NET BLOTCH: Monitoring of net and spot form net blotch resistance to fungicides

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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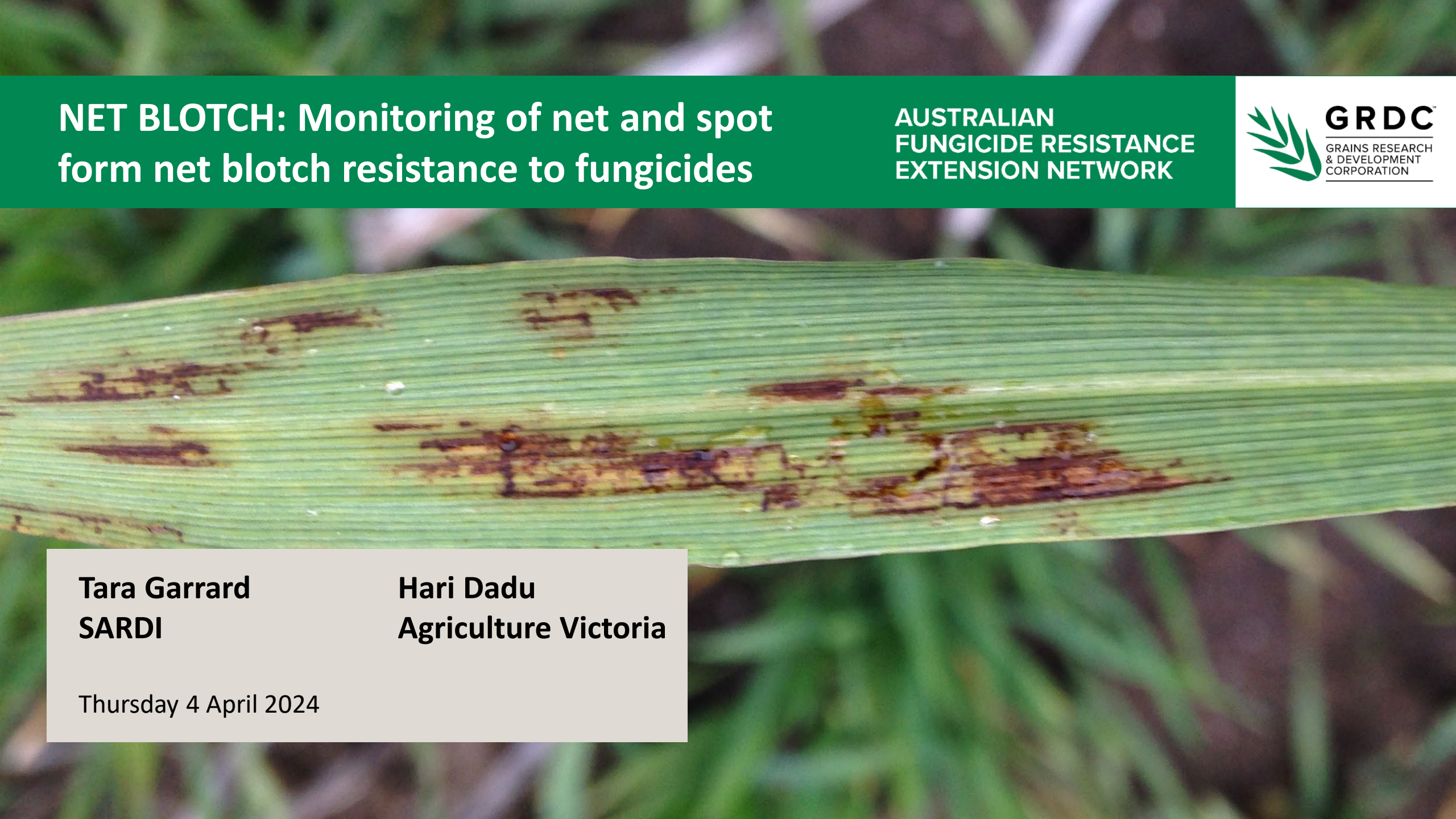

Tara Garrard
SARDI

Hari Dadu
Agriculture Victoria

Thursday 4 April 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

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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.

Monitoring of Net and Spot Form Net Blotch Fungicide Resistance

Dr Hari Dadu (Agriculture Victoria) and Dr Tara Garrard (SARDI)

Government of South Australia
Department of Primary Industries and Regions

SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

AGRICULTURE VICTORIA

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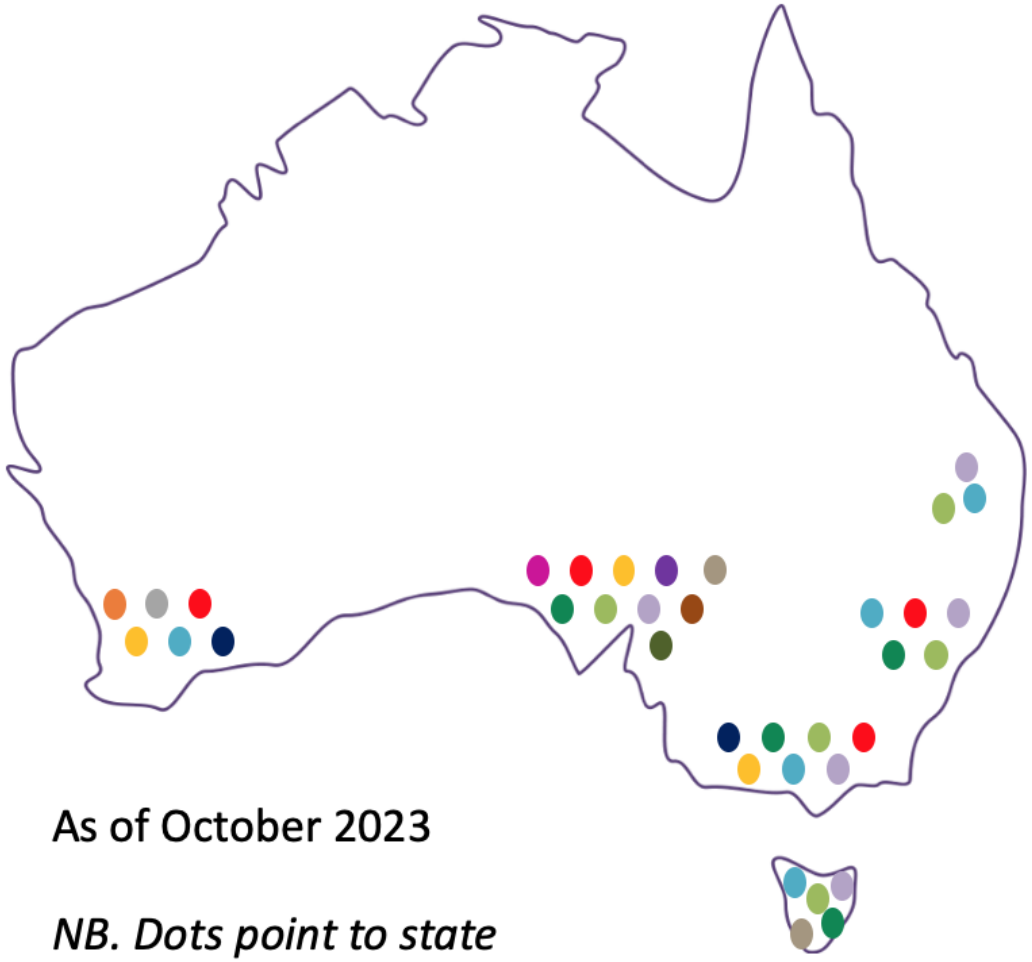
Fungicide Resistance in Australian Grains



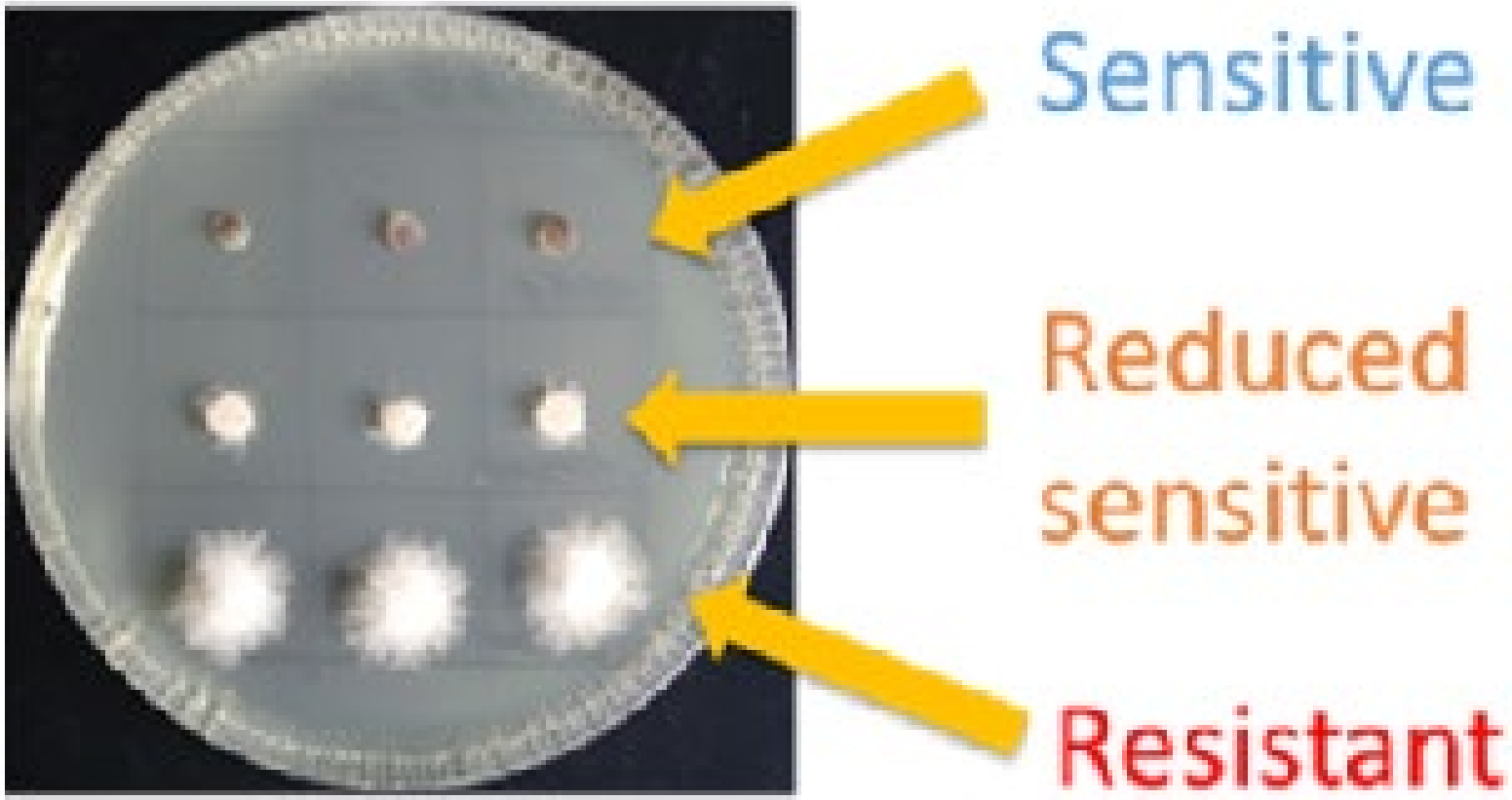
As of October 2023

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
RS, R	Barley Net Form Net Blotch – Group 7 (SDHI)
RS	Barley Net Form Net Blotch – Group 11 (QoI)
RS, R	Barley Spot Form Net Blotch – Group 3
L, RS, R	Barley Spot Form Net Blotch – Group 7
L, R	Wheat Powdery Mildew – Group 3
L, R	Wheat Powdery Mildew – Group 11 (strobilurins)
RS	Wheat Septoria tritici blotch – Group 3
L, R	Wheat Septoria tritici blotch – Group 11
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 sensitive R = Resistant

Fungicide resistance terminology



Key Barley Diseases

Fungicide resistance development risk

- Net form net blotch — Serious threat
- Spot form net blotch — Serious threat
- Powdery mildew — Serious threat
- Scald — Medium threat
- Leaf rust — Very low threat??

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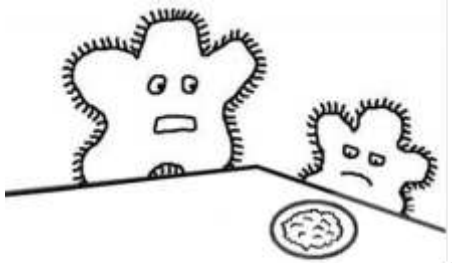
Fungicide Resistance – what's the risk?

Higher disease pressure = higher chance of fungicide resistance

Disease pressure increased by:

- Pathogen = polycyclic with short latent period, sexual reproduction, high spore production
- Fungicide = single mode of action used repeatedly
- Susceptible variety
- Early sowing
- Amenable weather
- Close rotations and stubble retention



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Net blotch life cycle

(Pyrenophora teres f. teres and Pyrenophora teres f. maculata)

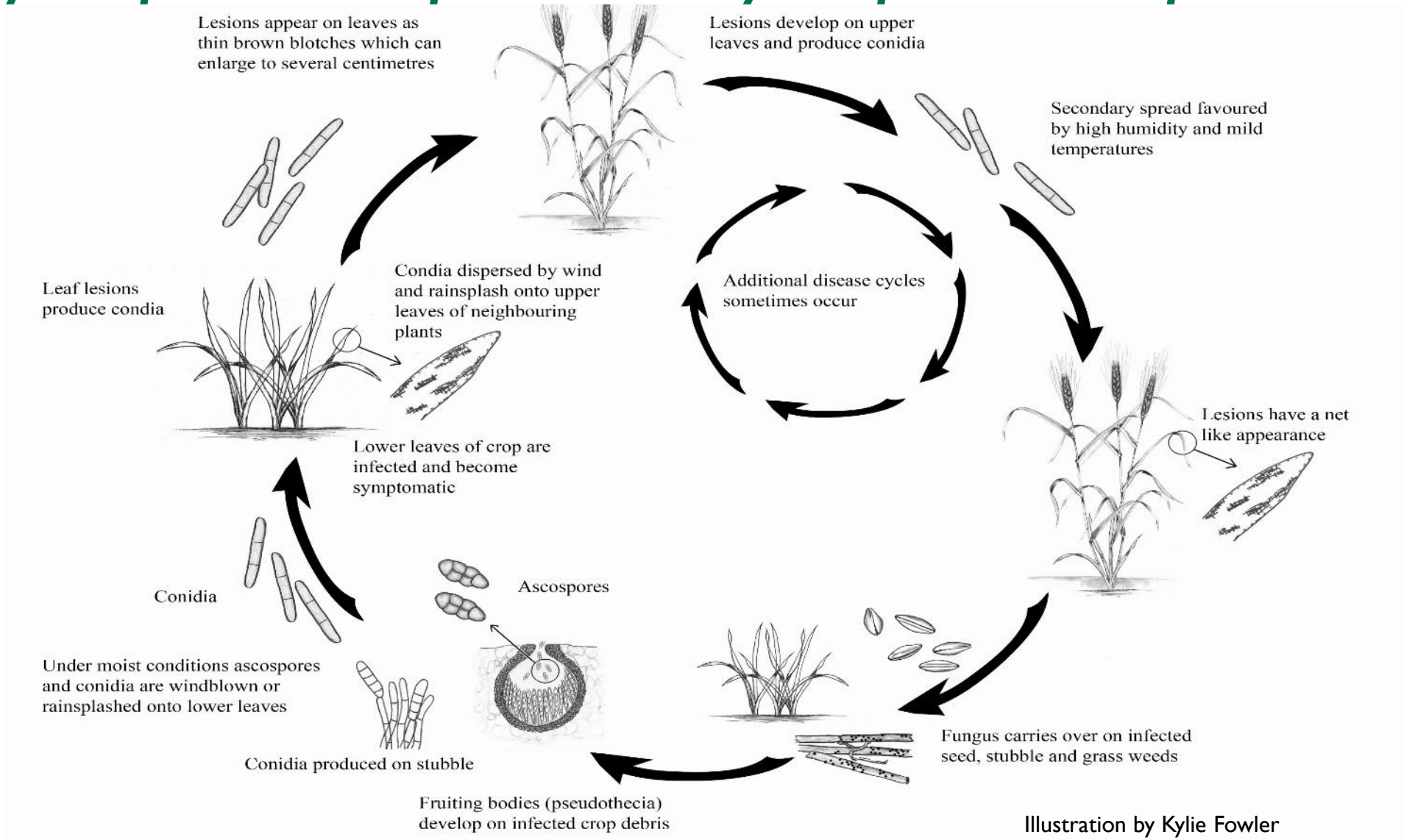

Illustration by Kylie Fowler

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Net blotch risk factors

- Growing susceptible varieties with little diversity in the region
- Growing barley on barley with stubble retention
- Early sowing
- Wet conditions
- Warm humid weather (NFNB)

Rain = Disease

Seasonal rainfall	Loss %	Loss t/ha
Below average	0-5%	0.1
Average	5-10%	0.3
Above average	10-25%	2.0

NFNB Pathotyping 2023

No.	Isolate	Variety	Location	State	Algerian	Banks	Beast	Beecher	Buff	Clho 5791/CI5791	Combat	Commodus CL	Corvette	Cyclops	Fathom	Fleet	Gilbert	Herta	Kiwi	Kombar	Laperouse	Leabrook	Maritime	Maximus CL	Minotaur	Navigator	Neo	Oxford	RGB Planet	Rosalind	Schooner	Scope	Shepherd	Skiff	SloopSA	Spartacus CL	Vlamingh	Westminster	Yeti	Zena
1	23053	Zena CL	Paskeville	SA	5	9	7	2	7	2	8	8	6	4	7	5	9	9	5	8	9	8	2	7	7	8	7	5	8	6	4	4	9	7	7	7	6	6	8	8
2	23049	Breeding line	Clinton Centre	SA	4	3	7	2	6	2	8	9	7	7	8	3	8	4	5	5	8	9	3	7	4	8	6	3	5	5	7	5	3	3	7	8	4	5	8	4
3	23012	RGT Planet	Corney Point	SA	5	9	7	2	5	1	8	8	7	6	8	6	7	9	5	7	9	7	2	7	6	9	8	6	9	5	5	5	9	8	7	7	6	6	9	8
4	23030	Breeding line	Lock	SA	2	3	7	1	4	1	5	6	6	6	7	2	4	2	2	3	6	7	5	4	3	8	4	2	3	4	5	5	2	2	4	7	3	3	4	2
5	23054	Commander	Bute	SA	2	1	6	1	3	1	6	7	7	6	7	2	5	3	2	4	8	7	2	5	3	8	7	2	4	3	6	5	2	2	5	7	3	3	5	3
6	74/23	Zena CL	Struan	SA	3	5	5	2	4	2	7	6	3	2	6	3	5	7	5	5	8	7	2	4	6	6	5	5	7	4	4	3	4	7	6	6	3	4	4	7
7	23067	RGT Planet	Padthaway	SA	3	7	6	1	3	1	7	6	5	3	7	5	5	6	4	6	7	6	3	5	5	4	7	6	7	3	2	3	7	5	5	6	4	4	5	7
8	23020	Breeding line	Carnarvon	WA	4	7	8	4	5	2	9	9	9	6	9	6	9	7	7	9	9	9	6	9	4	8	8	7	8	7	9	5	5	7	8	9	6	8	8	7
9	23019	Beast	Carnarvon	WA	4	4	7	3	3	2	9	8	7	6	8	5	8	7	4	8	9	8	3	8	4	8	8	7	7	7	8	3	5	7	7	8	4	7	8	7
10	23078	Scope CL	NVT Birchip	Vic	7	9	8	7	6	1	9	9	8	9	9	8	8	8	7	9	9	9	4	8	8	8	9	9	8	7	5	4	9	9	7	9	9	8	9	9
11	23077	Cyclops	NVT Birchip	Vic	4	5	4	1	3	1	7	7	4	4	6	4	6	5	4	7	7	7	2	6	5	7	7	5	7	4	3	2	4	6	4	6	7	4	6	7
12	Ptt23-030	RGT Planet	Streatham	Vic	7	7	6	2	4	1	6	5	6	8	8	7	7	7	4	6	7	7	5	8	7	9	9	7	8	7	5	6	9	8	7	8	7	8	8	7
13	Ptt23-015	Unknown	Kunat	Vic	2	2	5	1	3	1	7	6	7	6	7	3	5	4	2	4	7	6	4	7	3	7	6	3	4	5	4	3	2	3	4	6	2	4	4	3
14	Ptt23-008	Unknown	Birchip	Vic	3	6	7	2	3	2	6	8	4	5	6	3	6	6	4	6	8	5	2	6	6	8	6	6	7	3	4	2	2	7	2	7	3	5	8	7
15	Ptt23-002	Yagan	Horsham	Vic	3	2	8	2	7	2	9	6	7	5	7	8	7	4	2	6	9	7	2	6	2	5	3	3	3	4	6	4	1	3	6	7	2	3	6	2
16	Ptt23-013	Breeding line	Charlton	Vic	3	6	7	1	3	1	8	6	5	6	7	6	7	7	4	8	8	7	3	7	7	8	8	7	8	8	3	3	4	7	5	7	3	6	7	7
17	HRS23055a	Unknown	Toowoomba	Qld	5	5	8	1	4	1	9	9	7	7	8	6	8	9	4	8	9	8	7	9	5	7	9	8	8	8	7	7	4	9	7	8	7	7	8	7
18	HRS23035a	Unknown	Gatton	Qld	4	5	4	1	4	2	8	6	7	8	8	3	7	8	5	8	9	8	7	9	8	8	9	7	8	8	4	6	6	7	7	9	7	5	8	7
19	HRS23032a	Zena CL	Grafton	NSW	2	4	3	1	3	1	4	3	3	3	4	3	4	4	5	4	6	6	1	4	4	5	5	4	5	4	2	3	4	5	3	4	2	5	5	5
20	HRS23024a	Unknown	Shannon Brook	NSW	6	8	7	1	3	1	9	7	6	5	6	5	8	7	5	5	8	7	2	8	6	8	7	7	7	5	5	3	7	8	7	7	6	7	7	7

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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Fungicide resistance status

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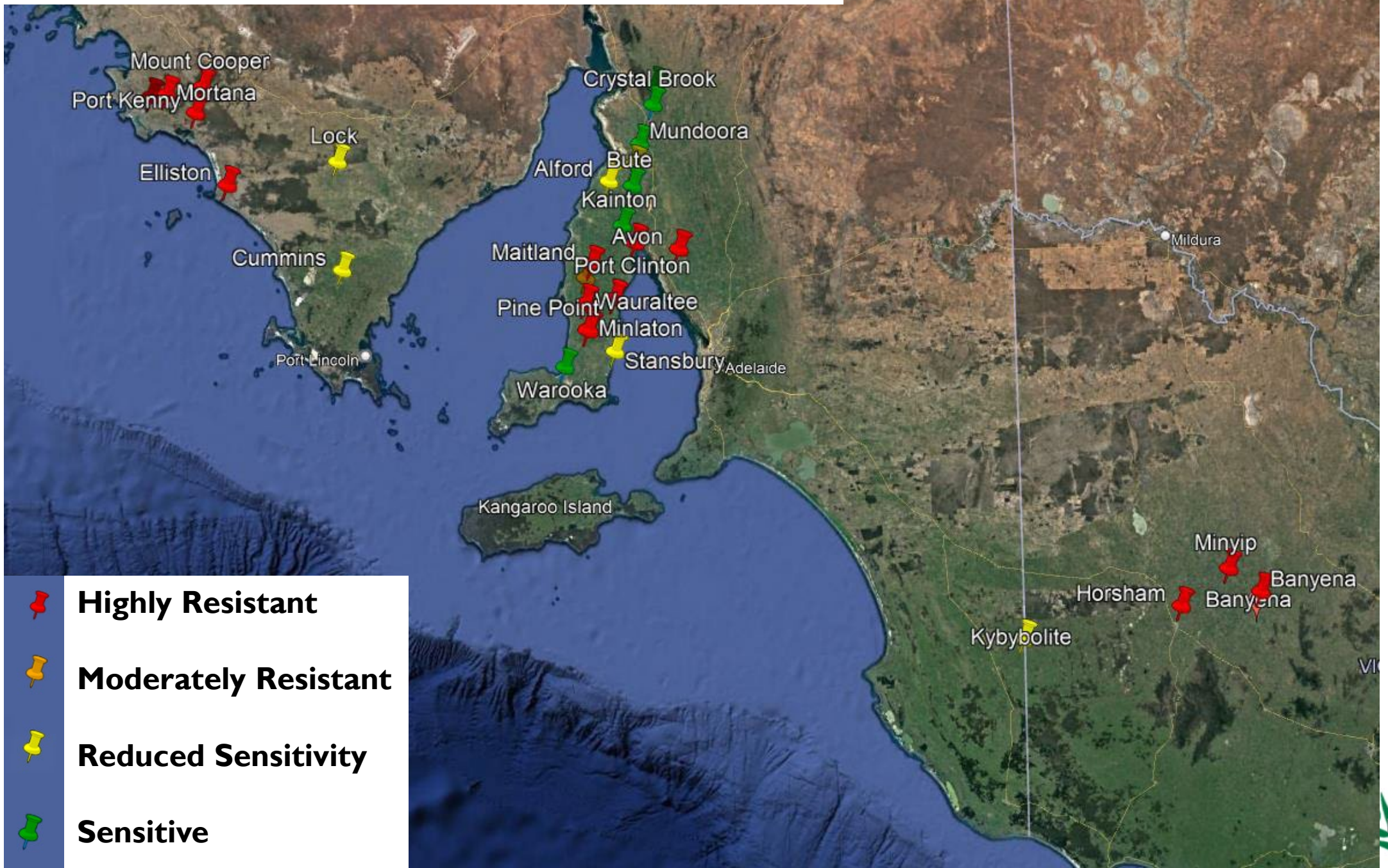
NFNB fungicide resistance status in AUS

Fungicide group	Compounds affected	NSW	QLD	SA	TAS	VIC	WA	Industry implications
3 (DMI)	Tebuconazole, propiconazole, prothioconazole, epoxiconazole		RS, L	RS		RS, L	R, RS	QLD and VIC – Mutations associated with resistance and reduced sensitivity to some DMI fungicides. SA and WA – Resistance and reduced sensitivity to some DMI fungicides.
7 (SDHI)	Fluxapyroxad		R, RS, L	R, RS		R, RS	R, RS	QLD, SA, WA and VIC – Resistance and reduced sensitivity to SDHI fungicides.
3 + 7	Tebuconazole (3), fluxapyroxad (7)			R, RS			R, RS	SA and WA – Resistance and reduced sensitivity to both DMI and SDHI fungicides due to the existence of double mutants.
11 (QoI)	Azoxystrobin, pyraclostrobin			RS, L				SA – Reduced sensitivity to QoI fungicides.

R = Resistant, RS = Reduced Sensitivity, L = Lab detection

NFNB resistance to Fluxapyroxad SA 2019-2021



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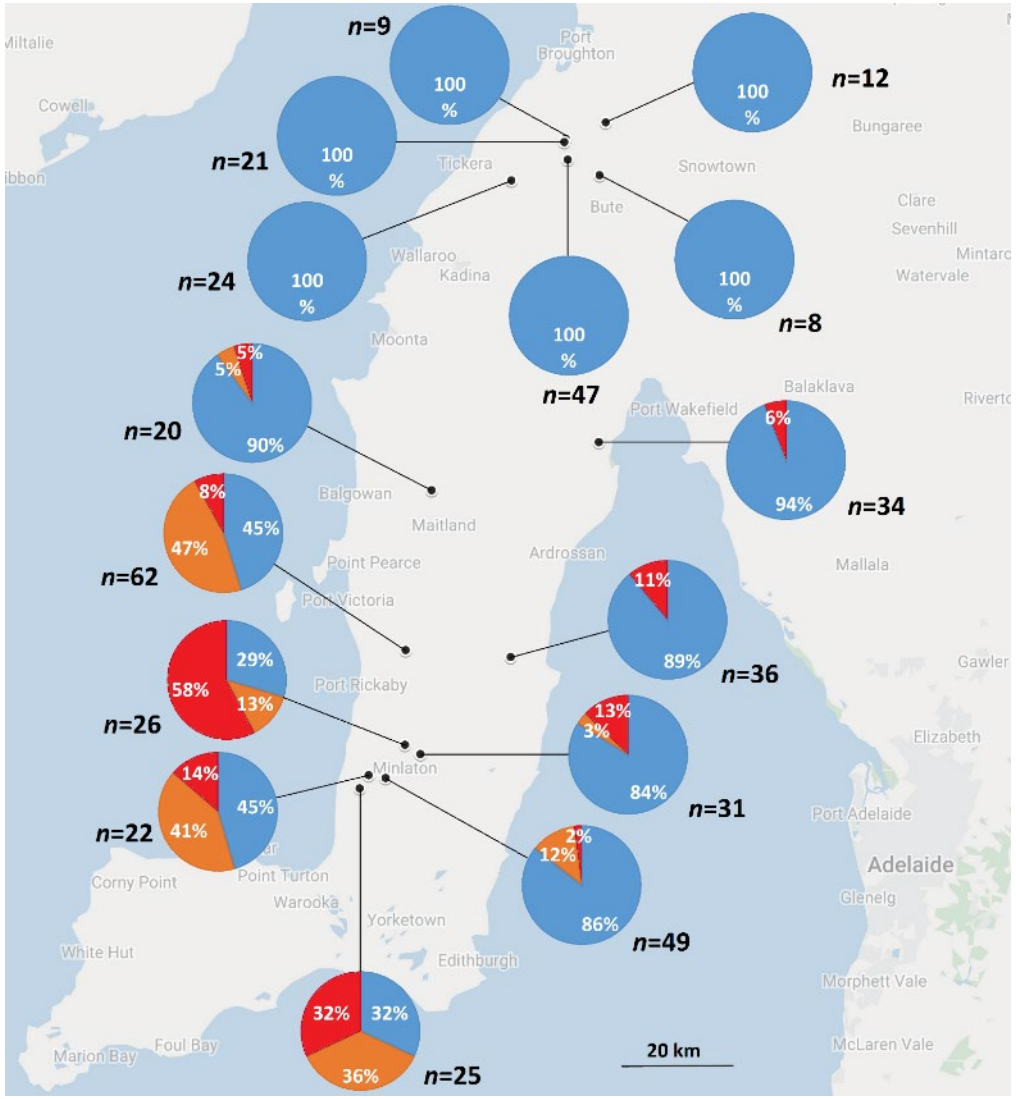
SDHI - Fluxapyroxad resistance



Sensitive	< 5 µg/mL	78.2 %
Reduced sensitivity †	5 µg/mL	11.7 %
Resistant ‡	10 µg/mL	10.1 %
		n = 427

† Sensitivity level equivalent to *SdhD*-D145G

‡ Sensitivity level equivalent to *SdhC*-H134R

As at February 2020

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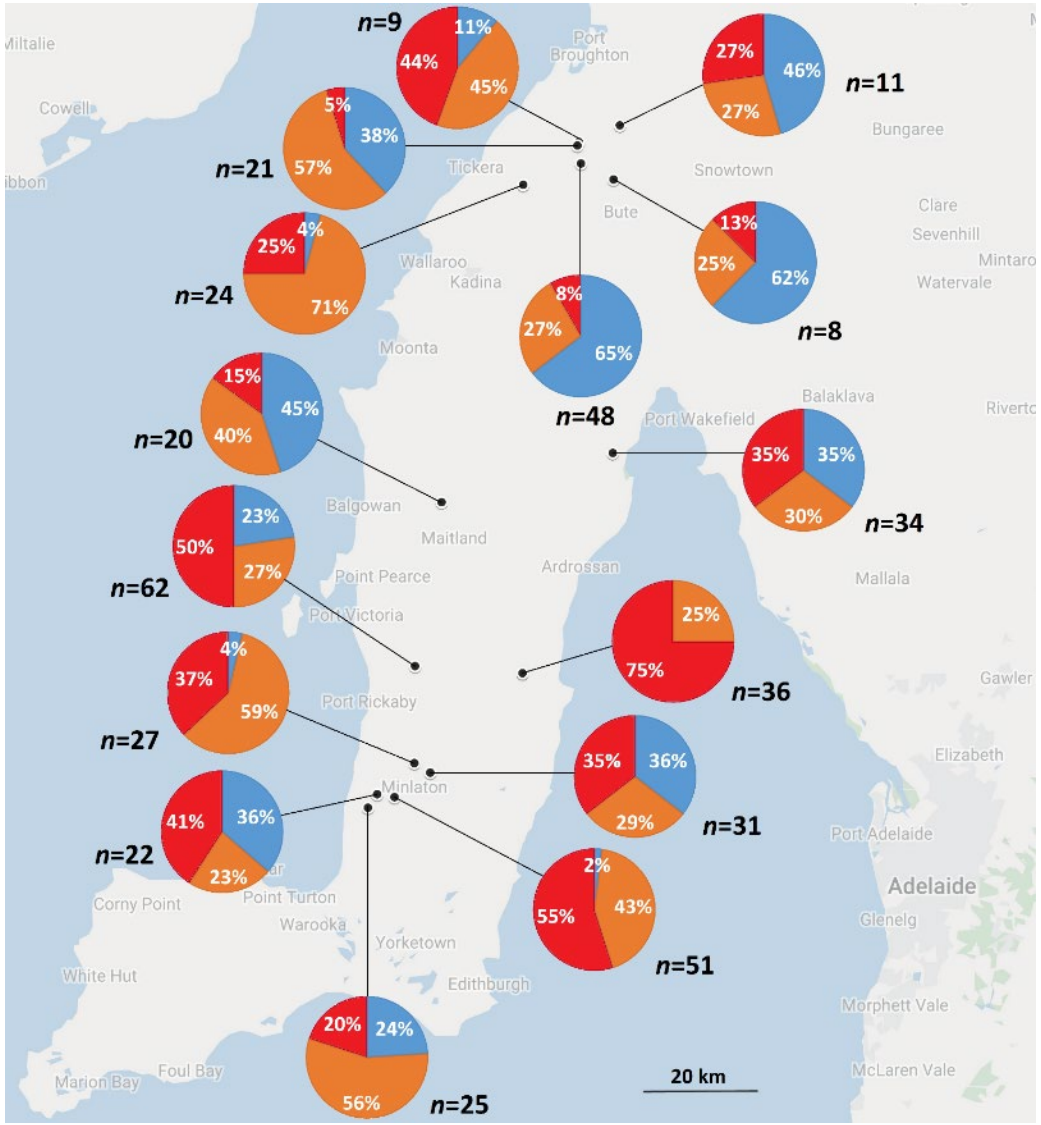
DMI – Tebuconazole resistance



Sensitive	< 15 µg/mL	26.3 %
Reduced sensitivity †	15 µg/mL	37.6 %
Resistant ‡	50 µg/mL	36.1 %
		n = 429

† Sensitivity level equivalent to F489L (*Ptt* or *Ptm*) or Indel (*Ptm*)

‡ Sensitivity level equivalent to F489L+Indel (*Ptm*) or F489L+CNV (*Ptt*)

As at February 2020

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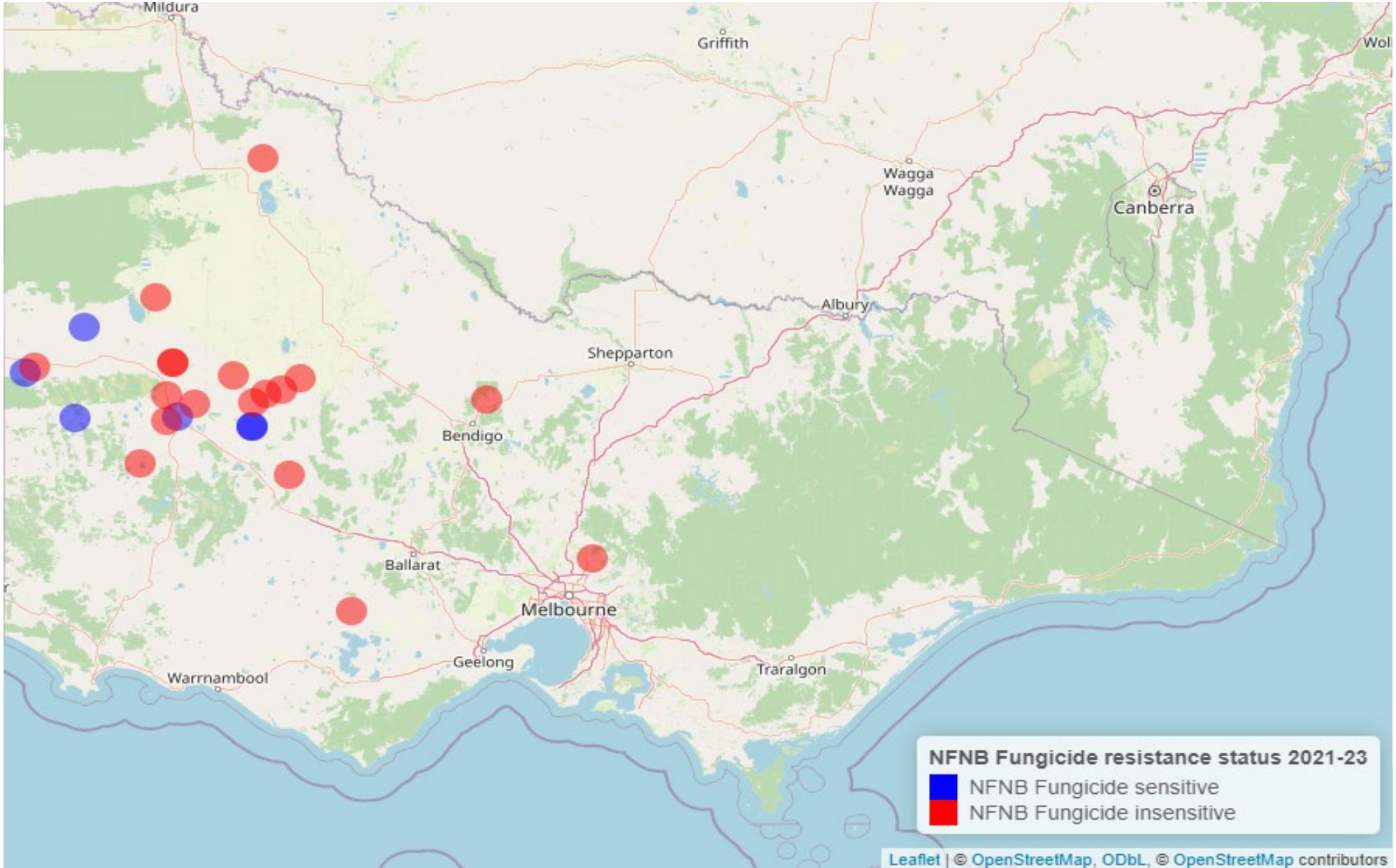
BASF researchers detect Australia's first known instance of genetic mutation affecting Group 11 fungicides

- BASF researchers detect F129L mutation in barley leaf samples infected by net form of net blotch (NFNB)
- The mutation can reduce the sensitivity of crop diseases to Group 11 (QoI) fungicides and is the first known occurrence in Australia
- The discovery is a reminder of the need to implement integrated disease management strategies to help manage the development of fungicide resistance

BASF researchers have detected Australia's first known instance of genetic mutation affecting Group 11 fungicides. The barley leaf samples infected by net form of net blotch (NFNB) were collected during a product trial in the Yorke Peninsula, South Australia last year. After being sent to Germany for genetic analysis, test results revealed the presence of the F129L mutation, the first known occurrence of the mutation in Australia.

NFNB fungicide resistance status, Vic 2021-23



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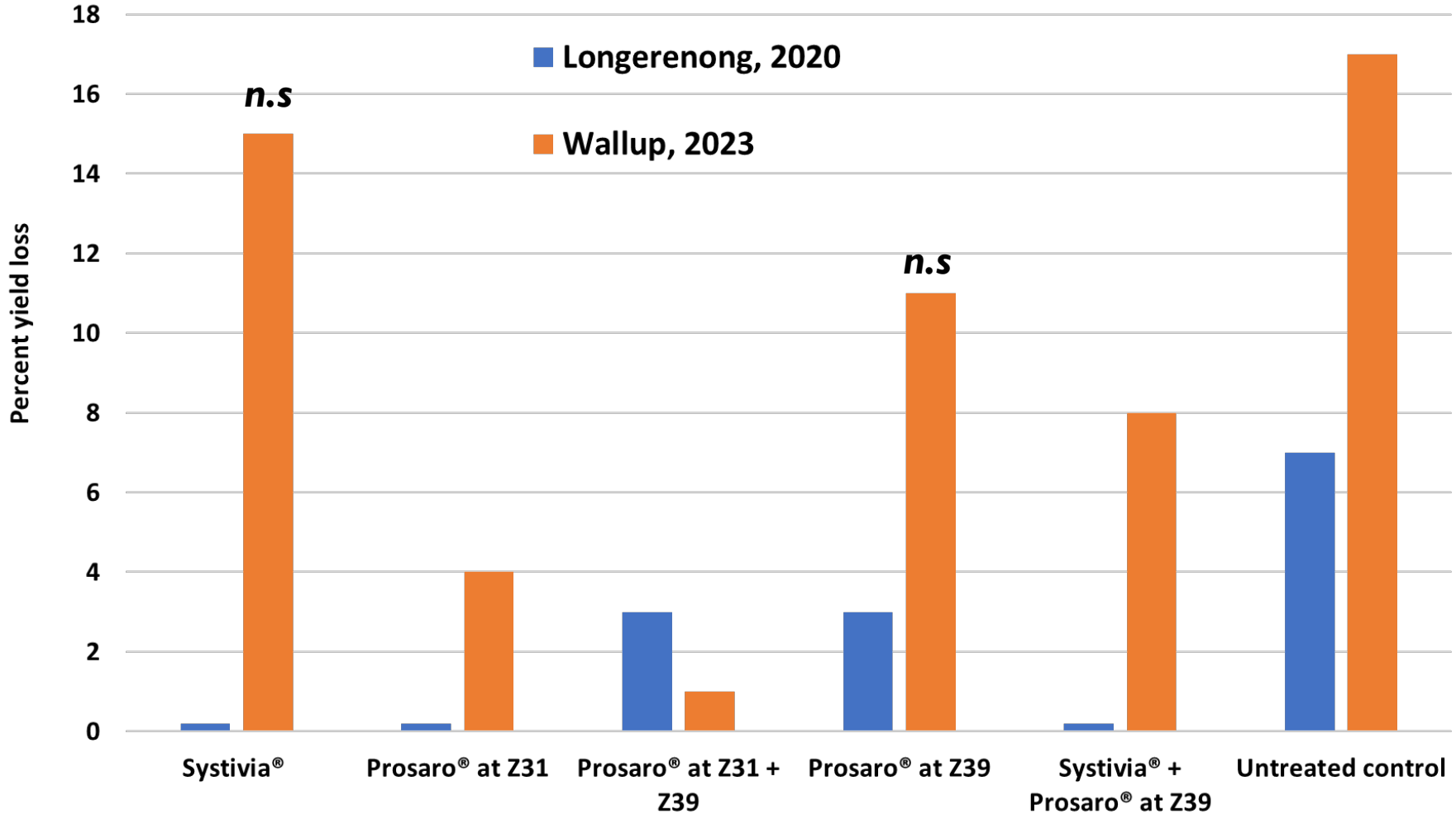
NFNB fungicide resistance status, Vic 2023

Response	DMI (Group 3)	SDHI (Group 7)
Sensitive	54%	41%
Reduced sensitivity	5%	37%
Resistant	41%	22%

Tebuconazole, propiconazole, prothioconazole, epoxiconazole and Fluxapyroxad will show reduced performance

Seed treatment less reliable for NFNB control



Fungicide treatments on seed (Fluxapyroxad 333g/L @ 150mL/100kg seed) or foliar (Prothioconazole 210g/L +Tebuconazole 210g/L @300mL/ha)

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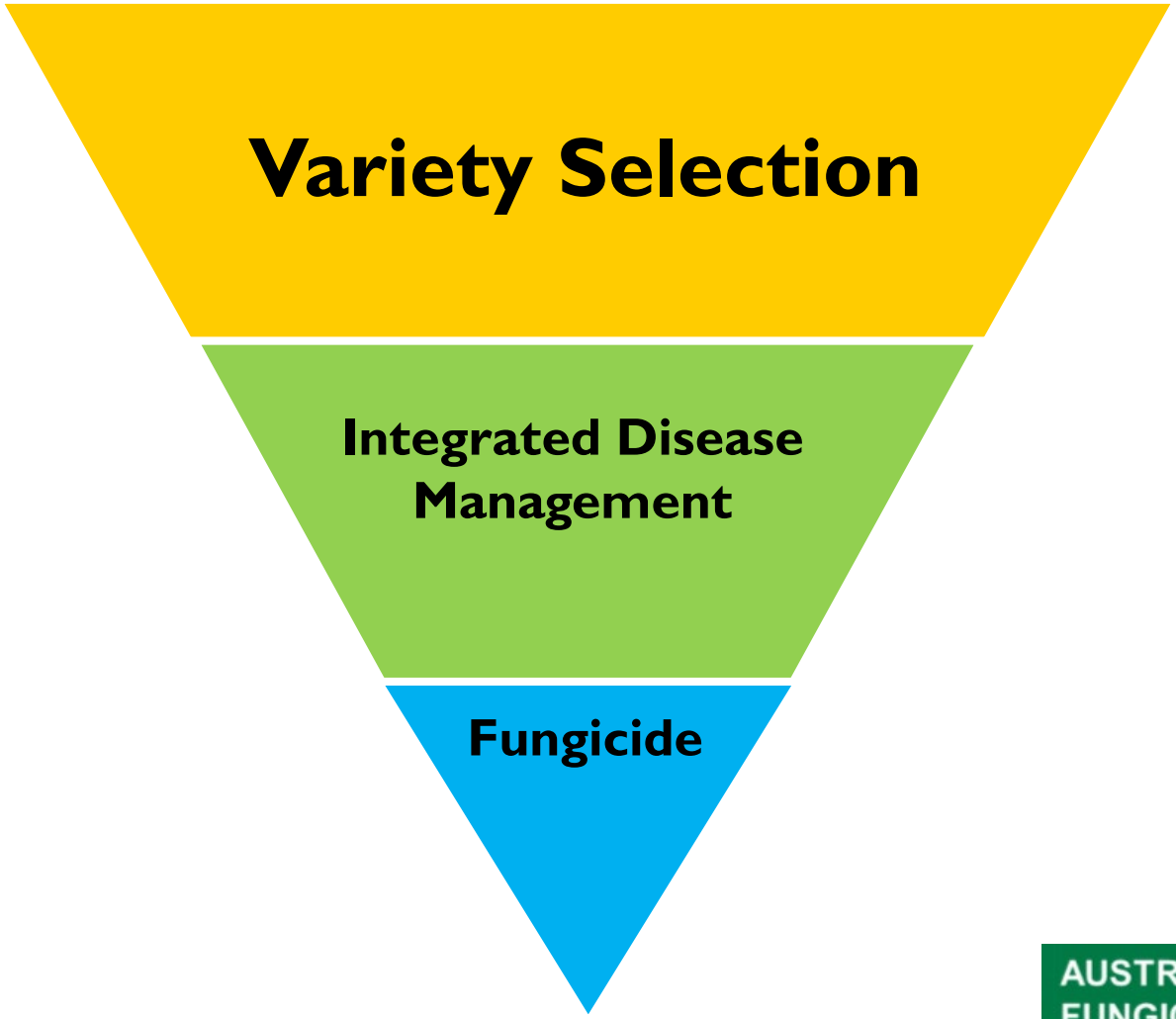
SFNB fungicide resistance status in Aus

Fungicide group	Compounds affected	NSW	QLD	SA	TAS	VIC	WA	Industry implications
3 (DMI)	Tebuconazole, propiconazole, prothioconazole, epoxiconazole		R, RS	RS		RS	R, RS	QLD, SA, VIC & WA - Reduced efficacy of some DMI compounds NSW & TAS – Continue to use at label rates
7 (SDHI)	Fluxapyroxad		R, RS				R, RS	QLD & WA - Reduced efficacy of fluxapyroxad NSW, SA, TAS & VIC - Continue to use at label rates
3 + 7	Tebuconazole (3), fluxapyroxad (7)						R, RS	WA - Reduced efficacy of both fluxapyroxad and some DMI compounds East Aus – Continue to use at label rates

R = Resistant, RS = Reduced Sensitivity, L = Lab detection

Fungicide Resistance Management



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Variety Selection

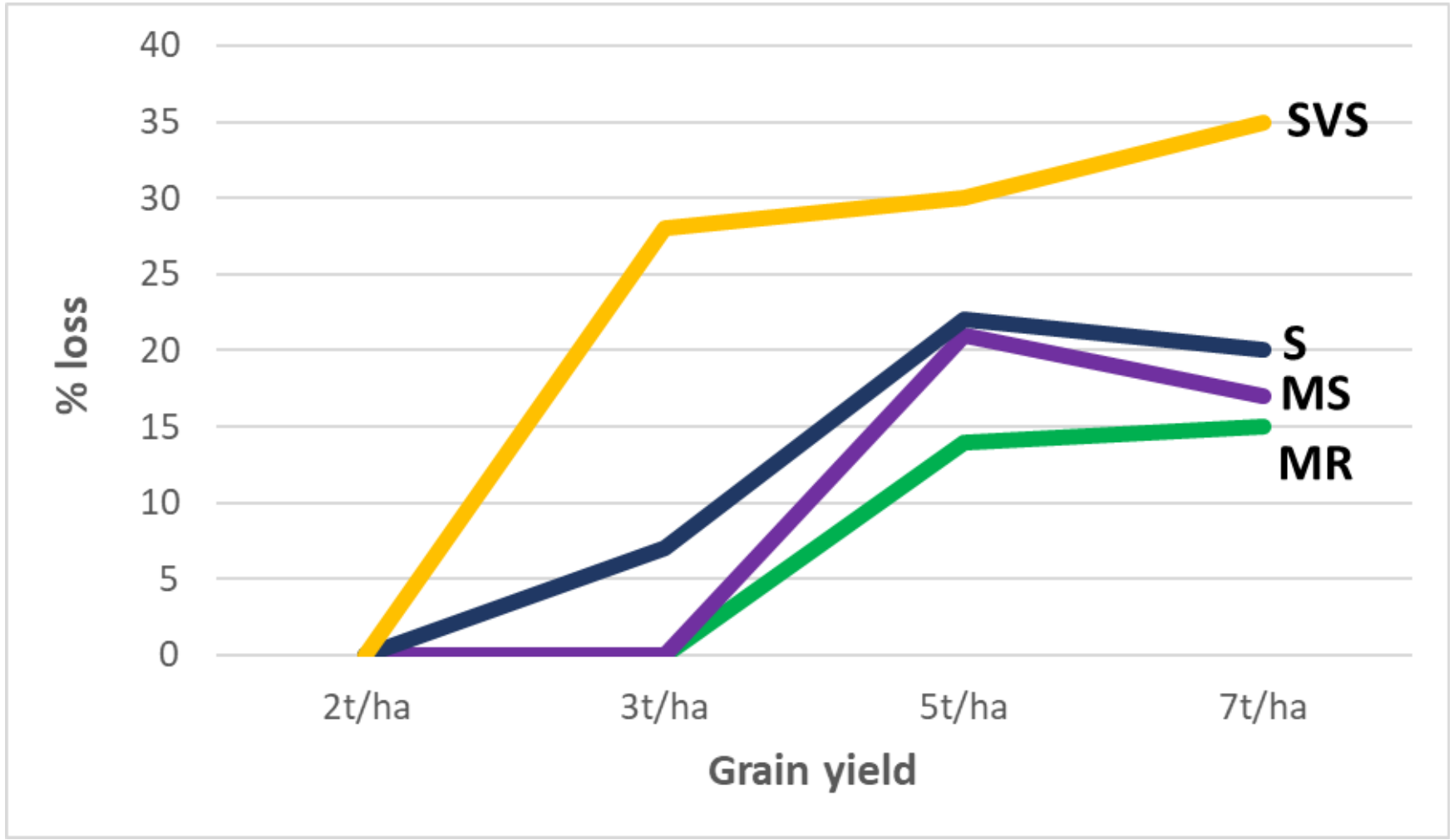
Know the diseases of risk for each variety

- **SVS** and **VS** ratings need to be proactively managed
- **MS** and **S** need to be monitored with a fungicide plan in place
- **MR** and **MRMS** should be monitored

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

Variety	Origin	Year of release	Resistances and tolerances	
			Net Blotch (Net Form) resistance	Net Blotch (Spot Form) resistance
Alestar	Elders Rural Services Australia Ltd	2014	MRMS-S	S
Banks	Intergrain Pty Ltd	2018	MR	S
Bass	Intergrain Pty Ltd	2011	MS-SVS	MSS
Beast	Australian Grain Technologies Pty Ltd	2020	MRMS-S	MS
Bottler	Grainsearch	2017	R-MS	MSS
Buff	Intergrain Pty Ltd	2018	MR-MS	MSS
Combat	Intergrain Pty Ltd	2022	MRMS-S	RMR
Commander	University of Adelaide	2008	S-VS	MSS
Commodus CL	Intergrain Pty Ltd	2021	MRMS-MSS	MSS

Variety selection – SFNB potential loss



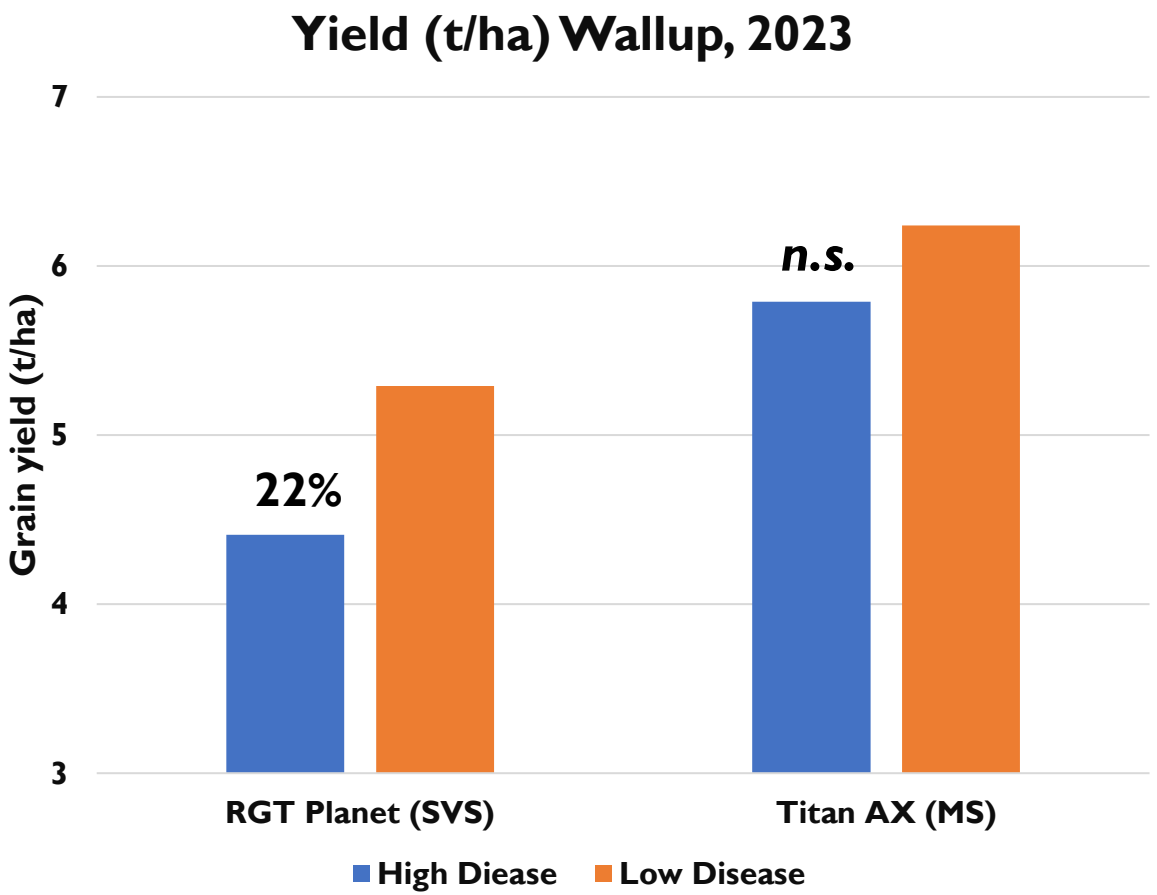

SPOT FORM NET BLOTCH
FACT SHEET
GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION
NATIONAL
FEBRUARY 2020

Spot form net blotch in barley: a comprehensive guide to economic management

KEY POINTS

Summary

Variety selection - NFNB



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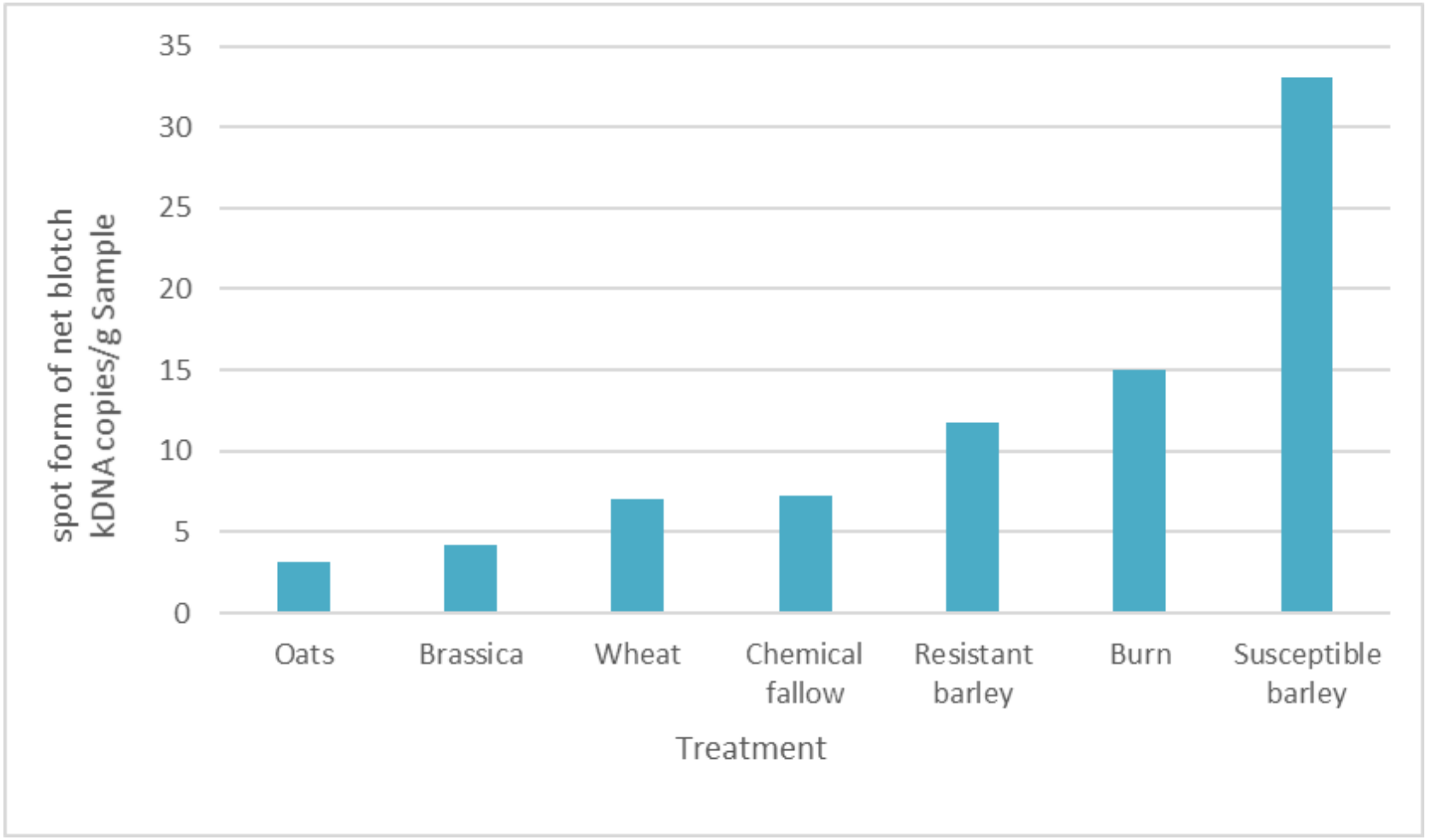
Crop rotation and cultural methods help reduce inoculum load

- Break between barley crops
  - Aim for >3 years
- Cereals/pulses/canola
  - More diversity is better

Crop rotation reduces inoculum load



Results from PredictaB soil sampling in Feb 2018.

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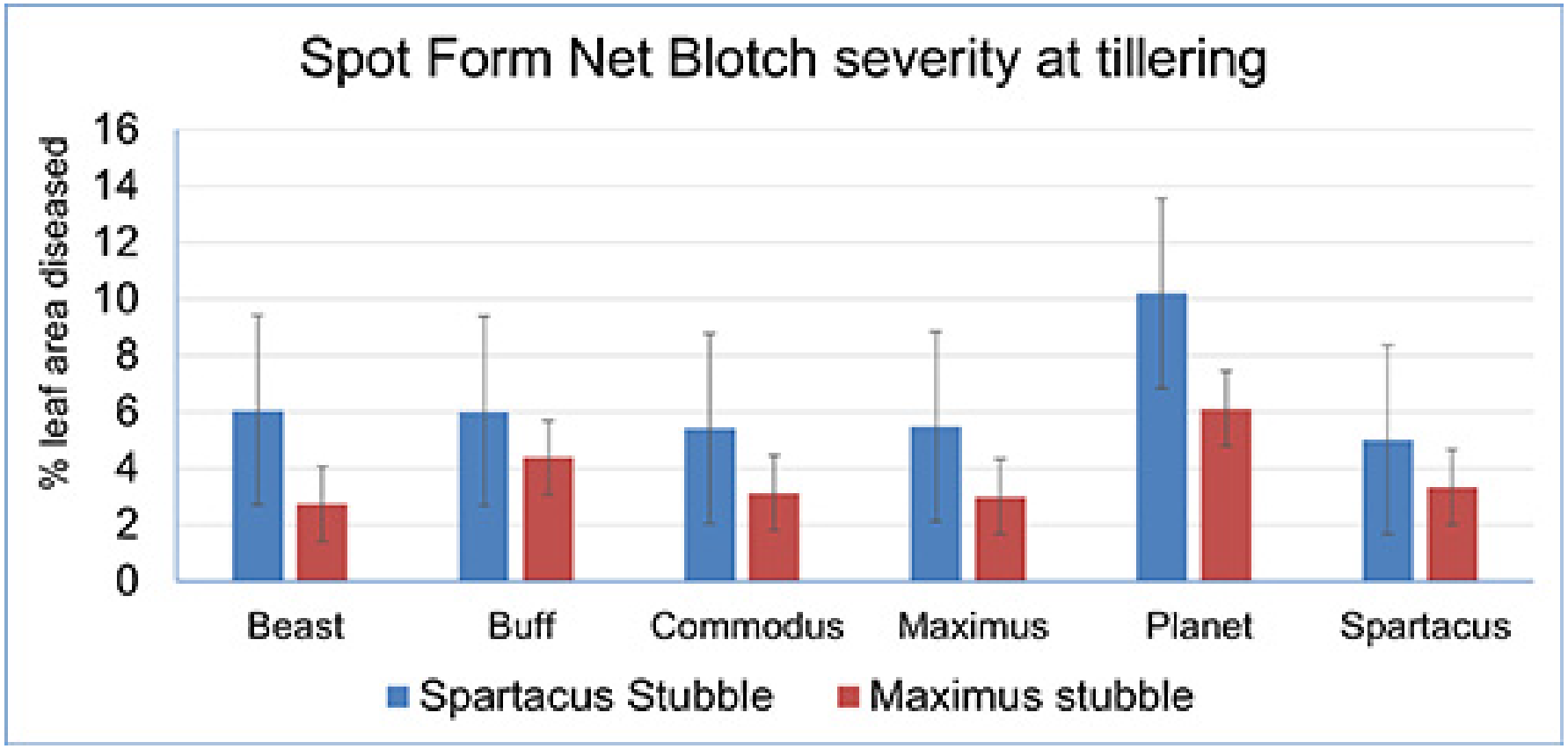
Crop rotation reduces inoculum load



Slide courtesy: Jason Bradley, DPIRD, WA

Fungicides: Avoid un-necessary use

- Not every blotch of a leaf is a fungal disease
- Not all disease causes yield loss
- Low disease levels not an issue
- Late epidemics of less concern
- Use decision support tools

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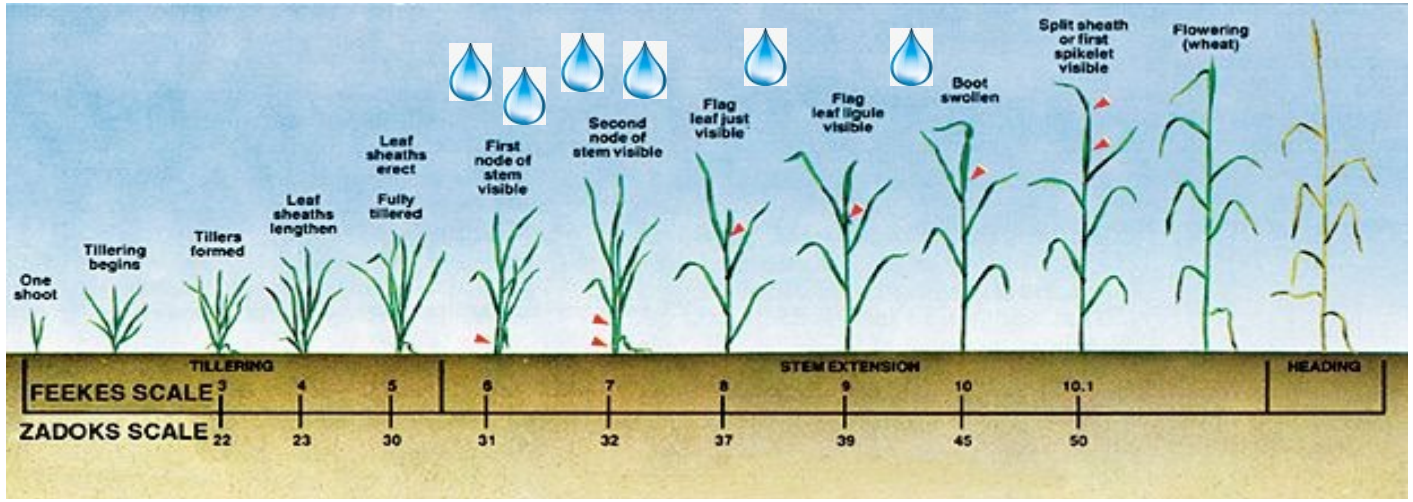
Effective strategies for Net blotches

Seed treatment + foliar fungicide at flag emergence (Z37-9)

or



Foliar fungicide at stem elongation (Z30-2) & flag emergence (Z37-9)

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When using fungicides

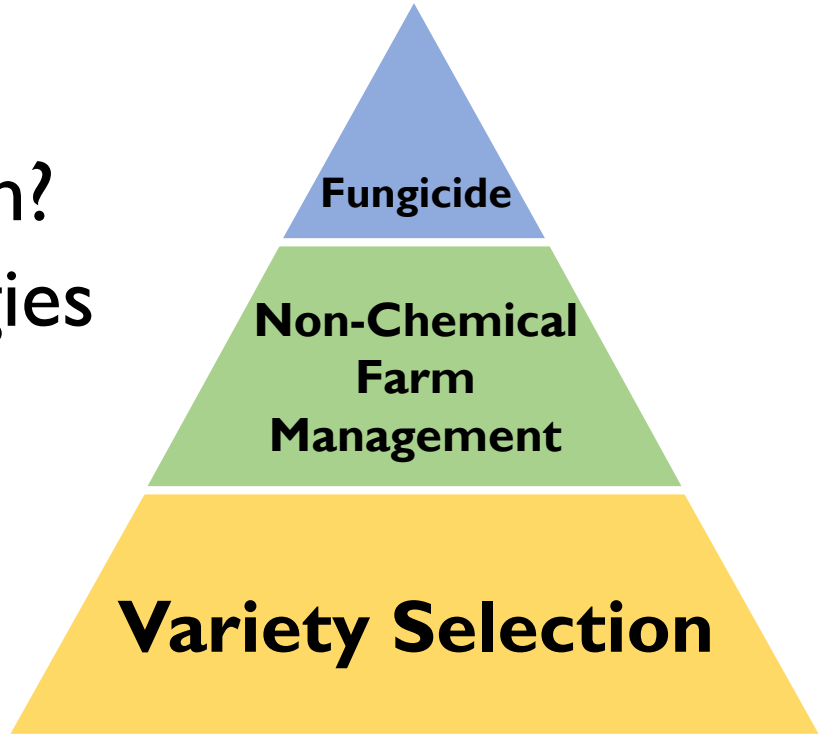
- Only spray if necessary – **limit applications**
- Avoid same fungicide active more than once in a growing season.
- If you can, use fungicide mixtures, preferably with more than one Mode of Action.
- Try to avoid using Group 7 SDHI and Group 11 QoI fungicide actives more than once in a growing season (even applied on seed or fertilizer).

Summary

Net Blotch fungicide resistance becoming more prevalent

KNOW YOUR RISK

- What resistances are present in your region?
- Use integrated disease management strategies
- Know your variety resistance rating
- Be proactive and have a plan
  - Target key fungicide timings
  - rotate modes of action



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Queensland Government | Department of Agriculture and Fisheries

BCG Shared Solutions | University of Tasmania | TIA | Tasmanian Institute of Agriculture

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

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

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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