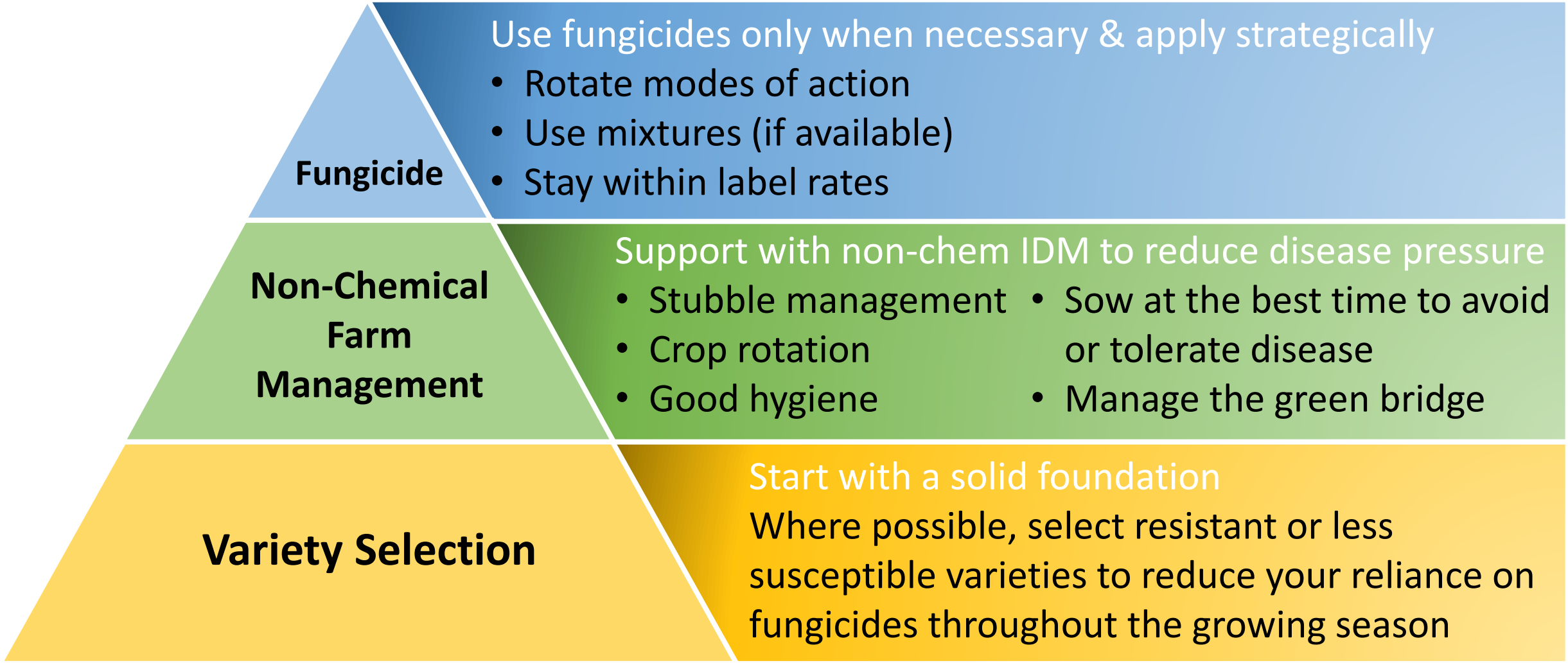

AFREN resources

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Find The Fungicide Resistance Management in Australian Crops guide here:

Centre for Crop and Disease Management

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Curtin University

Mungbean powdery mildew (PM) in Queensland

Improving Powdery Mildew Management in Mungbean (USQ2202-001RTX)
2022-2024

Photo: Lisa Kelly, QDAF

Mungbean PM

- Common disease, caused by two pathogens:
  Podosphaera xanthii and *Erysiphe vignae*
- Yield losses **up to 40%** if appears before flowering; environmental conditions are conducive during the season; and left unmanaged.
- May have an impact on desiccation efficacy.
- Available fungicides:
  Tebuconazole (Group 3)
  Veritas Opti (Teb & azoxystrobin, Gr
- Current recommendation: spray at disease and 2 weeks later, if needed.

And when is it needed? → use an app!

Australian Fungicide Resistance Extension Network

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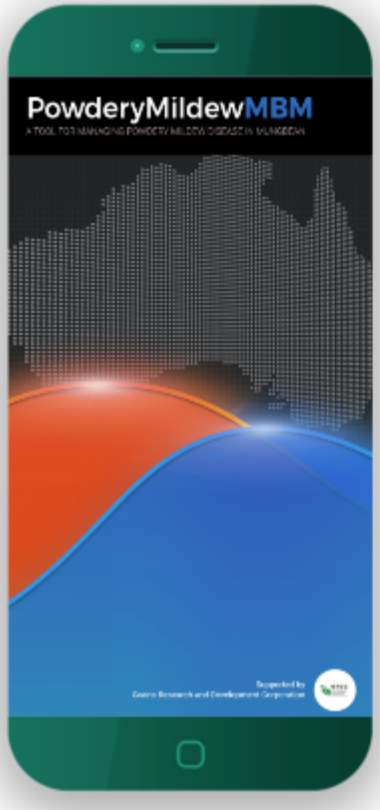
- Industry practice: a “preventive” spray with insecticide applications, followed by one (or two) more fungicide sprays
- How many sprays are economical?
- App (Decision Support Tool): free, easy to use, reliable



PowderyMildew MBM - Powdery Mildew management app for mungbean

PowderyMildewMBM uses a forecasting model to assist mungbean growers with fungicide application decisions, on a paddock by paddock basis, and the likely economic returns from those decisions.

The user can specify individual paddock data as well as expected weather conditions so that the output relates to their own cropping circumstances.

To download the PowderyMildewMBM App, click on the App store link below from your iPad, or the Google play link below from your Android tablet.

AVAILABLE ON THE App Store

GET IT ON Google play

GOVERNMENT OF WESTERN AUSTRALIA

Department of Primary Industries and Regional Development

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Australian Fungicide Resistance Extension Network

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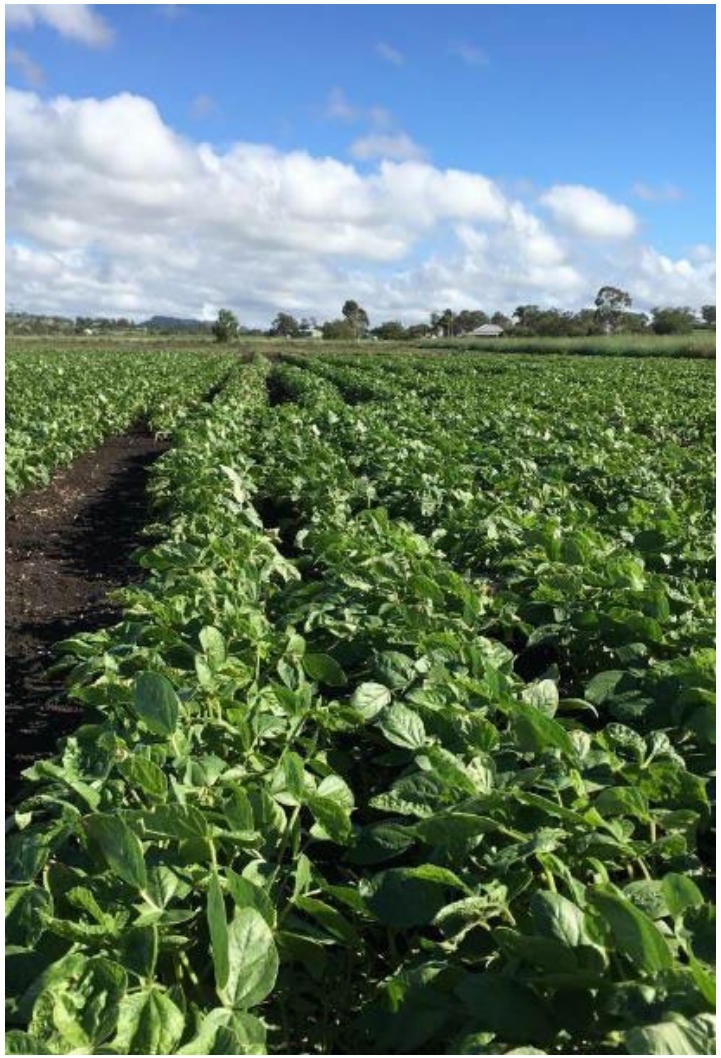

2022-2024:
Field trials in SE Qld to validate and demonstrate the value of the app

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Improving Powdery Mildew Management in Mungbean (USQ2202-001RTX)

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Fungicide and control treatments applied in three validation trials in 2023.

Treatment No.	Fungicide details	Code	No. sprays
1	One spray of Tebuconazole at first sign of disease	Teb x1	1
2	One spray of Veritas Opti®, low rate (250 ml/ha), at first sign of disease	Veritas x1	1
3	Two sprays of Tebuconazole: first at first sign of disease; then a second 2 weeks later	Teb x2	2
4	Two sprays of Veritas Opti®, low rate (250 ml/ha), as in #3	Veritas x2	2
5	Common Industry Practice #1: One spray with Teb and insecticide* at first sign of disease; then a second 2 weeks later, with insecticide*	Teb x2 insect	2
6	No fungicide applications (plots sprayed with water and surfactant only)	Control	0
7	Common Industry Practice #2: One preventative spray with Teb; then a second 2 weeks later; and a third 2 weeks later – all with insecticides*	Teb x3	3
8	One spray of Veritas Opti® HIGH rate (320 ml/ha), at first sign of disease	Veritas HIGH x1	1
9	Two sprays of Veritas Opti® HIGH rate (320 ml/ha), first at first sign of disease; then a second 2 weeks later	Veritas HIGH x2	2

*If needed

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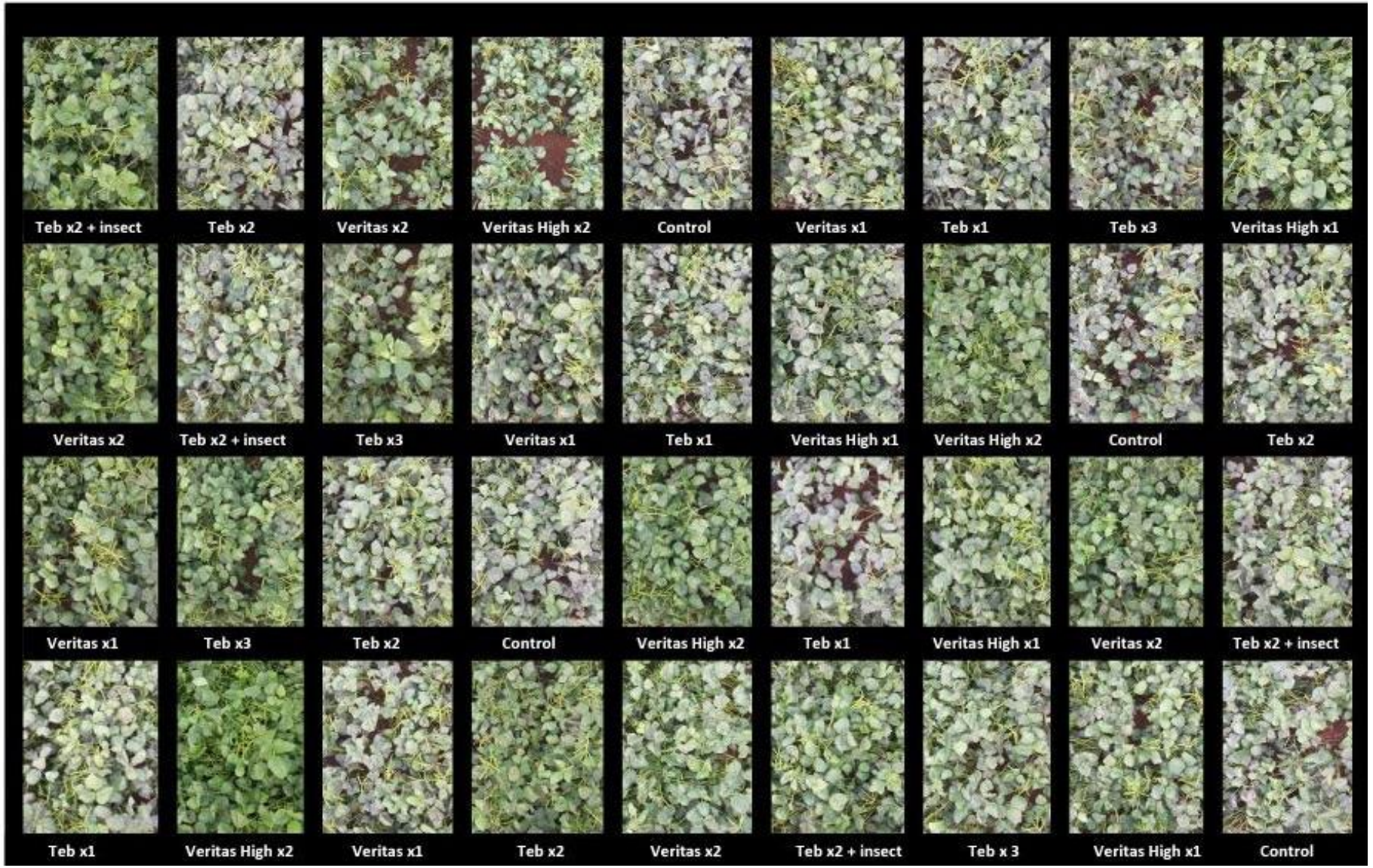

An aerial image of a mungbean PM fungicide trial in 2023.
(Courtesy Neil Robinson)

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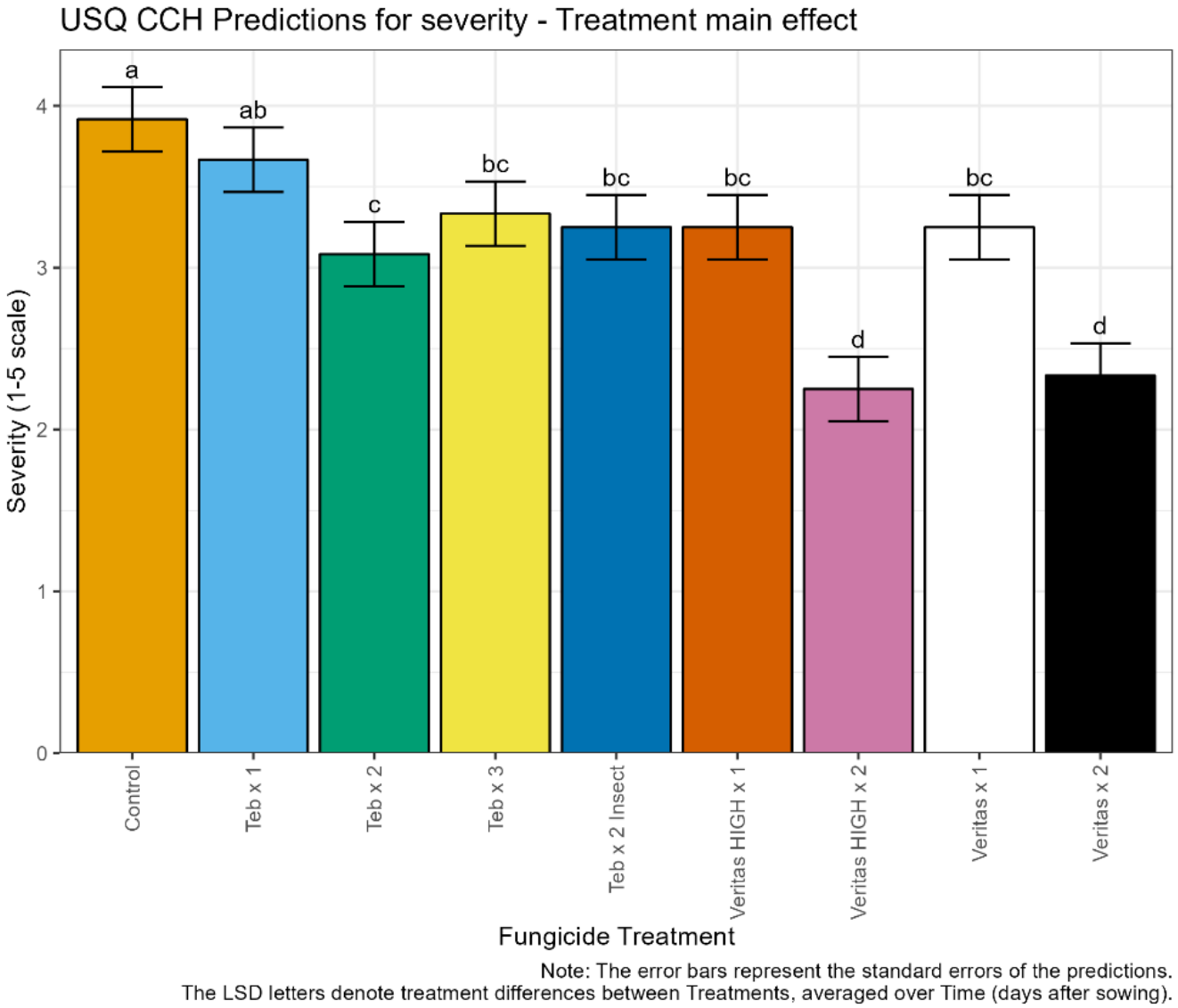

Note: The error bars represent the standard errors of the predictions.
The LSD letters denote treatment differences between Treatments, averaged over Time (days after sowing).

The severity of PM infection was significantly reduced by all fungicide treatments except Tebuconazole applied once, compared to the control ($P<0.001$).

No significant effect of fungicide treatments on yield ($P=0.453$) – PM appeared late in the season, at late flowering/green pod stages.

→ **The app did NOT recommend any sprays!**

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2022-2024: field trials in SE Qld to validate and demonstrate the value of the app – conclusions:

- “Preventive” sprays are not needed.
- App recommendations have always resulted in the most economic disease management.
- Some of the trials were the first experiments that compared the efficacy of the two available fungicide products, Tebuconazole and Veritas Opti®, against mungbean PM.

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100% PM control is never achieved with foliar sprays – why?

We sequenced the DNA markers for resistance to Group 3 (tebuconazole) and Group 11 (azoxystrobin) fungicides in mungbean PM samples collected from diverse paddocks & experiments since 2019:

* DNA marker for Group 3 resistance (G461S) detected in *Px* in two paddocks.
* DNA marker for Group 11 resistance (G143A) detected in both *Px* and *Ev*, altogether in four paddocks.

BACI Broadacre Cropping Initiative

Conclusions:

- The app supports spray decisions against mungbean PM in a reliable way. **The app's recommendations are useful for FR management**, in addition to calculating the immediate monetary value returns on sprays – if any.

- DNA mutations conferring resistance to both MoA groups that are available for mungbean PM control were **detected in the lab** in Qld samples, but their incidence appears to be low (monitoring needed).

- Mungbean PM control can be achieved in the field in an economic way with both MoA group fungicides.

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Further reading:

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Management of mungbean powdery mildew

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- GrowNotes™
- GRDC Update Papers
- All publications

Author: Lisa Kelly (QDAF/USQ), Kirsty Owen (USQ), Neil Robinson (USQ), Levente Kiss (USQ) | **Date**: 30 Jul 2024

Take home message

- Early sowing, variety choice and timely fungicide applications are crucial for powdery mildew management in mungbean
- Apply fungicide at the first sign of disease, and then 14 days later, to reduce disease severity
- Applying fungicides prior to disease establishment is not economical
- Using fungicides with two modes of action (MOA) is more effective than relying on a single active with one MOA.

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GRDC GROUNDCOVER

Hold the spray when it comes to powdery mildew

The Powdery Mildew MBM app not only helps reduce fungicide spray, but it has also shown that spraying before signs of powdery mildew is not worth it

FUNGICIDE RESISTANCE

10 Issue 168 | Jan – Feb 2024 | GRDC GROUNDCOVER SUPPLEMENT: Fungicide Resistance

GRDC GROUNDCOVER

Fungicide resistance in Queensland: be alert

The detection of fungicide resistance in Queensland highlights the need for industry to be vigilant and access advice

By Dr Sue Knights

When the first map of fungicide resistance cases in Australia was compiled in 2016 by the research team at Curtin University's Centre for Crop and Disease Management (CCDM), led by Associate Professor Fran Lopez-Ruiz, Queensland remained a blank region on that map.

However, ever-vigilant cereal pathologist Dr Steven Simpfendorfer from the NSW Department of Primary Industries noticed high levels of powdery mix of summer and winter crops, with the potential for some pathogens, particularly in pulses, to infect diverse crops, so we need to be vigilant year-round."

A pilot project on fungicide resistance, led by USQ's Centre for Crop Health and supported by the Broadacre Cropping Initiative (a partnership between the Queensland Government Department of Agriculture and Fisheries and USQ) has detected the DNA markers of both QoI and DMI resistance in a few samples of mungbean powdery mildew collected from 2019 to 2023 in Queensland.

"No field failures of fungicide have yet been reported; however, this laboratory detection is a red flag because DMIs and QoIs are the only two mode of and Tasmania – the GRDC made a submission to the Australian Pesticides and Veterinary Medicines Authority (APVMA) for three Emergency Use Permits with Grain Producers Australia being the holder of the permits

These permits were for the use of quinoxyfen and proquinazid (Group 13) and metrafenone (Group 50) fungicides for wheat powdery mildew. These two different modes of action have specific activity on mildews.

Professor Kiss, who is also part of AFREN, says these findings emphasise the need for growers to implement integrated management practices when it comes to managing fungal diseases and adhering to the AFREN Fungicide Resistance Five key actions.

"Keeping up with seasonal disease issues is also important, so seek advice from local pathology experts – who you can follow on social media – and further

The Fungicide Resistance Five – for Mungbean PM

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1. Avoid susceptible crop varieties

   All mungbean varieties are susceptible to PM to some extent

2. Rotate crops – use time and distance to reduce disease carry-over

   Inoculum is airborne, difficult to control by rotation

3. Use non-chemical control methods to reduce disease pressure

   Plant early in the summer season!

4. Spray only if necessary and apply strategically

   Use the app!

5. Rotate & mix fungicides / MoA groups

   Two MoA groups are available

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Acknowledgements:

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