AZOLE RESISTANCE IN SPOT FORM NET BLOTCH IN WESTERN AUSTRALIA

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Azole resistance in Spot form net blotch in Western Australia

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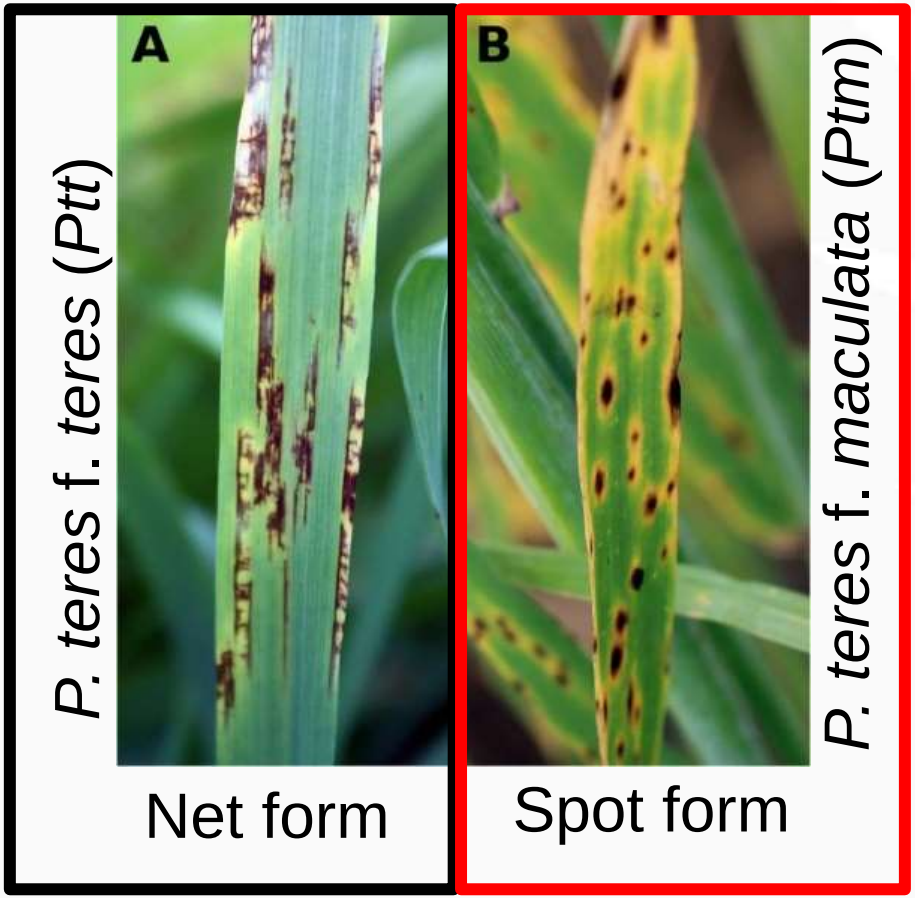
- Fungicide resistance to Group 3 (DMI) fungicides in SFNB is spreading in the southern region of WA.
- Resistance was found from 2017 onwards and was associated with the barley variety Oxford.
- Several Group 3 actives (DMI) are affected and effective management strategies need to be deployed to limit further development and spread of fungicide resistance.

Net Blotches of Barley – *Pyrenophora teres*



- Among the most economically significant diseases of barley worldwide
- Two species which are closely related:
  - *P. teres* f. sp. *teres* (*Ptt*), Net-form of Net blotch (NFNB)
  - *P. teres* f. sp. *maculata* (*Ptm*), Spot-form of Net blotch (SFNB)
- Demethylase-inhibitor (DMI) fungicides are a key component of control programs

Syme, RA, Martin, A, Wyatt, NA, Lawrence, JA, Muria-Gonzalez, MJ, Friesen, TL, Ellwood, SR (2018) Transposable Element Genomic Fissuring in Pyrenophora teres Is Associated With Genome Expansion and Dynamics of Host–Pathogen Genetic Interactions. *Frontiers in Genetics* **9**, **130**

Shock & Awe, or: When Control Fails

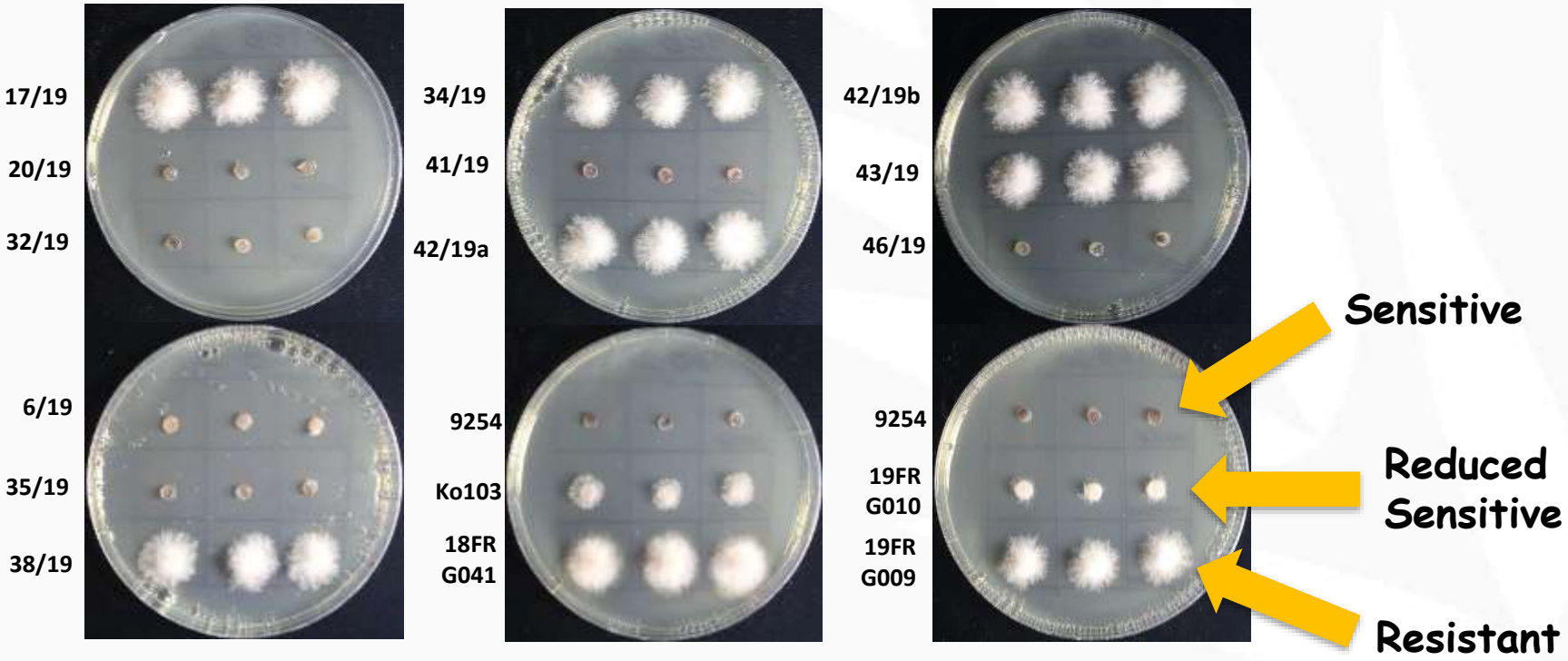
Photographs courtesy of Kith Jayasena (Department of Primary Industries & Regional Development, Western Australia).

A field in South Stirling showing symptoms of SFNB following treatment with:

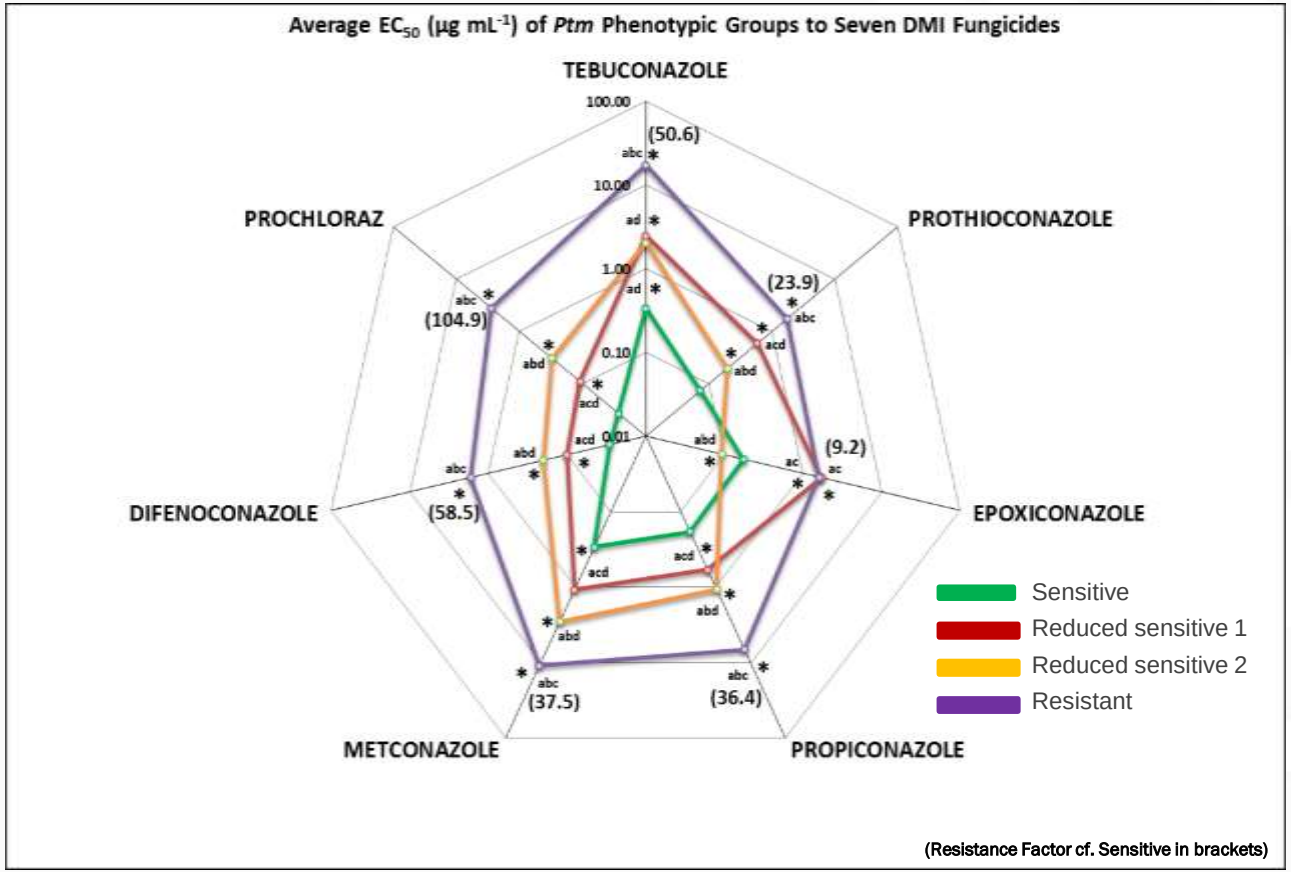
1. Tebuconazole, 400mL/100kg (SD)
2. Propiconazole, 325mL/ha @ Z25
3. Cyproconazole + Azoxystrobin, 400mL/ha @ Z31
4. Epoxiconazole, 250mL/ha @ Z39
5. Propiconazole, 500mL/ha @ Z52

Three levels of DMI sensitivity in SFNB

In vitro analysis of 268 isolates of *Ptm* collected 1996-2019 from WA barley-growing regions



Sensitivity to various DMI fungicides

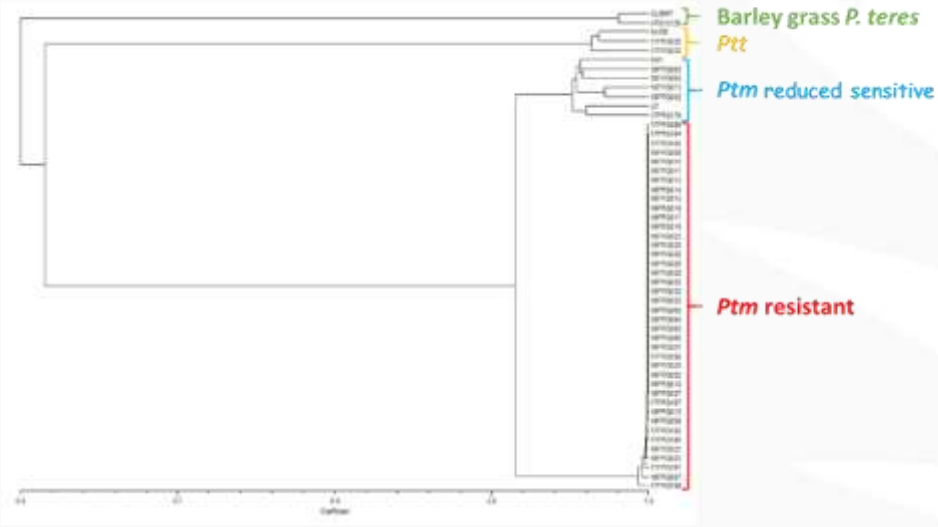


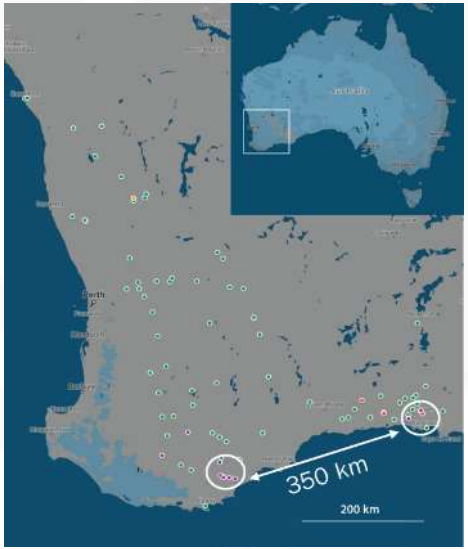
Three sensitivity groups:

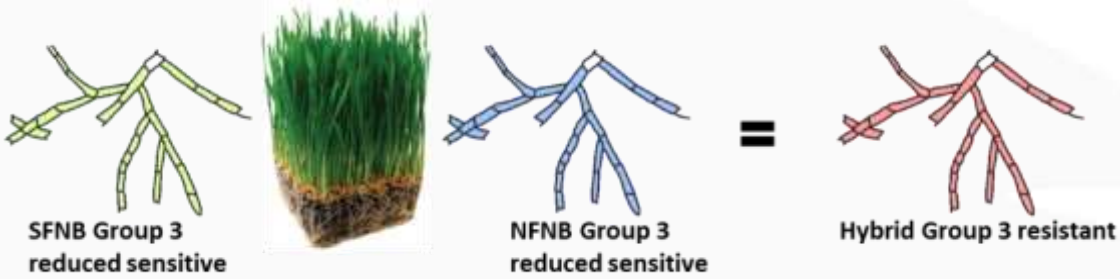
- Sensitive (S)
- Reduced sensitive (RS)
- Resistant (R)

*The mean difference between groups [a]S, [b]MR1, [c]MR2 & [d]HR is significant at 0.05 level (Kruskal-Wallis H test & Dunnett's T3)

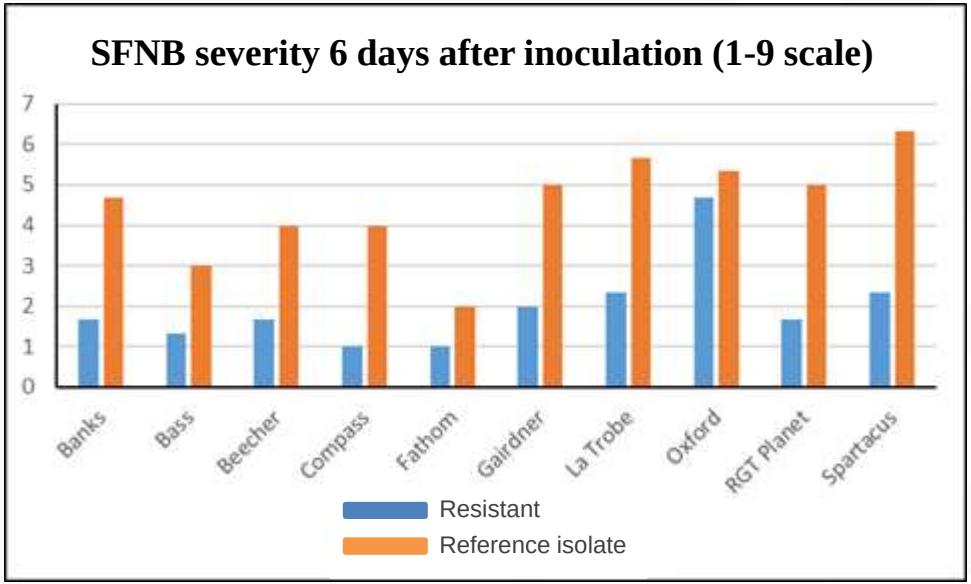
An interesting origin







Host genetics and fungicide resistance are associated



Photographs courtesy of Kith Jayasena (Department of Primary Industries & Regional Development, Western Australia).

Glasshouse seedling test

Two isolates (S and R)

No fungicides

DMIs are compromised in the field

Treatment	Fungicide active ingredient	FRAC group	Grain yield (t/ha)
Untreated			0.90 [c]
Propiconazole	250 g/L propiconazole	3	0.87 [c]
Opus	125 g/L epoxiconazole	3	0.89 [c]
Prosaro	210 g/L prothioconazole + 210 g/L tebuconazole	3 + 3	1.23 [bc]
AmistarXtra	200 g/L azoxystrobin + 80 g/L cyproconazole	11 + 3	1.34 [bc]
Radial	75 g/L azoxystrobin + 75 g/L epoxiconazole	11 + 3	1.47 [b]
Opera	85 g/L pyraclostrobin + 62.5 g/L epoxiazole	11 + 3	1.58 [b]
AviatorXpro	150 g/L prothioconazole + 75 g/L bixafen	3 + 7	2.43 [a]

P value <.001

From: Fungicide efficacy on DMI resistant spot form net blotch in West Australia's high rainfall zone. Andrea Hills. 19th Australian Barley Technical Symposium, 2019, Perth.

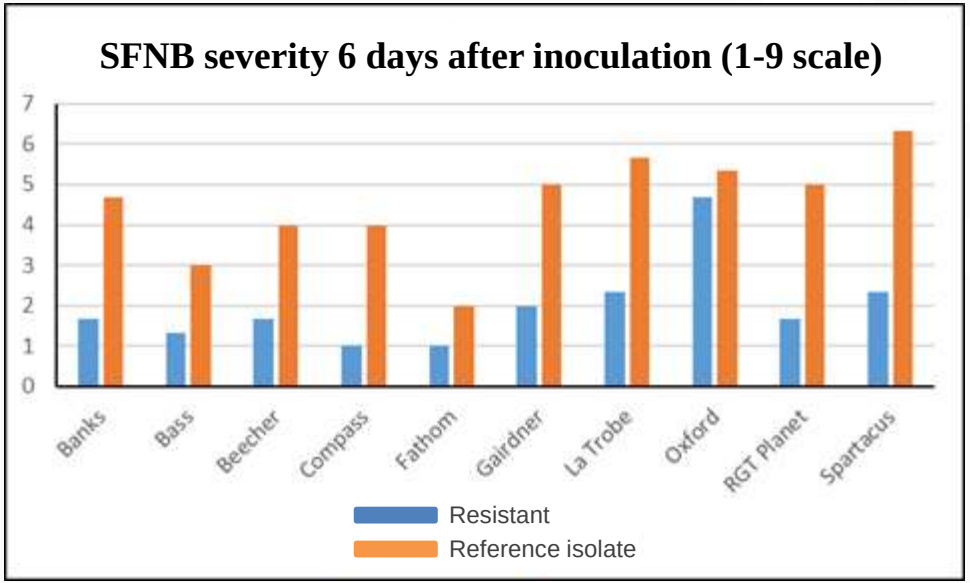
Dalyup paddock

Highest registered rate

Z47-49

Management strategies
Non-chemical methods

- Do not grow Oxford



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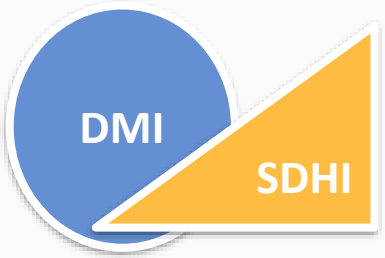
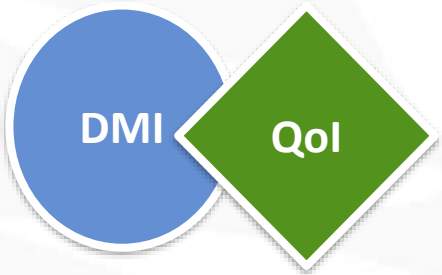
Chemical management

- Only spray if necessary – **limit applications**
- Choose mixtures with **different modes of action** (if available)





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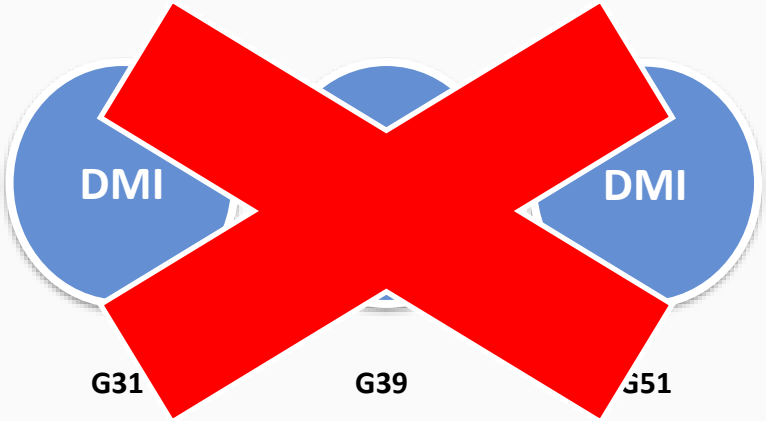

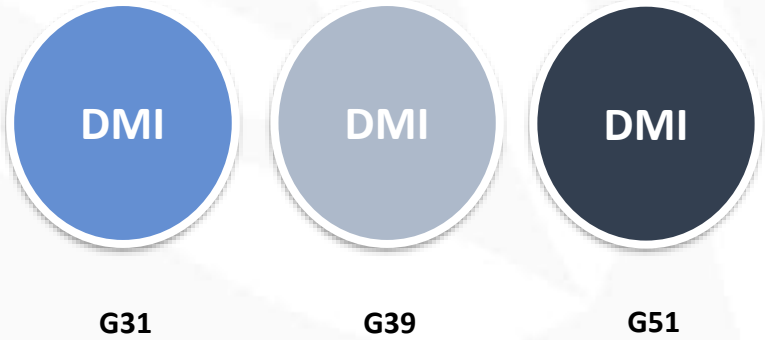

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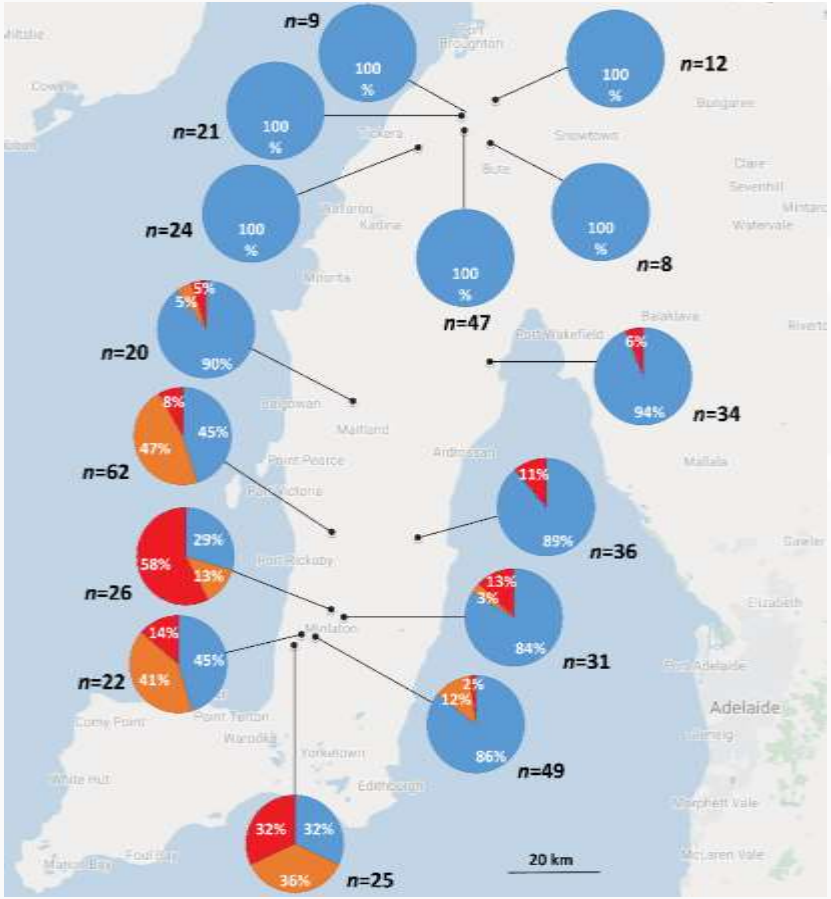
SDHI resistance in NFNB



Sensitive	78.2 %
Reduced sensitive †	11.7 %
Resistant ‡	10.1 %
	n = 427

† Sensitivity level equivalent to *SdhD*-D145G

‡ Sensitivity level equivalent to *SdhC*-H134R

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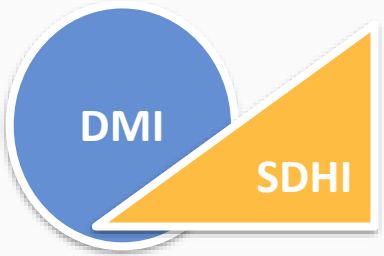

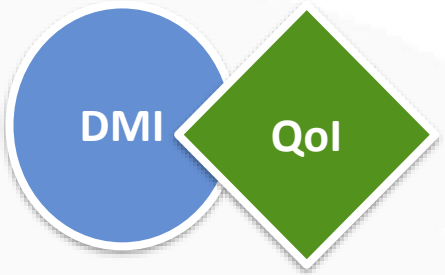

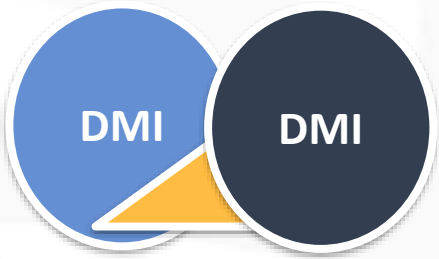

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- Group 7 & 11 fungicides (seed dressing and foliar) should not be used more than **once per season** in any crop rotation
- Use fungicides **before wide infection**
- Do not compromise effective control – **stay within label rates**
- **Test your samples!**

BATTLING NET BLOTCH IN BARLEY

WHEN CO-INNOVATION GOES TO WORK IN WA'S SOUTH – RESISTANCE DETECTION AND IN-FIELD SOLUTIONS

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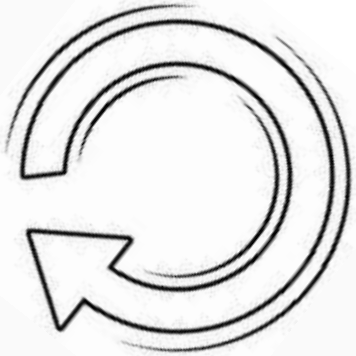
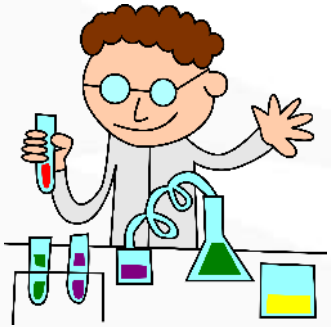
So there is resistance, now what?





How does the project work?

Extensive communication campaign

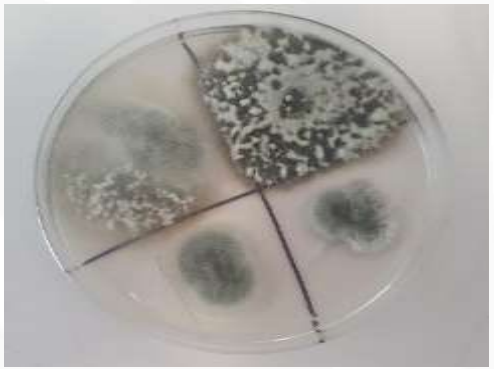
Distribution of 500 sampling kits across the southern wheatbelt

173 farmers and 330 paddocks

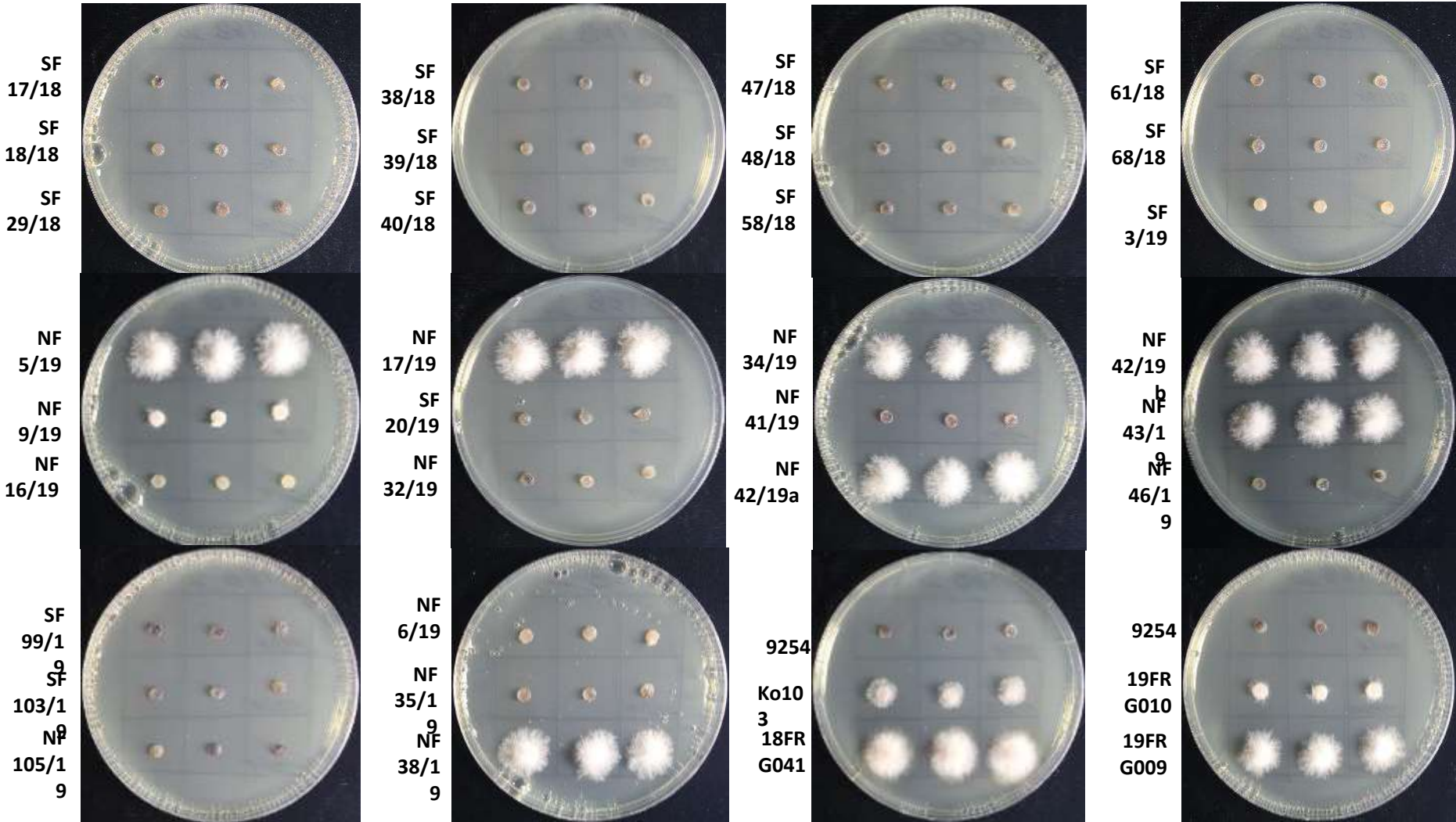
How does the project work?

Leaves were logged, photographed and scored (% leaf area of lesions)

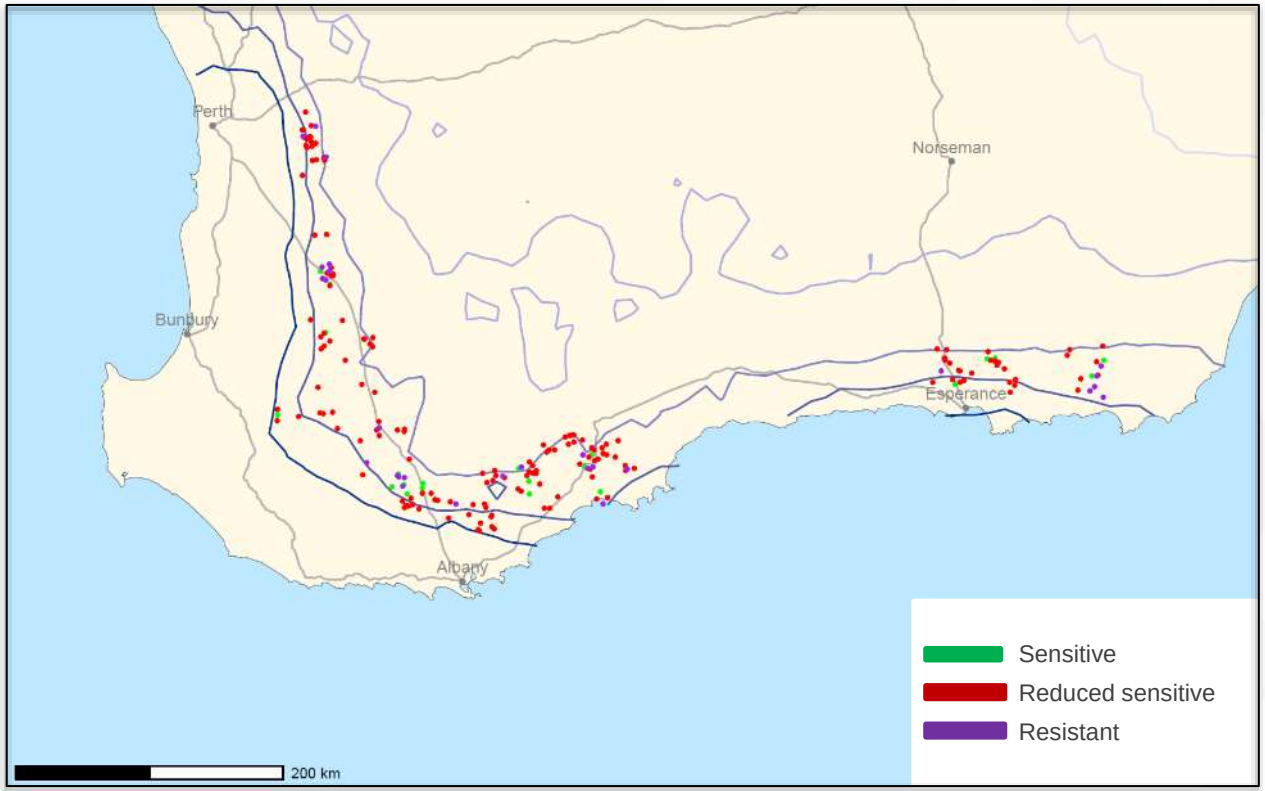
A composite sample (3 to 10 leaves) was selected, oven dried, milled and subsampled



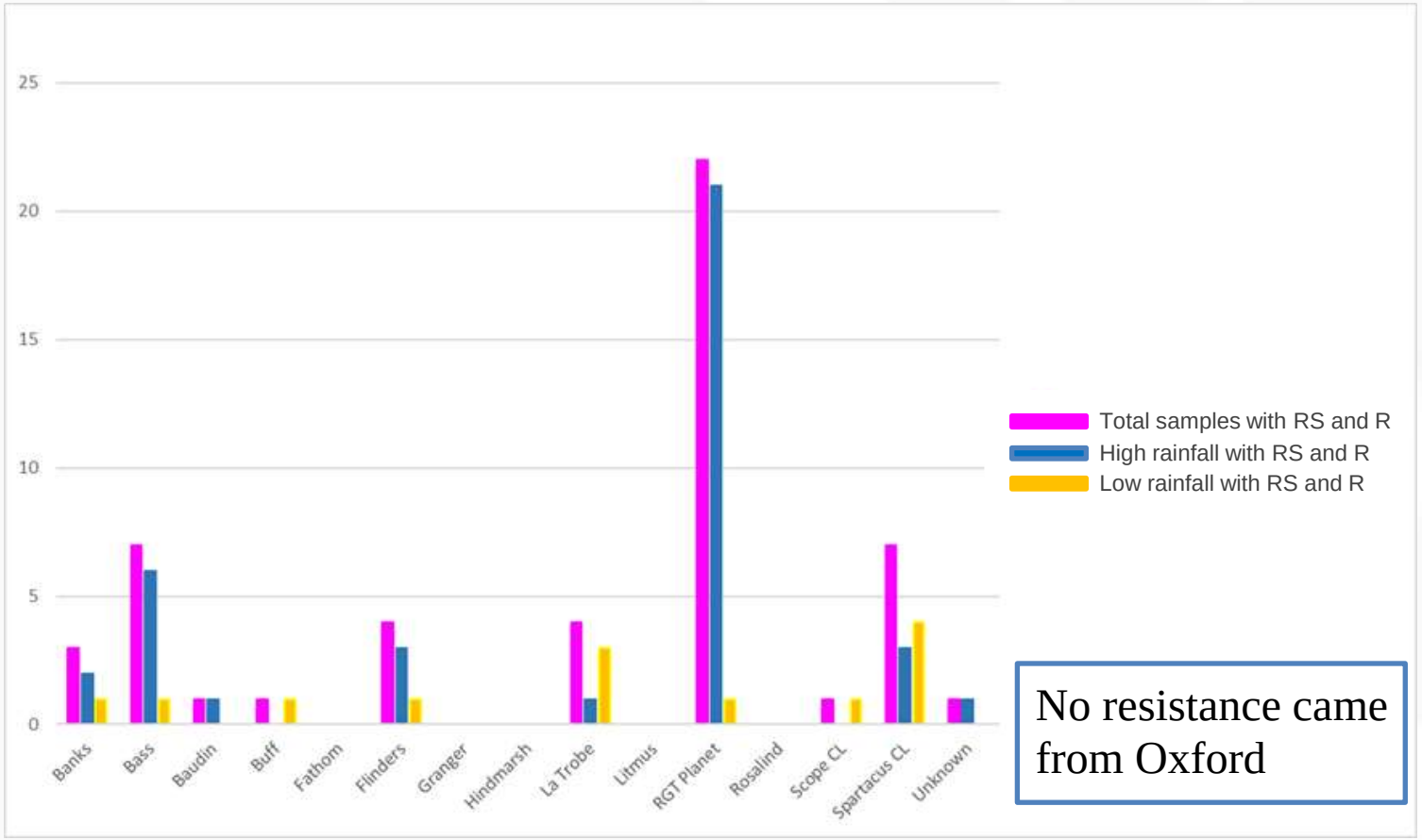
Fungicide resistance diagnosis


SF 17/18
SF 18/18
SF 29/18
SF 38/18
SF 39/18
SF 40/18
SF 47/18
SF 48/18
SF 58/18
SF 61/18
SF 68/18
SF 3/19
NF 5/19
NF 9/19
NF 16/19
NF 17/19
SF 20/19
NF 32/19
NF 34/19
NF 41/19
NF 42/19a
NF 42/19b
NF 43/19
NF 46/19
SF 99/19
SF 103/19
NF 105/19
NF 6/19
NF 35/19
NF 38/19
9254 Ko103
18FRG041
9254 19FRG010
19FRG009

Distribution of resistance in SFNB



Resistance is not limited to Oxford



No resistance came from Oxford

Management advice provided

Active ingredient from Group 3	Sensitive Result	Reduced Sensitivity Result	Fungicide Resistant Result	Common brand names of foliar fungicides registered for SFNB and NFNB
Tebuconazole				Veritas®, Custodia®
Propiconazole				Topnotch®, Aurora® 250, Bumper®, Cracker®, Detour®, Procon®, Propi® 250, Propicol®, Propicure®, Prestige®, Petulant® 250EC, Propeller® 250, Picaro® 250EC, Pace®, Restore®, Tilt® 250, Propiconazole 250, Propicon® 250, Slipstream®, Throttle® 500, Prop® 500, Propiconazole 500
Prothioconazole				Aviator Xpro®, Prosaro®
Epoxiconazole				Radial®, Serial® 150 EC, Tazer® Xpert, Avior Gold, Epoxiconazole 500, Soprano® 500 1, Opera®, Opus®125

Take home messages

- In 2019, the barley disease cohort project was established with participants from the South of the Western Australian Wheatbelt.
- 173 farmers are enlisted. Data obtained from 330 paddocks is currently being analysed.
- The project's aim is to directly engage and work with growers to find regionally relevant solutions to manage fungicide resistant diseases.
- The project currently focuses on SFNB and NFNB.

Acknowledgements

Centre for Crop and Disease Management (CCDM), Curtin University

Chala Turo, Kejal Dodhia, Simon Ellwood, Richard Oliver & **Wesley Mair**

Linda Thomson, **Megan Jones**, Azin Moslemy, Ting Tang, Wesley Mair, Lorenzo Covarelli & Mark Gibberd

Centre for Crop Health, University of Southern Queensland

Anke Martin

Department of Primary Industries and Regional Development (DPIRD), Government of Western Australia

Geoffrey Thomas, Andrea Hills & Kithsiri Jayasena