

FUNGICIDE RESISTANCE IN NSW/QLD

Steven Simpfendorfer – NSW DPI

Lisle Snyman – DAFQ

Levente Kiss – Centre for Crop Health, USQ



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**AUSTRALIAN
FUNGICIDE RESISTANCE
EXTENSION NETWORK**



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NSW
GOVERNMENT

Department of
Primary Industries



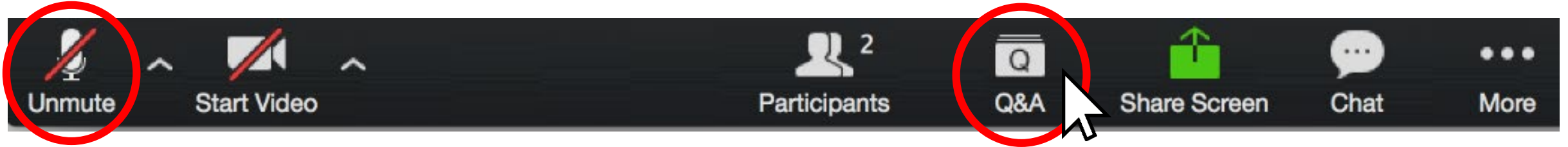
**Queensland
Government**



**UNIVERSITY
OF SOUTHERN
QUEENSLAND**

Housekeeping / Ground Rules

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EXTENSION NETWORK



- Everyone should automatically be muted. Please keep on mute.
- 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.
- In the unlikely event of webinar hacking, the webinar will be immediately shut down and a new webinar link will be sent to you via email within 10 minutes.
- Please be kind 😊

How to Q&A

Q&A

Open (2) Answered (0) Dismissed (0)

Jack Barker 2:43:31 PM Dismiss

When is the next webinar?

👍 1 Answer live Type answer

Eren Yaeger 2:42:44 PM

When are office hours?

👍 Answer live Type answer

Zoom Webinar

Speaker View

Participants (4)
Panelists (4) Attendees (0)

- Kylie Ireland (Me)
- AgCommunicators (Host)
- Angela van de Wouw
- Bridget Penna


Invite Mute Me Raise Hand

Zoom Webinar Chat

To: All panelists

Type message here...

Net form net blotch



Q&A

You asked: 18:03
What happens when I raise my hand?

Molly Parker answered: 18:04
I can take you off of mute.

Please input your question

Send Anonymously Send

Mute Stop Video Participants (4) **Q&A** Chat Share Screen Record Leave

Australian Fungicide Resistance Extension Network



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



grdc.com.au/afren



@theGRDC



afren@curtin.edu.au

#AFREN

Fungicide resistance in NSW/QLD

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Dr. Steven Simpfendorfer



Update on winter cereal disease management in 2020 – NSW

Dr. Lisle Snyman



2020 season QLD – changes and challenges

Prof. Levente Kiss



Management of fungicide resistance in Queensland grains crops



Department of
Primary Industries



Update on winter cereal disease management in 2020

Steven Simpfendorfer

Stripe rust in 2020



DS Bennett, Lockhart

Stripe rust in 2020

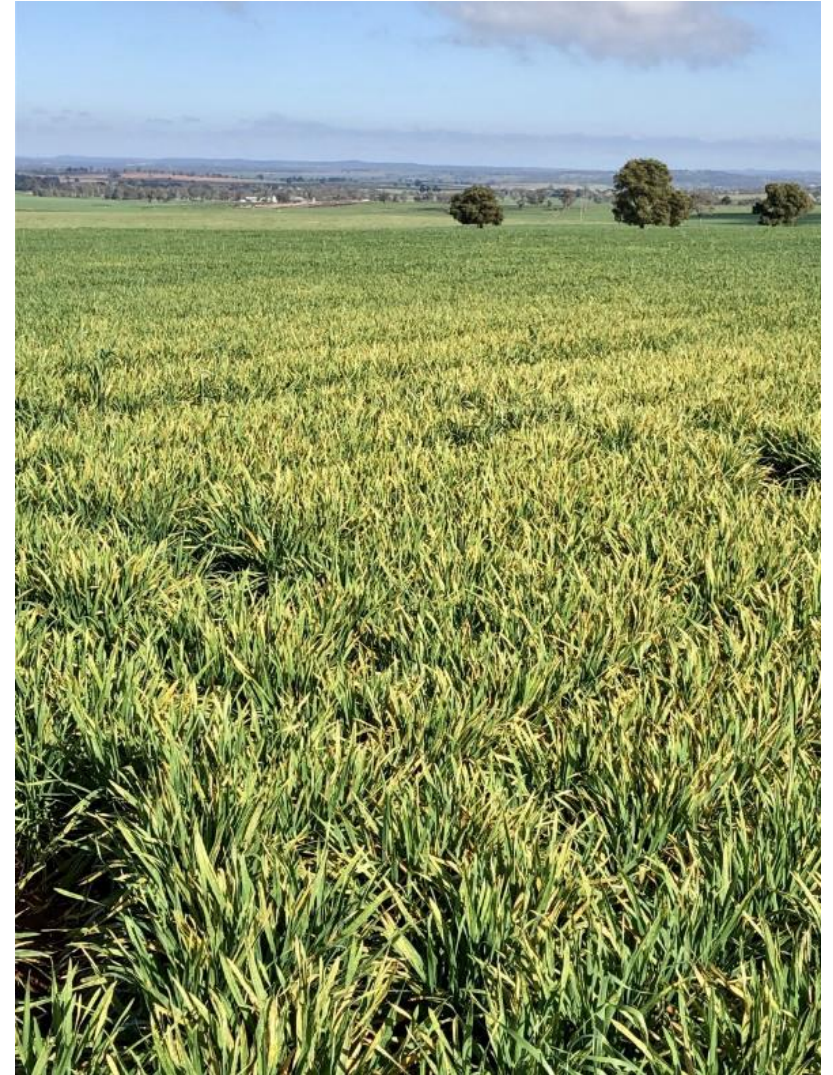


DS Bennett, Lockhart

Stripe rust in 2020



DS Bennett, Boggabri



DS Bennett, Dubbo

Stripe rust in 2020



LRPB Trojan

**New stripe rust pathotype
198 E16 A+ J+ T+ 17+**

**Vic and Tas - 2018
NSW x4, Vic x2, Qld x1 -2019**

**Wagga Yr NVT nursery 2019
Andrew Milgate**



Durum

Stripe rust in 2020



LRPB Trojan

**New stripe rust pathotype
198 E16 A+ J+ T+ 17+**

Variety	Yr198 resistance
DS Bennett	S
Illabo	MR
EGA Wedgetail	MS
LRPB Trojan	MSS
DBA Lillaroi	MS
LRPB Lancer	MR
LRPB Flanker	RMR

Wagga Yr NVT nursery 2019

Andrew Milgate

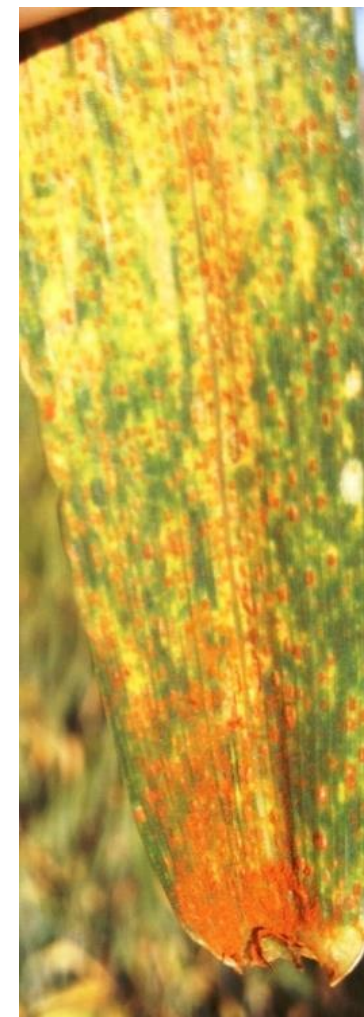


Durum

New Lr24 pathotype of leaf rust



Variety	Yr198 resistance	Lr24 resistance
DS Bennett	S	SVS
Illabo	MR	S
EGA Wedgetail	MS	MSS
LRPB Trojan	MSS	MS
DBA Lillaroi	MS	RMR
LRPB Lancer	MR	MS
LRPB Flanker	RMR	MSS

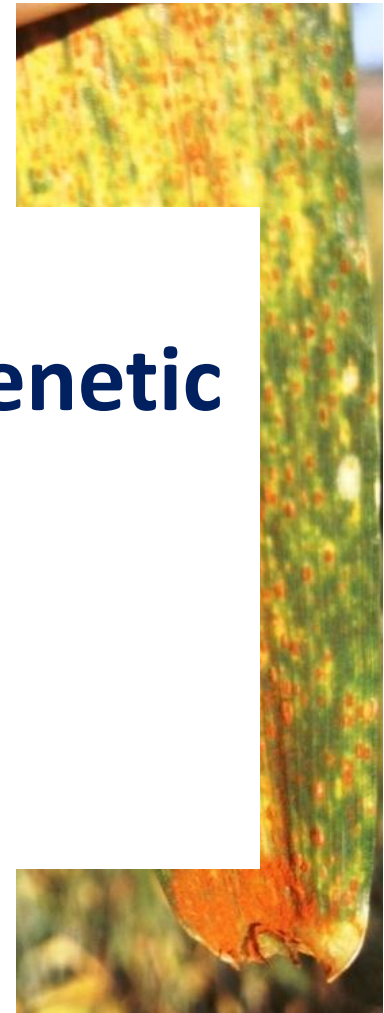


New Lr24 pathotype of leaf rust

Variety	Yr198 resistance	Lr24 resistance
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Fungal pathogens evolve to overcome genetic resistance

Why not also fungicides?



LIMIT SELECTION PRESSURE!

DON'T jump at shadows!



LIMIT SELECTION PRESSURE!

DON'T jump at shadows!



Fungicides DO NOT fix herbicide damage

Fungicides also DON'T fix nutrient issues



First: Get diagnosis right!

'This is not a disease'



Think before you spray!



Yellowing/spotting in cereal crops



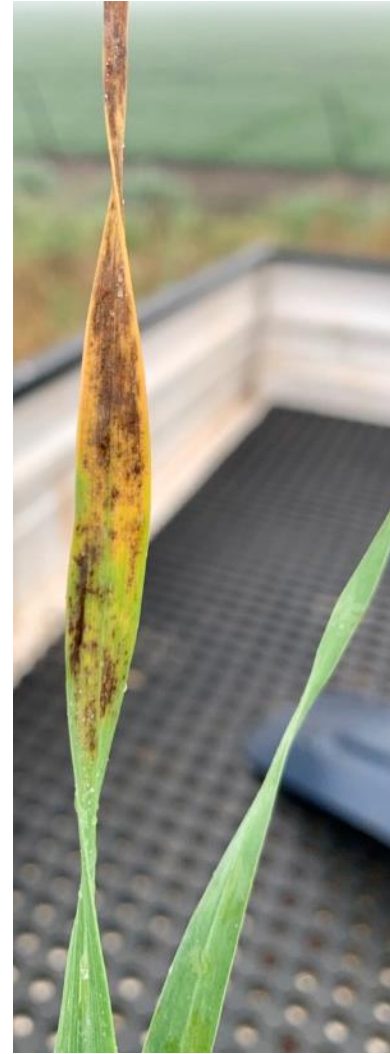
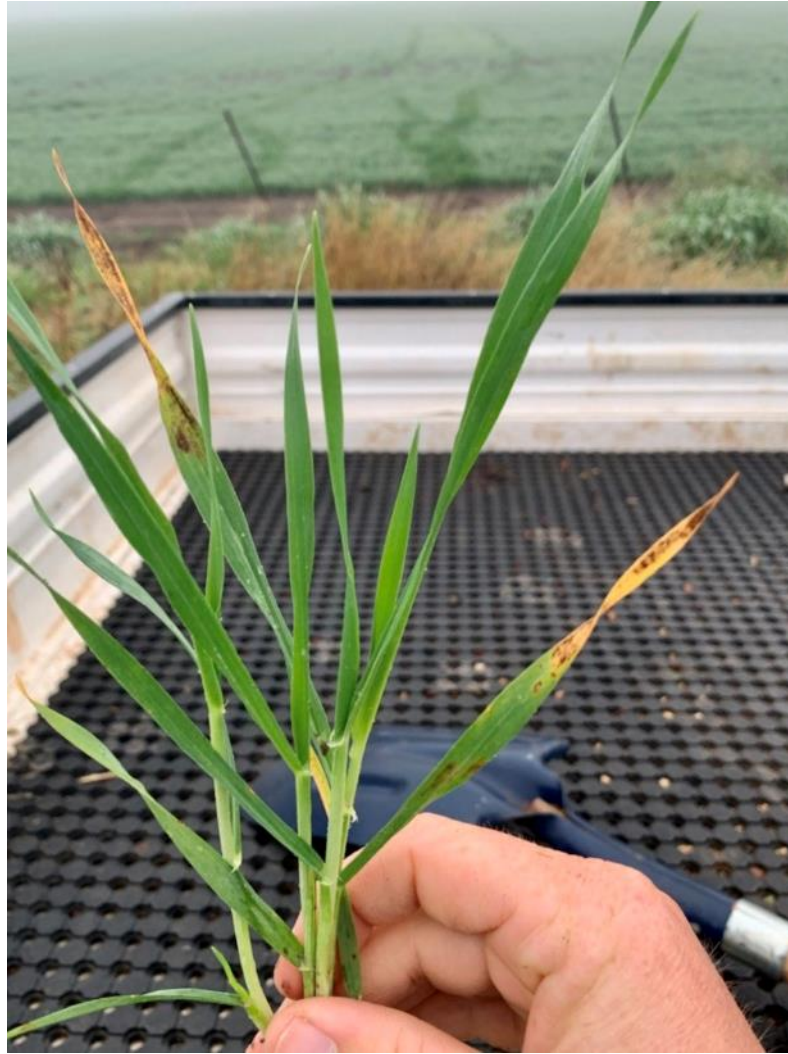
Wheat (e.g. Sunmax)

Yellowing/spotting in cereal crops



Wheat (e.g. Sunmax)

Yellowing/spotting in cereal crops



Barley (esp. Spartacus)

Yellowing/spotting in cereal crops



Fungal diseases DO NOT concentrate toward leaf tips!

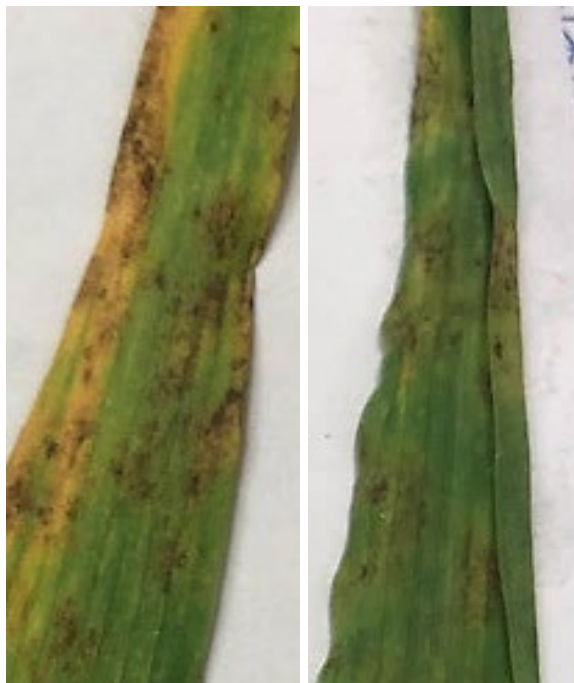


**You can get a second opinion
0439581672**



Barley (esp. Spartacus)

Physiological spots
Not disease



No fungal pathogens
recovered
from these lesions



Spot form of net-blotch
Lesions – leaf disease



Spores (conidia) of
Pyrenophora teres
recovered from these
lesions after
incubation in humid
chamber

Keep potential losses in perspective!



Grafton 2018
Natalie Moore (NSWDPI)

Keep potential losses in perspective!

**Worst case scenario
Do nothing
23% yield loss S-VS**

**Systiva or GS31 fungicide
Worst case scenario now
10% yield loss S-VS**

**Fungicides are an economic
decision!**

**Fungicides DO NOT increase
yield – they protect yield
potential**

Grafton 2018
Natalie Moore (NSWDPI)

Systiva (fluxapyroxad)



Fungicide resistance?
5 isolates CCDM
No reduced sensitivity



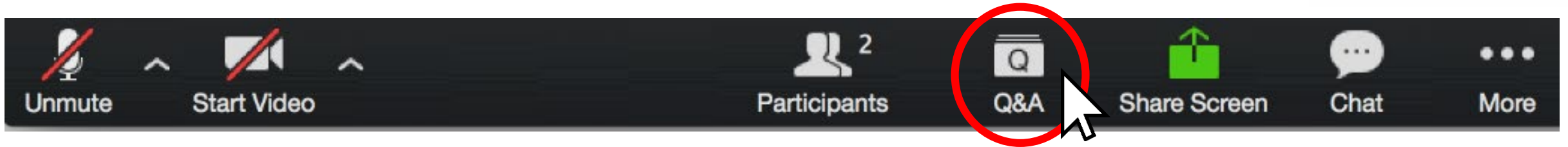
Photos: Gary Onus



Assistance is 'free'
0439 581 672



Keep the questions coming!



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2020 season QLD – changes and challenges

Lisle Snyman

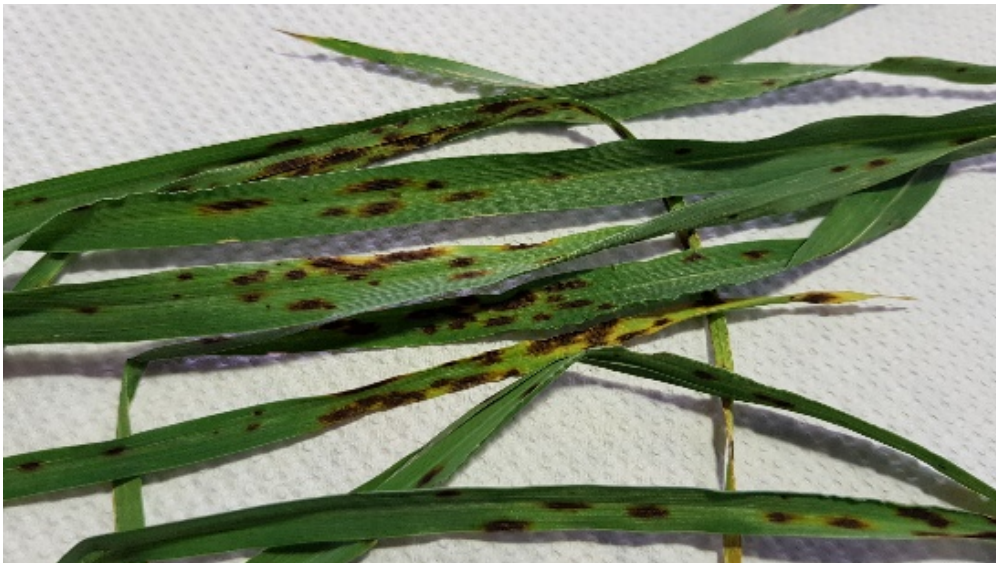
Net Form Net Blotch



- Occurs regularly in NR crops
 - 2016 (33), 2017 (35), 2018 (1 - HRF), 2019 (7)
- Three main pathotypes - NB85, NB73, NB50
 - Virulent on Maritime and Urambie
 - No new pathotypes 2018 & 2019
- Widespread cultivation of variety → increase in virulent pathotypes
 - Commander, Shepherd & Compass - Selection pressure
 - Commander & Shepherd S
 - Compass MRMS – APR
- Seed- and stubble-borne

23 samples SFNB (2019)

- Dalby, Chinchilla, Bundaberg, Childers, Emerald, Pittsworth
- NNSW: Croppa Creek Moree



Variety	SFNB	NFNB
Compass	MRMS	MRMS/MSS
Commander	MSS	MSS
Fathom	RMR	MRMS/S
GrangeR	SVS	MRMS/SVS
Hindmarsh	SVS	MS
La Trobe	SVS	MS
RGT Planet	S	S/MRMS
Rosalind	MSS	MRMS
Scope CL	MSS	MSS
Shepherd	SVS	SVS/MSS
Spartacus CL	SVS	MS
Westminster	S	S/MRMS

**Disease On
'Watch List' For
Barley Growers
This Season**

Author: [Toni Somes](#) | Date: 06 Aug 2019



Growers are being advised to monitor crops for spot form of net blotch (SFNB). DAF pathologist Lisle Snyman said incidents of the disease were unexpected given the dry conditions but being moisture-stressed may have made some crops more vulnerable this season. Photo Hugh Wallwork .



Pathotypes

- *MLLa* virulence detected in QLD 2014
 - 2020: Rosalind, Spartacus CL
- no new virulence
- *mlo* resistant to all isolates

Resistant varieties

- Fairview (*Mla13*), Flinders (*Mla1*), Granger (*mlo*), Oxford (*St*), RGT Planet (*mlo*), Scope (*Mla7*), Westminster (*mlo*)

Resistance breakdown

- Commander, Compass, La Trobe (*MLLa*), Shepherd (*Mla3*)




- Outbreak on Western Downs – 2018
 - Banks, Compass, Rosalind, Bottler, Grout, Shepherd, Commander, RGT Planet, Spartacus CL
- Barley
 - Wheat stem rust (*P. graminis* f. sp. *tritici*)
 - Rye stem rust (*P. graminis* f. sp. *secalis*)
 - Scabrum rust (hybrid)
 - Common wheat grass (*Elymus scaber*/*Agropyron scabrum*)
 - 2018 survey – rust infection at multiple sites

Scabrum rust

Variety Responses 2019 NVT

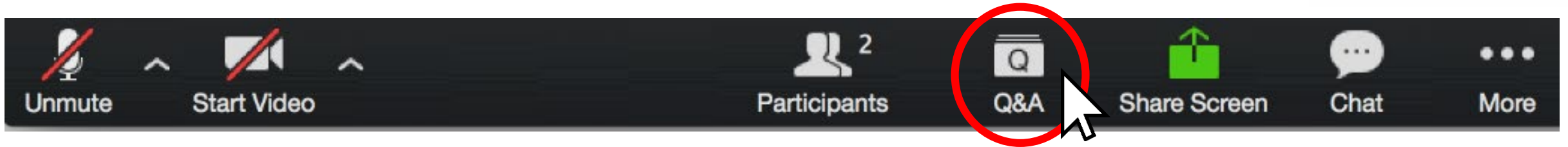
Variety	2019 QLD NVT	Variety	2019 QLD NVT
Hindmarsh	MSS	Explorer	SVS
La Trobe	MSS	Fleet	SVS
Litmus	MSS	Flinders	SVS
Alestar	S	Gairdner	SVS
Baudin	S	Granger	SVS
Biere	S	Grout	SVS
Compass	S	Lockyer	SVS
Fathom	S	Mundah	SVS
Flagship	S	Navigator	SVS
Keel	S	Oxford	SVS
Maltstar	S	RGT Planet	SVS
Rosalind	S	Schooner	SVS
Scope	S	Topstart	SVS
Spartacus CL	S	Urambie	SVS
Banks	SVS	Westminster	SVS
Bass	SVS	Bottler	VS
Brewstart	SVS	Charger	VS
Capstan	SVS	Fairview	VS
Commander	SVS	Shepherd	VS

- Favourable conditions
- Available inoculum
- Wheat not host - Scabrum rust
- Biotroph pathogen – not stubble-borne
- Most varieties vulnerable
- Susceptible varieties increase inoculum pressure
- Early fungicide application – not control disease
- Fungicide at 1st sign of disease



**Send samples to:
Lisle Snyman
604 Yangan Rd
Warwick, QLD**

Keep the questions coming!



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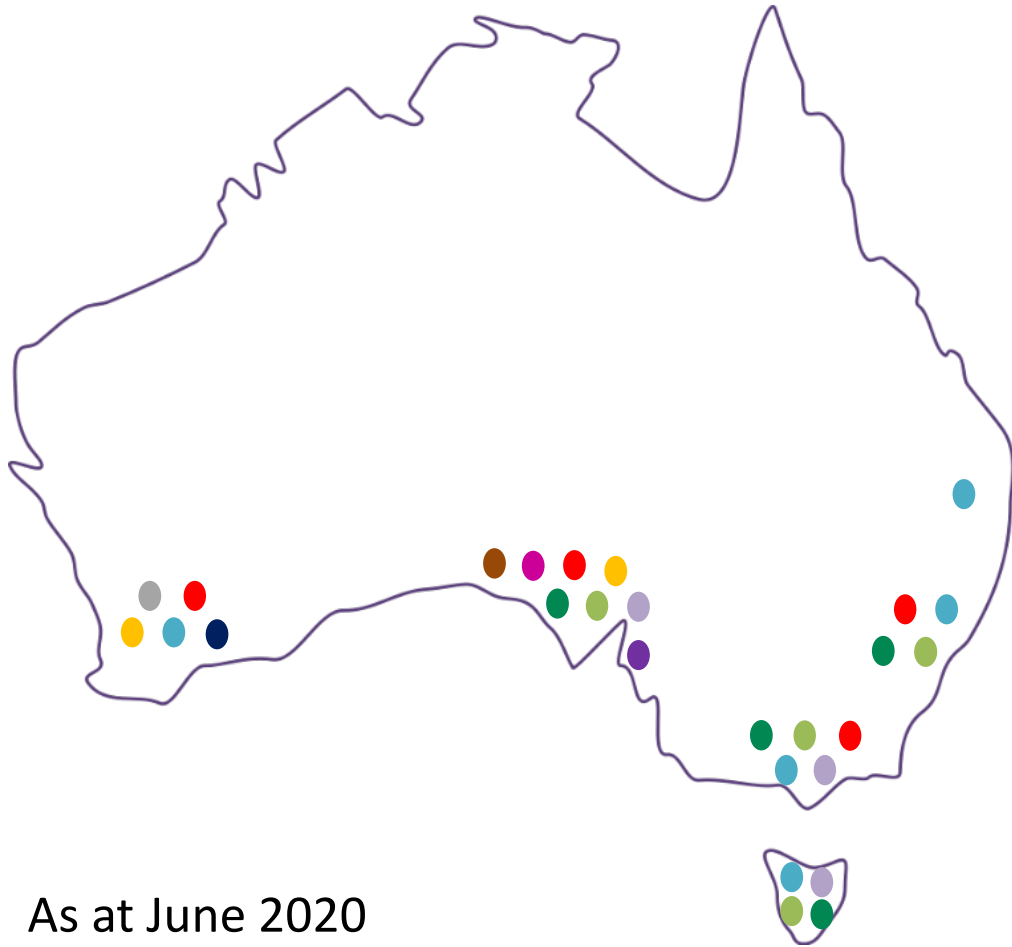


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Management of fungicide resistance in Queensland grains crops

Prof. Levente Kiss
USQ Centre for Crop Health

Fungicide resistance in Australian grains crops



As at June 2020

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

Disease and fungicide group

- L, RS, R ● Barley Powdery Mildew – Group 3 (DMI)
- L, RS, R ● Barley Net Form Net Blotch – Group 3
- L, R ● Barley Net Form Net Blotch – Group 7 (SDHIs)
- RS, R ● Barley Spot Form of Net Blotch – Group 3
- RS ● Wheat Powdery Mildew – Group 3
- L, R ● Wheat Powdery Mildew – Group 11 (strobilurins)
- RS ● Wheat Septoria tritici – Group 3
- L ● Canola Blackleg – Group 2 (MAP-kinase)
- RS ● Canola Blackleg – Group 3
- L ● Ascochyta Blight of Lentil – Group 1 (MBC)
- L ● Botrytis Grey Mould of Chickpea – Group 1

L = Lab detection RS = Reduced sensitivity R = Resistant

Fungicide resistance terminology

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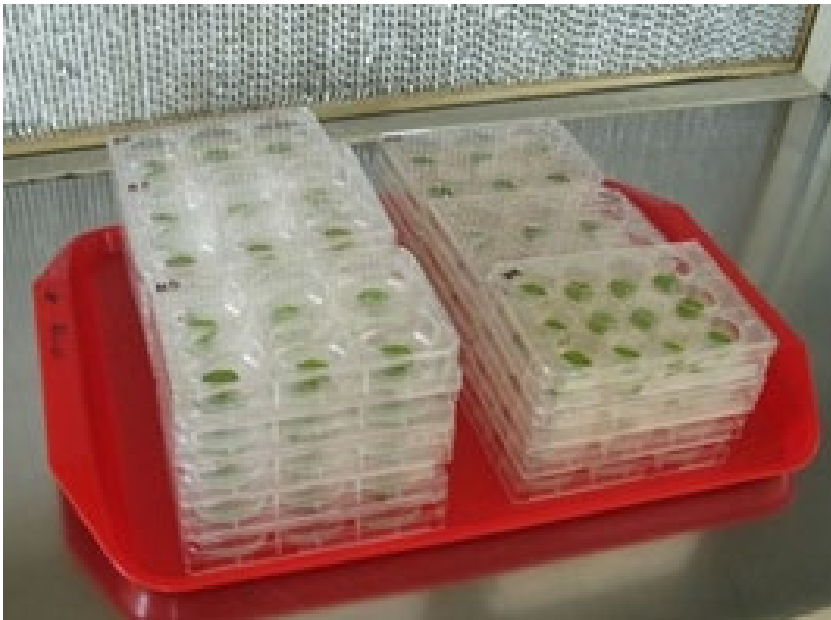


Term	Impact on fungicide use
Sensitive	Still works
Reduced sensitivity Lab Confirmation Required	Might still work okay <ul style="list-style-type: none">• May need to use higher rates• Higher risk of developing resistance
Resistant	Doesn't work – avoid use <ul style="list-style-type: none">• Field failure detected
Lab detection	Measurable decrease in sensitivity when fungus cultured in the lab ± mutation detection

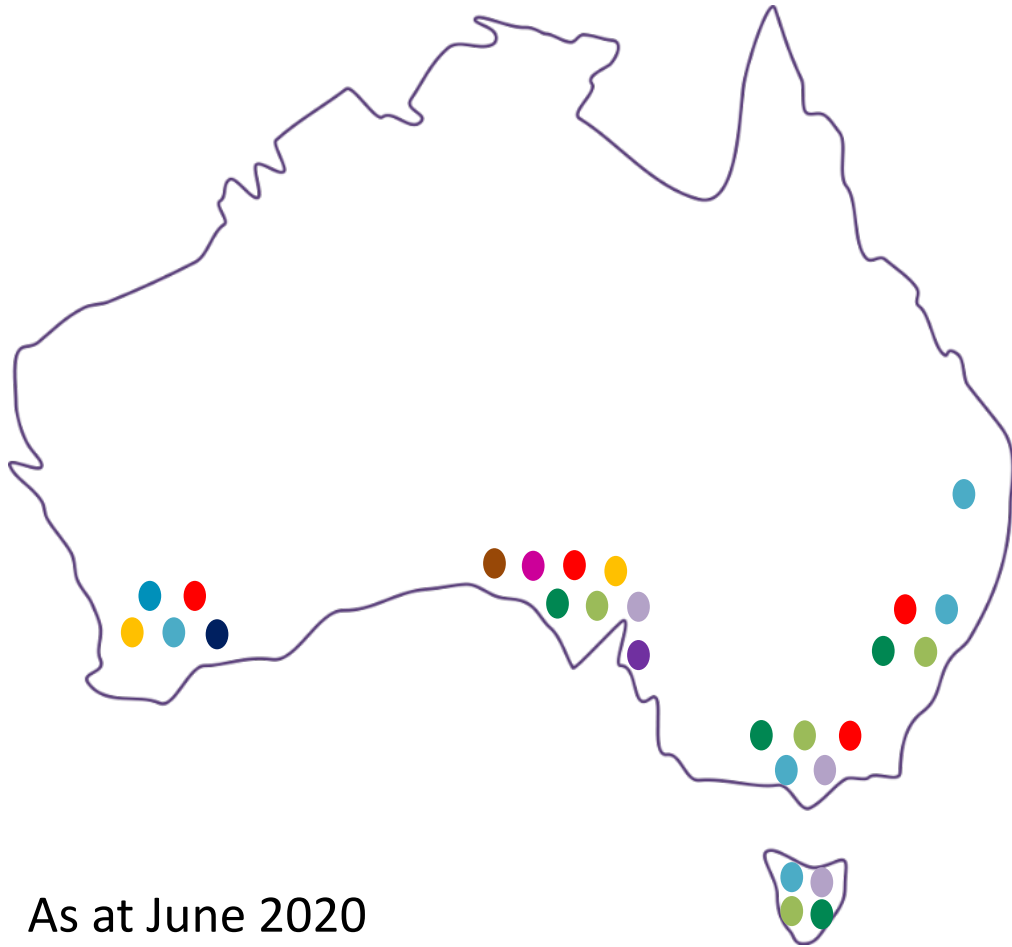
Fungicide resistance detection

To detect reduced sensitivity or resistance to a fungicide:

1. Field failure
2. Lab detection of reduced sensitivity of pathogenic strains isolated from the field – baseline sensitivity!
3. DNA-level detection of one or more mutations in the pathogen's gene(s) associated with the mode of action of the fungicide



Fungicide resistance in Australian grains crops



As at June 2020

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

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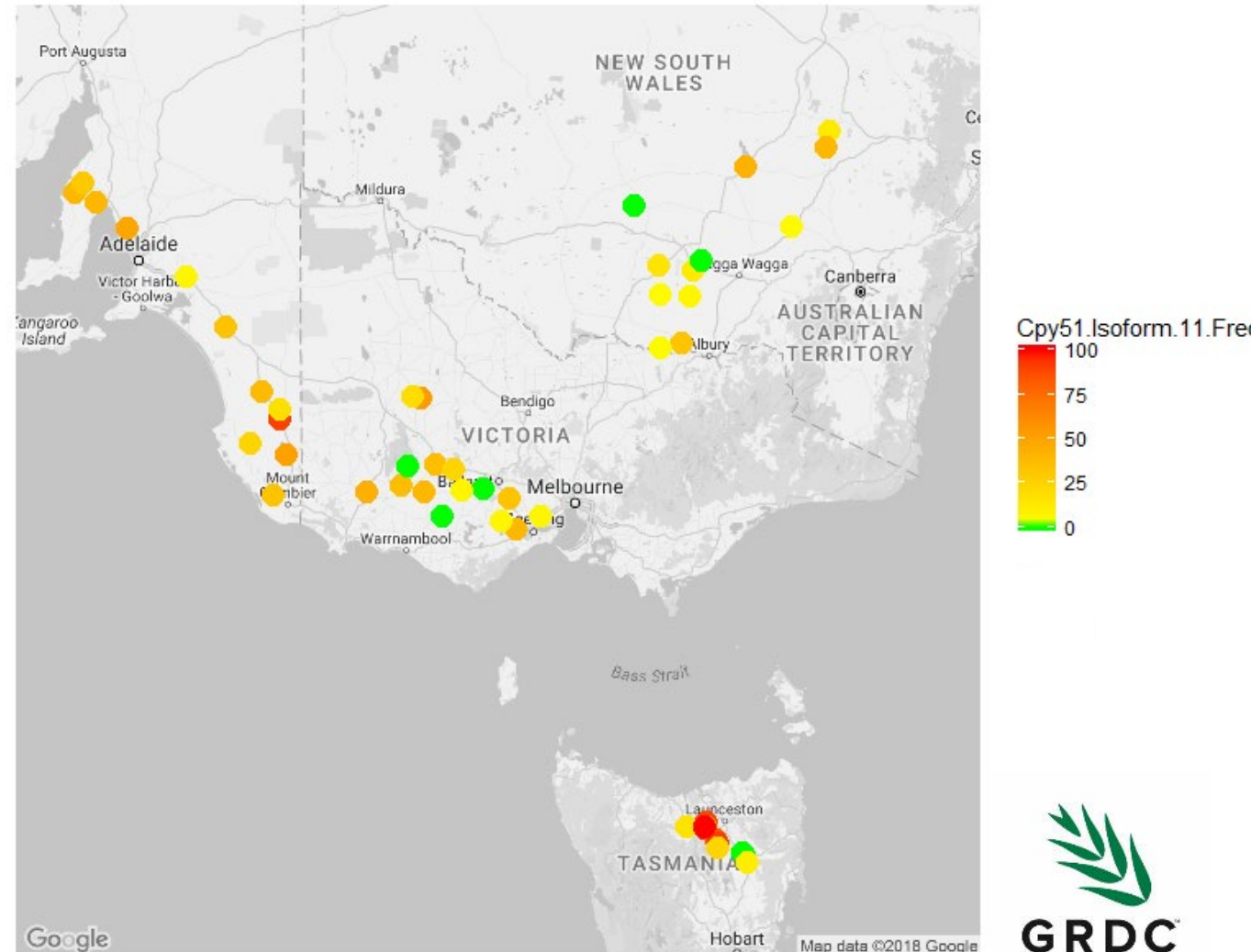
L = Lab detection RS = Reduced sensitivity R = Resistant

Septoria tritici blotch – Fungicide Resistance Survey 2017



Department of
Primary Industries

- Wide distribution of a **Cyp51** mutation (**isoform 11**) has led to a significant loss of sensitivity to some DMIs
- No changes to the sensitivity to strobilurins or SDHIs



Acknowledgements: Andrew Milgate



Septoria tritici blotch – Fungicide Resistance Survey 2017



Department of
Primary Industries

Active ingredient	Resistance status
Strobilurins	Effective
SDHIs (Bixafen, Fluxapyroxad)	Effective
Epoxiconazole	Effective
Prothioconazole	Effective
Cyproconazole	Less effective
Flutriafol	Less effective
Tebuconazole	Less effective
Propiconazole	Less effective
Triadimenol	Not effective

Current Field Performance - Barley Fungicides

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	Group 3 (DMI)						Group 7 (SDHI)						Group 11 (QoI)					
	e.g. epoxiconazole, flutriafol, propiconazole, tebuconazole						e.g. fluxapyroxad						e.g. azoxystrobin					
	NSW	Qld	SA	Tas	Vic	WA	NSW	Qld	SA	Tas	Vic	WA	NSW	Qld	SA	Tas	Vic	WA
Barley powdery mildew	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Net form of net blotch	✓	✓	✓	✓	✓	✗	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spot form of net blotch	✓	✓	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Barley scald	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Barley leaf rust	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Eyespot	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Ramularia leaf spot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- ✓ Active
- ✓ Some active compounds compromised – be selective based on the resistance profile of your farm or growing region
- ✗ Resistance to some or all active compounds – avoid if possible, or use only in mixture
- ✗ Resistance to most or all active compounds – avoid entirely if possible
- NR Not registered for this pathogen.

Current Field Performance - Wheat Fungicides

	Group 3 (DMI)						Group 7 (SDHI)						Group 11 (QoI)					
	e.g. epoxiconazole, flutriafol, propiconazole, tebuconazole						e.g. fluxapyroxad						e.g. azoxystrobin					
	NSW	Qld	SA	Tas	Vic	WA	NSW	Qld	SA	Tas	Vic	WA	NSW	Qld	SA	Tas	Vic	WA
Wheat powdery mildew	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	✗	✗	✓
Septoria tritici blotch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Septoria nodorum blotch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Leaf rust	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stripe rust	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stem rust	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Tan spot (yellow spot)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

- ✓ Active
- ✓ Some active compounds compromised – be selective based on the resistance profile of your farm or growing region
- ✗ Resistance to some or all active compounds – avoid if possible, or use only in mixture
- ✗ Resistance to most or all active compounds – avoid entirely if possible
- NR Not registered for this pathogen.

Apparently, no cases of fungicide resistance in Qld – why?

A pilot study supported by the ‘Broad Acre Cropping Initiative’, a DAF-USQ collaborative project – preliminary results



Department of Agriculture and
Fisheries

**Broad Acre Cropping
Initiative**

Mungbean powdery mildew



- Up to 30% yield loss without fungicide treatments (Thompson et al. 2016, GRDC)
- Currently, 2 fungicides available:
 - PER13979 Tebuconazole
 - PER82104 Custodia (azoxystrobin + tebuconazole)

Mungbean powdery mildew

- Known to develop resistance to DMIs on other crops in Europe
- In Australia - disease is caused by 2 powdery mildew species

(Lisa Kelly, Niloofar Vaghefi & Levente Kiss)

→ **Implications for fungicide resistance management?**

Research Article



Received: 22 October 2009

Revised: 15 January 2010

Accepted: 2 February 2010

Published online in Wiley InterScience: 29 March 2010

(www.interscience.wiley.com) DOI 10.1002/ps.1948

Sensitivities to DMI fungicides in populations of *Podosphaera fusca* in south central Spain

Francisco J López-Ruiz,^a Alejandro Pérez-García,^{b*}
Dolores Fernández-Ortuño,^a Diego Romero,^b Emilio García,^c
Antonio de Vicente,^b James KM Brown^d and Juan A Torés^a

Abstract

BACKGROUND: Cucurbit powdery mildew elicited by *Podosphaera fusca* (Fr.) U Braun & N Shishkoff limits crop production in Spain. Disease control is largely dependent on fungicides such as sterol demethylation inhibitors (DMIs). Fungicide resistance is an increasing problem in this pathogen. To overcome such risk, it is necessary to design rational control programmes based upon knowledge of field resistance. The aim of this study was to investigate the state of DMI sensitivity of Spanish *P. fusca* populations and provide tools for improved disease management.

Mungbean powdery mildew

- DNA markers associated with DMI resistance checked in several samples, in both powdery mildew species → no mutations
- **Field failures observed – samples welcome!**



Mungbean powdery mildew - Management

Currently, we recommend two fungicide applications (Melloy et al. unpublished)

- First application at first sign of disease
- Second application two weeks later

But what if you're not sure?

Acknowledgement - A/Prof. Adam Sparks

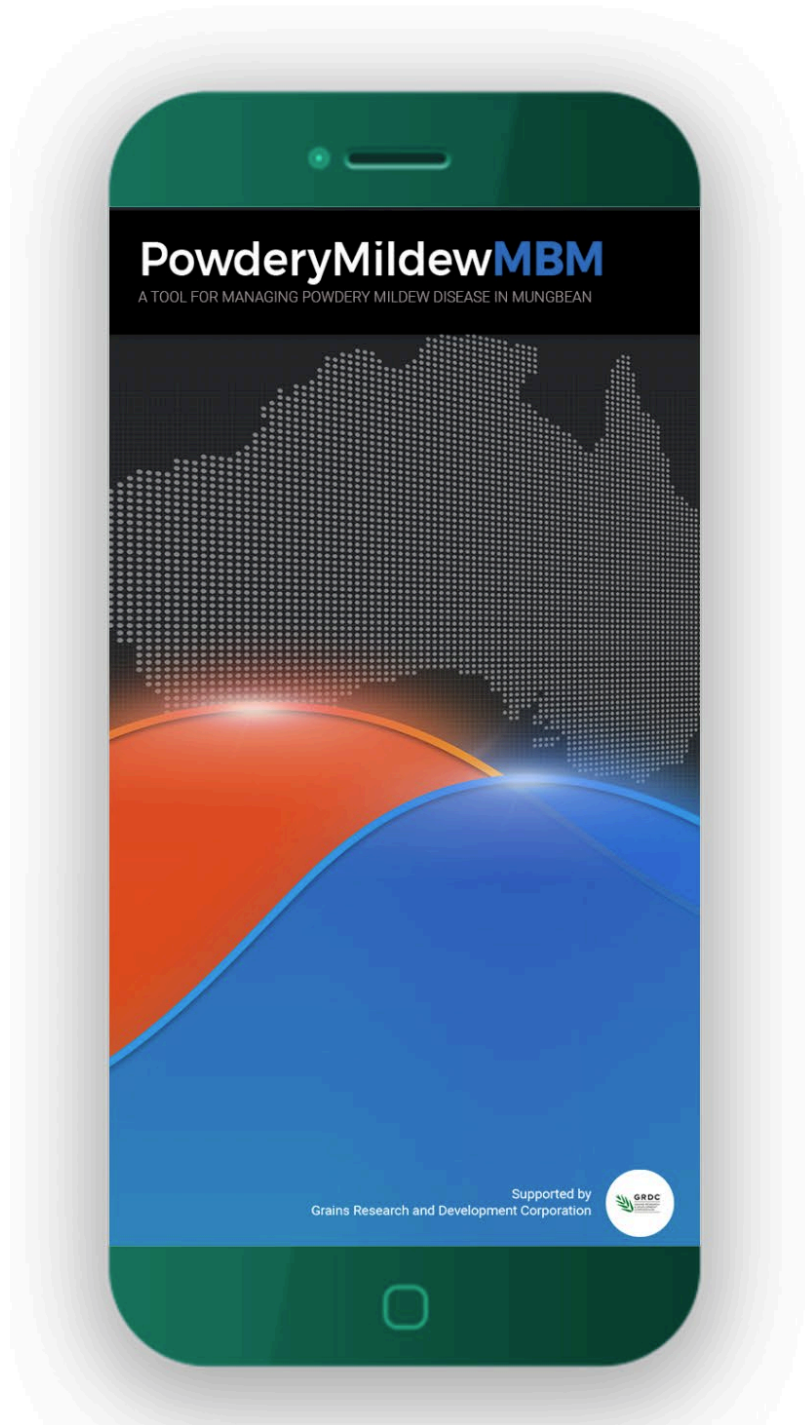


Use a DSS!

What does it offer?

- Alternative to calendar spray programs
- Enhance timing of fungicide sprays to disease development
- Economic benefits (spray reduction)
- Environmental benefits (spray reduction)
- ***Resistance management strategy***





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.



What does it look like?

A clear and easy to use set of questions are presented on your Android or iPadOS tablet for you to answer.

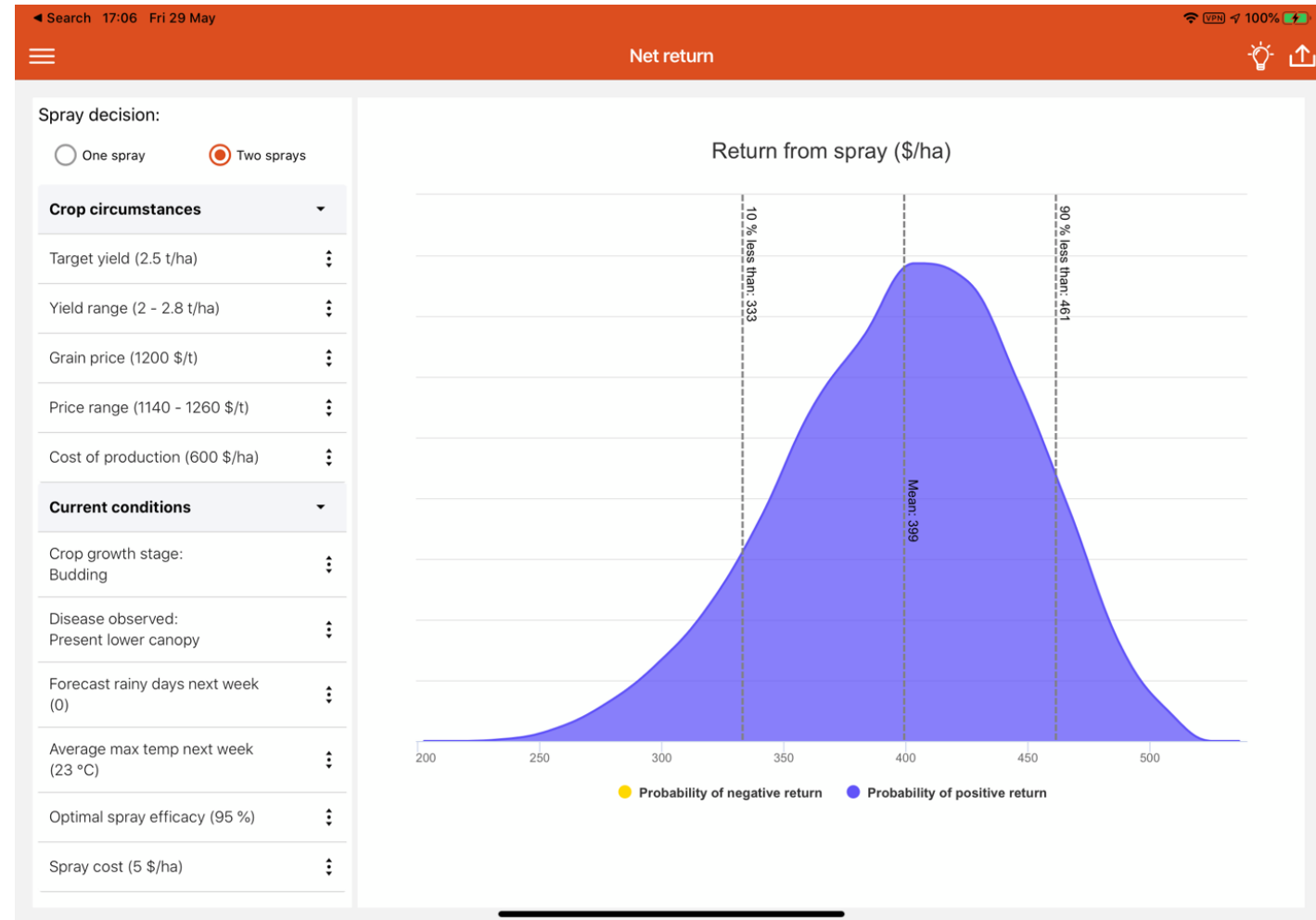
14:23 Thu 28 May 100%

Summary

Spray decision:	No spray	With spray	Change due to spray
<input checked="" type="radio"/> One spray <input type="radio"/> Two sprays			
Crop circumstances			
Target yield (1 t/ha)	Expected yield (t/ha)	Expected yield (t/ha)	Expected yield (t/ha)
Yield range (0.6 - 1.2 t/ha)	Minimum 0.65	Minimum 0.72	Minimum 0.06
Grain price (1100 \$/t)	Mean 0.78	Mean 0.86	Mean 0.09
Price range (1045 - 1155 \$/t)	Maximum 0.9	Maximum 0.99	Maximum 0.11
Cost of production (600 \$/ha)			
Current conditions			
Crop growth stage: Vegetative	Loss to Powdery mildew (t/ha)	Loss to Powdery mildew (t/ha)	Loss to Powdery mildew (t/ha)
Disease observed: Present lower canopy	Minimum 0.15	Minimum 0.08	Minimum -0.06
Forecast rainy days next week (2)	Mean 0.19	Mean 0.1	Mean -0.09
Average max temp next week (23 °C)	Maximum 0.23	Maximum 0.13	Maximum -0.11
Optimal spray efficacy (95 %)			
Spray cost (20 \$/ha)	Net return (\$/ha)	Net return (\$/ha)	Net return (\$/ha)
	Minimum 113	Minimum 176	Minimum 50
	Mean 254	Mean 330	Mean 76
	Maximum 386	Maximum 474	Maximum 103

How does it work?

A possible use case showing the Net return view, showing the target (entered by the user) and expected (calculated by the app) net return resulting from zero or two fungicide applications



Supported by:



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Department of
**Primary Industries and
Regional Development**



**QUEENSLAND
GOVERNMENT**

Department of Agriculture and
Fisheries

**Broad Acre Cropping
Initiative**

DAW00228 - National pathogen management modelling
and delivery of decision support

DAW1810 - Disease epidemiology and management tools
for Australian grain growers

Fungicide Resistance – Mitigate the Risk!

- Single-site mode of action

✓ **Rotate & mix chemistries**

- Pathogen risk

- Polycyclic (numerous disease cycles per year)?

✓ **Reduce disease pressure**

- High spore production?

- Infects all growth stages of the crop?

✓ **Rotate crops**

- Does the pathogen have a sexual stage?

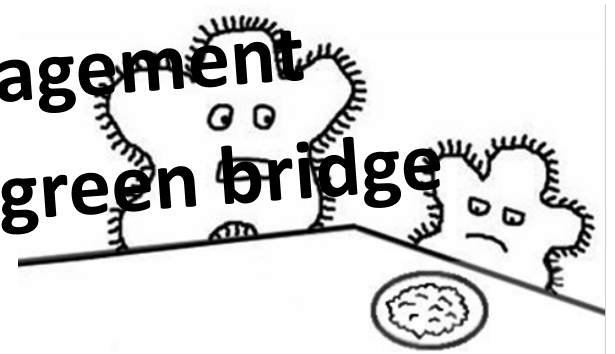
✓ **Stubble management**

- Do they overwinter?

✓ **Manage the green bridge**

- Frequent application of the fungicide

✓ **Minimise use & spray strategically**



"But Timmy, you've to use
our fungicides or you'll
never become resistant"



To conclude:

Little is known about fungicide resistance in Qld.

Our recently started projects focused on mungbean powdery mildew so far; other grains pathogens should also be monitored.



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**AUSTRALIAN
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Find out more:

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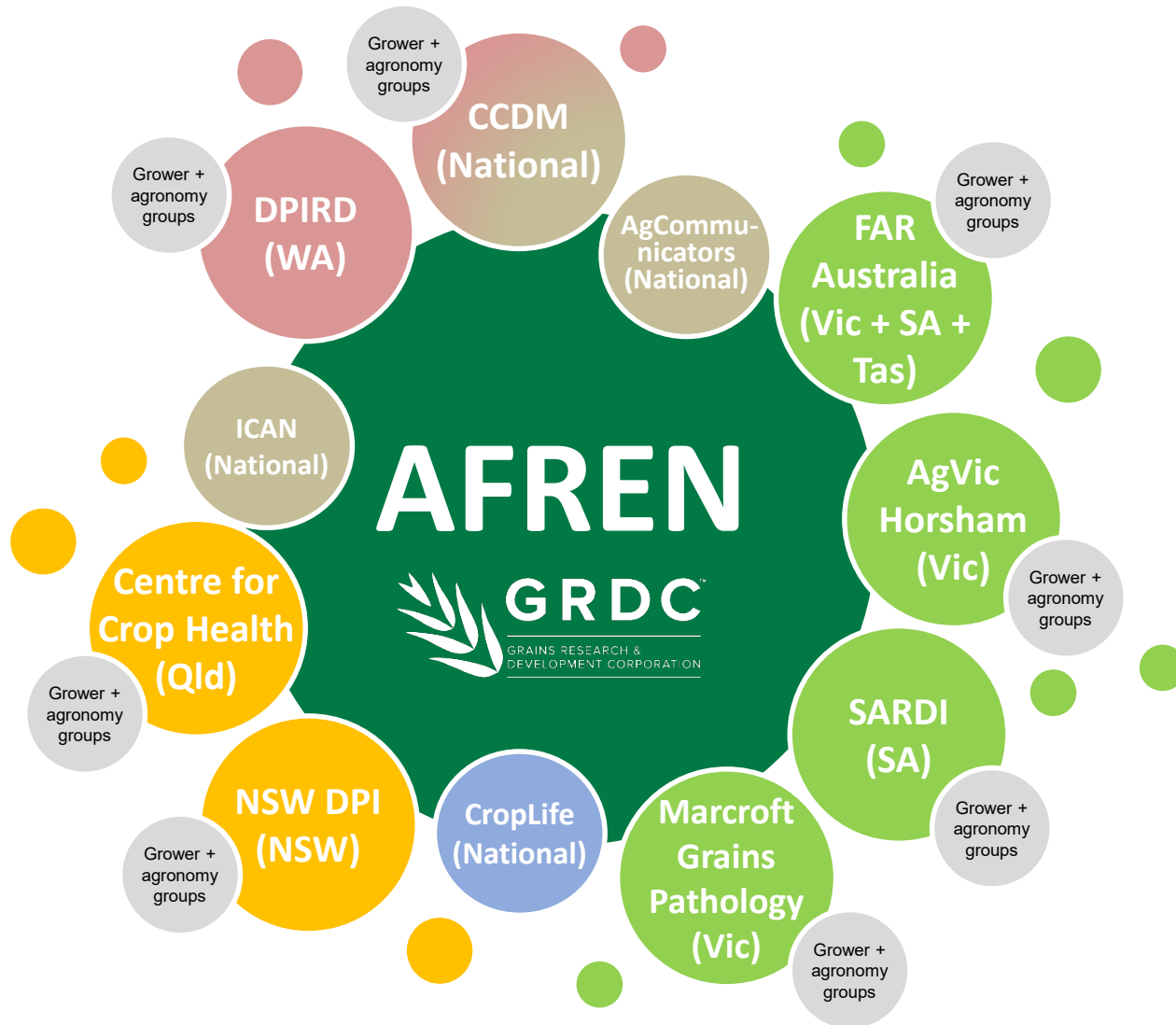
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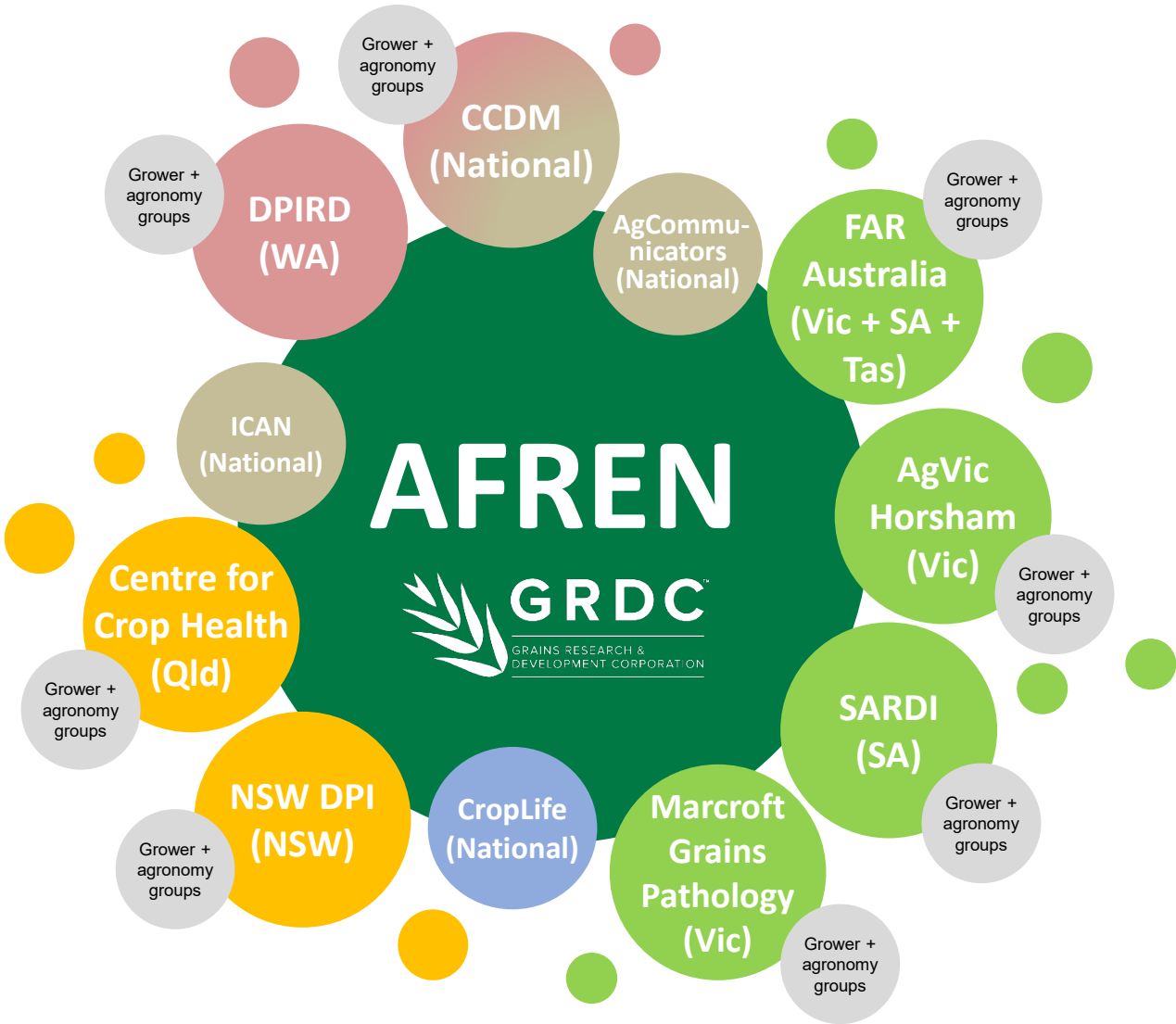


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Fungicide resistance management guide

Workshops, info sessions & webinars

Factsheets, updates & email alerts

- HRZ – 4 Aug
- WA – TBD
- Vic - TBD



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If you suspect fungicide resistance, let us know what's happening & help us sample!