GOA trial site report

Wheat: understanding risk associated with growing varieties with varying susceptibility to diseases.

Grain Orana Alliance

Trial code:	GADI02024-2
Season/year:	Winter 2024
Location:	Gollan - Binginbar
Trial partners:	Nathan Simpson
Paddock history	Canola

Keywords

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

Take home messages

In wet seasons yield of the:

- susceptible varieties maybe 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) trails.

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 NVT[1], out yielding the standard varieties (i.e. Vixen[A] averaged 105 and 108% of EGA Gregory[A] in the NVT north east and west trials 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 trails 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 commonly to the GOA region with a range of disease resistance ratings were selected and treated with either a full fungicide package or untreated. The varieties and their ratings are listed in Table 1. The fungicides applied are outlined in Table 2.

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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)
03/09/2024	Aviator Xpro	150 g/L prothioconazole + 75 g/l bixafen	3+7	400
05/07/2024	Opus	125 g/L epoxiconazole	3	500
05/08/2024	Prosaro 420SC	210 g/L prothioconazole + 210 g/L tebuconazole	3	300
21/05/2024	Impact	250 g/L flutriafol	3	400*
24/09/2024	Amistar Xtra	201 g/L azoxystrobin + 80 g/L cyproconazole	3+11	400

*Used as an in-furrow treatment

Site Selection

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

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Rainfall

The 2024 season was relatively wet with an in-crop rainfall of ~286.6 mm. Rainfall details are in Table 3.

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

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2023	86	29	26	41	6	44	32	16	8	38	100	47	**473**
2024	72	55	35	63	42	60	53	51	19	50	112	82	**694**
LTA	67	53	52	41	41	47	46	43	44	56	59	57	**606**

Results

Disease

Disease levels in the paddock were determined by collecting 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.

Very little rust (note that the QPCR test does not distinguish between the various cereal rust pathotypes) or septoria was detected where wheat was treated with fungicides. Rust levels increased as the disease resistance rating decreased. Beckom had higher levels (in the unsprayed) of septoria and yellow leaf spot than other varieties. No treatment was completely free of all diseases (**Figure 1**).

[1] 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 site yield in the treated plots was 4.36 t/ha. For half the varieties there was no yield difference between the treated and unsprayed; these all had an East Coast disease rating of MS or higher.

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Figure 2. Yield of sprayed and unsprayed wheat varieties of varying East Coast resistance ratings. Treatments with the same letter are not significantly different.

- The 5 varieties with a rating of MSS or lower had yield reductions in the unsprayed. The yield of Vixen[A] was reduced by ~ 56%. LRPB Raider[A], with an MR rating, had a ~11% yield reduction. Screenings were very low, and at these levels the binned grade would not have changed (except for the untreated Vixen[A]). Five varieties had increased screenings in unsprayed plots. Vixen[A] went from 1.8% in the treated to 15% in the untreated.
- There were differences between the sprayed and unsprayed treatments, but not for all varieties (Figure 1). There were no yield differences for Longsword[A], LRPB Lancer[A], LRPB Reliant[A], Beckom[A], LRPB Hellfire[A] and Condo[A]. The remainder had yield reductions ranging from 11-56%. Fungicide Vixen[A] had the highest yield with 4.9 t/ha and had the highest yield reduction where it was not treated with fungicides; the resulting yield was 2.1 t/ha.
- The highest yield: + Fungicide Vixen[A] - 4.9 t/ha.
- The lowest yield: Untreated Vixen[A] - 2.1 t/ha.

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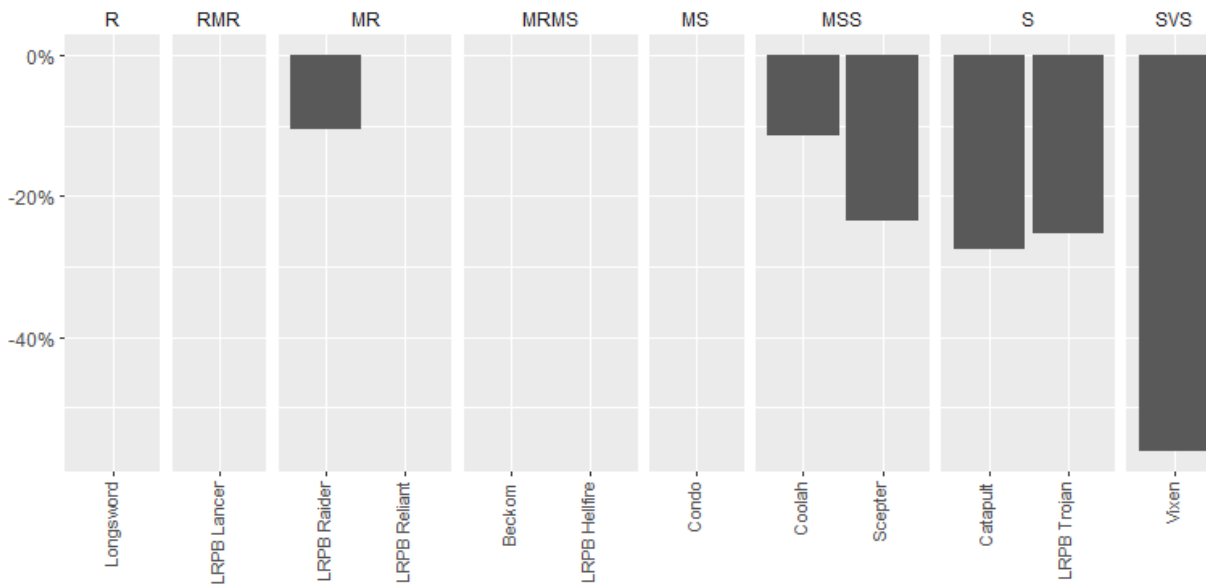

Figure 3. Wheat yield reductions (%) as a result of not applying fungicide (compared to a full fungicide program) of a range of varieties with varying East Coast disease resistance ratings.

Grain quality

- There were no differences in grain quality between the sprayed and unsprayed treatment of each variety except for +Fungicide LRPB Hellfire[A], whose screenings were 1.2% (Figure 2).
- Screenings were below 5% for all varieties except for unsprayed Vixen[A], which blew out to ~15%.

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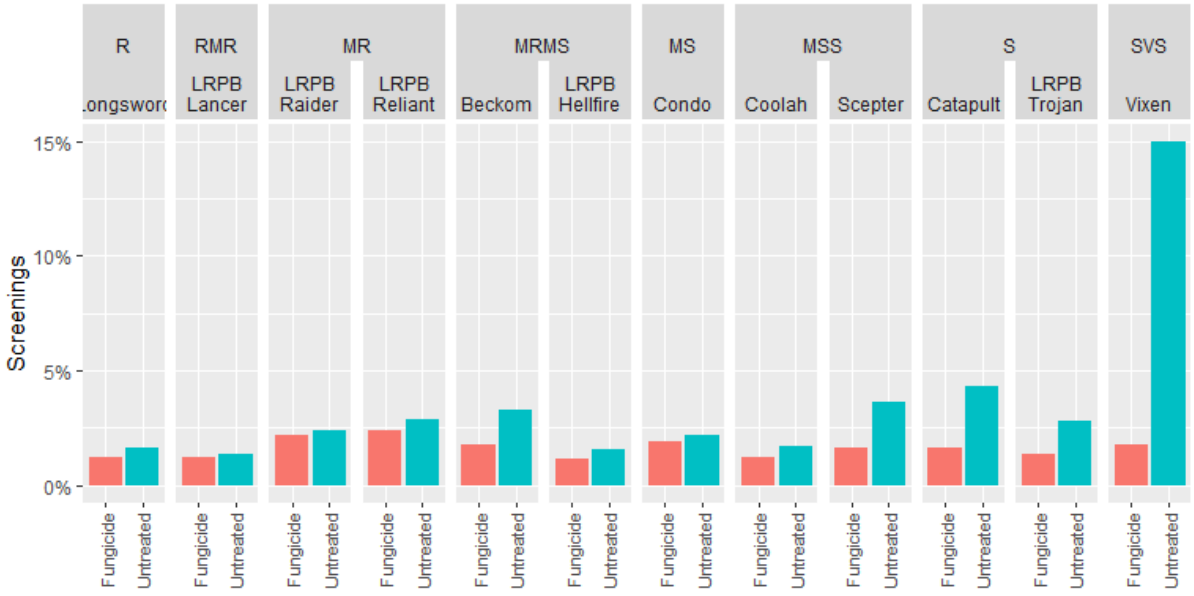

Figure 4. Screenings (%).

Discussion

2024 was an above average rainfall year at Gollan, which provided conditions that allowed the proliferation of cereal foliar diseases. The site average yield was ~4 t/ha; the average protein was 13%.

There was over 1 t/ha yield difference between the highest and lowest yielding treated varieties (Vixen[A] and LRPB Lancer[A] respectively), in part reflecting NVT results i.e. Vixen[A] often outperforms LRPB Lancer[A2]. Some of the varietal yield differences may be due to varieties being sown out of their recommended window, such as Longsword[A] (sowing date 21/05/2024).

The East Coast resistance ratings proved to be a reasonably good guide (with some exceptions, i.e. LRPB Raider[A]) to the yield and screenings response of various varieties under foliar disease pressure. Generally, yield decreased (in the untreated) as the resistance decreased. It appears that stripe rust has been the major driver of yield decreases, as although Beckom[A] had high levels of septoria and YLS in the untreated, there was no yield difference (between the sprayed and unsprayed). The high levels of stripe rust detected in the Vixen[A], caused a considerable yield difference between the sprayed and unsprayed treatments.

There was a much larger difference in yield, ~ 2.2 t/ha, when comparing the unsprayed treatments. Varieties with MSS rating had significant yield reductions from foliar diseases. Except for LRPB Raider[A], varieties with a rating of MS or better had no yield loss due to foliar diseases.

[2] NSW Winter crop variety sowing guide

The attraction of varieties with more susceptibility is the higher yield potential. Vixen[A] (SVS) (treated) had the highest yield, however it was not better than Beckom[A] (MRMS). Comparing the unsprayed varieties, the Vixen[A] yield was less than half that of Beckom[A] and was the lowest yield of all varieties.

Conclusions

Growing varieties with lower disease resistance can suffer yield losses of over 50% if conditions prevent the fungicide application. These circumstances will build inoculum levels in the environment and put pressure on more resistant varieties.

There are varieties with better disease resistance that yield as good as Vixen[A] .

Acknowledgements

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Appendix

Results

Disease		Yield					Screenings				
Rating	Variety	Treated		Untreated		Δ	Treated		Untreated		Δ
R	Longsword	4.37	bc	4.37	bc	ns	1.2	hi	1.6	fghi	ns
RMR	LRPB Lancer	3.88	fg	3.81	g	ns	1.2	hi	1.3	ghi	ns
MR	LRPB Raider	4.16	cd	3.72	gh	0.44	2.2	efg	2.4	def	ns
	LRPB Reliant	4.14	cdef	3.96	defg	ns	2.4	def	2.9	cde	ns
MRMS	Beckom	4.62	ab	4.37	bc	ns	1.7	fghi	3.3	cd	1.6
	LRPB Hellfire	4.08	def	3.89	efg	ns	1.2	i	1.6	fghi	ns
MS	Condo	4.13	cdef	4.16	cde	ns	1.9	efghi	2.2	efgh	ns
MSS	Coolah	4.19	cd	3.71	gh	0.48	1.2	ghi	1.7	fghi	ns
	Scepter	4.62	ab	3.53	hi	1.09	1.7	fghi	3.7	bc	2
S	Catapult	4.67	a	3.38	i	1.29	1.6	fghi	4.3	b	2.7
	LRPB Trojan	4.61	ab	3.44	i	1.17	1.4	ghi	2.8	cde	1.4
SVS	Vixen	4.86	a	2.13	j	2.73	1.8	fghi	15.0	a	13.2