

GOA trial site report

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

Grain Orana Alliance

Trial code:	GODI02725-2
Season/year:	Winter 2025
Property name:	Kiewa
Location:	Gilgandra
Trial cooperator:	James Hassell/Daniel Volkovski

Keywords

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

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.
- Protecting the flag leaf was important. Fungicide applications at growth stage (GS) Z39 was as good, or more effective than earlier applications.
- Using varieties with a better disease resistance package can considerably reduce the risk associated with disease in cases where spraying is not possible.
- A 'head wash' fungicide application did not impact yield or quality.

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

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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 indicates 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 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 it is 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 23/05/2026 and harvested on 20/11/2026. The varieties, treatment timings and their ratings are listed in Table 1, while the fungicides applied are outlined in Table 2.

¹ NVT (National Variety Trial)

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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	2 late	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
14/07/2025	Prosaro	210 g/L prothioconazole, 210 g/L tebuconazole	3	300	Z21
12/08/2025	Tazer® Xpert	80 g/L azoxystrobin, 31.25 g/L epoxiconasol	3+11	500	Z32
8/09/2025	Tazer® Xpert	80 g/L azoxystrobin, 31.25 g/L epoxiconasol	3+11	500	Z39 (Vixen)

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Date	Chemical	Active(s)	Group	Rate (mL/ha)	Crop stage
12/09/2025	Tazer® Xpert	80 g/L azoxystrobin, 31.25 g/L epoxiconasol	3+11	500	Z39 (Lancer and Sunmaster)
2/10/2025	Tazer® Xpert	80 g/L azoxystrobin, 31.25 g/L epoxiconasol	3+11	500	Heading

Site Selection: This site was selected because it is a higher rainfall area, with reports of disease outbreaks in the past.

Rainfall:

The 2025 season was good, with Gilgandra having above average rainfall in April and May (Table 3). The in-crop rainfall was ~255.4 mm. July was close to average rainfall, with August to November below average. Rust was visible in the trial in early September.

Table 3. Monthly rainfall² (mm) and long-term average (LTA) at trial site.

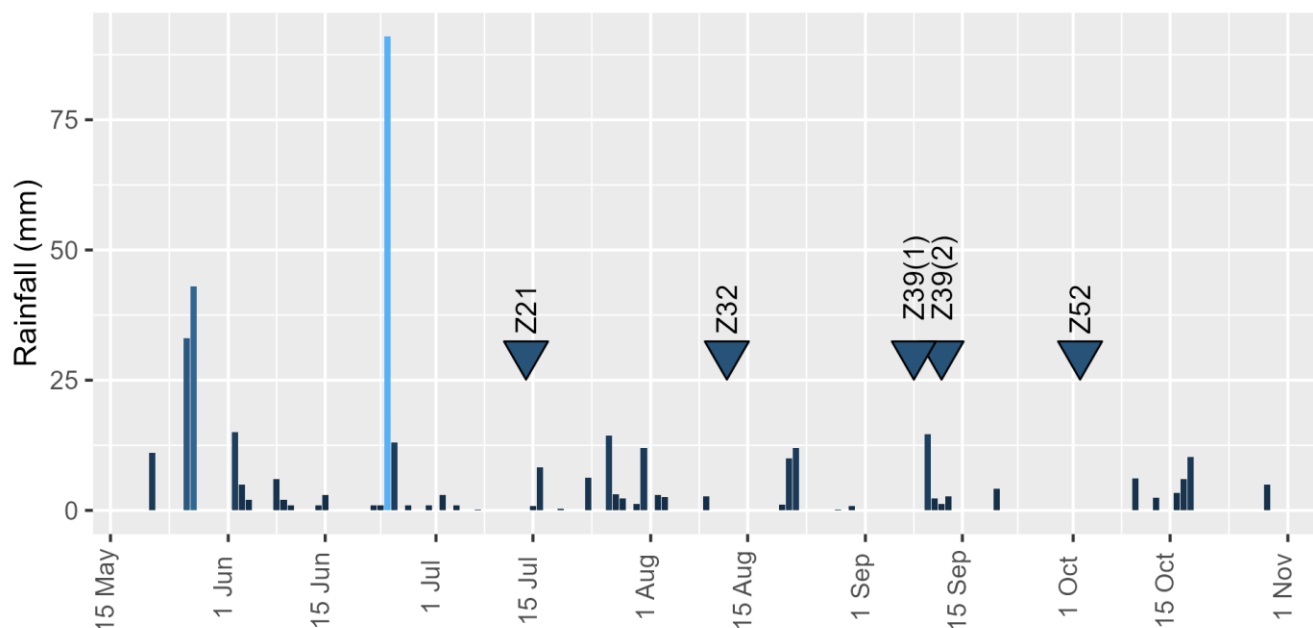
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2025	78	37	115	55	40	20	49	32	25	33	20	58	562
LTA	65	56	52	40	42	46	44	38	41	48	51	55	578

Rainfall was reasonably consistent during the main growing period with falls of generally less than 20 mm, and several occasions with rain falling over consecutive days.

² Gridded data for the trial site from: Access Gridded Data | LongPaddock | Queensland Government

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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.



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). pQCR testing was conducted to determine what species were present, see below.

Grain yield:

The site average in the treated plots was 4.76 t/ha.

LRPB Lancer^A had a similar yield where no fungicides were applied to where it was fully sprayed Figure 2.

OBSERVATIONS:

- no sprays: Sunmaster^A and LRPB Lancer^A had higher yields Vixen^A
- 4 sprays: Sunmaster^A had higher yields than Vixen^A and LRPB Lancer^A
- 1 spray:
 - on Vixen^A at Z39: was as good as 2, 3 or 4 fungicide applications
 - on Vixen^A at Z21: along with the untreated Vixen, had the lowest yield
 - on Vixen^A at Z39: was as good as or better than any of the Vixen^A 2 spray strategies.
- 2 sprays:

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- Z21 and Z32 on Vixen^A were not as good as a single Z39 spray.
- Sprayed and unsprayed LRPB Lancer^A had similar yields.

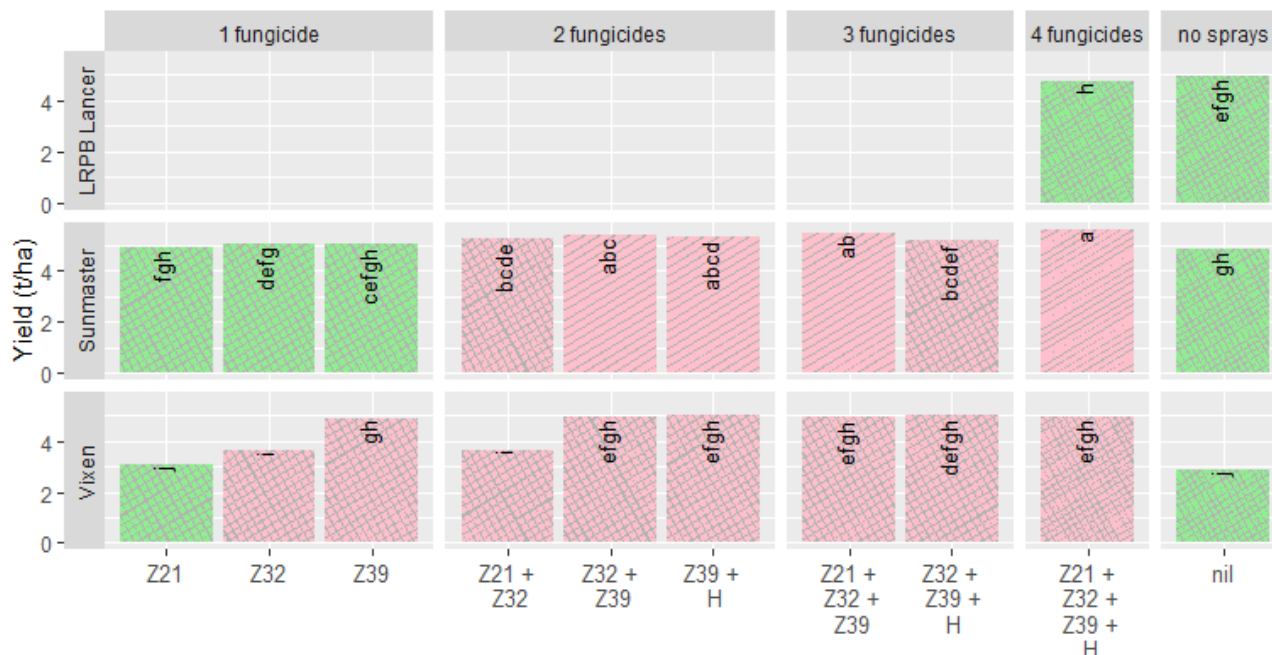


Figure 2: Yield (t/ha) for the different fungicide management strategies. Treatments with the same letter are not significantly different. Treatments with pink shading are different to the untreated within a variety.

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 Z21 and no sprays: had similar high screenings, both above 20%
- one fungicide at Z32 and 2 fungicides (Z21 + Z32): had screenings between 15 and 20%
- all other fungicide strategies had screenings below 10%.

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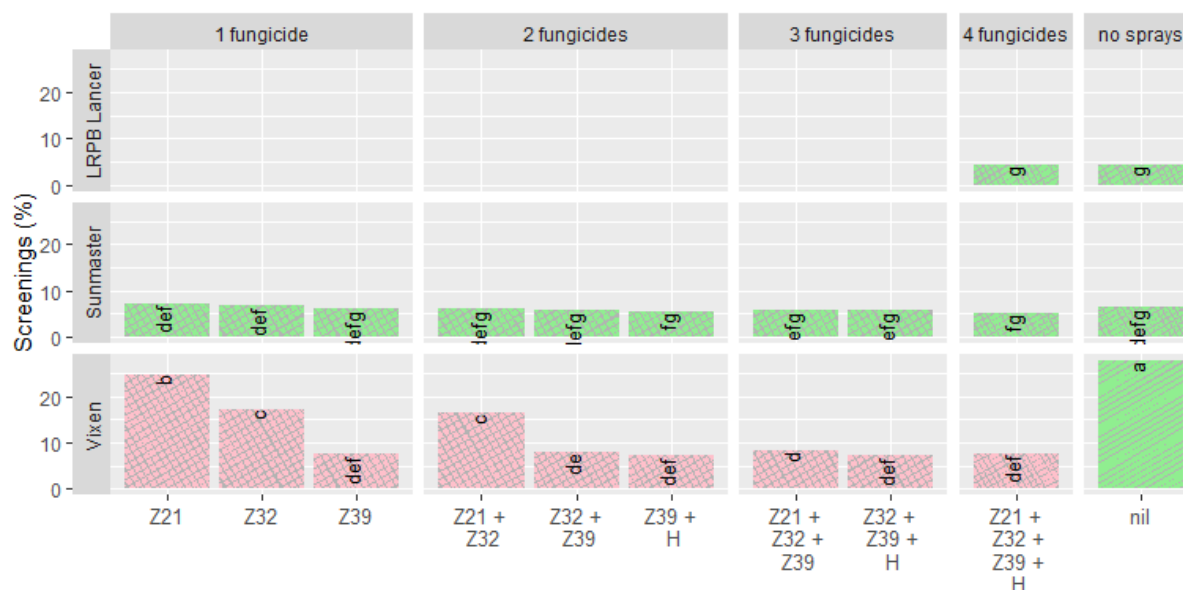


Figure 3. Screenings (%). Treatments with the same letter are not significantly different. Treatments with pink shading are different to the untreated within a variety.

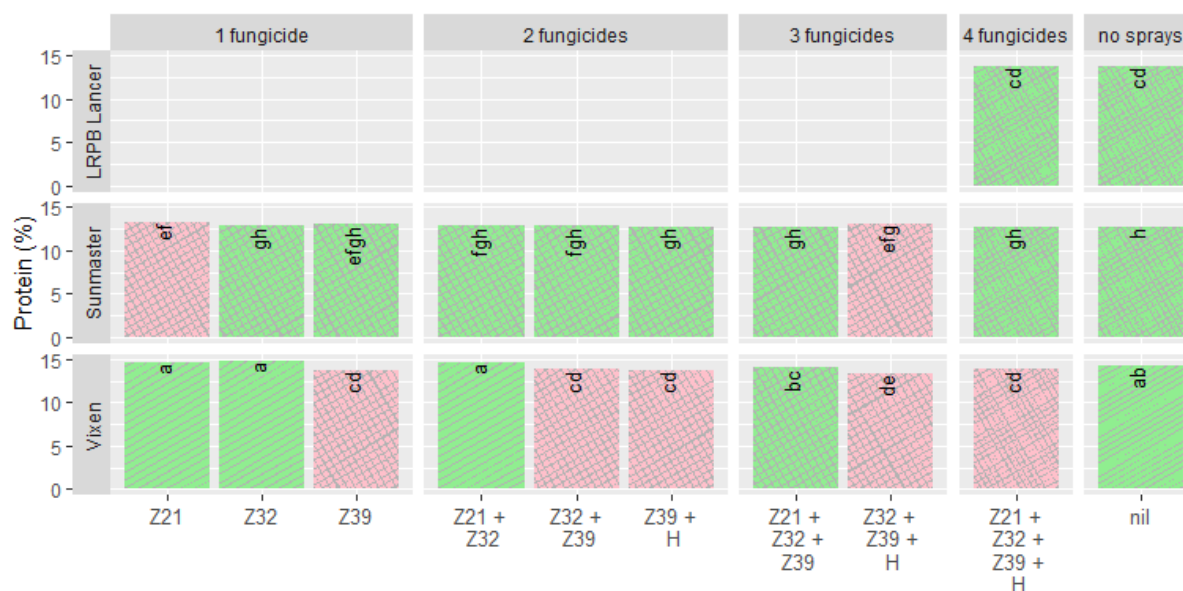


Figure 4. Protein (%). Treatments with the same letter are not significantly different. Treatments with pink shading are different to the untreated within a variety.

The highest protein level was Z32 Vixen^A at 14.72%, while the lowest was nil Sunmaster^A at 12.70% (Figure 3).

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Before harvest a limited selection of leaf samples were collected from selected treatments for DNA (PredictaB) testing³ 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).

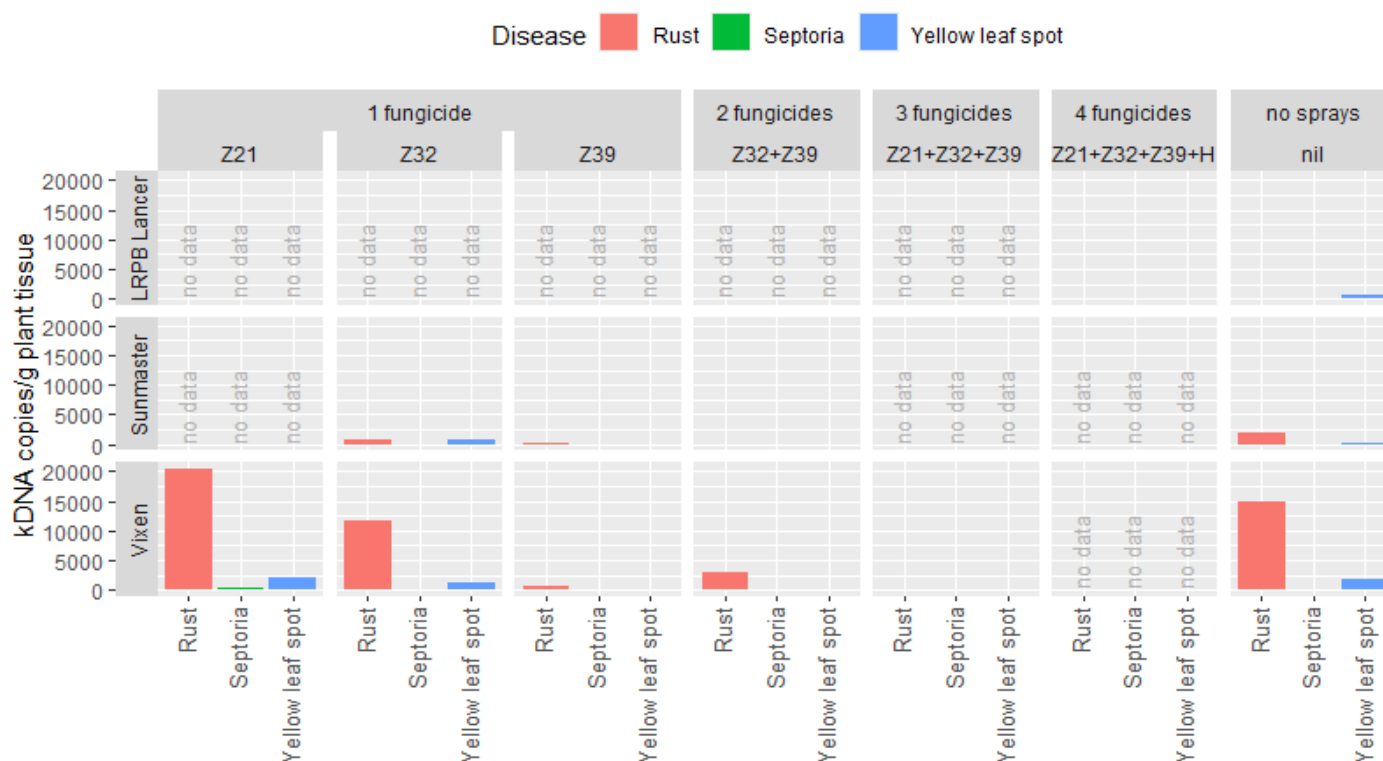


Figure 5. Disease levels found on leaf samples collected prior to harvest using qPCR testing. Note that these results are indicative only, not statistically robust, as they represent a single replicate from a subset of the full treatment list rather than all 4 reps.

Discussion

2025 was an average rainfall year at Gilgandra, with lower than average from August to September. Disease levels were high enough to see treatment differences.

The average site yield was ~4.76 t/ha, average protein was 13.53%, and average screenings were 9.19%. The diseases observed were stripe rust (*Puccinia striiformis*) and YLS (*Pyrenophora tritici-repentis*). Very low levels of septoria (*Zymoseptoria tritici*) were also found with qPCR testing.

The grower at this site uses high rates of nitrogen (N), which is likely to have influenced the onset of the APR gene. Background N in the paddock was tested to be 200 kg N/ha, 70 kg N/ha was predrilled as urea and a further 70 kg N/ha was applied in-crop. The current recommendation is that in high N situations varieties should

³ 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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be managed as if they are one resistance level lower. For example, Sunmaster^A is rated moderately resistant to moderately susceptible (MRMS), should be treated as moderately susceptible (MS), and Vixen^A goes from susceptible-very susceptible (SVS) to very susceptible (VS).

Prosaro[®] and Tazer[®] Xpert have both curative (prothioconazole or epoxiconazole) and protective (tebuconazole or azoxystrobin) activity. Applications before Z39 on Vixen^A did not provide enough protective activity to maximise yields. Rust and yellow leaf spot were observed in the trial at Z39. Fungicide application at this timing did have a treatment effect on Vixen^A, with possibly curative and protective activity. The effect of the single Z39 application on Sunmaster^A is not so clear, as the yield was no better than the untreated control.

Where varieties received 4 fungicide applications i.e. full protection, Sunmaster^A outyielded LRPB Lancer^A by ~0.9 t/ha, reflecting NVT results where Sunmaster^A often outperforms LRPB Lancer^{A4}.

The early Z21 and a head wash spray to control potential fusarium head blight⁵, did not appear to provide any benefit. The early application may have been warranted in a season like 2022, where seasonal conditions led to early outbreaks of stripe rust, but not in this season where the rust development cycle did not develop early.

LRPB Lancer^A was included as a reference, and, despite the presence of disease, there were no differences in yield or quality between a very high fungicide input strategy and no sprays, hence justifying its 2025 ECR⁶ rating of RMR. Vixen^A is known to suffer considerable yield penalties in the presence of leaf diseases, with an ECR of SVS. Its APR gene does not become active until after GS39 and might not be fully expressed 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. Flutriafol was not included in this trial, however, would have been unlikely to change the outcome as the disease was not evident until well after the persistence time.

The unsprayed Vixen^A had a yield loss of 42% when compared to where it got 4 fungicide applications. This highlights its susceptibility and the potential yield loss from disease. A single spray application on Vixen^A at Z39 was enough to achieve its full yield potential and maintain grain quality. In 2025 the most critical timing for Vixen^A was the Z39 application, one spray at this timing maintained over 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 ~14%. In Sunmaster^A, the APR gene expression initiates around Z37-Z39⁷, with the high N at this site it is more likely to be around ~Z51. The critical time to spray Sunmaster^A is less clear than for Vixen^A, however application of 2 or more fungicides (regardless of timing) provided a yield benefit. Multiple applications that included a Z39 spray were as good as the full or 4 spray strategy (with the exception of the Z32 + Z39 + H treatment).

⁴ Grains Research and Development Corporation. (2025). National Variety Trials.

⁵ 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>

⁶ NVT Disease Ratings | NVT <https://nvt.grdc.com.au/nvt-disease-ratings>

⁷ Management of striperust 2023 https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/1449691/Stripe-rust-management-2023.pdf

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This trial demonstrates that 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. Where disease is present, the yield penalties may only amount to ~10% for the MRMS variety if fungicide control is limited, but up to 42% for the SVS variety.

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 >40% 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 no yield losses.
- Understanding the ECR disease ratings, how this relates to the expression of the APR gene can be very useful when developing a disease management strategy.

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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	8.00	ab	0.81	abcdefg	4.91	fgh	13.30	ef	7.25	def
	Vixen	7.50	bcd	0.77	ij	3.05	j	14.62	a	24.87	b
Z32	Sunmaster	7.75	abc	0.80	efghi	5.08	defg	12.85	gh	6.80	def
	Vixen	7.50	bcd	0.78	hij	3.60	i	14.72	a	17.32	c
Z39	Sunmaster	8.25	a	0.82	abcdef	5.07	cefg	13.10	efgh	6.17	defg
	Vixen	7.50	bcd	0.79	ghi	4.90	gh	13.77	cd	7.67	def
Z21 + Z32	Sunmaster	7.67	abc	0.84	ab	5.25	bcde	12.91	fgh	6.15	defg
	Vixen	7.50	bcd	0.80	defghi	3.63	i	14.55	a	16.52	c
Z32 + Z39	Sunmaster	8.25	a	0.83	abcd	5.40	abc	12.87	fgh	5.87	defg
	Vixen	7.75	abc	0.81	cdefgh	4.94	efgh	13.82	cd	8.05	de
Z39 + H	Sunmaster	8.00	ab	0.83	abc	5.35	abcd	12.72	gh	5.52	fg
	Vixen	7.00	d	0.75	jk	5.00	efgh	13.77	cd	7.27	def
Z21 + Z32 + Z39	Sunmaster	8.20	a	0.84	a	5.50	ab	12.77	gh	5.67	efg
	Vixen	8.00	ab	0.78	hij	4.92	efgh	14.00	bc	8.27	d
Z32 + Z39 + H	Sunmaster	7.75	abc	0.81	bcdefgh	5.22	bcdef	13.15	efg	5.75	efg
	Vixen	8.00	ab	0.77	ij	5.05	defgh	13.42	de	7.22	def
Z21 + Z32 + Z39 + H	LRPB	7.25	cd	0.71	l	4.74	h	13.80	cd	4.15	g
	Lancer	8.25	a	0.83	abc	5.62	a	12.75	gh	5.27	fg
	Vixen	7.75	abc	0.78	hij	4.95	efgh	13.85	cd	7.77	def
nil	LRPB	7.25	cd	0.73	kl	4.98	efgh	13.80	cd	4.17	g
	Lancer	8.00	ab	0.82	abcde	4.82	gh	12.70	h	6.62	defg
	Vixen	8.00	ab	0.79	fghi	2.84	j	14.32	ab	27.67	a
Isd	Isd	0.61		0.03		0.32		0.45		2.52	