AFREN WEBINAR:
Northern region seasonal update

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

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Wednesday 4 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

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Housekeeping

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- To ask a question:
  - Click on Q&A on the bottom of your screen, 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.

Fungicide resistance

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Australian Fungicide Resistance Extension Network

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Why do we use fungicides?

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- Protect the yield potential of crops
- Limit the impact of disease on yields
- Disease control, not elimination
- Risk of severe disease
  - Background inoculum levels, crop susceptibility, environment

What is fungicide resistance?

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- A reduction in sensitivity of a fungus to a specific fungicide
  - Heritable (genetic) characteristic
  - Potential cross resistance within fungicide groups
- Fungicides have reduced ability to control disease
  - Spectrum of control ranging up to field failure
- Risk of yield loss if fungicide resistance develops
- Level of reliance on fungicides can inform risk

How does fungicide resistance emerge?

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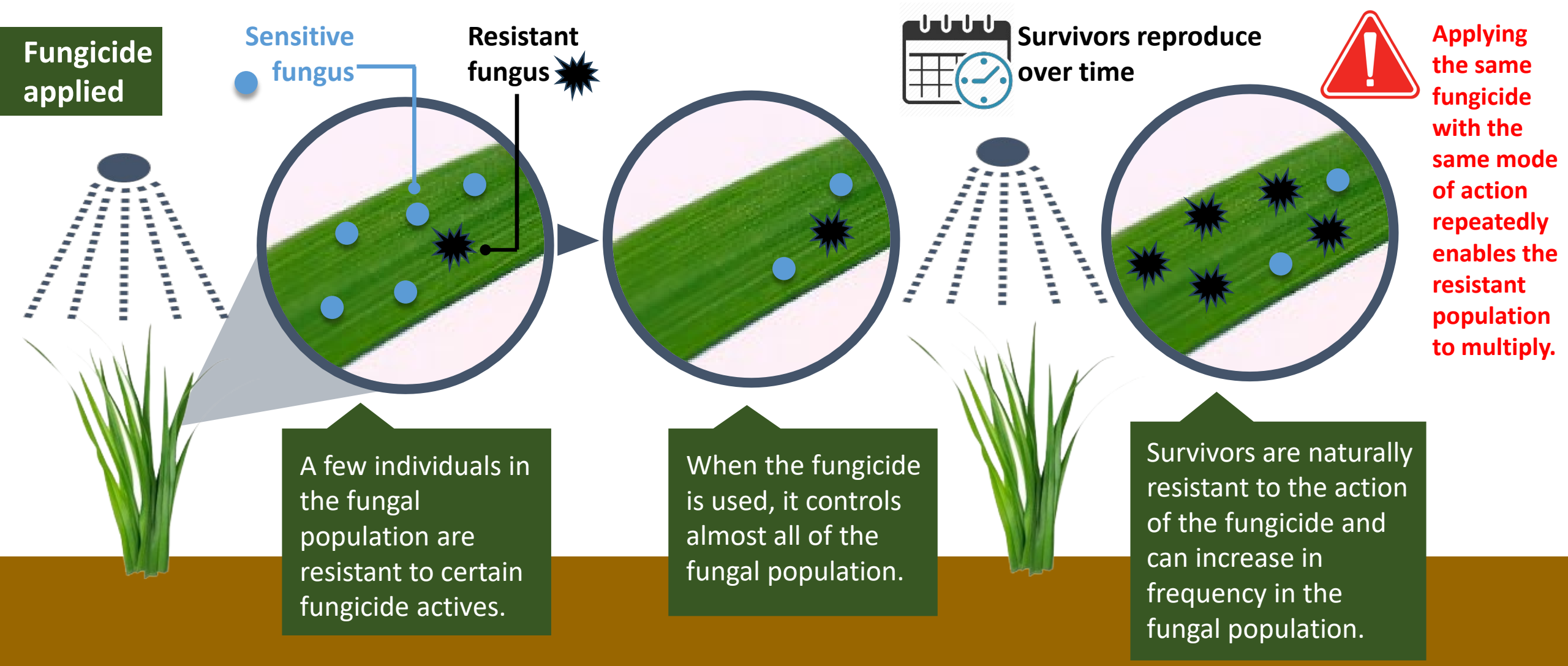

Modified from CropLife Australia Fungicide Resistance Management Fact Sheet - https://www.croplife.org.au/resources/programs/resistance-management/fact-sheet-fungicide-resistance/

Path to fungicide resistance

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- Every fungicide application selects for resistant fungi (diseases)
- Diseases differ in risk for resistance
- Fungicides differ in risk for resistance development
- Can we reverse resistance after it emerges?

Co-pilot

Fungicide resistance terminology

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Sensitive

- Fungi are killed by a fungicide at recommended label rate

Reduced sensitive

- Fungi can persist at low fungicide rates
  - Reduction in product performance
  - May not be noticeable in the field
  - May need maximum label rates of fungicide to obtain control

Resistant

- Fungi survive at maximum fungicide rates
  - Fungicide fails to provide acceptable control of pathogen in the field at maximum label rates

Lab detection

- Phenotype – fungal growth on media
- Genotype – fungal DNA sequence associated with resistance

Ireland et al. 2021 , Fungicide resistance management in Australian grain crops, GRDC

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.

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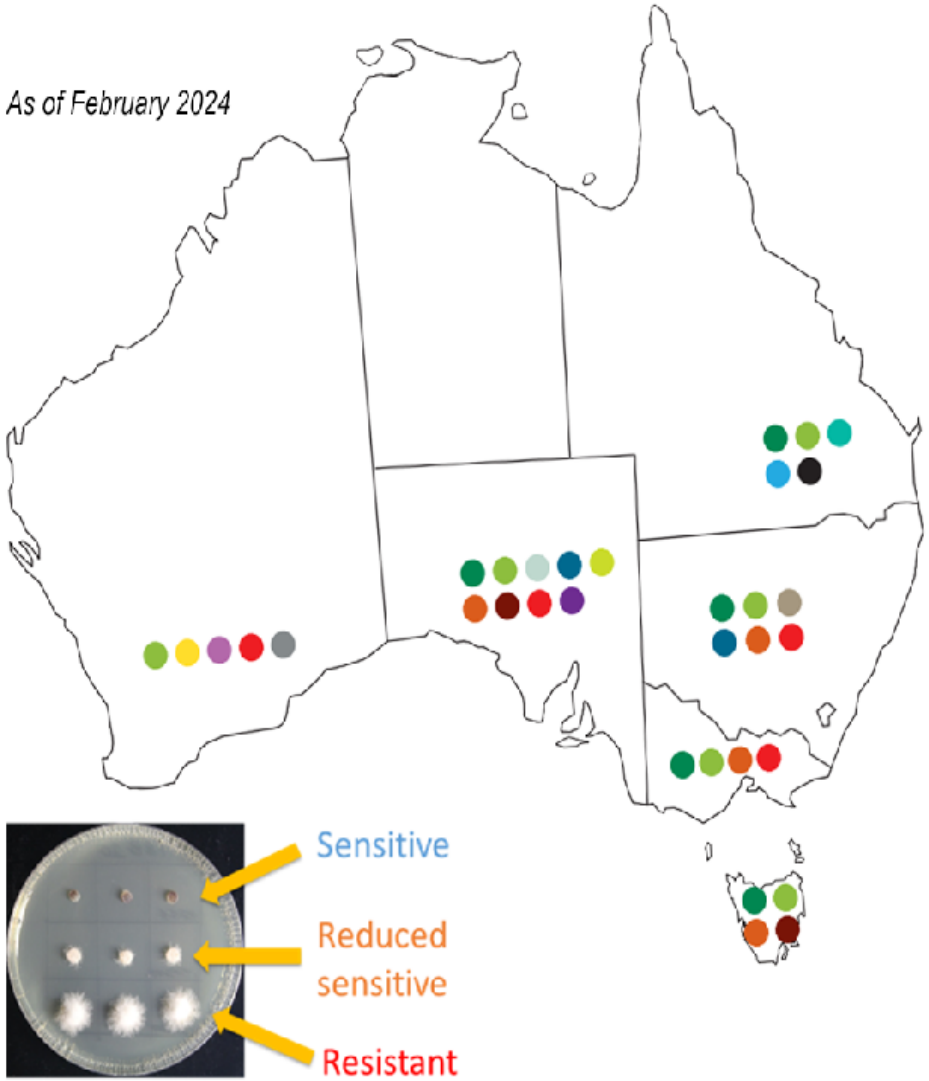
As of February 2024



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

Wheat powdery mildew	R - Group 11 QoI; Group 3 DMI
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
Septoria tritici blotch	RS - Group 3 DMI
Septoria tritici blotch	L mutation R - Group 11 QoI
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 – risk factors

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- More disease (pathogen) = Greater chance of fungicide resistance

- Risk of fungicide resistance greatest when:
  - Pathogen = rapid reproduction, high virulence
  - Fungicide = single mode of action used repeatedly
  - Host = susceptible variety

Fungicide management

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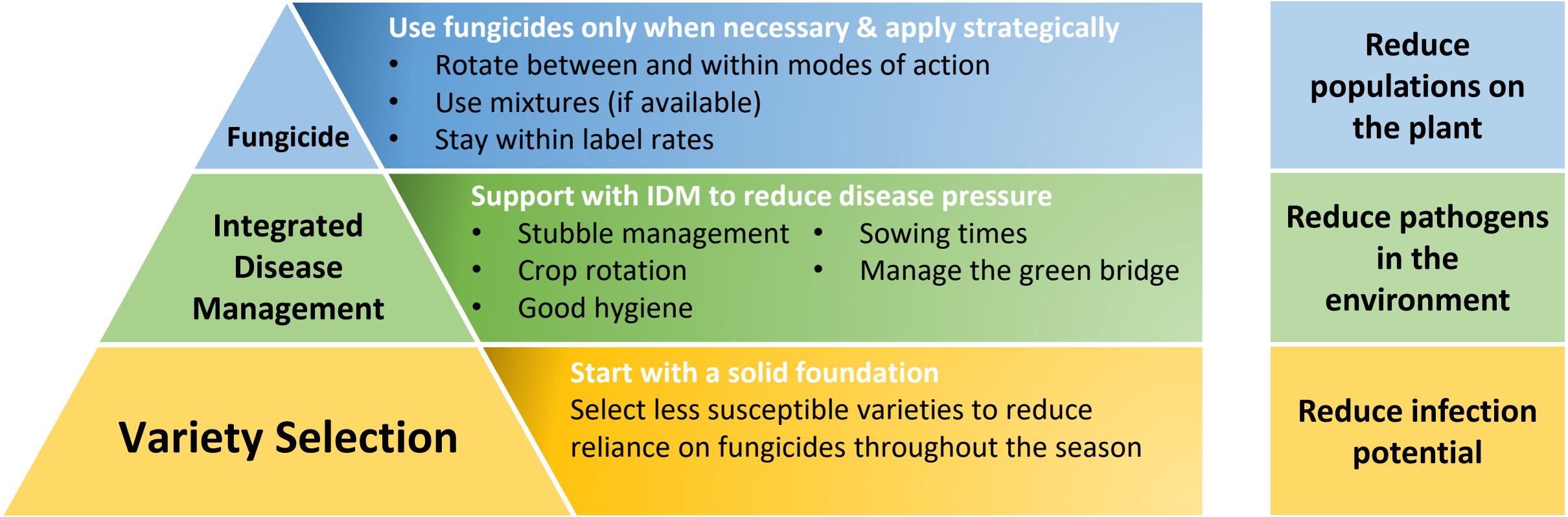

Fungicide management

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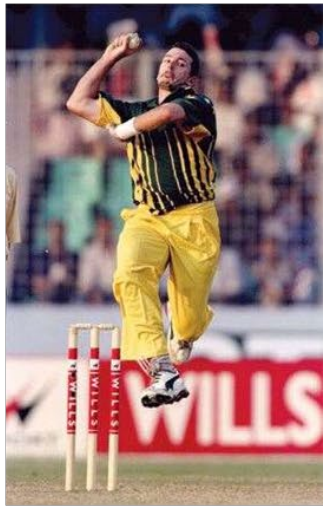
Mixtures

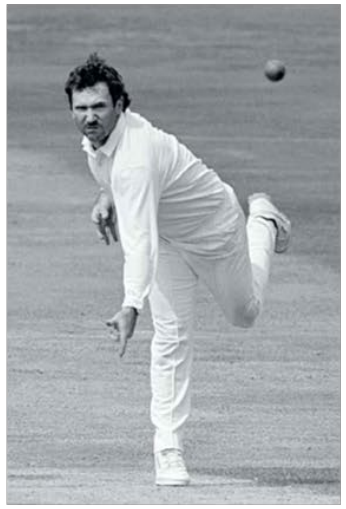

Wrist spin

Group 3

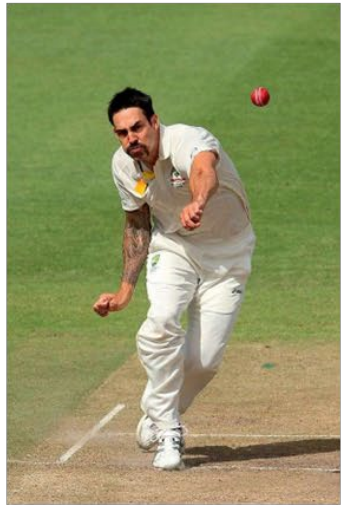
Swing

Group 7

Finger spin

Group 11




Pace

Fungicide management tips

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- Only spray if necessary – **limit applications**
- Choose mixtures with **different modes of action** (if available)
- Never apply the same Group 3 fungicide twice in a row – **alternate sprays**
- 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**
- **Monitor fungicide effectiveness** & test your samples

Monitoring fungicide resistance

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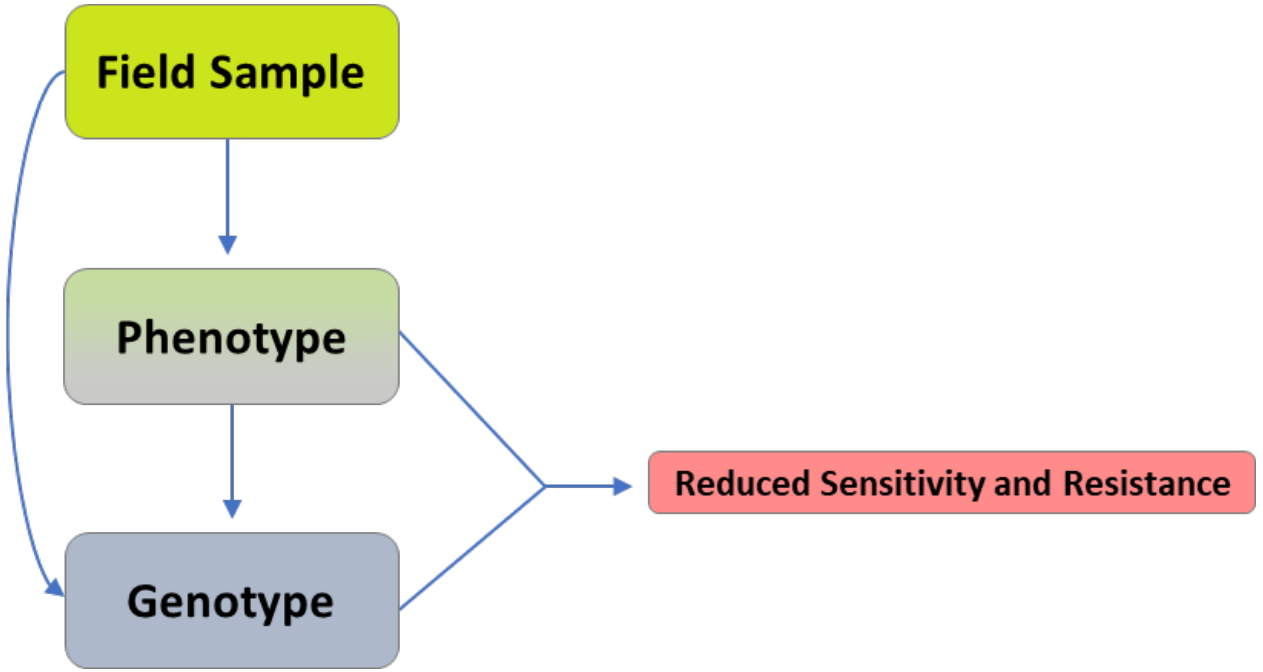
- Characterisation
  - Phenotype
    - Growth with fungicides
  - Genotype
    - Link DNA changes to phenotype
- Informed Detection
  - Monitor DNA changes in field samples
    - Fungal isolates - pure
    - Leaf lesions – mixtures
- Not just presence, but how much



The Fungicide Resistance Five

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1. Avoid susceptible crop varieties
2. Rotate crops – use time and distance to reduce disease carry-over
3. Use non-chemical control methods to reduce disease pressure
4. Spray only if necessary and apply strategically
5. Rotate & mix fungicides / MoA groups

Connect with AFREN

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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

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

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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

Fungicide resistance in Queensland

Disease	Fungicide Group
Mungbean Powdery Mildew	Group 3
	Group 11
Wheat Powdery Mildew	Group 3
	Group 11
Wheat Leaf Rust	Group 3
Barley Powdery Mildew	Group 3
Barley Leaf Rust	Group 3
Barley Net Blotch	Group 3
	Group 7
	Group 11

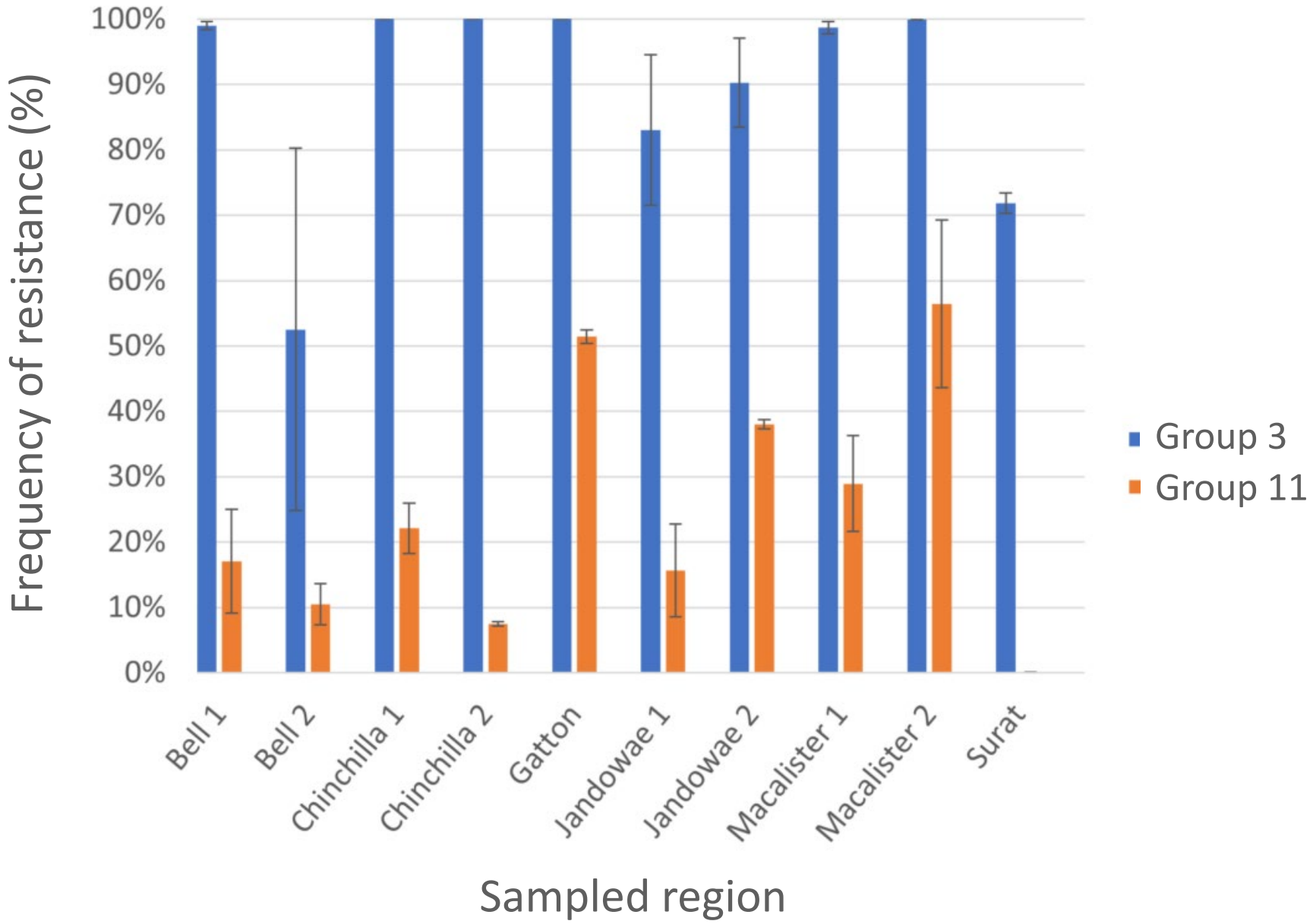
Wheat powdery mildew - 2022

- Group 3 and 11 resistance detected
- Group 3 resistance in all fields
- Group 11 resistance in 5 of 6 fields

Source: https://www.ccdm.com.au/queensland-joins-the-rest-of-australia-with-fungicide-resistance/

Wheat powdery mildew - 2022

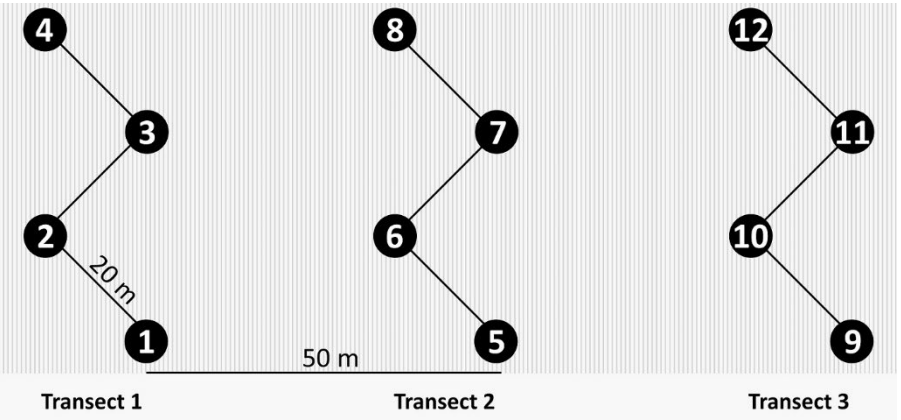
Steven Simpfendorfer – NSW DPI
Kejal Dodhia – CCDM
Fran Lopez-Ruiz - CCDM

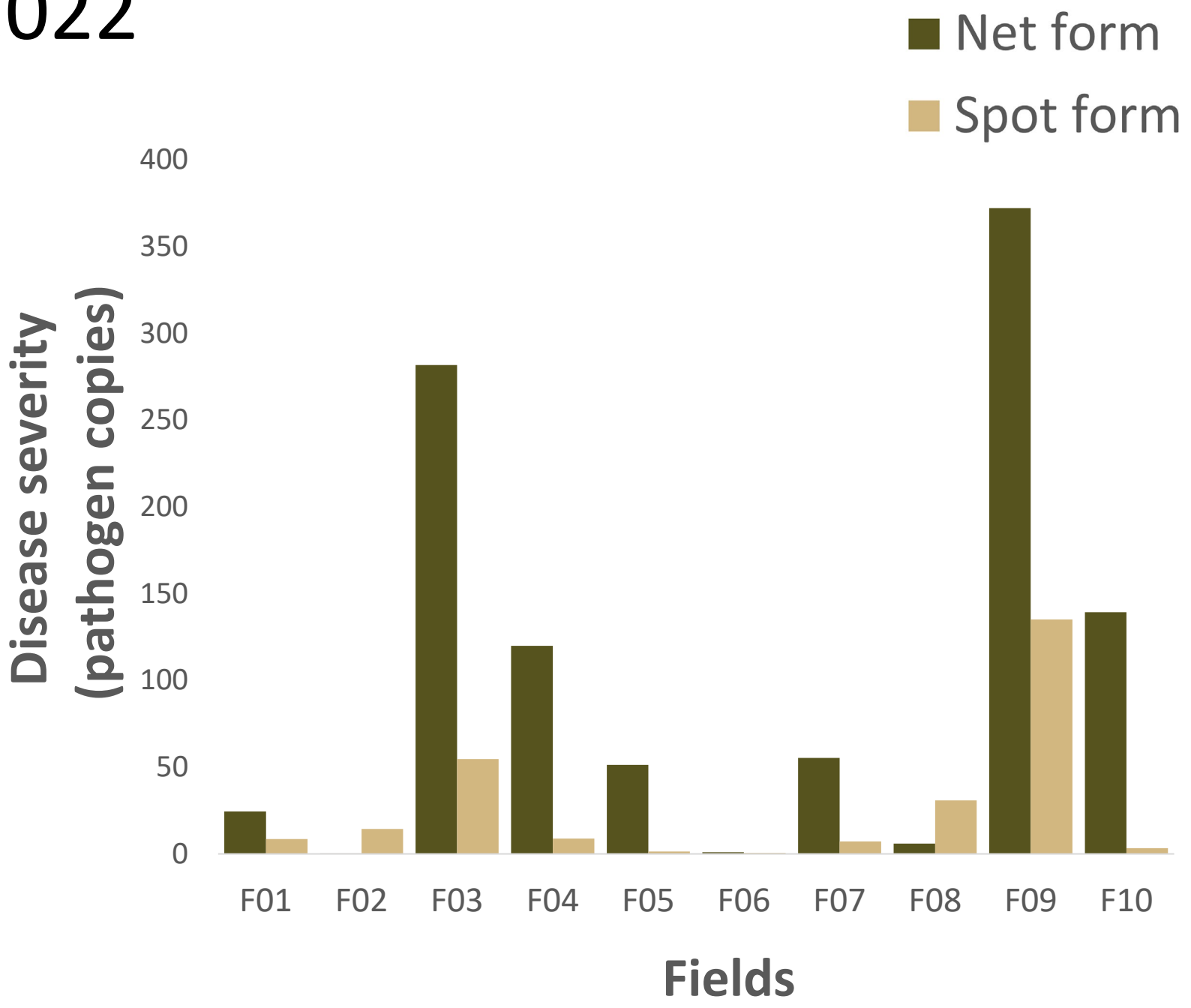


Source:
https://www.ccdm.com.au/queensland-joins-the-rest-of-australia-with-fungicide-resistance/

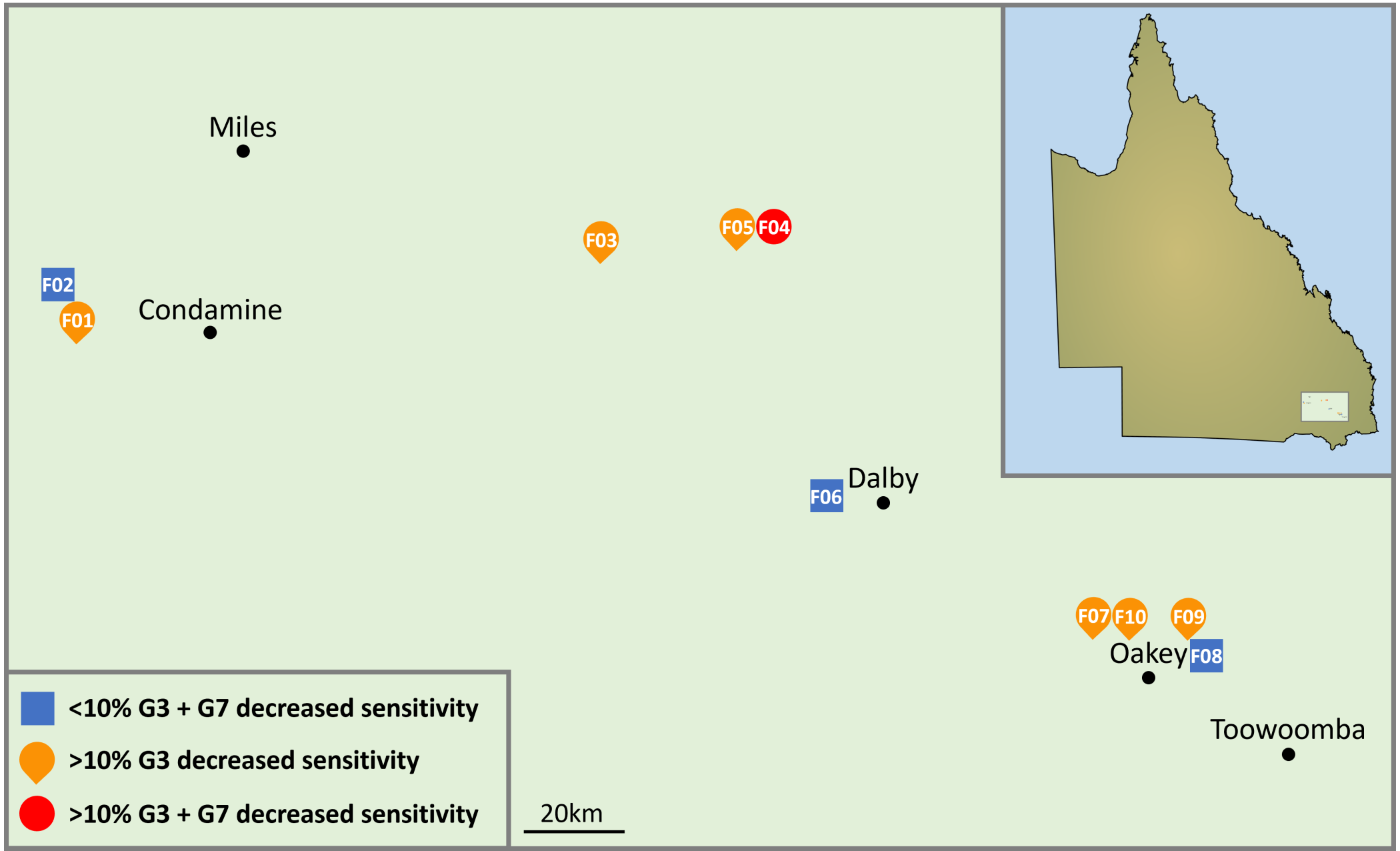
Barley net blotch - 2022

- 10 barley fields sampled
- Combined 60 lesions
- Quantified DNA markers

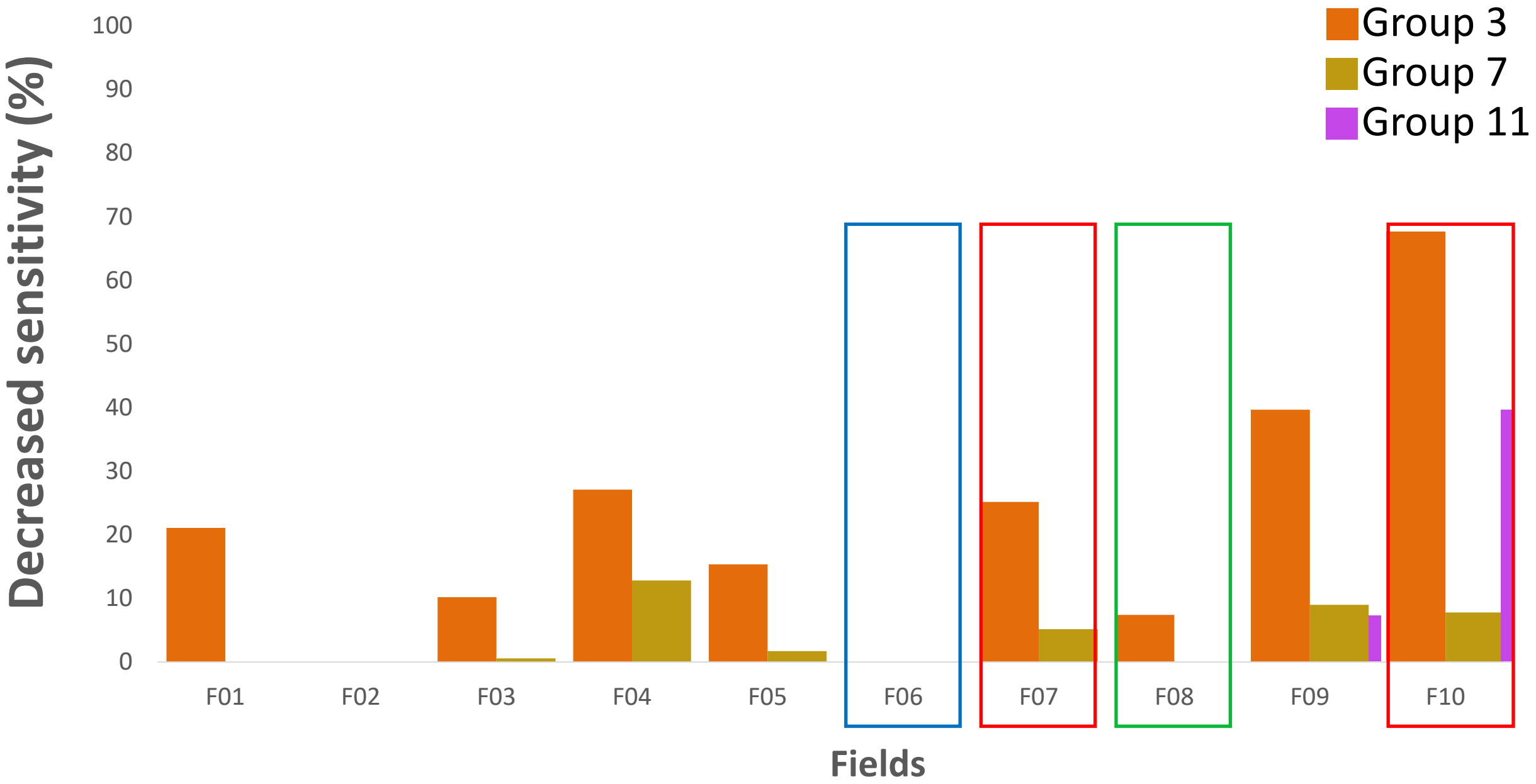




Field locations



Decreased fungicide sensitivity frequencies



Group 3 - Demethylation Inhibitors (DMI)

- **80%** of fields had decreased sensitivity
- **34%** of the population had decreased sensitivity

Group 7 - Succinate Dehydrogenase Inhibitors (SDHI)

- **60%** of fields had decreased sensitivity
- **6%** of the population had decreased sensitivity

Group 11 – Quinone Outside Inhibitors (QoI)

- **20%** of fields had decreased sensitivity
- **5%** of the population had decreased sensitivity

Key messages

- Fungicide resistance present in Queensland
  - Variety selection and inoculum management critical
  - Fungicide application strategies should include mixed modes of action
    - can be informed by testing field samples

Acknowledgements

Fungicide Resistance Group (CCDM)

Kul Chandra Adhikari
Wesley Mair
Kejal Dodhia
Lincoln Harper
Steven Chang
Leader: Fran Lopez-Ruiz

Centre for Crop Health

Ahmed Saad
Anke Martin
Levente Kiss
Lisle Snyman (DAFQ)

UniSQ Capacity Building Grant - 2022

Queensland Agronomists & Growers

Russell Wood (Wood Ag)
Matthew Skerman (Nutrien Ag Solutions)

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BACI Broadacre Cropping Initiative

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Questions

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University of Southern Queensland

Northern region seasonal update

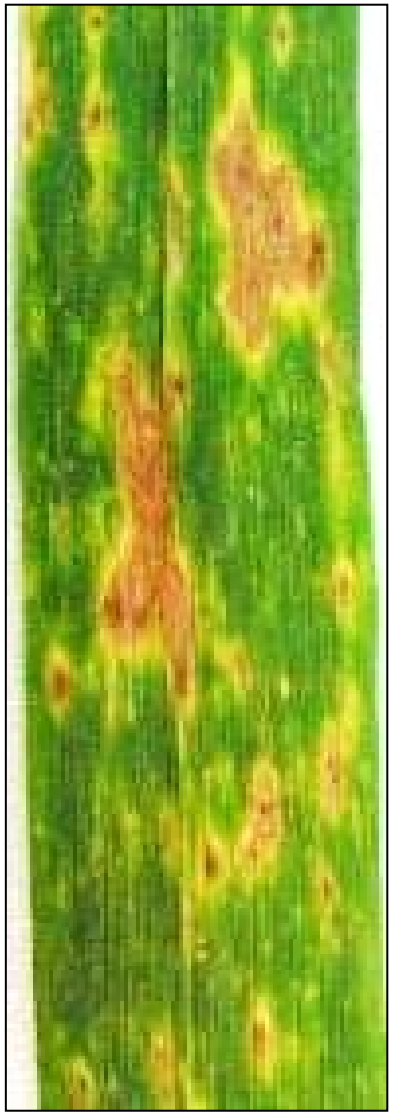
Brad Baxter & Steven Simpfendorfer

NSW DPIRD

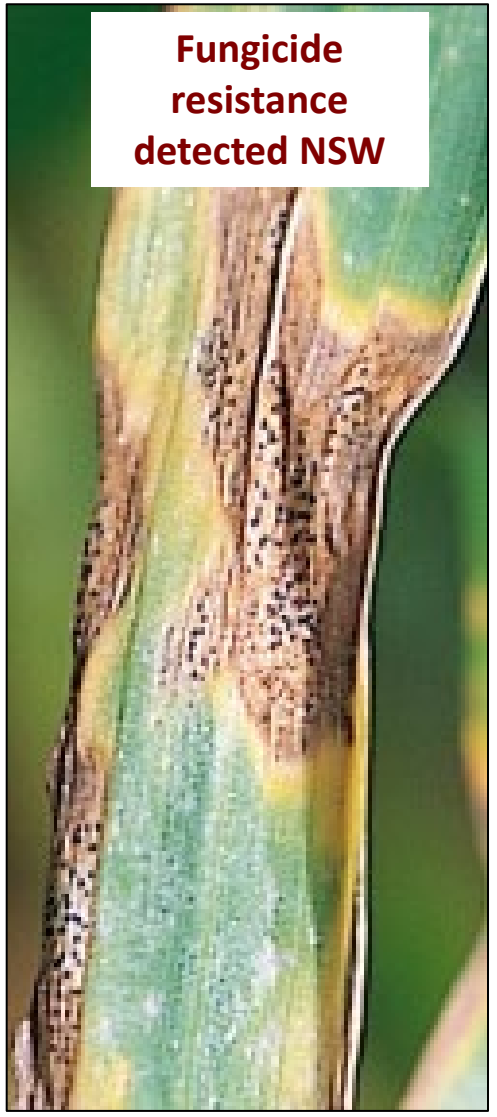
Stripe rust
12-20°C
5-6 h leaf wetness
10-14 days
60-80% yield loss

Leaf rust
15-25°C
5-6 h leaf wetness
7-10 days
30-40% yield loss

Powdery mildew
15-22°C
>70% humidity
7 days
15-25% yield loss



Yellow spot
15-28°C
>6 h leaf wetness
4-7 days
30-40% yield loss



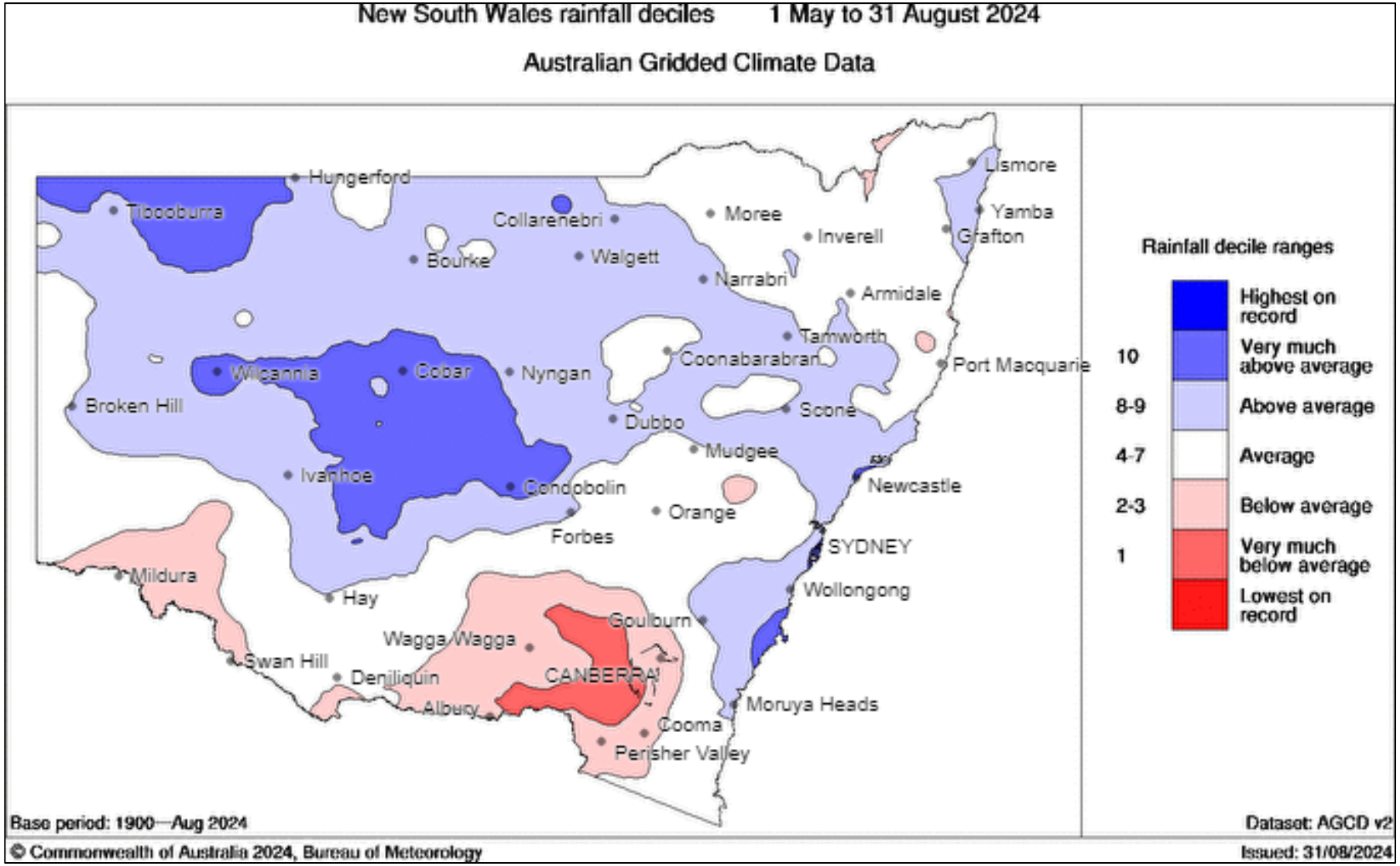
Septoria tritici blotch
15-20°C
48 h leaf wetness
21-28 days
40-60% yield loss

2024 NSW DPI Plant Diagnostics

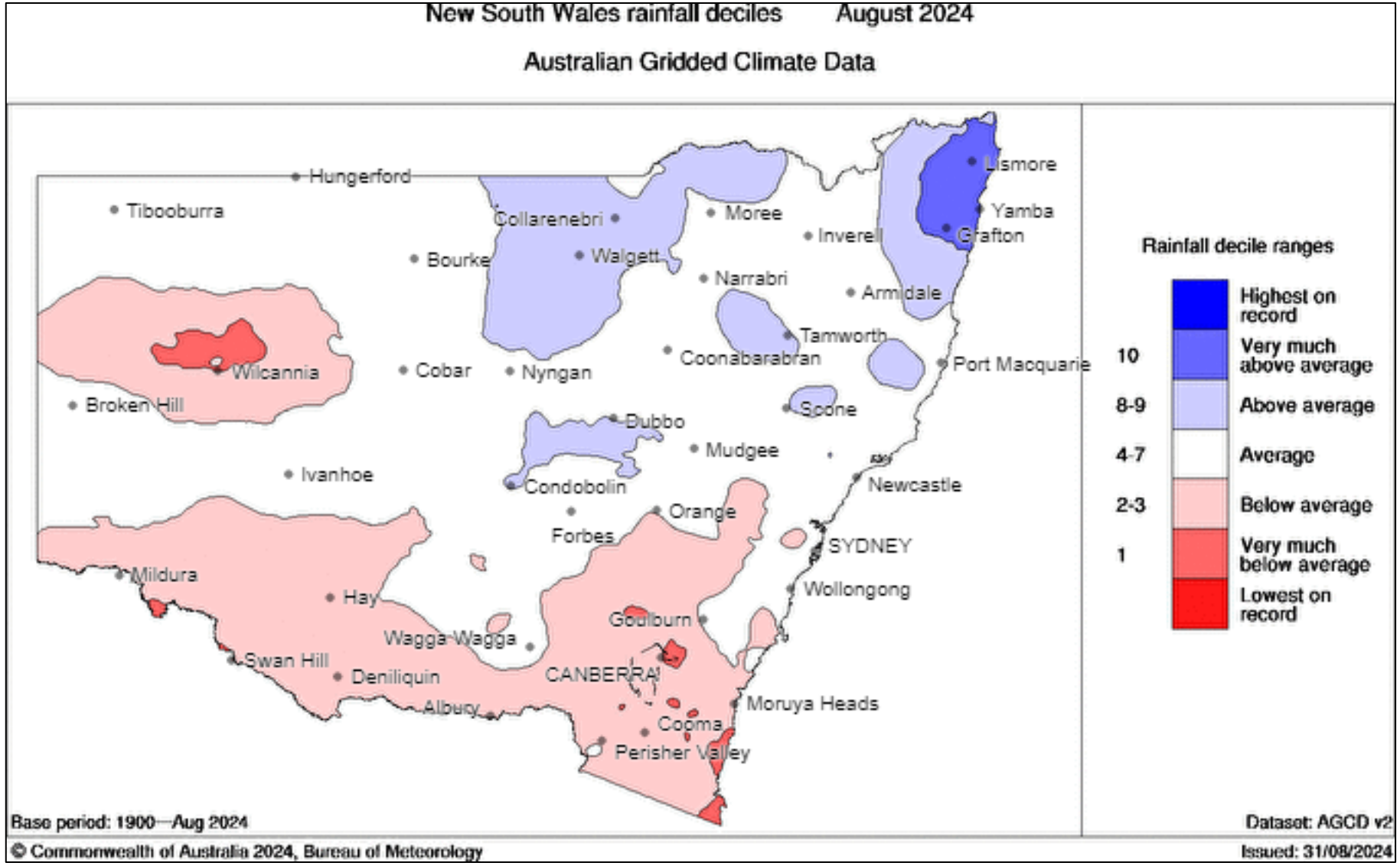
Disease/ Issue	2024- To 1st Sept	2023	2022	2021	2020	2019
Stripe rust (wheat)	94	53	379	343	194	13
Other minor diseases*	62	10	1	1	4	2
Environmental (e.g., frost damage, waterlogging)	58	19	16	24	45	4
Fusarium crown rot	58	98	89	99	61	14
Septoria tritici blotch (wheat)	45	52	104	56	17	13
Yellow leaf spot (wheat)	30	16	49	56	10	4
Physiological/melanism	28	18	68	20	65	10
Nutrition	24	3	11	18	16	2
Other non-disease (e.g., soil constraint, leaf blotching/mottling)	24	21	42	53	34	24
Herbicide	22	15	27	7	28	6
Wheat streak mosaic virus	22	1	3	23	3	1
Loose smut	19	37	8	11	9	1
Spot form of net blotch (barley)	17	13	30	50	65	32
Bacterial blight (other cereals)	9	8	8	4	30	0
Net form of net blotch (barley)	9	10	11	20	23	0
Barley grass stripe rust	8	1	6	2	20	1
Fusarium head blight	8	62	389	18	10	0
Seedling root disease complex (Pythium, crown rot, Rhizoctonia, take-all)	7	8	6	13	8	2
Rusts crown and stem (oats)	6	1	21	24	29	4
Common root rot	5	1	3	26	2	3
Leaf rust (wheat)	4	0	21	37	35	2
Wheat powdery mildew	4	0	53	17	53	1
Barley yellow dwarf virus	3	25	3	4	19	1
Take-all	3	1	6	33	16	1
Other oat foliar diseases (red leather leaf, septoria blotch, bacterial blight)	1	3	4	9	26	12
Ramularia	1	3	-	-	-	-
Barley powdery mildew	0	0	9	8	12	0
Leaf rust (barley)	0	2	8	3	0	0
Rhizoctonia	0	0	3	9	12	7
Ring spot	0	0	5	2	0	1
Scald (barley)	0	2	9	7	65	4
White grain disorder (Eutiarosporella spp.)	0	2	21	1	1	0
Total	**571**	**485**	**1413**	**998**	**912**	**165**

* Note this figure includes minor diseases plus sample still under analysis.

Environmental conditions – GS rainfall

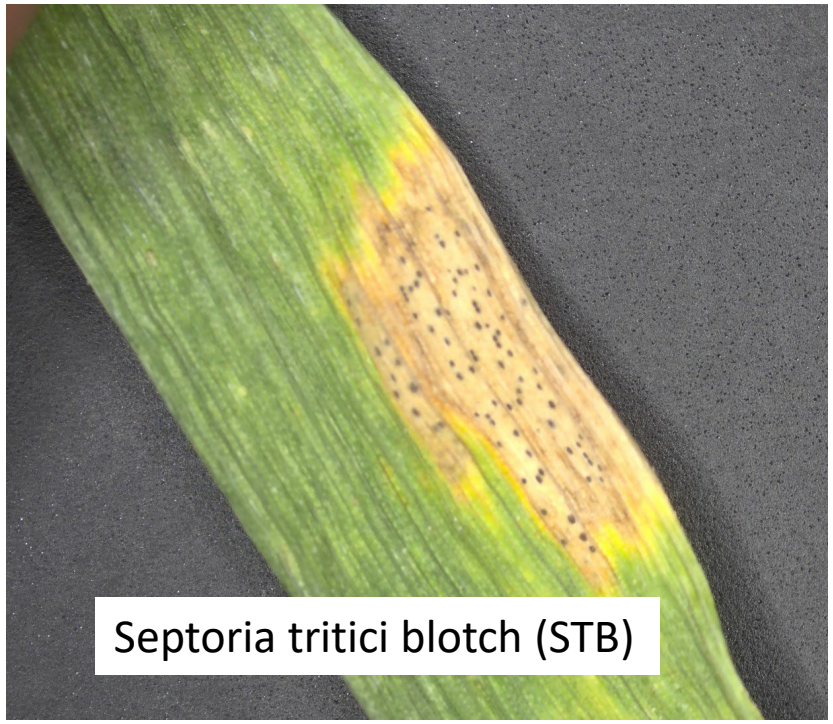


Environmental conditions- August 2024

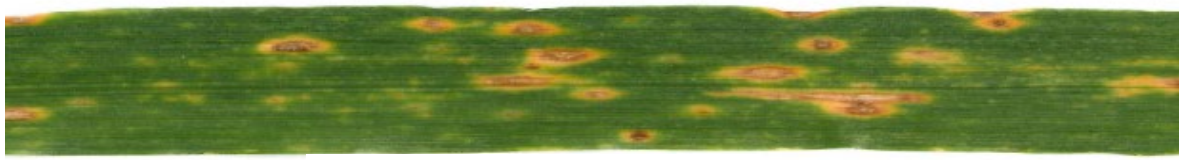


Key months for disease progression August to October

Septoria tritici blotch



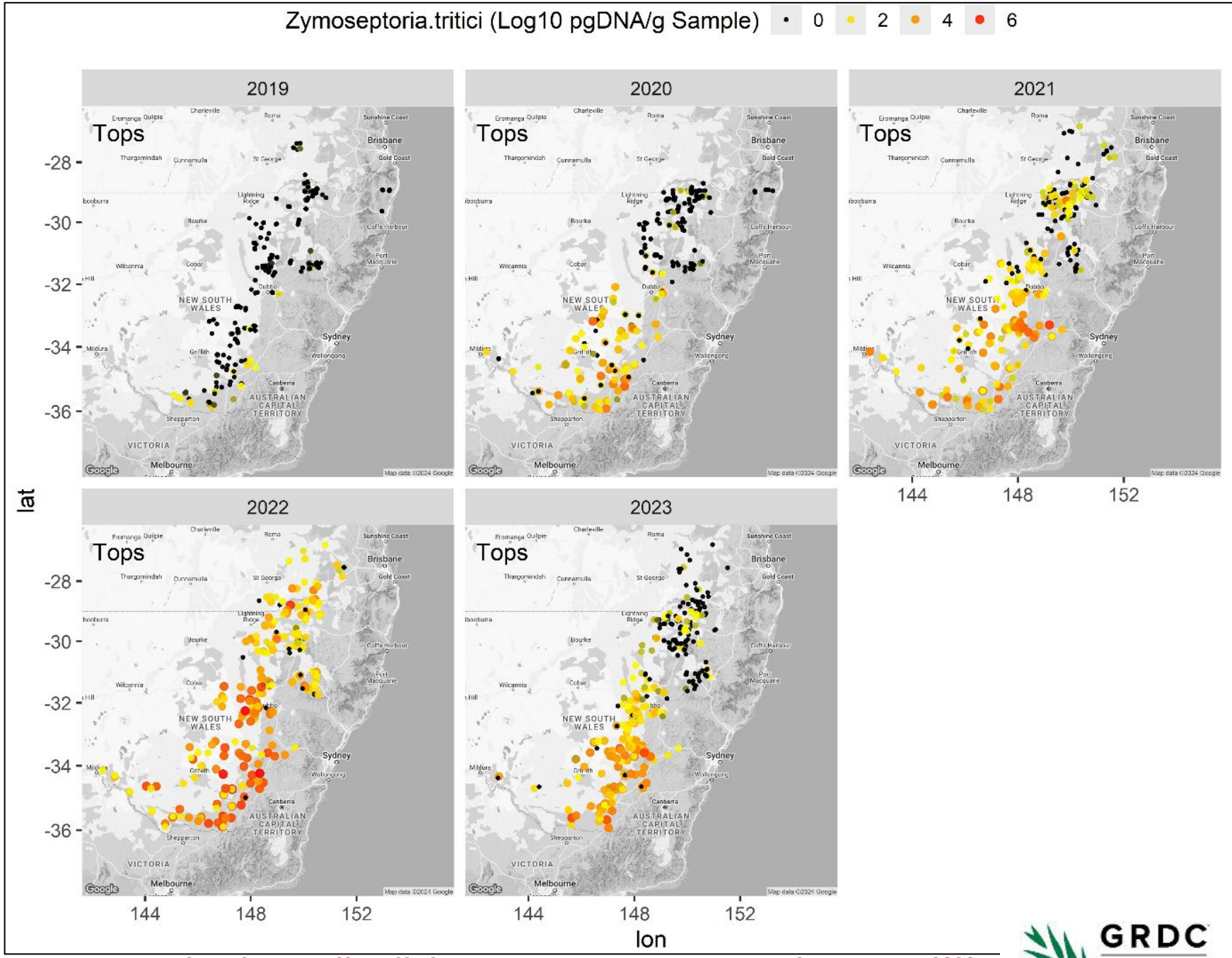
Septoria tritici blotch (STB)



Yellow leaf spot (YLS)

	Zymoseptoria tritici (STB)	*Pyrenophora tritici-repentis (YLS)*
Primary inoculum Ascospores	Wind dispersed long distance	Wind dispersed short distance
Secondary inoculum Conidia	Splash dispersed/physical Short distance	Wind dispersed Short/medium distance
Latent phase	2-5 weeks	7-12 days
Survives fallow	On stubble for at least 2 years	On stubble for at least 2 years
Resistance risk	High	Moderate-low

Septoria tritici blotch



MASSIVE thanks to all collaborating agronomists and growers!!!!

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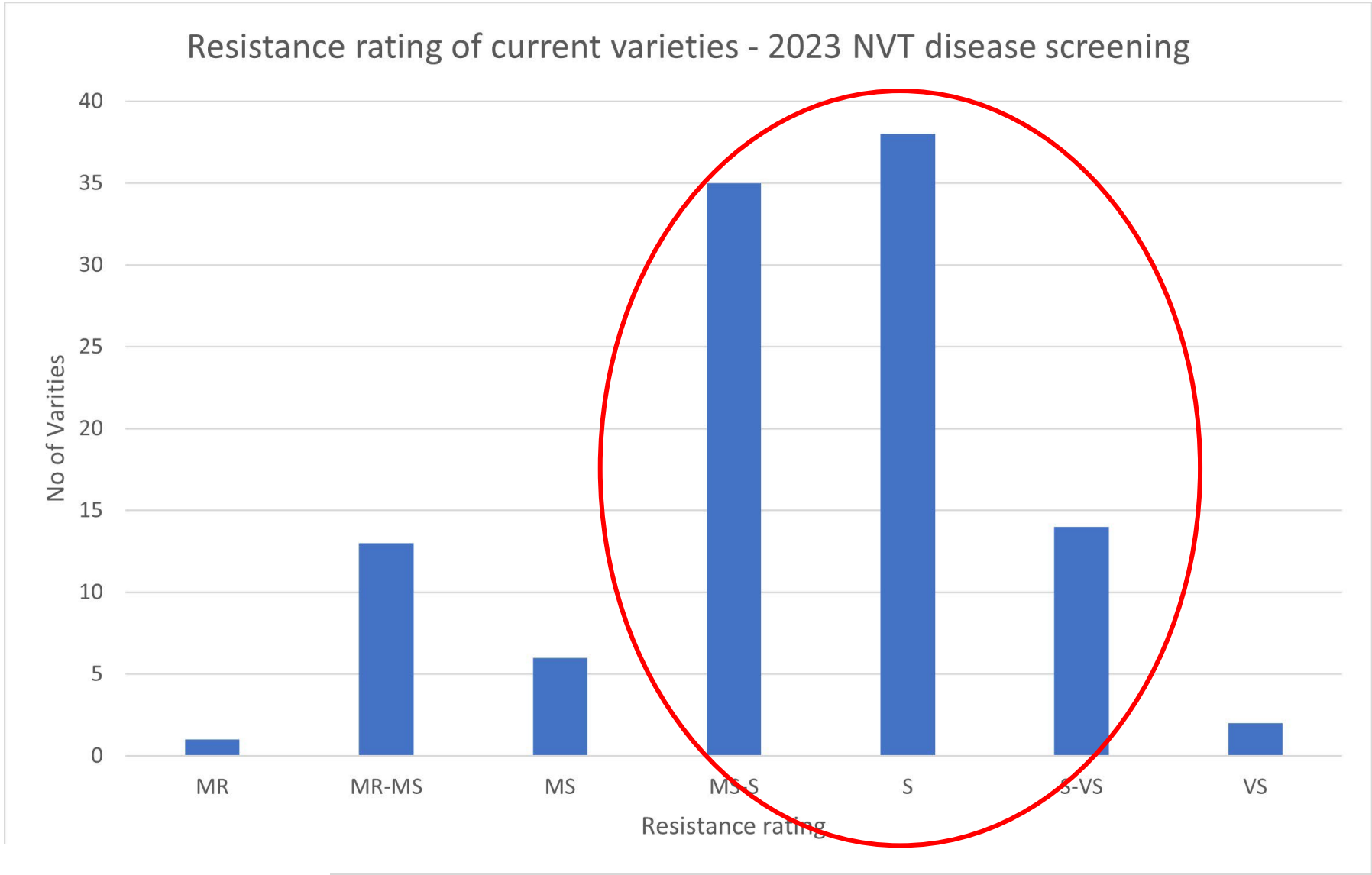
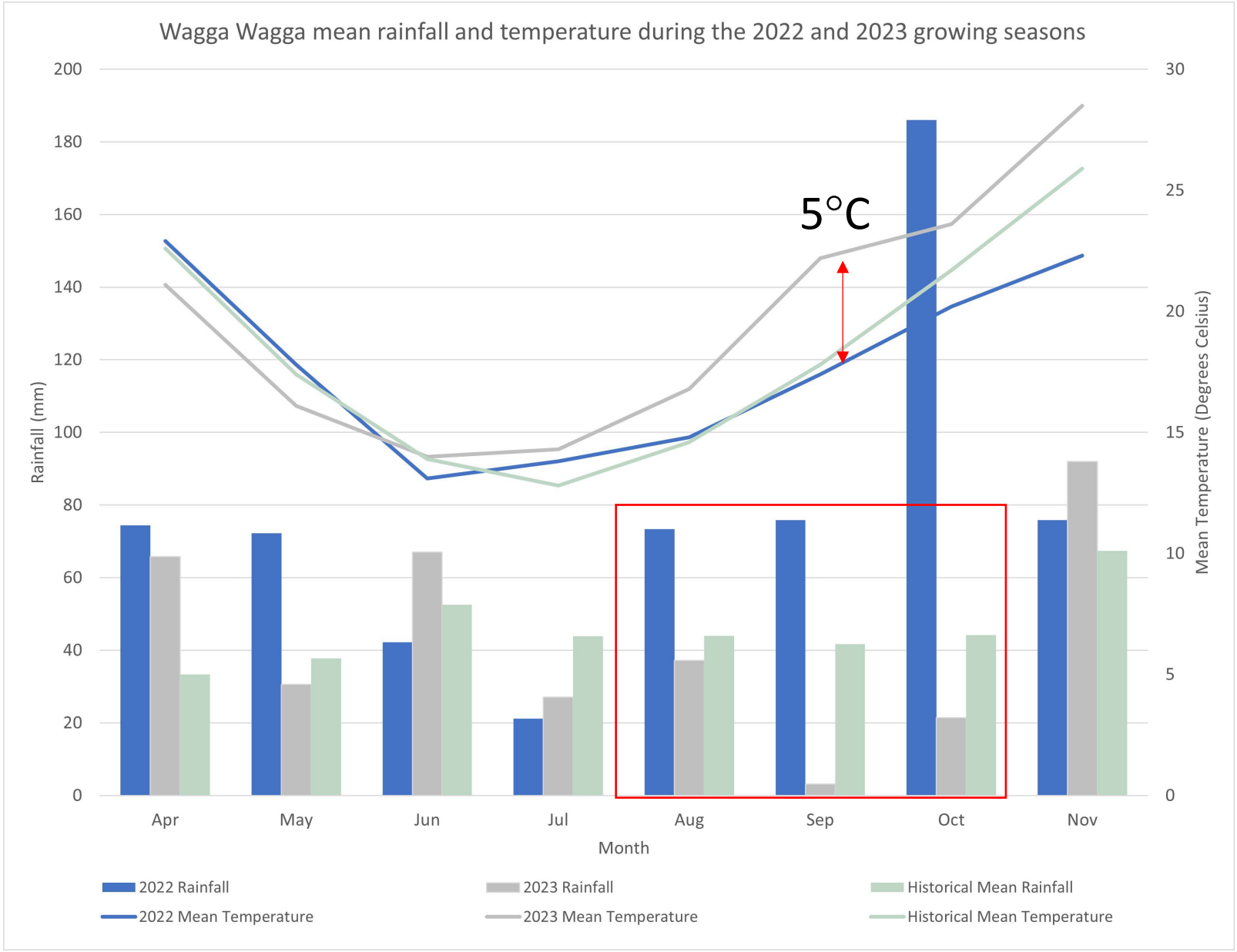
Septoria tritici blotch – host resistance



Department of Primary Industries and Regional Development

Data: 2023 NVT resistance ratings

Seasonal conditions overriding factor



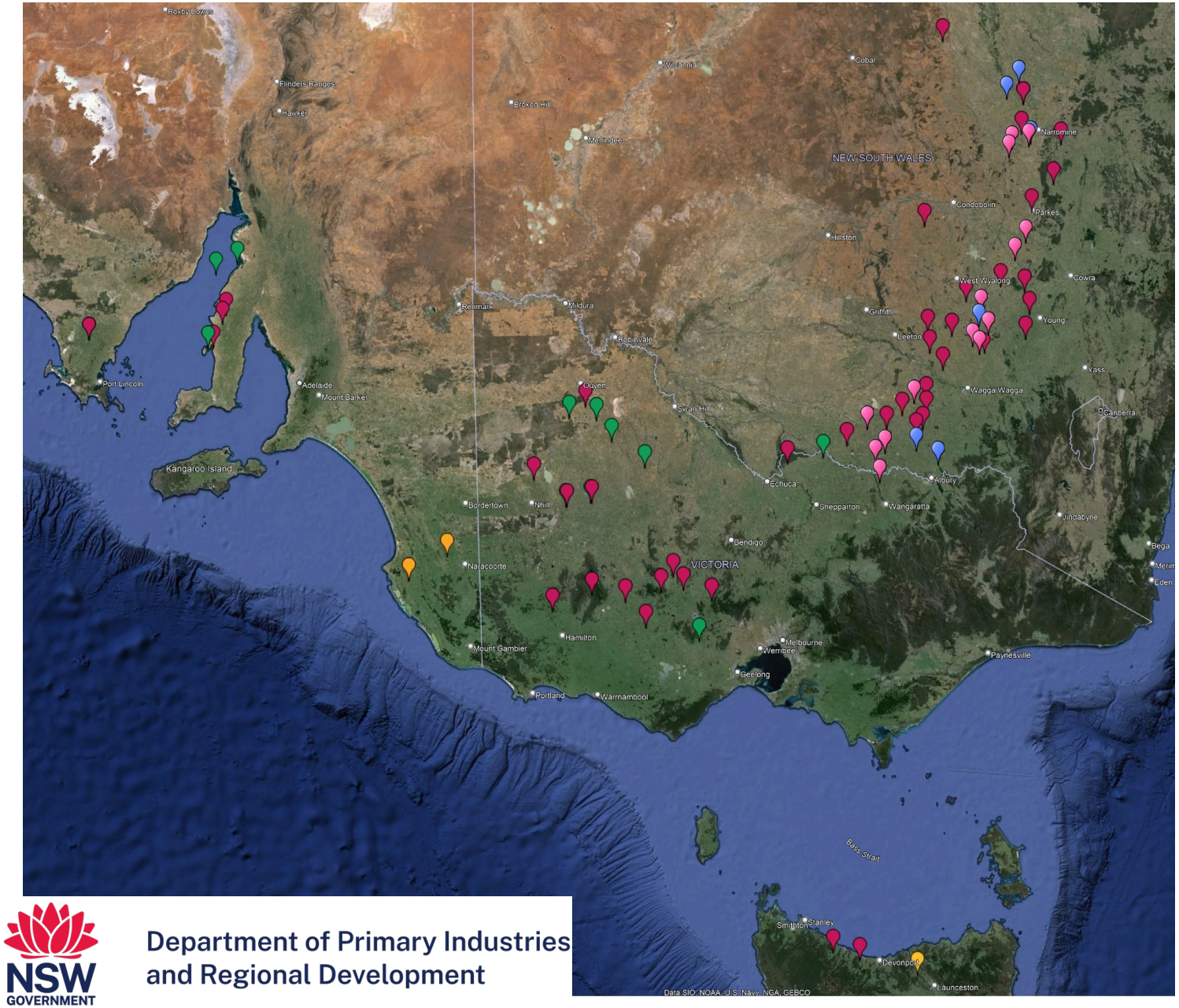
Month	2022	2023
August	5	3
September	4	0
October	5	1

Table: no. of rainfall events (>2 days in duration)

Graph evident of difference between central/northern NSW and southern NSW during 2024

Data: BOM, Wagga Wagga Site

Septoria tritici blotch – fungicide resistance 2022/23



2022 Presence G143A (Qol, Strobilurin) mutation

2022 Absence of Cyp51 G1 mutation

2022 Presence of Cyp51 G1 mutation

2023 Absence of Cyp51 G1 mutation

2023 Presence of Cyp51 G1 mutation

But what does this mean practically?

Department of Primary Industries and Regional Development

NSW GOVERNMENT

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Data courtesy of Fran Lopez-Ruiz and CCDM team. NOTE: only NSW data updated for 2023. VIC, TAS and SA is 2022 only

STB in crop management

- Environment.
- Each fungicide application is a potential resistance selection event.
- Do not apply fungicides if they are not required! Correct identification!
- Majority crop received GS31/32.
- GS39 onwards sprays. Done? Do we need them?
- Group 11 (Qol, Strobilurins) still effective.

STB in crop management

- Environment.
- Each fungicide application is a potential resistance selection event.
- Do not apply fungicides if they are not required! Correct identification!
- Majority crop received GS31/32.
- GS39 onwards sprays. Done? Do we need them?
- Group 11 (Qol, Strobilurins) still effective.
- Group 3 (DMI, triazoles) varied efficacy.
- Rotate MOA, actives and use mixtures.
- Adhere to labels/MRL's.
- Seek help if you suspect spray failure.

Active ingredient	Reduced sensitivity or resistance (NSW)	Still effective at field rates (NSW)
Cyproconazole	✓	?
Epoxiconazole	✓	✓
Flutriafol	✓	✗*
Propiconazole	✓	✗*
Prothioconazole	✓	✓
Tebuconazole	✓	✗*
Azoxystrobin (G11)	✗	✓

* Can be effective where Cyp51 G1 mutation is not present

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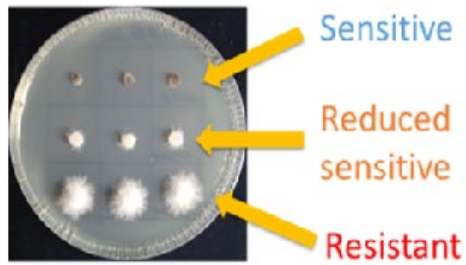
GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

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.

Monitor barley crops!



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

Wheat powdery mildew	**R** - Group 11 Qol; Group 3 DMI
Septoria tritici blotch	**RS** - Group 3 DMI
Septoria tritici blotch	**L mutation R** - Group 11 Qol
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
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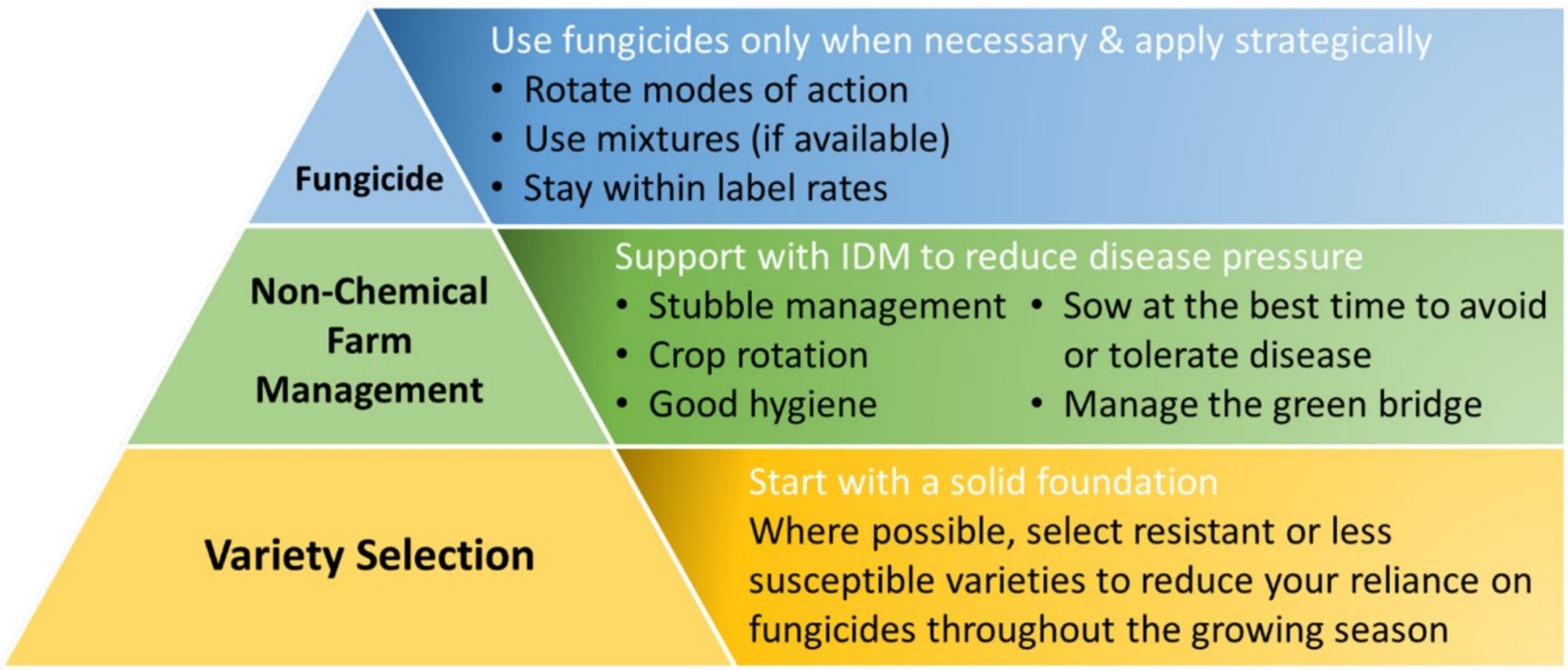
Barley net form of net blotch	**R, RS** - Group 3 DMI; **R** - Group 7 SDHI; **L mutations RS** - Group 11 Qol
Barley net form of net blotch	**R, RS** - Group 3 DMI; **R** - Group 7 SDHI
Barley spot form net blotch	**L mutations R, RS** - Group 3 DMI; **L mutations R, RS** - Group 7 SDHI
Barley spot 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 Qol

Fungicide resistance management



Source: AFREN

Picture courtesy of Harry Wakefield Delta Ag, Coolamon.

AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

GRDC Grains Research & Development Corporation

NSW Government

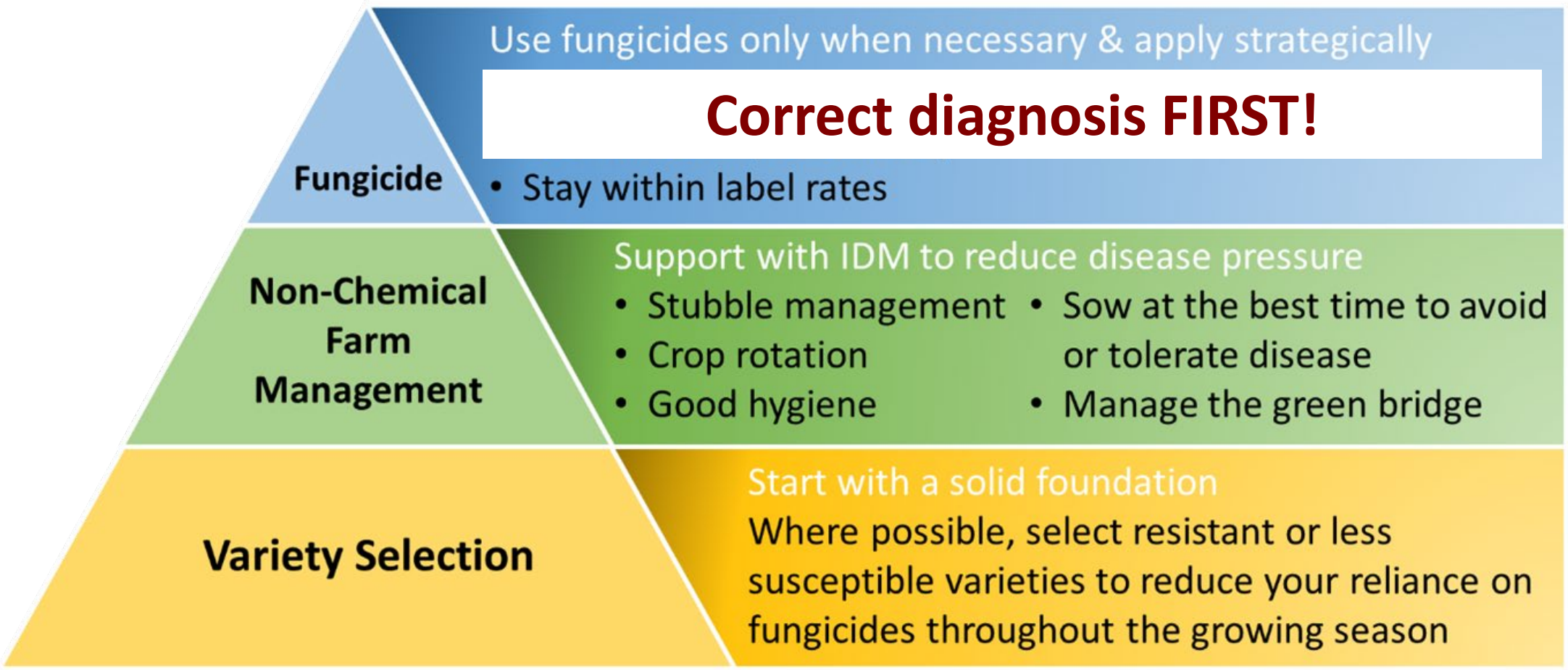
Department of Primary Industries and Regional Development

Centre for Crop and Disease Management

GRDC

Curtin University

Fungicide resistance management



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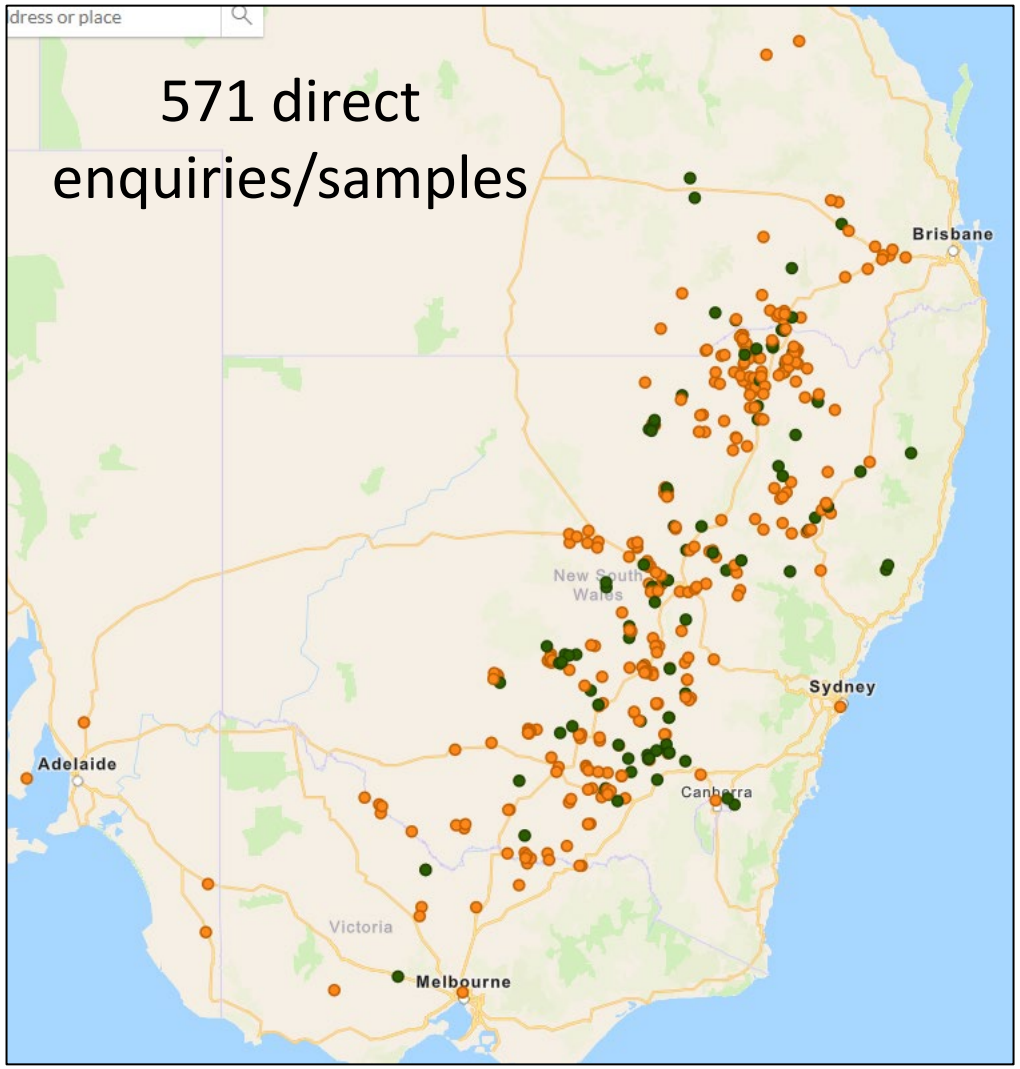
Most common ‘disease’ in 2024?



Misdiagnosis (23%)

Consider recent climatic conditions?

Illabo wheat

Spartacus barley

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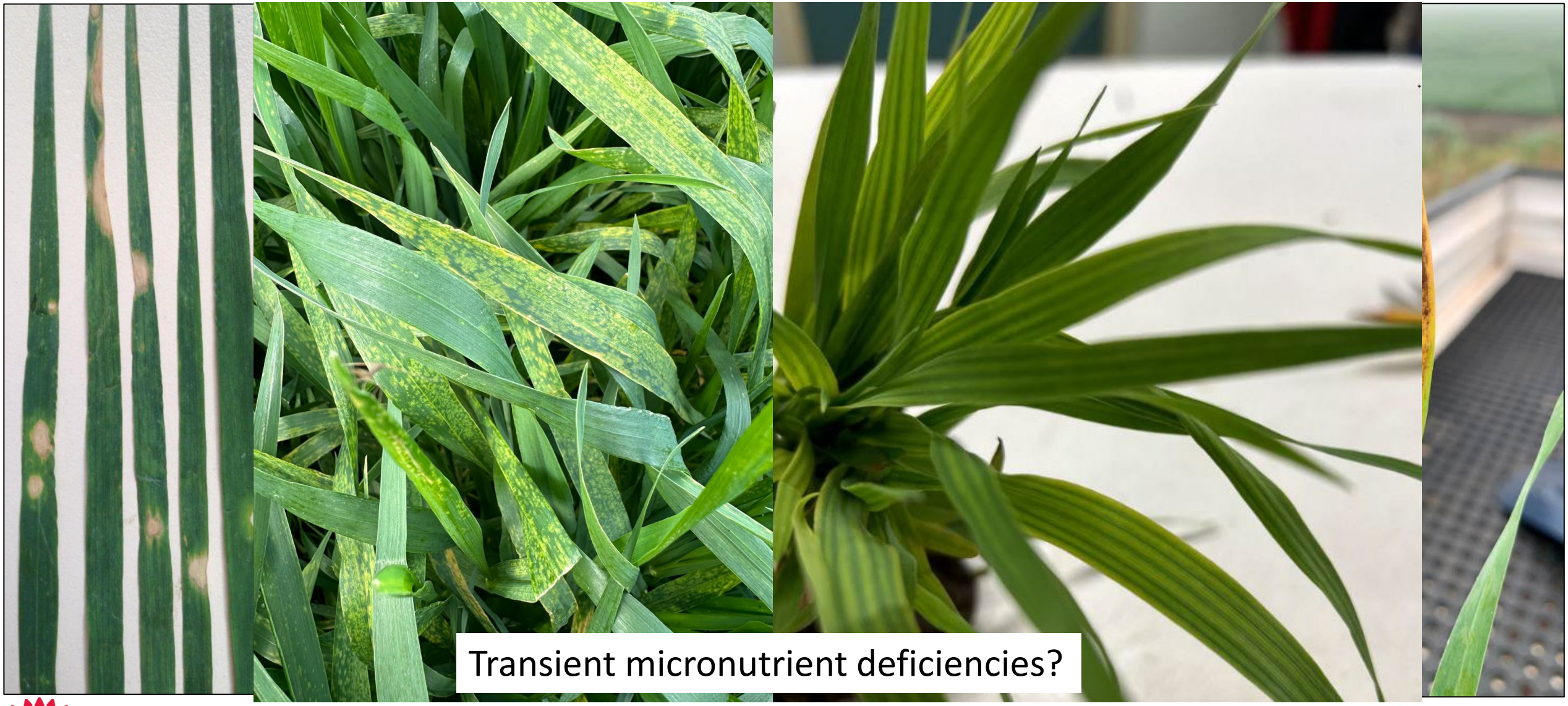


Transient micronutrient deficiencies?

Genetics?

Leaf tip necrosis - Lr34/Yr18
e.g. Raider and Flanker

Huerta-Espino *et al.* 2020

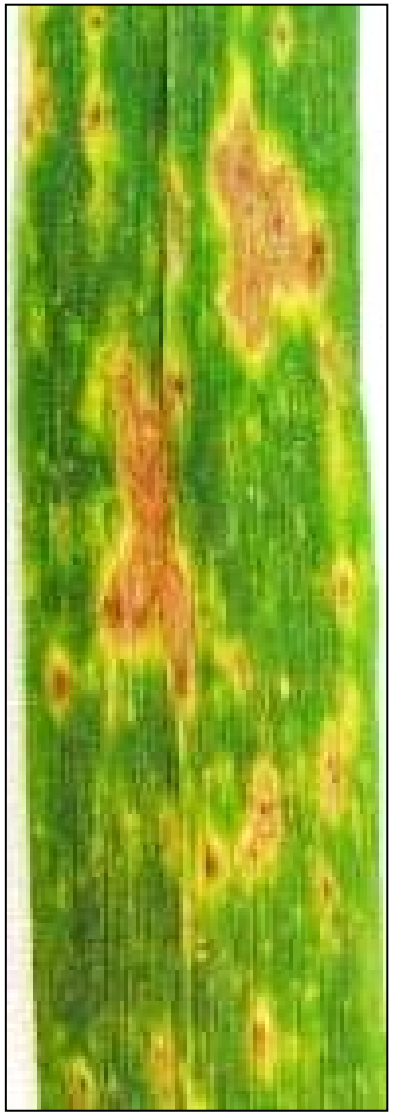
Melanism - Sr2 e.g. Sunmax

Stripe rust
12-20°C
5-6 h leaf wetness
10-14 days
60-80% yield loss

Leaf rust
15-25°C
5-6 h leaf wetness
7-10 days
30-40% yield loss

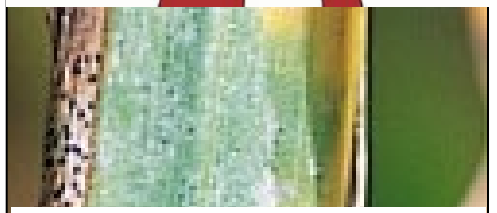
Fungicide resistance detected NSW/Qld

Powdery mildew
15-22°C
>70% humidity
7 days
15-25% yield loss



Yellow spot
15-28°C
>6 h leaf wetness
4-7 days
30-40% yield loss

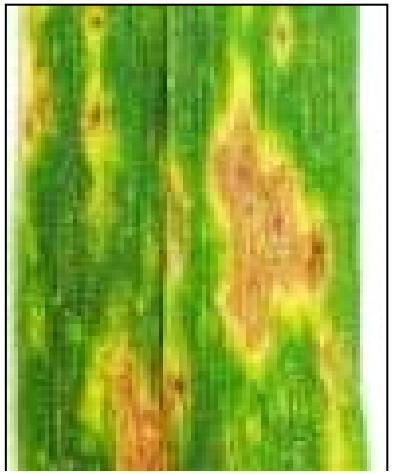
Fungicide resistance detected sNSW



NOT a nNSW/Qld disease!

Septoria tritici blotch
15-20°C
48 h leaf wetness
21-28 days
40-60% yield loss

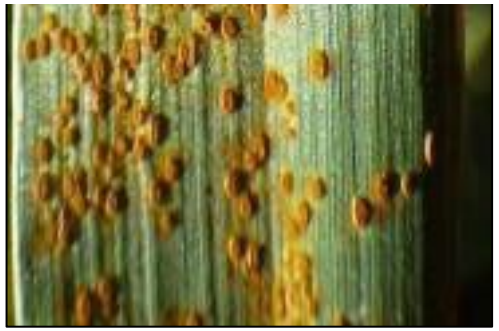
Fungicide resistance detected NSW/Qld

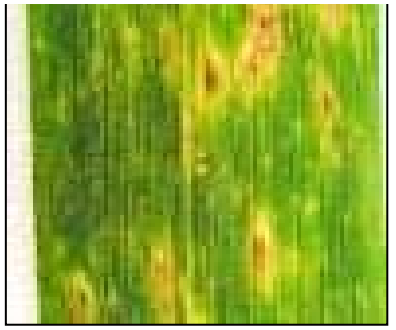


Fungicide resistance detected sNSW

Fungicide curative activity = ½ of cycle time

Also useful in preventing misdiagnosis pre-GS39!





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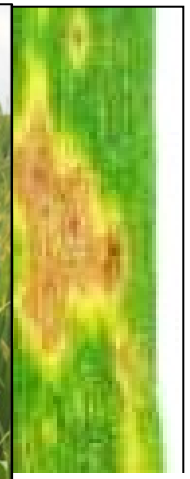

Fungici cle time

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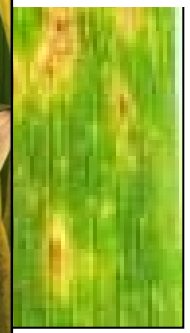

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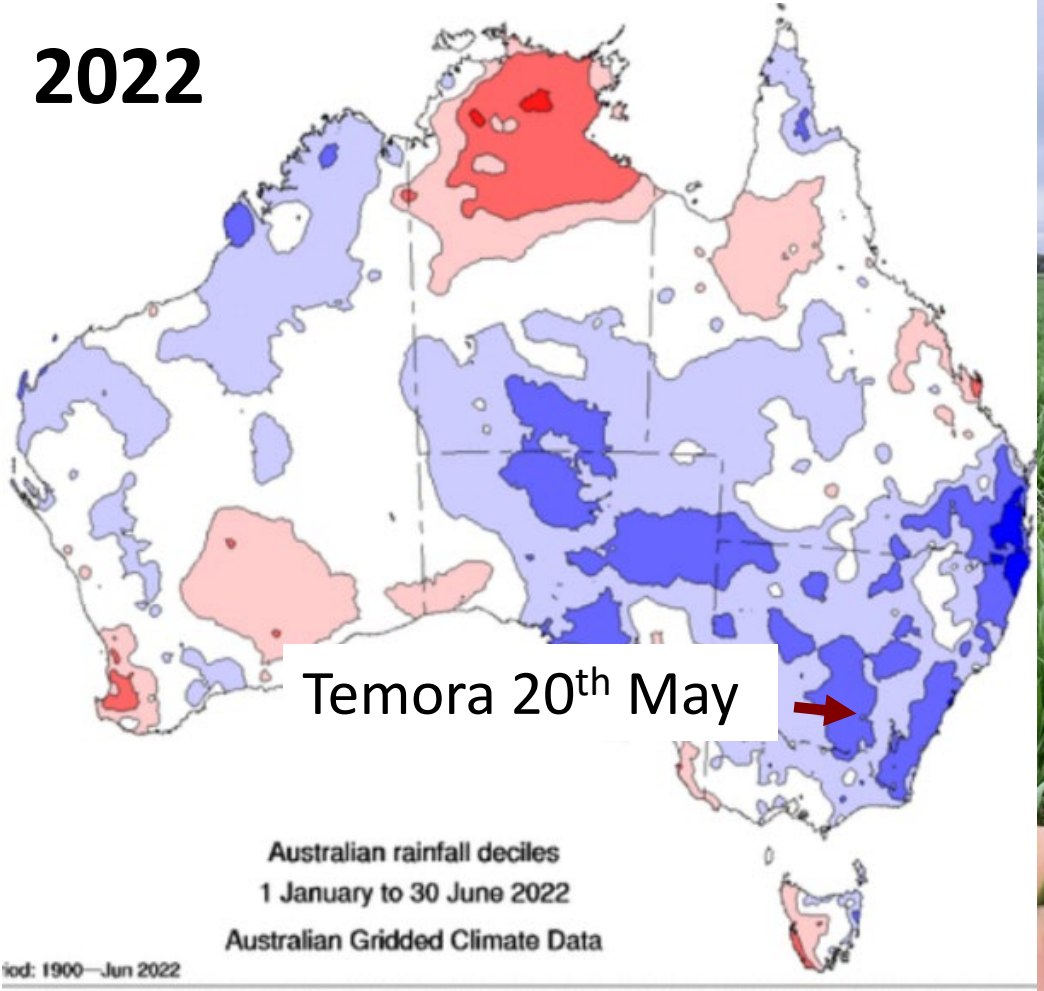
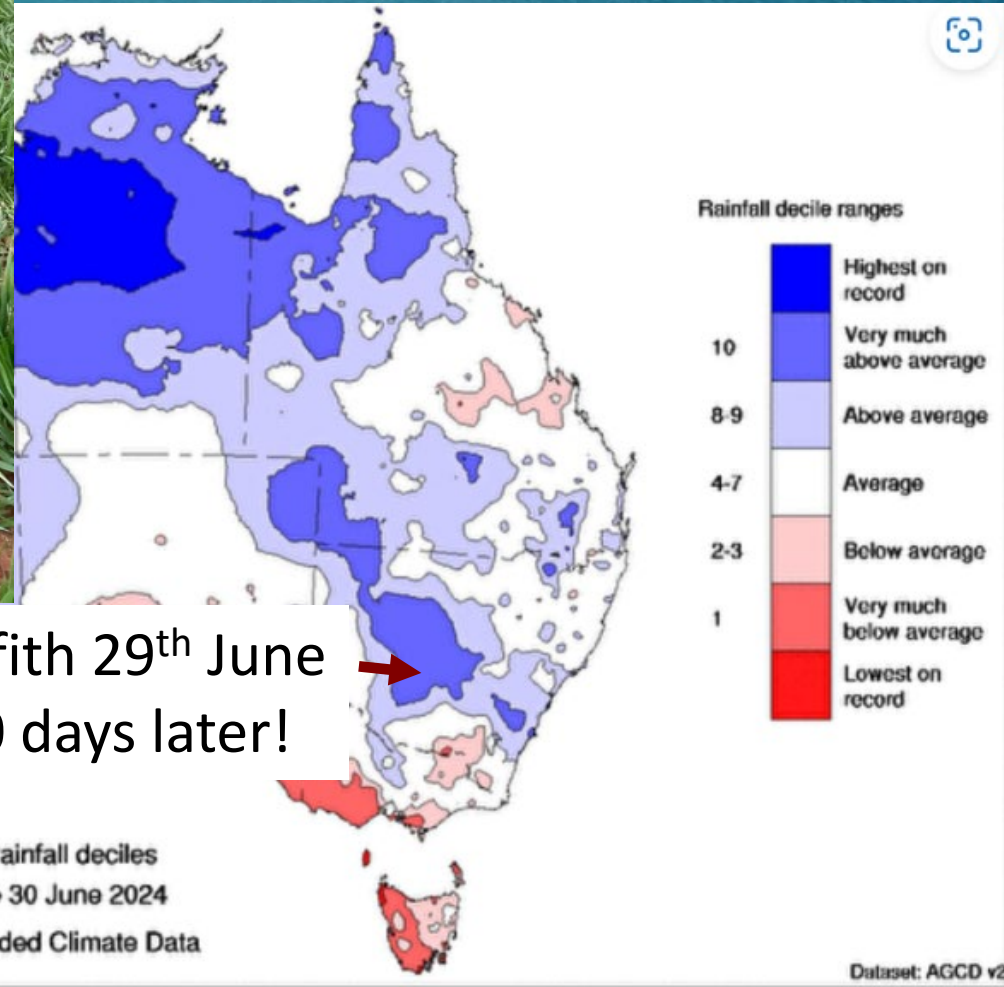
2022

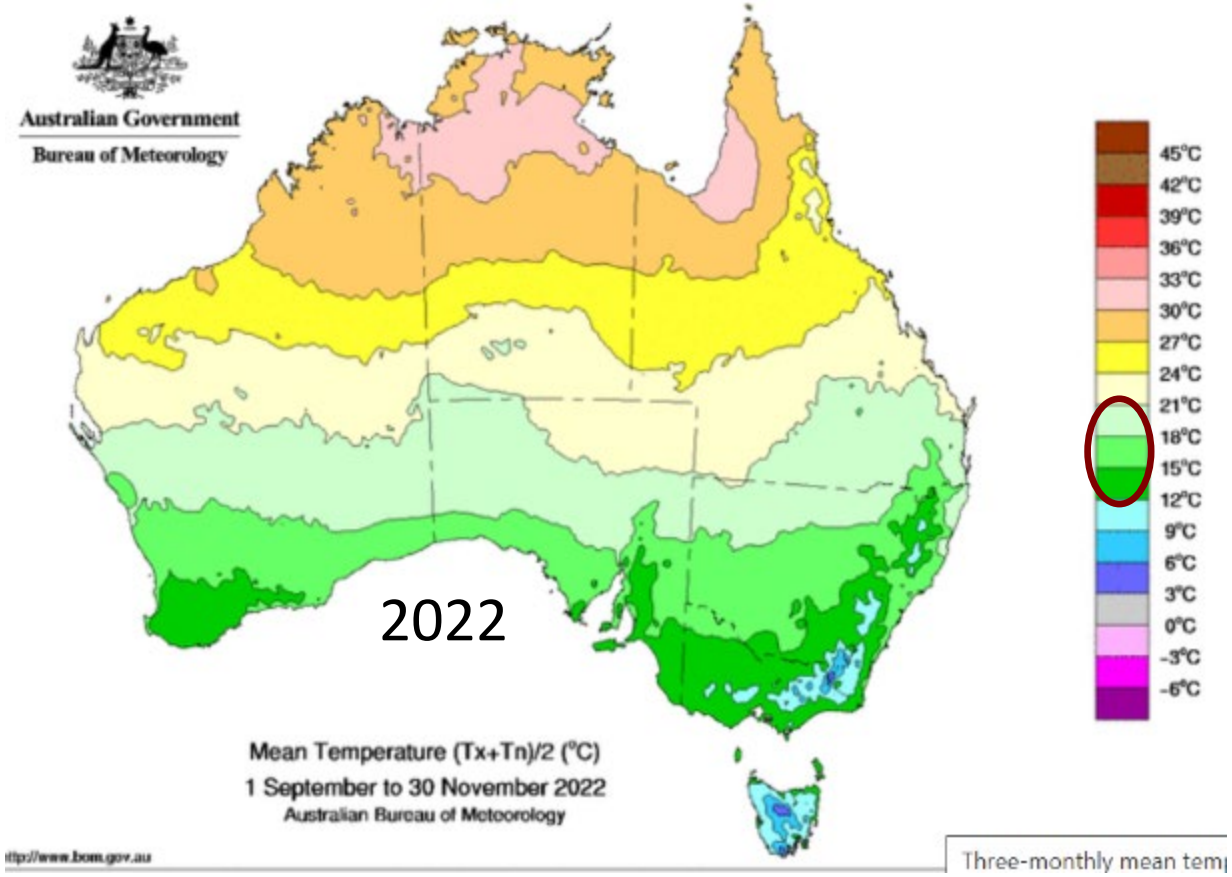


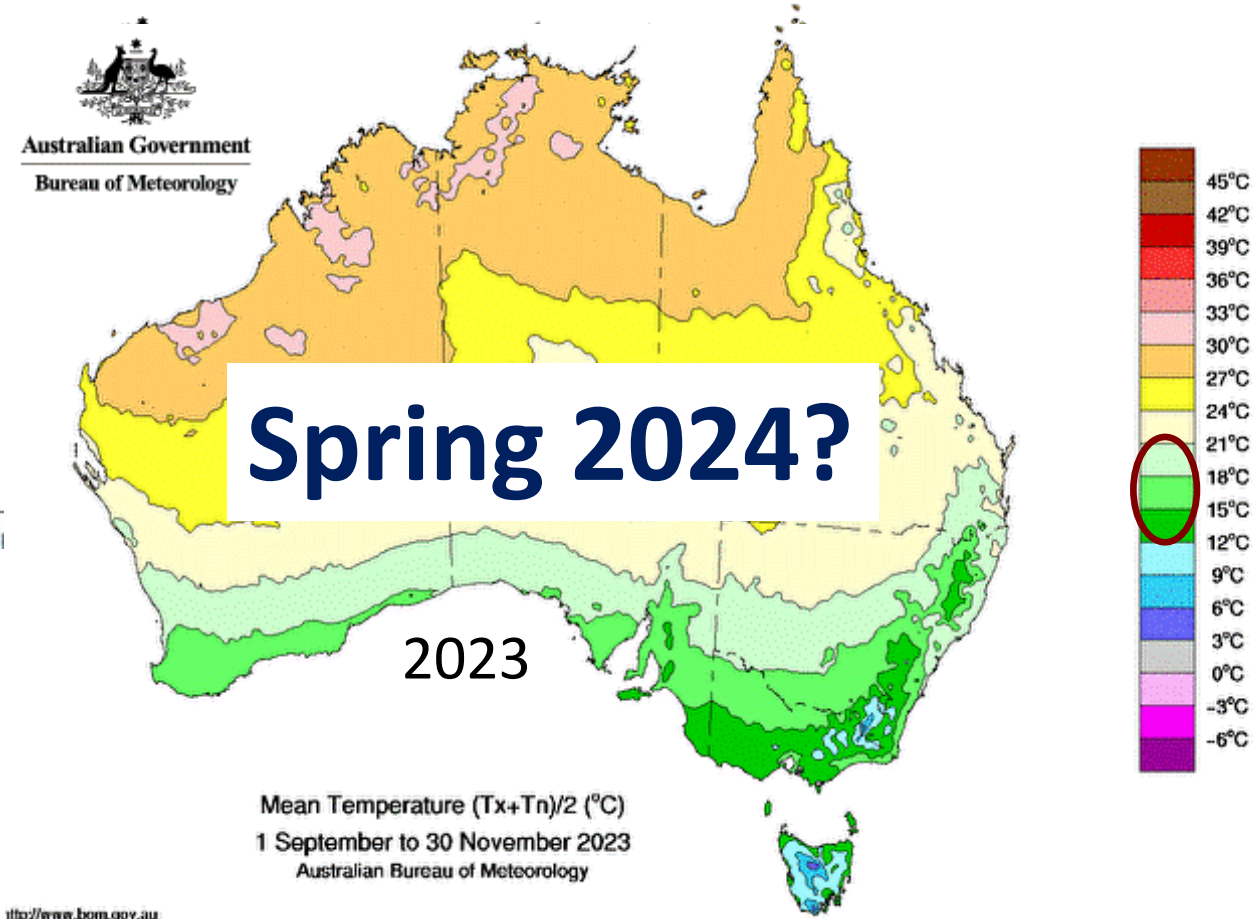
Temora 20th May



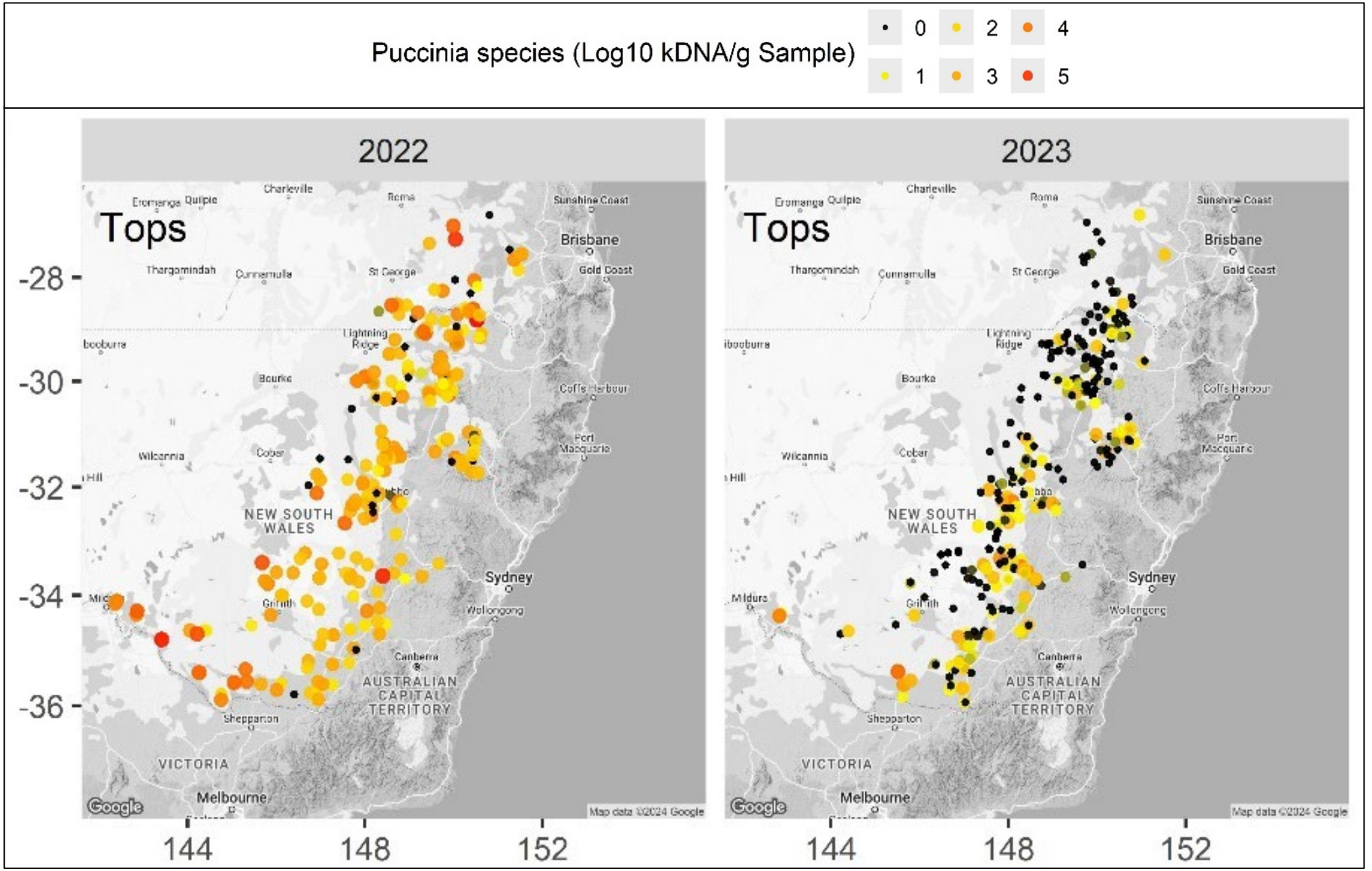
Griffith 29th June
40 days later!

2022 very conducive to stripe rust!





Stripe rust



MASSIVE thanks to all collaborating agronomists and growers!!!

Using Adult Plant Resistance (APR)

Infection then APR

Infection then APR

APR then infection

Using Adult Plant Resistance (APR)

Fungicide strategy is to protect until APR active (i.e. resistance level)

Infection then APR

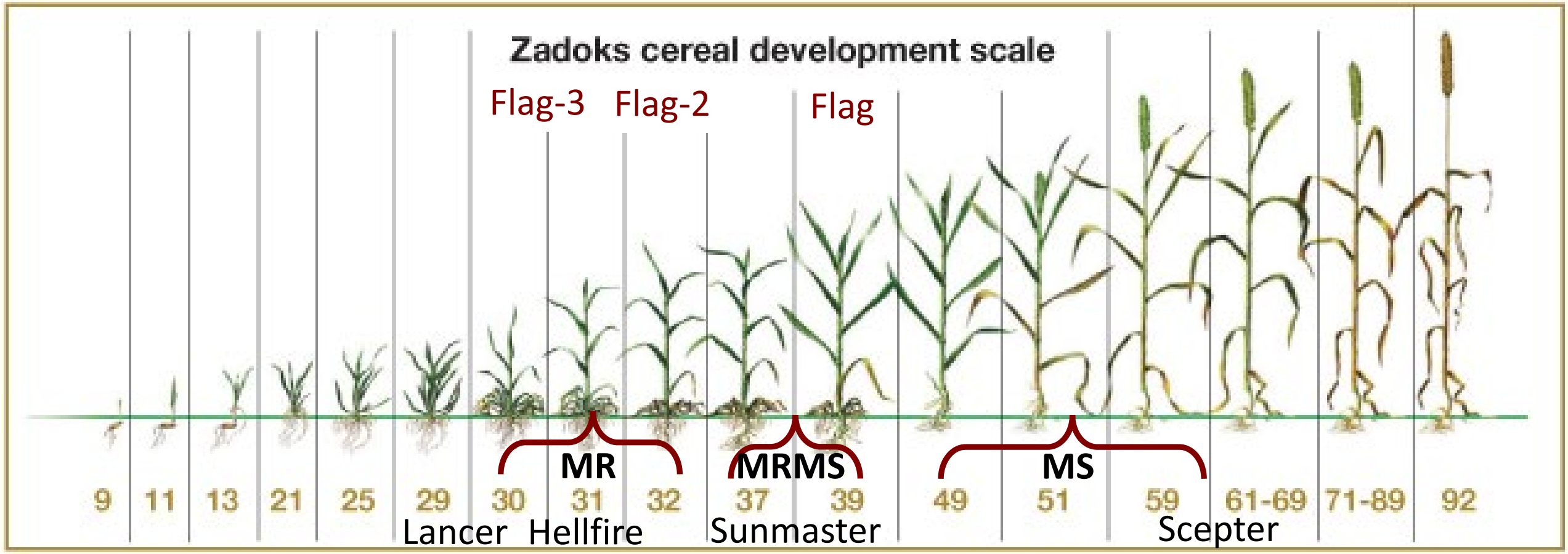
Infection then APR

APR then infection

Stripe rust – the spray dilemma

Yield is about keeping top three leaves green

Fungicide only protects emerged leaves (~2-3 weeks)



Stripe rust – the spray dilemma

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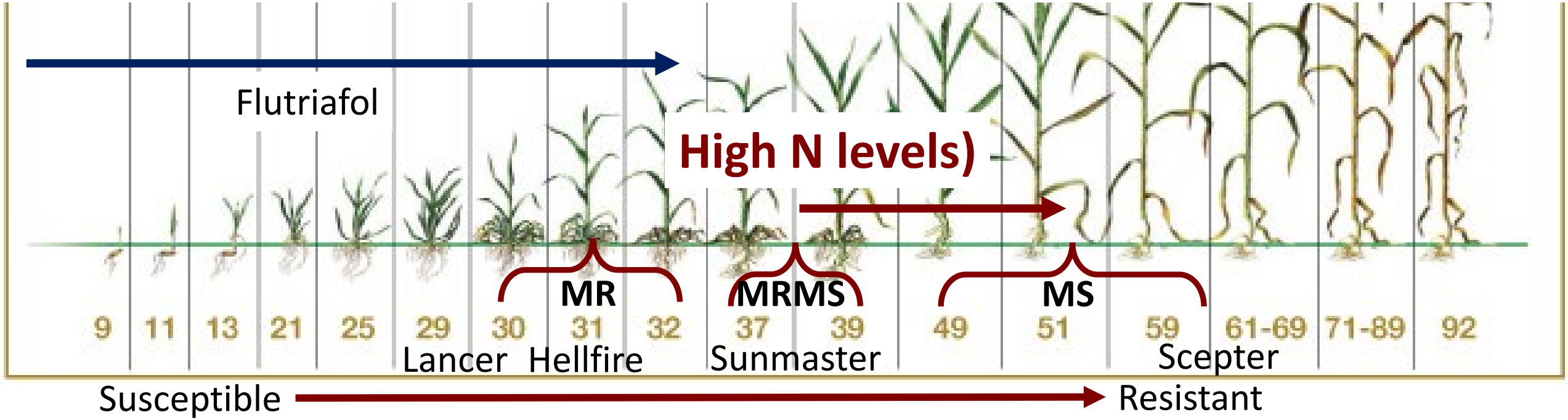
What are your varieties resistance levels and paddock N level?

What are the growth stages?

Use to match strategy in 2024



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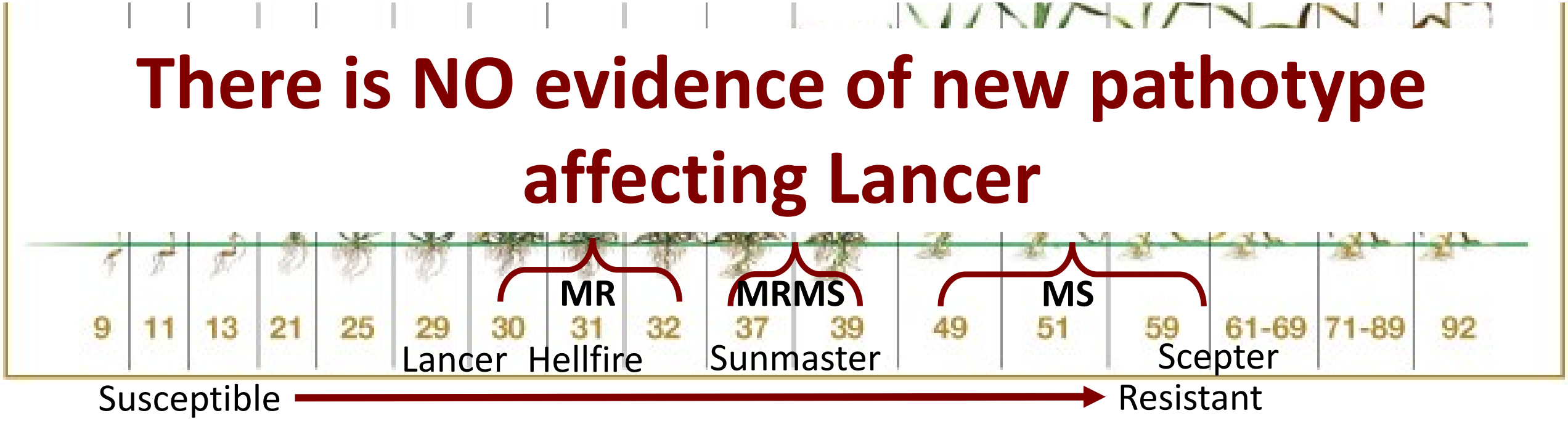
There is NO evidence of new pathotype affecting Lancer



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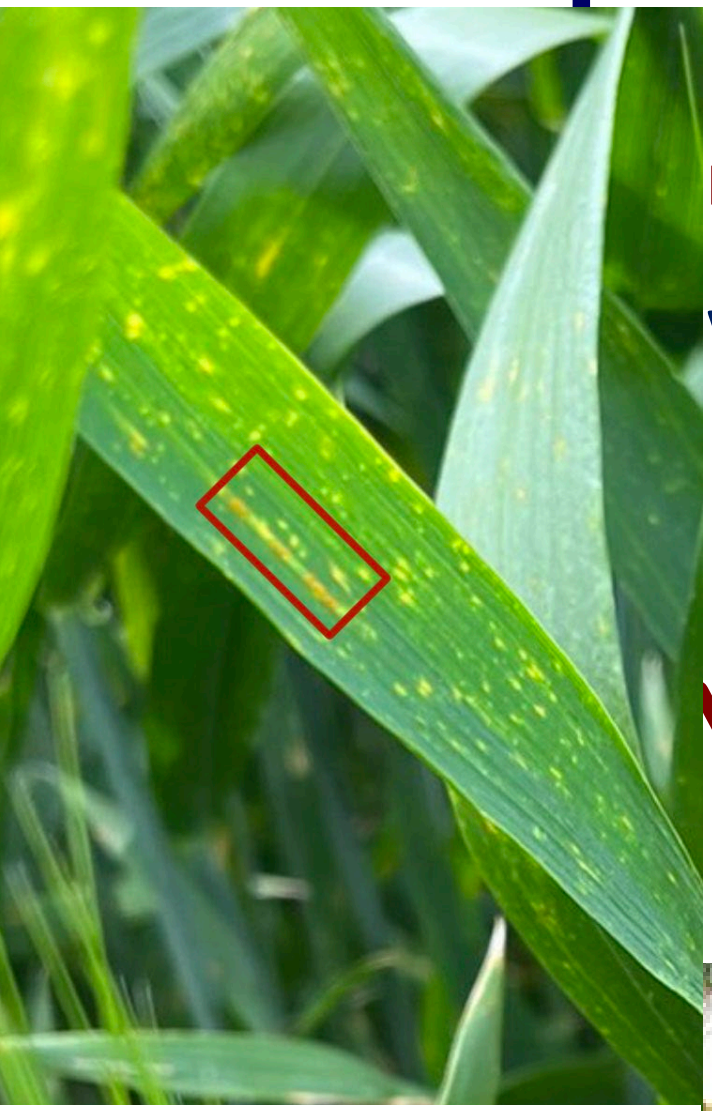


‘What fungicide do I spray?’

about keeping top three le

nly protects emerged leav

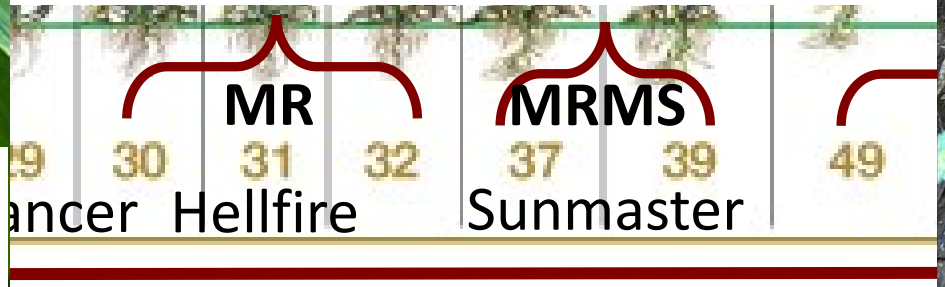
varieties resistance levels

What are the growth sta

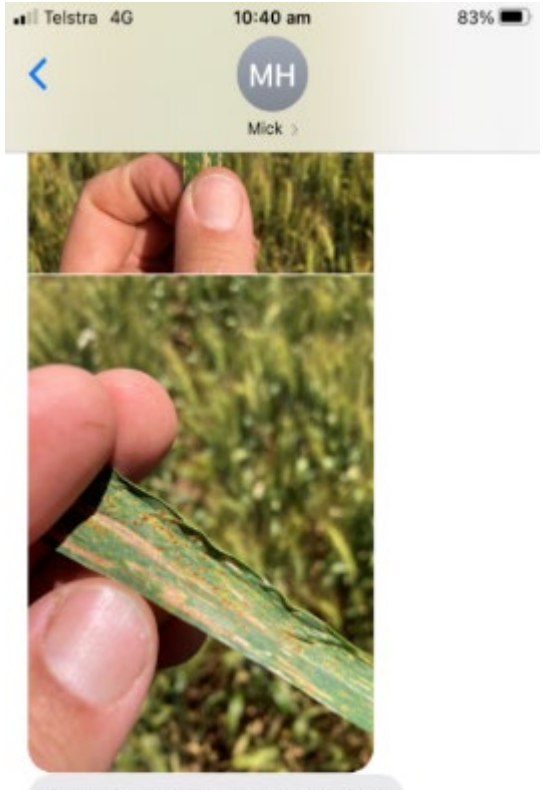
Use to match strategy in

NO evidence of ne

affecting Lance



Support is available – You do NOT need AI!



You can get a second opinion

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B: 0428294121

Huge thank you to all the agronomist and growers who support this service and crop surveys!!

NSW GOVERNMENT
Department of Primary Industries and Regional Development

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

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Thank you

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