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Wheat: revisiting fungicide application timing for the control of leaf diseases in Central West NSW.

Grain Orana Alliance

Trial code:	GODI02725-1
Season/year:	Winter 2025
Property name:	Leichardt
Location:	Geurie
Trial cooperator:	Andrew Robinson

Keywords

DI027, disease, NVT, risk, stripe rust, fungicides, yield response, wheat

Take home messages

- It is important to understand what level of yield is protected by fungicides, but also critical to understand the risk level by growers in relying on fungicides to protect yields.
- The East Coast disease rating (ECR) is a good indicator of a variety's performance in the presence of leaf disease.
- One spray on Sunmaster[A] at Z32 was as good as 2, 3 or 4 fungicide applications.
- Protecting the flag leaf is important. Fungicide applications at GS (growth stage) Zadocks (Z) 39 were as or more effective as earlier applications.
- Using varieties with a better disease resistance package can considerably reduce the disease risk where spraying is not possible or delayed.
- A 'head wash' fungicide application did not impact yield or quality.

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Background

2022 was a prolific year for fungal disease in Central West NSW with stripe rust prevalent in many wheat crops. Grain Orana Alliance (GOA) planted 5 sentinel wheat sites to a range of wheat varieties with the aim of early identification of pathogens. In 2022, stripe rust developed earlier than normal in the growing season, before expression of the adult plant resistance (APR) resistance genes, which made early pathogen identification difficult using sentinels. However, as the crop matured it was evident that some varieties were far more resistant than others and pathotype identification using the sentinels was possible. Yields were obtained from these trials; varieties with lower resistance ratings yielded less than half of those with the most resistance in some cases.

Generally, varieties with lower resistance ratings perform well in National Variety Trials (NVT)[1], typically out yielding the standard varieties (i.e. Vixen[A] averaged 105% and 108% of EGA Gregory [A] in the NVT North East and West respectively), however in the 2022 sentinel trials the varieties with lower resistance rating had a very high yield penalty. The difference between the NVT data and the sentinel work indicate that there might be a significant yield gap caused by foliar fungal diseases, remembering that the NVT trials are managed/treated liberally for fungal disease while the GOA sentinel work had no fungicides applied.

While it is important to understand what level of yield is protected by fungicides, it is also critical to understand what level of risk has been taken on by growers in relying on fungicides to protect yields. In 2022, there were many cases where growers were unable to spray as paddocks were too wet. It also illustrates the risk to growers if resistance develops, and fungicides are not as effective. This knowledge may help shift farmers to grow more resistant varieties.

GOA has conducted trials in 2023 and 2024 and found that growing susceptible (S), higher yielding varieties had a much greater potential yield penalty in the presence of disease than the upside when disease was not present. To better understand this dynamic, it was decided to revisit fungicide application number and timing to assess what might be the minimum required, and when is it more critical to ensure susceptible varieties are sprayed.

Aims

- To quantify the yield (and quality) penalty of selected wheat varieties with differing resistance ratings with different fungicide management strategies.
- Understand the yield implications of not being able to apply a spray at a critical time.

Treatment descriptions

Three varieties commonly grown in the Orana Region with a range of disease resistance ratings were selected and were treated with a range of common fungicide management options. The trial was sown on the 2/06/2026 and harvested on 1/12/2026. The varieties, treatment timings and their ratings are listed in Table 1, while the fungicides applied are outlined in Table 2.

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Table 1. Varieties, disease ratings and fungicide application timings

Description	Number of sprays	Fungicide timing	ECR2025
Sunmaster	Nil	Nil	MRMS
Sunmaster	1 early	Z21	MRMS
Sunmaster	2 early	Z21 + Z32	MRMS
Sunmaster	3 early	Z21 + Z32 + Z39	MRMS
Sunmaster	4	Z21 + Z32 + Z39 + H	MRMS
Sunmaster	1 mid	Z32	MRMS
Sunmaster	2 mid	Z32 + Z39	MRMS
Sunmaster	3 late	Z32 + Z39 + H	MRMS
Sunmaster	1 late	Z39	MRMS
Sunmaster	2late	Z39 + H	MRMS
Vixen	Nil	nil	SVS
Vixen	1 early	Z21	SVS
Vixen	2 early	Z21 + Z32	SVS
Vixen	3 early	Z21 + Z32 + Z39	SVS
Vixen	4	Z21 + Z32 + Z39 + H	SVS
Vixen	1 mid	Z32	SVS
Vixen	2 mid	Z32 + Z39	SVS
Vixen	3 late	Z32 + Z39 + H	SVS
Vixen	1 late	Z39	SVS
Vixen	2 late	Z39 + H	SVS
LRPB Lancer	Nil	Nil	RMR
LRPB Lancer	4	Z21 + Z32 + Z39 + H	RMR

Table 2. Fungicide applications list.

Date	Chemical	Active(s)	Group	Rate (ml/ha)	Crop stage
24/07/2025	Prosaro® 420SC	210 g/l prothioconazole, 210 g/l tebuconazole	3	300	Z21
29/08/2025	Tazer® Xpert	80 g/l azoxystrobin, 31.25 g/l epoxiconasol	3+11	500	Z32
17/09/2025	Tazer® Xpert	80 g/l azoxystrobin, 31.25 g/l epoxiconasol	3+11	500	Z39 (Vixen)
30/09/2025	Tazer® Xpert	80 g/l azoxystrobin, 31.25 g/l epoxiconasol	3+11	500	Z39 (Lancer and Sunmaster)
15/10/2025	Tazer® Xpert	80 g/l azoxystrobin, 31.25 g/l epoxiconasol	3+11	500	Heading

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Site Selection

This site was selected because it is a higher rainfall area with past reports of disease outbreaks.

Rainfall

2025 was a good season in Geurie, with close to average rainfall for the first 6 months of the year (Table 3), the in-crop rainfall was ~288.2 mm. July and August had below average rainfall and September was very wet. Conditions were conducive to disease proliferation; stripe rust and yellow spot were observed in Vixen[A] with a leaf area reduction in untreated susceptible varieties (data not presented).

Table *3*. Monthly rainfall[1] (mm) and long-term average (LTA) at the trial site.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2025	66	53	56	46	41	44	32	23	92	8	4	36	**501**
LTA	62	51	52	46	43	46	45	42	43	52	57	55	**594**

Rainfall (Figure 1) was reasonably consistent during the main growing period with a large fall of rain prior to flag leaf emergence (~Z39)

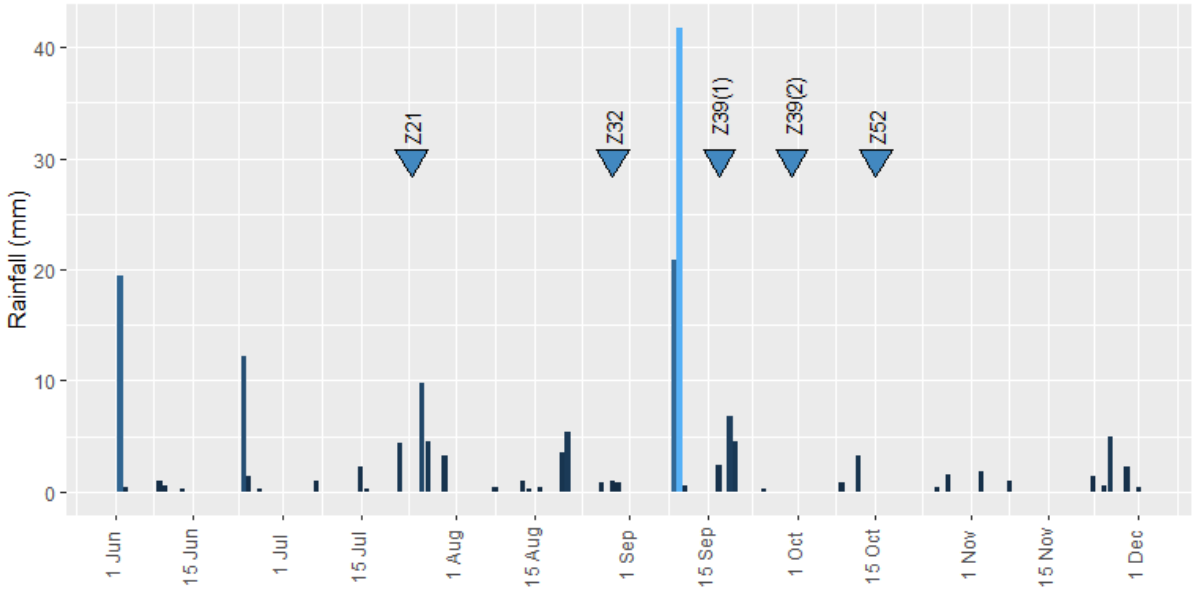

Figure 1. Daily rainfall received (vertical lines) and spray timings (inverted triangles). Timings are Zadok growth stages, Z39(1) Vixen[A], Z39(2) Sunmaster[A] and LRPB Lancer[A].

[1] Gridded data for the trial site from: Access Gridded Data | LongPaddock | Queensland Government

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Results

Conditions were conducive to disease proliferation; stripe rust and yellow leaf spot were observed in Vixen[A] with a visible reduction in leaf area (data not presented). YLS was detected at Z32, low levels of stripe rust were detected at Z39 and high levels were observed by Z47. pQCR testing was conducted to determine what species were present (see below).

Grain yield

The average yield in the treated plots was 4.32 t/ha. LRPB Lancer[A], resistant-moderately resistant (RMR) rating, had a similar yield where no fungicides were applied compared to fully sprayed.

- The highest yield was 5.32 t/ha.
- The lowest yield was 2.22 t/ha.

Observations

- No sprays: Sunmaster[A] had a higher yield than Vixen[A] and LRPB Lancer[A] .
- 1 spray:
  - on Sunmaster[A] at Z32 was as good as 2, 3 or 4 fungicide applications
  - on Vixen[A] at Z21 resulted in the lowest yields (like untreated Vixen[A])
  - on Vixen[A] at Z39 was as good as or better than any of the Vixen[A] 2 spray strategies
  - on Vixen[A] at Z39 was not as good as Vixen[A] 3 (Z21+Z32+Z39) or 4 sprays.
- 4 sprays: Sunmaster[A] had higher yields than Vixen[A] with LRPB Lancer[A] the lowest yielding.
- Sprayed and unsprayed LRPB Lancer[A] had similar yields.

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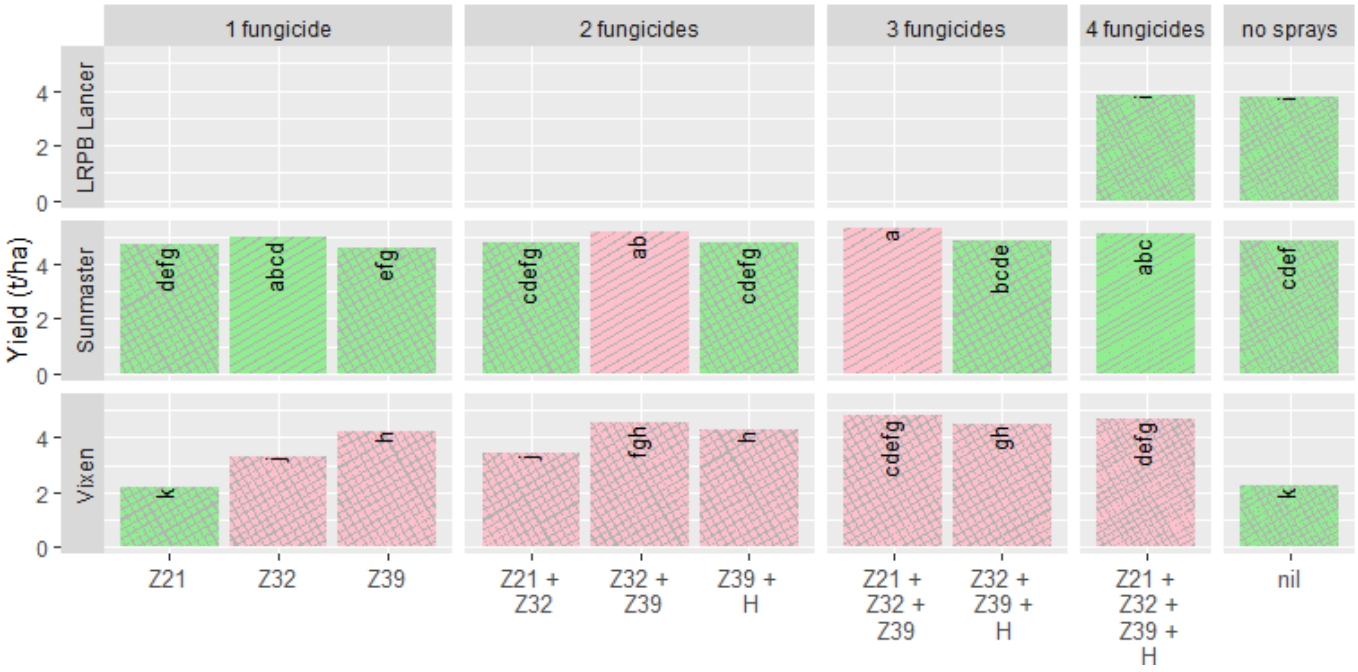

Figure 2. Yield (t/ha) for the different fungicide management strategies. LRPB Lancer[A] only received the 4-fungicide treatment. Treatments with the same letter are not significantly different. Treatments with pink shading are different to the untreated within a variety.

Grain quality

- Screenings were moderate at this site with considerable treatment differences in Vixen[A] (Figure 3).
- LRPB Lancer[A] and Sunmaster[A] had no differences in screenings regardless of the treatment.

Vixen[A]

- One fungicide at Z32 and no sprays had similar high screenings, both above 15%.
- One fungicide at Z21 and 2 fungicides (Z21 + Z32) had screenings between 10-12%.
- All other fungicide strategies had screenings below 6%.

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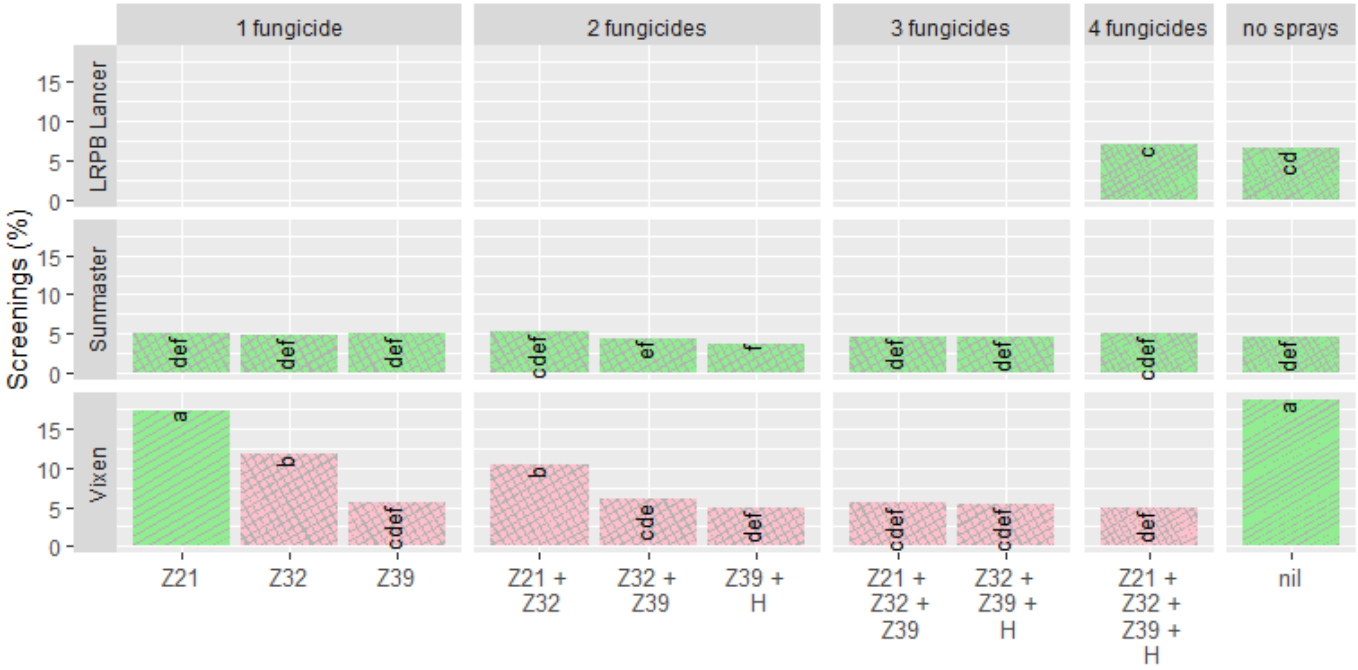

Figure 3. Screenings (%). Treatments with the same letter are not significantly different. LRPB Lancer[A] only received the 4-fungicide treatment. Treatments with pink shading are different to the untreated within a variety.

The highest protein of 15.35% (Figure 4) was LRPB Lancer[A] sprayed at Z21 + Z32 + Z39 + H. The lowest was Vixen[A] at 13.05% sprayed at Z39 + H.

- LRPB Lancer[A], regardless of fungicide, had the highest protein, above 15%.
- Sunmaster[A], with 4 fungicides (13.6%), had slightly higher protein than where it was unsprayed (13.1%).
- Vixen[A] sprayed at Z39, in any fungicide management strategy, had lower protein levels than all other strategies, or where it was not sprayed at all.

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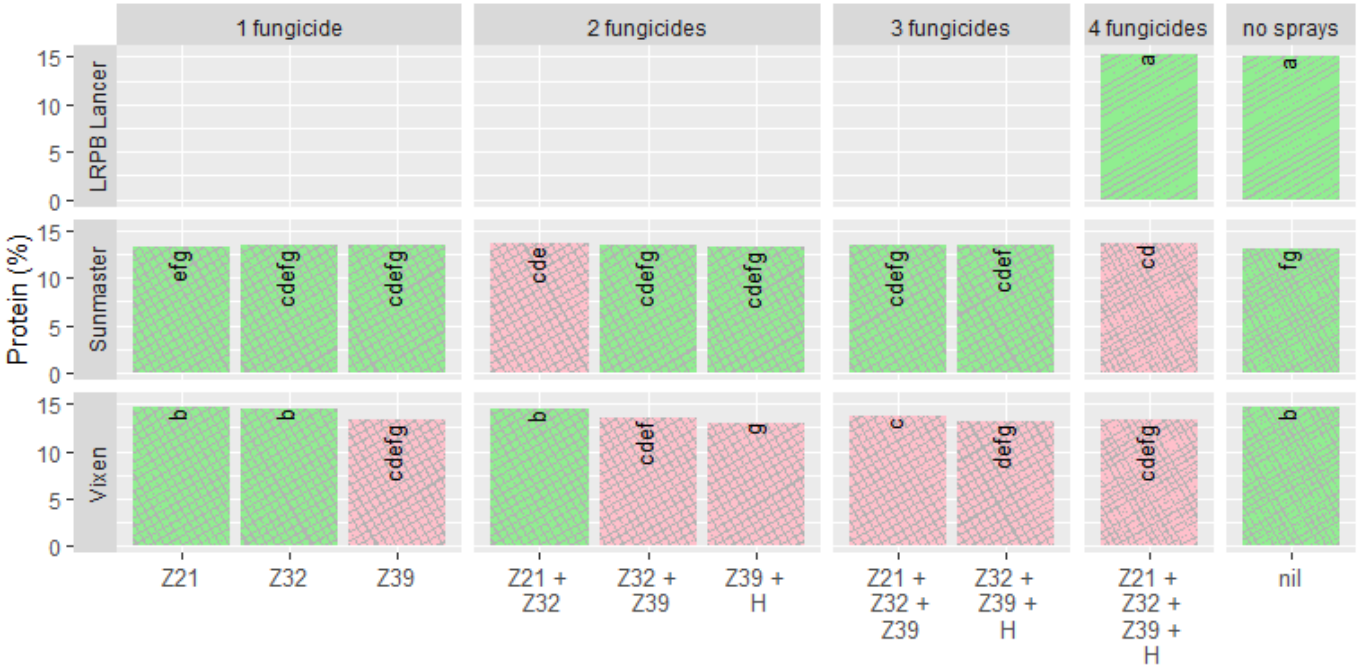

Figure 4. Protein. LRPB Lancer[A] only received the 4-fungicide treatment. Treatments with the same letter are not significantly different. Treatments with pink shading are different to the untreated within a variety.

Before harvest a limited selection of leaf samples were collected from selected treatments for DNA (PredictaB) testing[2] which confirmed the presence of rust (leaf, stripe and stem), YLS, and septoria, however the level of YLS and septoria was very low (**Figure *5***).

[2] **Ophel-Keller, K., McKay, A., Hartley, D., Herdina, & Curran, J. (2008). Development of a routine DNA-based testing service for soilborne diseases in Australia. *Australasian Plant Pathology*, 37, 243–253.**

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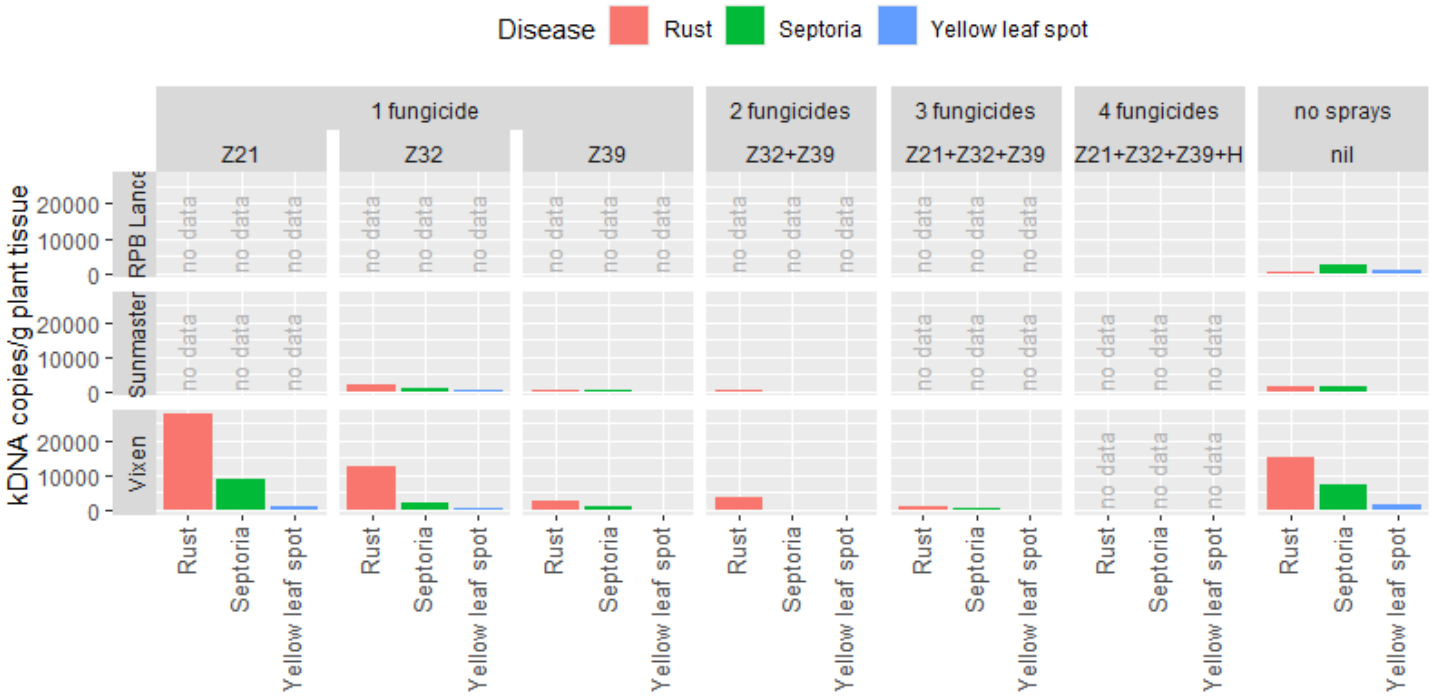

Figure 5. Disease levels found on leaf samples collected prior to harvest using qPCR testing. Note that these results are indicative only, not statistically robust, as they represent a single replicate from a subset of the full treatment list rather than all four reps.

Discussion

2025 was an above average rainfall year at Geurie, which provided ideal conditions for the proliferation of cereal foliar diseases. The site's average yield was ~4.32 t/ha, average protein 13.79%, and average screenings were 6.86%. The diseases observed were yellow spot (*Pyrenphora tritici-repentis*) and stripe rust (*Puccinia striiformis*). The presence of these was confirmed with qPCR testing which also detected the presence of septoria (*Zymoseptoria tritici*).

Where varieties received 4 fungicide applications, there was ~1.3 t/ha yield difference between Sunmaster[A] and LRPB Lancer [A], in part reflecting NVT results i.e. Sunmaster[A] often outperforming LRPB Lancer [A3].

The early Z21 and a head wash spray (to control fusarium head blight?[4]) did not appear to provide any benefit. The early application would have been warranted in a season like 2022, where a perfect set of conditions led to early outbreaks of stripe rust.

[3] Grains Research and Development Corporation. (2025). National Variety Trials.

[4] Fusarium head blight and white grain issues in 2022 wheat and durum crops - GRDC https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2023/02/fusarium-head-blight-and-white-grain-issues-in-2022-wheat-and-durum-crops

LRPB Lancer[A] was included as a reference, and that there were no differences in yield or quality between the high, 4-spray fungicide strategy and no sprays, justifying its 2025 resistant-moderately resistant (RMR) ECR[5].

Vixen[A] is known to suffer considerable yield penalties from leaf diseases, with an ECR of susceptible-very susceptible (SVS). Its APR gene does not become active until after GS39 and might not fully express until GS55, and even then, is likely to be weak. The recommendation for SVS varieties is for an application of flutriafol at sowing, followed by a minimum of one fungicide application at GS39 and more as required, particularly if diseases are present.

The unsprayed Vixen[A] had a yield loss of 52% when compared to 4 fungicide applications. This highlights its disease susceptibility and potential yield loss. At none of the fungicide timings was a one spray strategy enough to achieve its full yield potential, while a 3-spray strategy was as good as a 4-spray strategy. In 2025 the most critical timing for Vixen[A] was the Z39 application, one spray at this timing maintained around 90% of the yield of the 4-spray strategy. Where one or 2 earlier applications (at Z21 or Z32) were applied and simulating the scenario where the Z39 could not be applied, considerable yield losses were observed.

The yield differences between the sprayed and unsprayed Sunmaster[A] were minimal (5%) compared to Vixen[A] (where the yield was reduced by more than 52%). Z32 was the most critical timing for fungicide application on Sunmaster[A], a single application at this timing resulted in no yield loss (compared to a 4-spray strategy). Any 2 or 3 spray strategy that included a Z23 application was also as good as a 4-spray strategy. In Sunmaster[A] moderately resistant to moderately susceptible (MRMS), the APR gene expression initiates around Z37-Z39[6], showing that a single application at Z39 was too late and resulted in yield losses.

Alternate wheat varieties with genetically higher resistance ratings such as Sunmaster[A] can achieve yields close to the better yielding susceptible varieties such as Vixen[A], but where disease is present, yield penalties may only amount to ~10% if fungicide control is not possible

Selecting wheat varieties with improved disease ratings may result in slightly lower yields when no disease is present but have far less downside risk to yield and profit where fungicide applications are delayed or missed.

Growing wheat varieties with better disease resistance is good for the industry as it reduces the risk of breakdowns in genetic resistance to disease and/or the development of fungicide resistance.

Conclusions

- Growing varieties with lower disease resistance can suffer up to 80% yield reduction if conditions prevent fungicide application. These circumstances will build inoculum levels in the environment and put pressure on more resistant varieties.
- Fungicide management in more susceptible varieties is critical and requires a higher level of diligence to ensure yield losses.

[5] NVT Disease Ratings | NVT https://nvt.grdc.com.au/nvt-disease-ratings

[6] Management of striperust 2023 https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/1449691/Stripe-rust-management-2023.pdf

- Understanding the East Coast disease ratings, how this relates to the expression of the APR gene can be very useful when developing a disease management strategy.

Acknowledgements

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DISCLAIMER — TECHNICAL

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Appendix

Results

Applications number - timing	Variety	Plant establishment (plants/m2)		Vegetation index (95 DAS)		Yield (t/ha)		Screenings (%)		Protein	
Z21	Sunmaster	7.50	abc	0.74	bcde	4.73	defg	13.17	efg	4.98	def
	Vixen	5.75	fgh	0.73	de	2.22	k	14.57	b	17.40	a
Z32	Sunmaster	8.25	a	0.78	abc	5.00	abcd	13.45	cdefg	4.70	def
	Vixen	5.75	fgh	0.74	bcde	3.32	j	14.52	b	11.70	b
Z39	Sunmaster	7.50	abc	0.76	abcd	4.61	efg	13.47	cdefg	5.00	def
	Vixen	5.25	gh	0.75	abcd	4.25	h	13.40	cdefg	5.65	cdef
Z21 + Z32	Sunmaster	8.00	ab	0.77	abcd	4.82	cdefg	13.62	cde	5.25	cdef
	Vixen	5.25	gh	0.76	abcd	3.42	j	14.50	b	10.45	b
Z32 + Z39	Sunmaster	7.75	ab	0.76	abcd	5.16	ab	13.37	cdefg	4.45	ef
	Vixen	5.00	h	0.70	e	4.53	fgh	13.57	cdef	5.95	cde
Z39 + H	Sunmaster	7.75	ab	0.74	cde	4.78	cdefg	13.32	cdefg	3.70	f
	Vixen	6.25	defg	0.73	de	4.28	h	13.05	g	4.88	def
Z21 + Z32 + Z39	Sunmaster	7.00	bcde	0.79	ab	5.32	a	13.47	cdefg	4.65	def
	Vixen	6.00	efgh	0.76	abcd	4.80	cdefg	13.75	c	5.50	cdef
Z32 + Z39 + H	Sunmaster	8.00	ab	0.80	a	4.88	bcde	13.52	cdef	4.55	def
	Vixen	5.25	gh	0.72	de	4.52	gh	13.22	defg	5.35	cdef
Z21 + Z32 + Z39 + H	LRPB Lancer	6.50	cdef	0.76	abcd	3.84	i	15.35	a	7.03	c
	Sunmaster	8.00	ab	0.79	ab	5.09	abc	13.65	cd	5.15	cdef
	Vixen	5.75	fgh	0.74	bcde	4.69	defg	13.42	cdefg	4.88	def
nil	LRPB Lancer	7.25	abcd	0.75	bcd	3.77	i	15.10	a	6.48	cd
	Sunmaster	7.25	abcd	0.75	bcd	4.83	cdef	13.12	fg	4.63	def
	Vixen	5.25	gh	0.75	bcd	2.24	k	14.63	b	18.60	a
lsd	lsd	1.10		0.05		0.31		0.46		1.97	