

GOA trial site report

Wheat: understanding the ‘risk’ associated with growing varieties with varying susceptibility to foliar diseases.

Grain Orana Alliance

Trial code:	GADI02024-1
Season/year:	Winter 2024
Location:	Manildra
Trial partners:	Terry Cotton
Paddock history	Canola

Keywords

GADI020, disease, NVT, risk, stripe rust, fungicides, yield response

Take home messages

In wet seasons yield of:

- susceptible varieties may be reduced by more than 70% if fungicides cannot be applied
- resistant varieties may be less than 10% under the same conditions.

The yield penalty for using susceptible varieties was far greater than the yield gains

Varieties with higher resistance ratings can achieve yields similar to high yielding, susceptible lines but with much lower risks

Yield differences occurred between varieties, consistent with those seen in National Variety Trials (NVT) trials.

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Background

The 2022 season was prolific 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 varieties with the aim of early pathogen identification. Strip rust developed earlier in the season 2022 is expected and before expression of the adult plant resistance (APR) genes, making early pathogen identification via sentinel sites difficult. As the crop matured, the differing varietal resistance ratings were evident. As expected, some varieties had a poorer resistance package with pathotype identification using sentinels now possible. Trial yields showed varieties with lower resistance ratings yielded less than half of those better resistance ratings.

Generally, varieties with lower resistance ratings perform well in NVT¹, 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). But in this 2022 trial, the varieties with the lower resistance rating suffered a very high yield penalty. The difference between the NVT data and the sentinel work indicates a large yield gap caused by foliar diseases. The NVT trials are managed/treated liberally for fungal disease while the GOA sentinel trials applied no fungicides.

While it is important to understand what level of yield is protected by fungicides, it is also critical to understand what level of risk growers take when relying on fungicides to protect yields. In 2022, there were many cases where growers were unable to spray paddocks due to wet conditions. These trials also illustrate the risk to growers if fungicide resistance develops, and these products are not as effective. This knowledge may help shift growers to adopt more resistant varieties sooner.

This trial looks to quantify the yield losses caused by foliar diseases of several common varieties grown in the GOA region by employing a full fungicide package strategy and comparing it to untreated varieties.

Aims

- To quantify the yield penalty of a range of common wheat varieties with differing resistance ratings in the presence of fungal diseases.

Treatment descriptions

Twelve varieties selected are commonly grown in the GOA region and have a range of disease resistance ratings. They were treated with a full fungicide package or nil fungicide. The varieties and their ratings are listed in Table 1. The fungicides applied are outlined in Table 2.

¹ NVT (National Variety Trial)

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Table 1: Varieties and disease ratings.

Variety	2023 East Coast rating	239 rating	198 rating
Beckom	MRMS	MR	MR
Catapult	S	S	MRMS
Condo	MS	MRMS	MRMS
Coolah	MSS	-	-
Longsword	R	RMR	RMR
LRPB Hellfire	MRMS	-	-
LRPB Lancer	RMR	RMR	RMR
LRPB Raider	MR	RMR	RMR
LRPB Reliant	MR	-	-
LRPB Trojan	S	-	SVS
Scepter	MSS	MRMS	MR
Vixen	SVS	-	-

Table 2: Fungicide applications list.

Date	Chemical	Active(s)	Group	Rate (ml/ha)
03/10/2024	Amistar Xtra	202 g/L azoxystrobin + 80 g/l cyproconazole	3+11	400
04/07/2024	Tebuconazole	430 g/L tebuconazole	3	145
17/09/2024	Aviator Xpro	150 g/L prothioconazole + 75 g/L bixafen	3+7	500
22/08/2024	Prosaro 420SC	210 g/L prothioconazole + 210 g/L tebuconazole	3	300
24/07/2024	Opus	125 g/L epoxiconazole	3	500
24/10/2024	Amistar Xtra	203 g/L azoxystrobin 80 g/L cyproconazole	3+11	400
28/05/2024	Impact*	250 g/L flutriafol	3	-

*Used as an in-furrow treatment

Site Selection

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This site was selected as a higher rainfall area where there were reports of disease outbreaks in 2022.

Rainfall

The 2024 season was a good one in Manildra with close to average rainfall (Table 3), the in-crop rainfall was ~316.7mm. Conditions were conducive to disease proliferation; stripe rust and septoria were observed in the untreated plots and there was a significant reduction in leaf area in untreated susceptible varieties (data not presented).

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
2023	54	29	116	86	12	39	27	35	14	29	90	77	608
2024	76	79	21	80	37	89	54	58	35	35	84	68	716
LTA	60	57	54	45	46	49	53	51	45	56	57	57	630

Results

Disease

Disease levels in the paddock were determined by collecting leaf samples (key yielding leaves, top 3, main stem and head) prior to harvesting. These were then tested using qPCR to determine the amount of DNA of various pathotypes in the sample.

Disease levels were very low where wheat was treated with fungicides. Rust levels (note that the QPCR test does not distinguish between the various cereal rust pathotypes) increased as the disease resistance rating decreased. Vixen had the highest levels of all 3 diseases assessed (in the untreated). All plots regardless of variety and fungicide treatment had some disease present (**Figure 1**).

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

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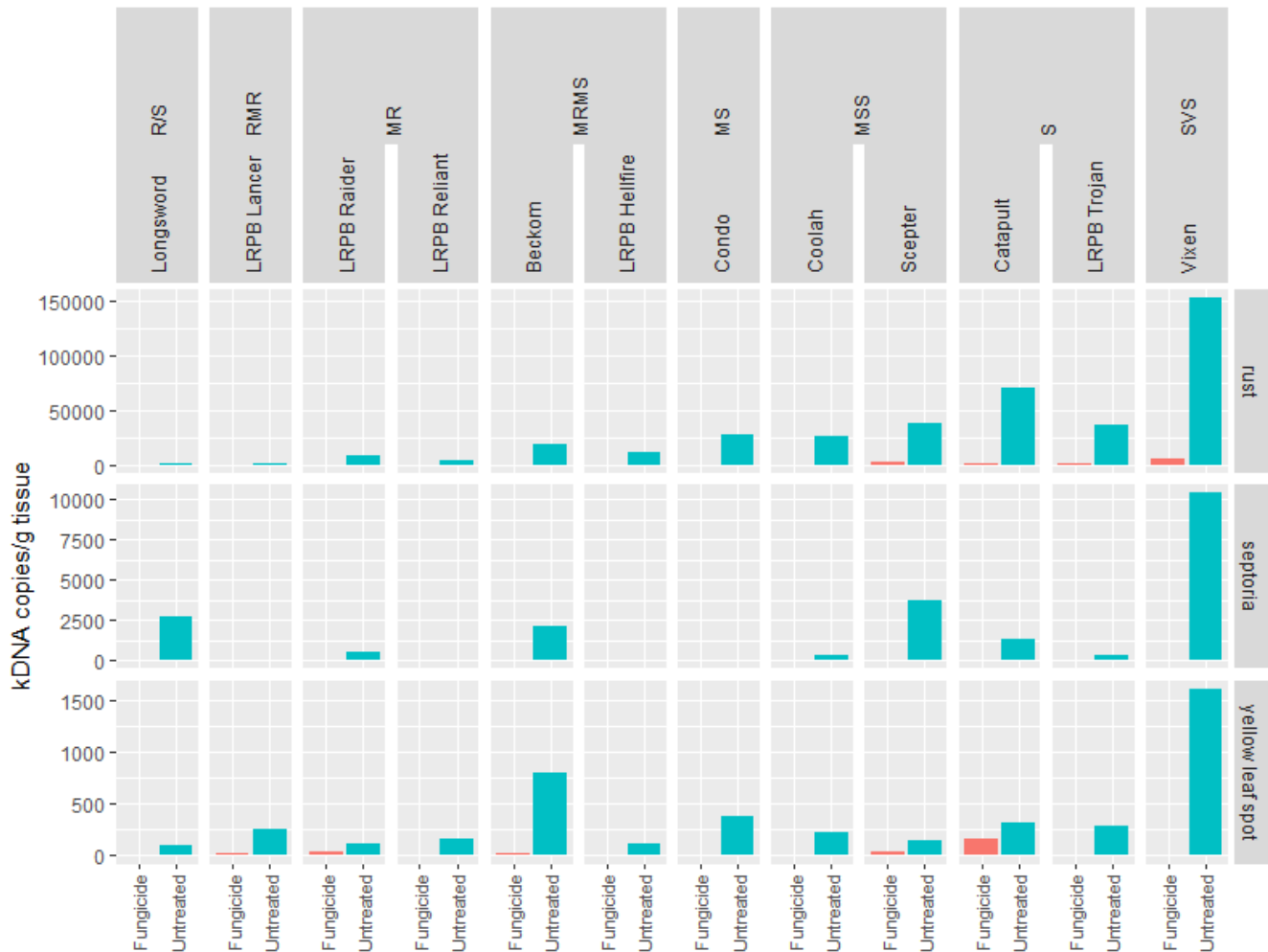


Figure 1. Levels of disease, rust, yellow leaf spot and septoria, present in plant tissue sampled prior to harvest (note that the test cannot distinguish between the different forms of cereal rusts).

Grain yield

The average yield in the treated plots was 4.69 t/ha.

All varieties, except for Longsword^A, had a yield reduction in the untreated plots. The reduction ranged from ~7% for LRPB Reliant^A (MR rating) to ~79% for Vixen^A (SVS rating).

Longsword^A was the only variety not to have a reduced yield in the untreated (Figure 1).

- Highest yield was Beckom^A @ 5.1 t/ha.
- The lowest yield was Untreated Vixen^A @ 1 t/ha.

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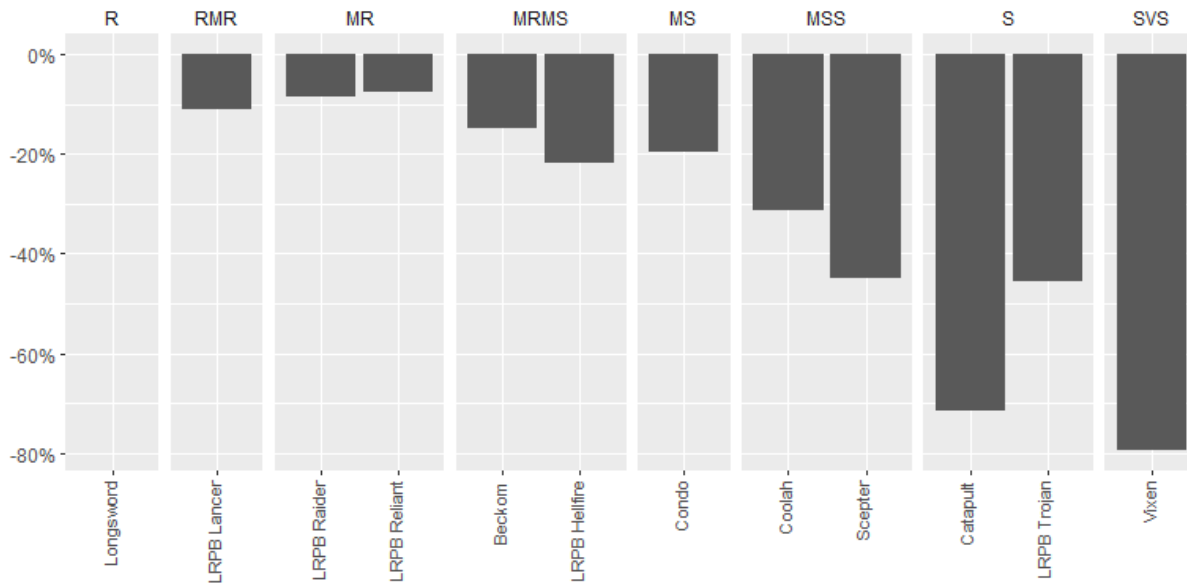


Figure 1: Wheat yield reductions (%) as a result of not applying fungicide (compared to a full fungicide program) to a range of varieties with varying disease resistance ratings.

Grain quality

- Screenings were low in the treated plots, all under 5%.
- Six varieties had increased screenings in the untreated plots, 5 of which would have resulted in a lower grade upon delivery.
- Catapult^A and Vixen^A had very high screenings, 20.0 and 16.9% respectively, in the nil fungicide plots (Figure 2).
- Highest protein was Untreated LRPB Hellfire @ 14% while the lowest was Fungicide Catapult^A @12%.

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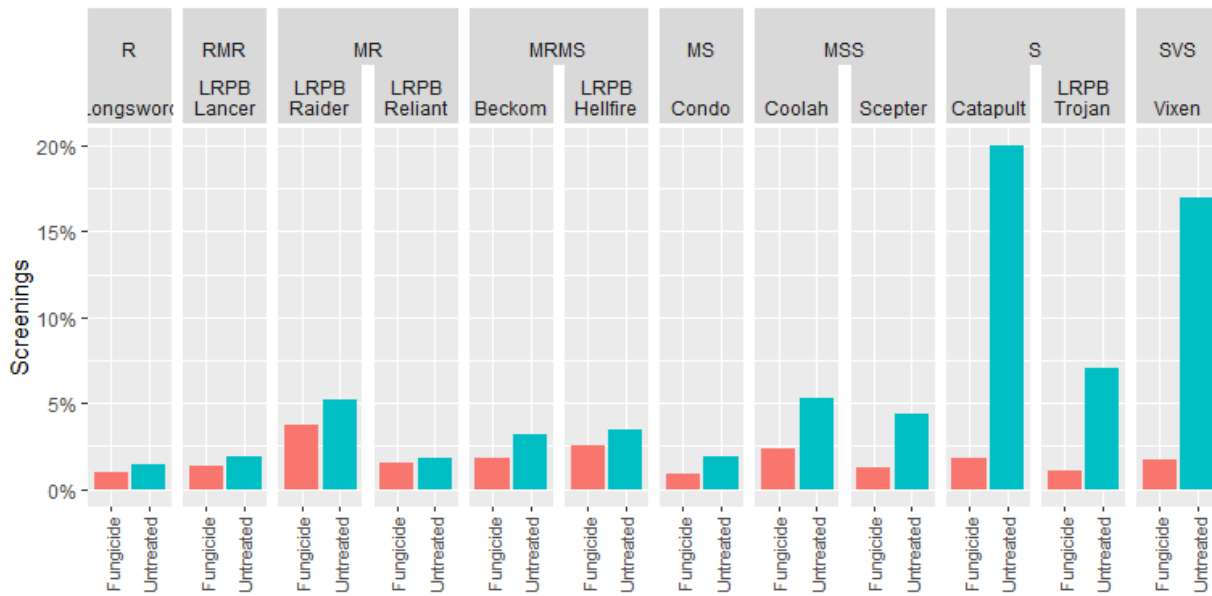


Figure 2: Screenings (%).

Discussion

The 2024 season at Manildra was very wet, and with conditions that allowed the proliferation of cereal foliar diseases. The average site yield was ~4.00 t/ha. The wet season was conducive to leaf disease proliferation and very high infection levels (of the main cereal diseases) were detected in untreated susceptible varieties (such as vixen).

There was over 1 t/ha yield difference between the highest and lowest yielding treated varieties (Beckom^A and LRPB Hellfire^{A3}), in part reflecting NVT results where Beckom^A often outperforms LRPB Hellfire^{A3}.

The East Coast resistance ratings proved to be a reasonably good guide to the yield and screenings response of these varieties under foliar disease pressure. Generally, yield decreased (in the untreated) as the resistance decreased.

There was a much larger yield difference, ~ 3.6t/ha, when comparing the unsprayed treatments. All varieties, except Longsword^A, had significant yield reductions with disease pressure. Untreated Vixen^A had the lowest yield at 1 t/ha, a 3.87 t/ha yield loss, compared to the sprayed treatment. Catapult^A (S) had a yield reduction of 3.44 t/ha compared to the sprayed treatments.

Several varieties, such as Vixen^A and Catapult^A, have become popular in recent years because of their perceived higher yield potential, despite low levels of stripe rust resistance.

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

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These varieties perform well when diseases are absent or adequately controlled; however, if fungicide application is compromised, yield penalties can be up to ~80%. Vixen^A yielded less than a quarter of that of Beckom^A in this trial.

There are alternate wheat varieties with genetically higher resistance ratings that can achieve yields close to the better yielding, susceptible varieties, 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 diseases are absent but have a smaller downside in yield and profit risk 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

- Varieties with lower disease resistance can have 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.

Under very heavy disease pressure, even the more resistant varieties can suffer yield losses.

Acknowledgements

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Appendix

Results

Disease	Variety	Yield (t/ha)				Screenings (%)					
		Treated		Untreated		Δ	Treated		Untreated		Δ
R	Longsword	4.86	bc	4.65	cde	ns	1.0	i	1.4	hi	ns
RMR	LRPB Lancer	4.43	ef	3.94	g	0.49	1.3	hi	1.9	ghi	ns
MR	LRPB Raider	4.36	f	3.99	g	0.37	3.7	def	5.3	d	1.6
	LRPB Reliant	4.68	cd	4.33	f	0.35	1.6	hi	1.8	ghi	ns
MRMS	Beckom	5.09	a	4.34	f	0.75	1.8	ghi	3.2	efg	ns
	LRPB Hellfire	4.06	g	3.17	h	0.89	2.6	fgh	3.5	ef	ns
MS	Condo	4.78	bc	3.84	g	0.94	0.9	i	1.9	ghi	ns
MSS	Coolah	4.55	def	3.13	h	1.42	2.4	fghi	5.3	d	2.9
	Scepter	4.93	ab	2.72	i	2.21	1.3	hi	4.4	de	3.1
S	Catapult	4.81	bc	1.37	j	3.44	1.8	ghi	20.0	a	18.2
	LRPB Trojan	4.81	bc	2.62	i	2.19	1.1	i	7.0	c	5.9
SVS	Vixen	4.87	bc	1.00	k	3.87	1.7	ghi	16.9	b	15.2