SPRING FIELD DAYS 2023

Thursday 12th October 2023
Daysdale/Balldale

Friday 13th October 2023
Bundalong

SOWING THE SEED FOR A BRIGHTER FUTURE

Special thanks to our host farmers:

Peter Hanrahan
Ed Nixon
Adam Inchbold

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Maximising the benefits of early sown wheat and barley NGN

2023 Project outline

Research Locations – Finley and Griffith, NSW
The core outputs of the project will be centred on two dryland research sites at Daysdale (hosted by Peter Hanrahan) and Beelbangera, near Griffith in NSW. In the second year of research there has been more time to coordinate a trial program and therefore both research sites in Year 2 will operate under the same protocols testing two objectives. The first trial series will be looking at the germplasm (both wheat and barley) available and how they perform at early (target 10-15th April) and late (10-15th May) sow dates. The second trial series will be investigating the management of early sown wheat cultivars.

Research Program to be implemented at both research sites in 2023.
Aim: To examine the phenology, crop structure, dry matter production and yield of different germplasm in relation to early and late sow timings in the medium rainfall environment.

Proposed approach:
In Year 2 the aim is to establish two randomised small plot trial to firstly look at phenology and canopy structure of various long season wheat and barley cultivars at two sowing dates, and secondly to investigate ways to manipulate/manage canopy biomass and the effects on grain yield.

Trial 1
Treatments – under a single standard management for each scenario
In trial 1 the focus will be on development (phenology assessments) and adaption of long season spring wheats and shorter season winter wheats to two time of sowing scenarios. The trial will be managed with what is regarded a typical approach for the region.

Time of sowing
Both sow dates will be blocked and replicated within the one trial with all cultivars at each sow date to allow for statistical comparisons between sow dates.
1. April sown (10-15th April) wheat and barley.
2. May sown (10-15th May) wheat and barley.

Germplasm (Cultivars)
With more time to plan and collect seed for 2023 trials, a larger cultivar list has been developed with some newer germplasm alongside regional benchmarks. The following eighteen cultivars, 4 Barleys and 14 wheats, will be tested under each time of sowing.

Barley Varieties

1. Newton	Winter Barley
2. RGT Planet	Spring Barley
3. Beast	Spring Barley
4. Maximus CL	Spring Barley

Wheat Varieties

1. RGT Waugh	Slow Winter
2. Anapurna	Slow Winter
3. RGT Accroc	Slow Winter
4. Illabo	Medium Winter
5. LRPB Mowhawk	Quick Winter
6. Longsword	Quick Winter
7. Stockade	Very Slow Spring
8. Nighthawk	Slow Spring
9. LongReach Raider	Slow Spring
10. Rockstar	Slow Spring
11. Lancer	Medium Spring
12. Scepter	Quick-Mid Spring
13. BASF Reilly	Quick-Mid Spring
14. Vixen	Quick Spring

Trial 2

Treatments

In trial 2 the focus will be on how best to manage the biomass of early sown wheat cultivars to adapt them to a lower rainfall, higher temperature region where too much biomass has the potential to negatively impact yield. The trial will investigate 3 management factors: cultivar, seeding rate and simulated grazing.

Cultivars

1. RGT Cesario (slow winter)
2. RGT Accroc ('flexible' winter)
3. Longsword (Quick winter)
4. LongReach Raider (Slow Spring)

Seeding Rate

1. Target 20 plants/m^2 (30 seeds/m^2)
2. Target 60 plants/m^2 (90 seeds/m^2)
3. Target 120 plants/m^2 (180 seeds/m^2)

Simulated Grazing

1. Un-grazed control
2. Mechanical defoliation (<GS30) *

*All varieties grazed at the same calendar date when first cultivar is ready

Barley Management options to close the yield gap and reduce pre harvest losses

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Key Findings

- Additional N supply and increased fungicide intensity were more important than cultivar and PGR application to achieve high yields in 2022.
- N supply ranging from 62kg N/ka (0N applied) to 197kg N/ha (135kg N/ha applied) resulted in a yield increase of 1.6t/ha under an intensive fungicide program.
- Increasing fungicide intensity under high N management resulted in yield gains of up to 1.4t/ha.
- Variety choice accounted for approximately 1t/ha of variability with the variety RGT Planet out yielding Cyclops and Leabrook, with 6.98t/ha achieved at TOS2.

Introduction

While it is assumed the new frontier for barley is 25kg.ha.mm this has rarely been demonstrated. Outside of variety selection recent research has demonstrated that canopy management in barley through the use of fungicides, sowing time, and plant growth regulation can explain yield responses ranging from 3 – 8 t/ha within similar genetics in cooler and milder production environments. These factors have been more important than Nitrogen management, particularly where yield potential exceeds 5t/ha and on fertile soils. There may be more scope to close the yield gap in the short to medium term with improvements in disease management, head loss, brackling and lodging control but has not been replicated in lower yielding environments.

This research aims to achieve and derive water limited potential yields in environments defined by heat, frost and terminal drought during grain fill. Our primary objective is to update management guidelines to achieve water limited yield potentials in LRZ – MRZ barley.

Methodology

Plot size	1.75 m x 10.0 m	**Fertiliser**	DAP (18:20) + 1%Zn +Impact @80kg/ha
TOS1: Seeding date	April 17, 2022	**Crop History**	Oaten Hay 2021
Harvest Date	November 28, 2022	**Soil N**	62kg N/ha (0-90cm)

TOS2: Seeding date June 17, 2022 **Location** Hart, SA

Harvest Date December 1, 2022

A replicated split-plot trial was established at Hart, SA to evaluate different agronomic strategies and the associated yield gap. Assessments collected include NDVI, lodging scores, head loss assessment, and grain yield and quality.

Two sowing sates were evaluated, an early sowing date (TOS 1 – Sown 27th April, effective sow date of 30th May after 26mm rain) and an on time sowing date (TOS2 – Sown 17th June). Each sowing date consisted of 8 levels of increasing management applied to 3 barley cultivars.

Table 1. *Summary of management levels*

Trt	Treatment name	Fungicide	Canopy	Nitrogen*
2	Nil Fungicide Low N	Nil	Nil	Low (55kg N/ha)
1	Intermediate Low N	1 Unit	Nil	Low (55kg N/ha)
5	Full Potential Low N	Full	Nil	Low (55kg N/ha)
4	Nil Fungicide High N	Nil	Nil	High (135kg N/ha)
3	Intermediate High N	1 Unit	Nil	High (135kg N/ha)
6	Full Potential High N	Full	Nil	High (135kg N/ha)
7	Full Potential Canopy	Full	PGR31/37	High (135kg N/ha)
8	Dual Purpose System	Full	Defoliation	High (135kg N/ha)
9	Nil N	Full	Nil	Nil

***N applied as a single application on 15th July 2022.**

Table 2. *Fungicide strategies applied.*

Treatment no	Sowing	GS31	GS39-49	GS59
Nil		---	---	---
1 Unit		Prosaro 300ml/ha		
Full	Systiva 150ml/100kg	Prosaro 300ml/ha	Aviator Xpro 500ml/ha	Opus 500ml/ha

Table 3. *Canopy intervention strategies applied.*

Treatment no	GS30	GS33 - 7
Nil	---	---
PGR	Moddus Evo 200ml/ha	Moddus Evo 200ml/ha
Defoliation#	Yes	

Defoliation = Simulated grazing

Table 4. Barley cultivars investigated.

Cultivar		Description
1.	RGT Planet	High yielding but disease susceptible
2.	Cyclops	High yielding low rainfall erect cultivar
3.	Leabrook	Vigorous lodging check

Results and discussion

Grain yields varied from 4.09t/ha to 6.98t/ha across all treatments in the trial. In 2022, yield was maximised by applying the high rate of N, controlling disease with an intensive fungicide program, growing the high yielding variety RGT Planet and by defoliating the canopy.

Table 5. Influence of increasing agronomic management on barley grain yield (t/ha).

Nitrogen	Fungicide	Canopy	Cyclops		RGT Planet		Leabrook		Mean	
Low	Nil	-	4.61	l	5.83	fg	4.37	mn	**4.94**	**e**
Low	Low	-	5.07	j	5.99	e	4.87	k	**5.31**	**d**
Low	High	-	5.60	h	6.39	c	5.30	i	**5.76**	**c**
High	Nil	-	4.50	lm	5.67	h	4.35	n	**4.84**	**e**
High	Low	-	5.60	h	6.50	bc	5.30	i	**5.80**	**c**
High	High	-	5.93	ef	6.57	b	5.69	gh	**6.06**	**b**
High	High	PGR	5.95	ef	6.50	bc	5.72	gh	**6.05**	**b**
High	High	Defoliation	6.16	d	6.90	a	6.03	de	**6.36**	**a**
Nil	High	-	4.33	n	5.06	j	4.10	o	**4.49**	**f**
		Mean	**5.30**	**b**	**6.16**	**a**	**5.08**	**c**		
		Pval Trt x Cultivar	<0.001				LSD P=.05		0.15	
		Pval Trt	<0.001				LSD P=.05		0.23	
		Pval Cultivar	<0.001				LSD P=.05		0.05	

Fungicide strategy

The fungicide strategies implemented varied from no fungicide, a single foliar fungicide at GS31, and up to the use of 3 foliar fungicides plus Systiva on the seed. Increasing the fungicide program intensity was most important under a high nitrogen program, where the application of Prosaro at GS31 gave a 0.96t/ha yield response and increasing to 3 foliar sprays gave an addition 0.26t/ha of grain yield (table 1.). This is despite the nil fungicide treatments under both nitrogen regimes having the same levels of disease (table 2).

High levels of disease were assessed in this trial, with rust being the predominant disease, particularly late in the season, with small amounts of net form and spot form of net blotch also present.

No fungicide treatment gave complete control/prevention of disease. However, the high intensity fungicide program was required to give the best disease control in a high-pressure year reducing disease infection from 83.3 % leaf area infected down to 0.8% in Leabrook.

Table 6. *Influence of increasing agronomic management on disease infection (% leaf area infected). Total disease infection includes Net form Net Blotch, Spot form Net Blotch but was mostly Leaf Rust. Assessed mid grain fill.*

Nitrogen	**Fungicide**	**Canopy**	Cyclops		RGT Planet		Leabrook		**Mean**	
Low	Nil	-	61.0	d	52.3	e	74.6	b	**62.6**	**a**
Low	Low	-	29.3	g	42.5	f	58.7	de	**43.5**	**b**
Low	High	-	0.7	h	1.8	h	0.4	h	**0.9**	**c**
High	Nil	-	69.7	bc	51.6	e	83.3	a	**68.2**	**a**
High	Low	-	35.1	fg	31.4	g	63.7	cd	**43.4**	**b**
High	High	-	1.5	h	2.3	h	0.8	h	**1.5**	**c**
High	High	PGR	1.9	h	1.6	h	0.5	h	**1.4**	**c**
High	High	Defoliation	1.8	h	3.4	h	4.1	h	**3.1**	**c**
Nil	High	-	1.2	h	4.5	h	1.6	h	**2.4**	**c**
Mean			**22.5**	**b**	**21.3**	**b**	**32.0**	**a**		
		Pval Trt	<0.001				LSD P=.05		9.4	
		Pval Var	<0.001				LSD P=.05		2.8	
		Pval TrtxVar	<0.001				LSD P=.05		8.5	

Nitrogen Management

Nitrogen program was a significant driver of grain yield, yields increased from 4.49t/ha with no applied nitrogen to 6.06t/ha with 135kg N/ha applied (table 1.). Except for the nil fungicide, each fungicide program implemented was higher yielding under higher nitrogen rates.

Higher nitrogen rates did create more lodging and earlier lodging (figure 1.), but scores overall were low (max 163 of a 0-500 score) and were likely not limiting yield. A similar story is shown for brackling, where higher N rates experienced higher levels of brackling which resulted in more head loss but a yield penalty of this isn't evident.

However, if harvest was delayed or bad weather was experienced later in the season, the result may have been different. It should also be noted that increasing fungicide intensity helped to reduced lodging and head loss (figure 1).

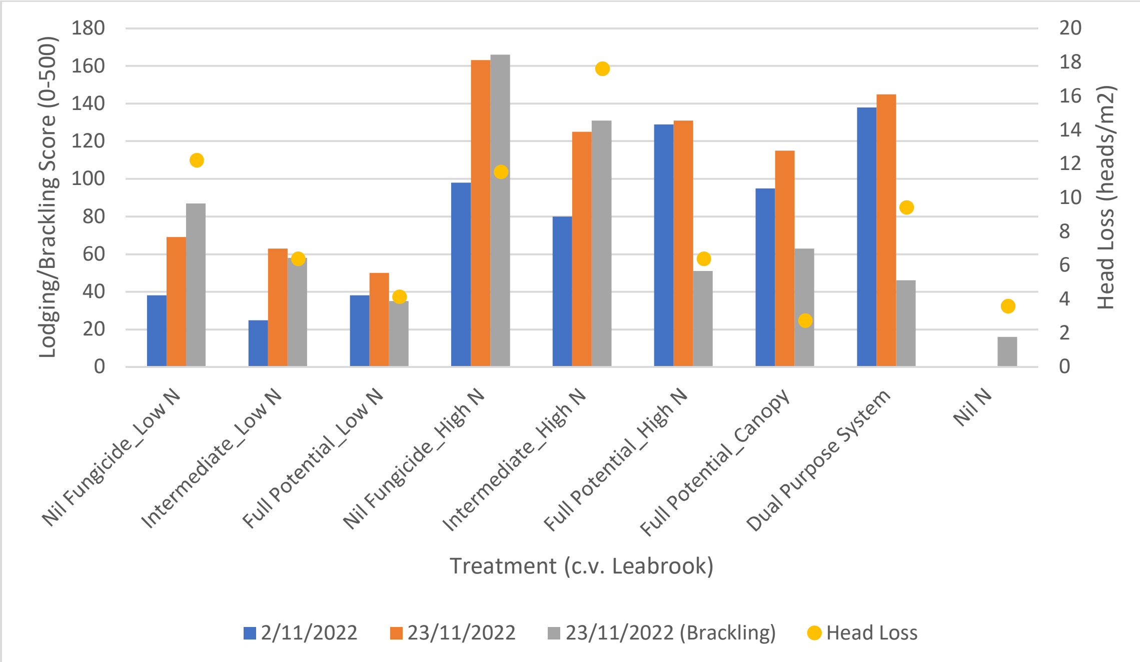

Figure 1. *Influence of increasing agronomic management of Leabrook barley on crop lodging/brackling and head loss. Assessed 23rd Nov.*

Canopy Management

Canopy management tactics implemented in this trial included defoliation and the use of plant growth regulators (PGR's). The highest yields were achieved in treatments where the canopy was defoliated pre GS30. This is likely a factor of 2022 being a longer/wetter season than normal where excess growth prior to GS31 can be unproductive and lead to lower yields through lodging and shading. In a more 'normal' or less productive season the response to defoliation may be different.

Canopy management through the use of PGR's helped to reduce lodging and head loss, but as mentioned above when discussing nitrogen rates, this did not result in yield differences.

Variety Choice

Three varieties were selected for this trial, each with specific traits to be tested, these being RGT Planet (high yielding, disease susceptible), Cyclops (low rainfall, erect type), and Leabrook (Vigorous lodging susceptible).

Variety choice accounted for 1.18t/ha in yield variation (Figure 2.). RGT Planet was the highest yielding variety with an average yield of 6.16t/ha, followed by cyclops yielding 5.3t/ha and the lowest yielding variety was Leabrook achieving 5.08t/ha.

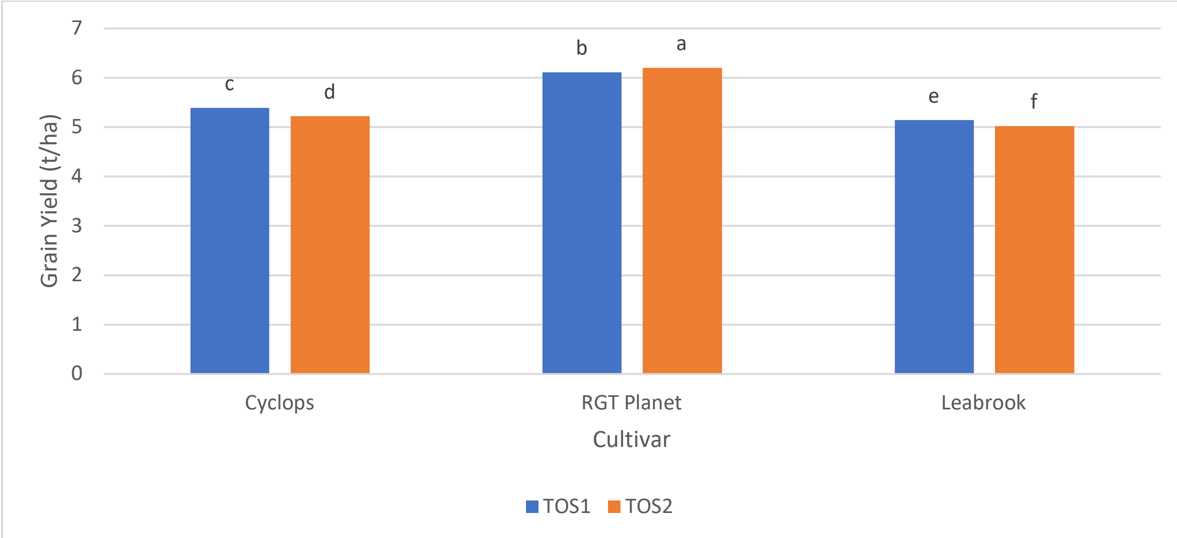

Figure 2. *Influence of cultivar and time of sowing on grain yield (t/ha).*

Despite RGT Planet being included as a disease susceptible variety (rated s-vs to net blotches) Leabrook experienced the highest disease pressure, this is due to high amounts of rust present in the season. Leabrook also experienced the highest levels of lodging, brackling and head loss of the three cultivars.

Sow Date

Two sow dates were used in this trial to try to shift flowering date, 27th April (effective sow date 30th May after rainfall), and 17th June. On average, time of sowing didn't effect yield (TOS1 – 5.55t/ha, TOS2 – 5.48t/ha) but there was an interaction between sow date and variety. RGT Planet was highest yielding at TOS2 (6.20t/ha vs 6.11t/ha) while Leabrook and Cyclops were higher yielding at TOS1 (5.14t/ha vs 5.02t/ha and 5.39t/ha vs 5.22t/ha respectively) showing the importance of matching sow date with the phenology of the individual cultivar.

Time of sowing also had a significant effect on disease levels present. It is generally expected that early sown crops are more susceptible to disease, however in this trial we saw higher disease infection with later sown crops (figure 3.). This is likely due to TOS2 canopies staying greener for longer making them susceptible to rust infections later in the seasons as temperatures start to rise.

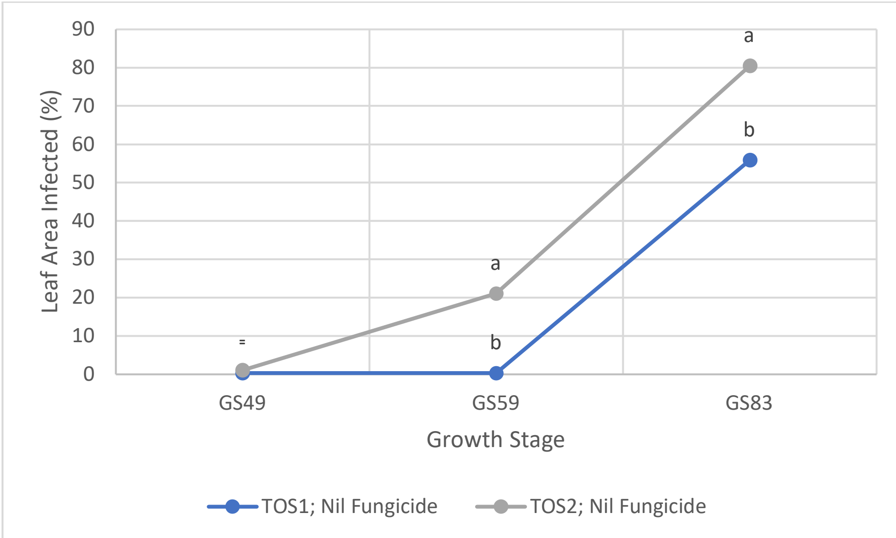

Figure 3. *Influence of time of sowing on disease infection.*

Conclusion

This research has demonstrated that in environments of higher yield potential (increased N supply, high rainfall season) it is important to protect the upper canopy, this can be done through the use of fungicides and growth regulators. We have shown that these decisions can result in yield gains/losses of close to 3t/ha.

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Pushing yield barriers in irrigated and dryland faba bean

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Keywords

faba bean, yield potential under dryland and irrigation

GRDC codes

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Take home messages:

- In 2020 and 2021, faba bean crops yielding over 7t/ha were produced under irrigation in northern Victoria and southern NSW on red brown duplex and grey clay soils (highest yield of 7.88t/ha)
- In 2021 in a dryland scenario in NE Victoria, faba beans achieved yields over 7t/ha.
- Faba bean crops yielding over 7t/ha had total in season water availability of 500mm or more either as growing season rainfall (GSR) alone or GSR plus irrigation.
- Excessive rainfall in October 2022 (in many cases 200mm for the month), reduced faba bean yields through a combination of transient water logging and increased disease pressure.
- Under irrigation, the yield penalty from low plant populations (15 plants/m2 and below) was 'magnified' when targeting high yielding crops.
- Allowing 30 kg N fixed per tonne of faba bean dry matter measured at peak biomass (30% podding and considers roots contribution) and using 40 kg N removed per tonne of grain is a useful way of estimating net N contribution also known as N balance.
- Nitrogen applied at 6-8 leaf stage with trace elements (mix of Zn, Mn, Cu, S, B, and Mo) increased yield in faba bean by 0.53 t/ha in a dryland trial at Bundalong, Victoria, achieving the highest yield of 7.96 t/ha.

Pushing yield boundaries

The research results presented in this paper was generated between 2019-2022 at irrigated research sites at Kerang, Victoria (grey clay), Finley, NSW (red brown duplex) and in dryland scenarios at Bundalong and Dookie in Victoria (red/brown soils). The research is primarily based on the Optimising Irrigated Grains (OIG) project, which seeks to push productivity boundaries in six crops including faba beans. Supplementary data have been generated as part of the 'Southern Pulse Agronomy' project and both projects have been resourced by GRDC.

What makes a 7-tonne crop?

Growing season rainfall (GSR) and irrigation

In the majority of research conducted in the Optimising Irrigated Grains project, high yields of >7t/ha have been associated with growing season rainfall (GSR) and/or irrigation totalling ≥500mm. In 2021 with a mild spring and a GSR of 500mm near Bundalong, dryland plots yielded over 7t/ha. In 2022, even though GSR in excess of 500mm were recorded, yields did not reach 7t/ha due to waterlogging and disease pressure in part due to a total of 200mm of rainfall in October. Under irrigation many of the 7t/ha plus yields have been achieved with surface (flood) irrigation, however in 2021 at Finley, autumn irrigation caused winter waterlogging due to higher than average rainfall.

Increased importance of plant population under irrigation

Irrigated grain production for faba beans plateaus at around 25 – 30 plants/m^2 on red/brown soils with little to be gained above 30 plants/m^2. On grey clays the optimum plant population is slightly lower at 20-25 plants/m^2, however if this falls below 20 plants/m^2 under irrigation the yield loss can be significant. With higher yield potentials in irrigated cropping systems, small differences in plant populations have a potential 'magnifying' effect on grain yield, with reductions in population of 10-15 plants/m^2 resulting in significant losses of 1.0 - 1.5t/ha. Moving from 20 to 30 plants/m^2 under irrigation has increased yield by 0.5t/ha and whilst populations greater than 30 plants/m^2 were rarely higher yielding. The risk of poorer performance in higher populations has been very low in comparison to the risk when populations drop below the optimum. In dryland scenarios where typically yield potential is lower, reductions in grain yield associated with populations falling below the optimum have been far less significant.

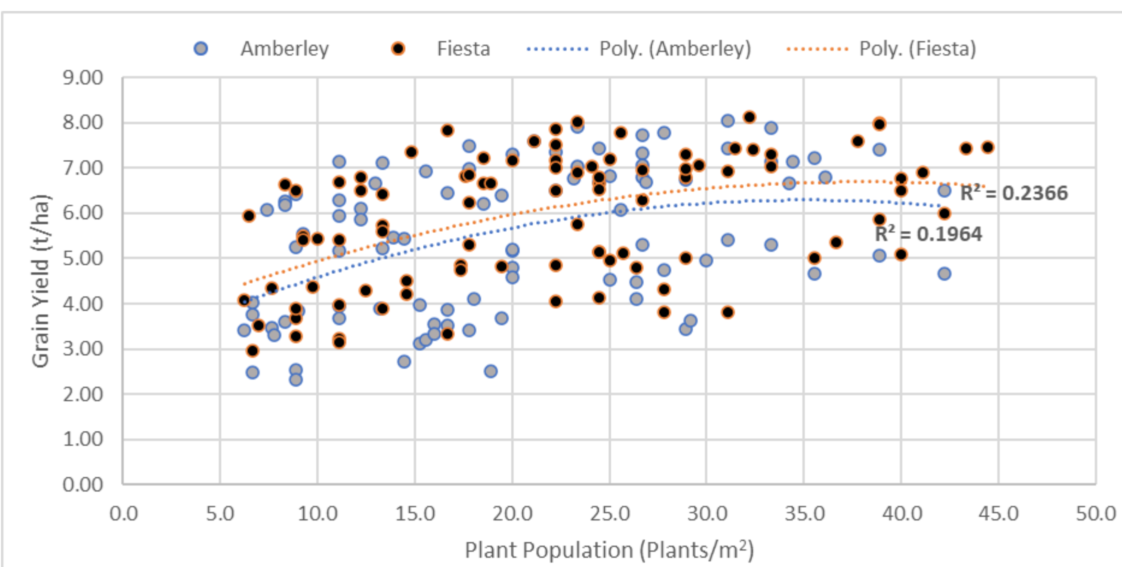

Figure 1. *The influence of faba bean plant populations on grain yield (t/ha). Data points from 6 trials across two years (2020 & 2021) and two sites – Finley, NSW and Kerang, Victoria.*
(Poly. = Polynomial line applied to data)

Whilst slower sowing speeds are necessary for the higher seed rates, high seed rates are one of the most important factors influencing faba bean yield under irrigation in the OIG project. So, in summary, for irrigated crops there are greater negative consequences of populations that are too low (i.e. 10-15 plants/m^2) than too high (i.e. greater than x-x plants/m^2, Table 1).

Table 1. *Grain yield (t/ha) of four seed rates grown under surface irrigation. Finley, NSW 2020 mean of two cultivars PBA Amberley & Fiesta (GSR 244mm plus 3 x 80mm surface irrigations – total 484mm).*

Seed rate (mean Plant Population)	Grain Yield (t/ha)	
12 seeds/m2 (12 plant/m^2)	6.20	b
24 seeds/m2 (23 plants/m^2)	7.10	a
36 seeds/m2 (29 plants/m^2)	7.19	a
48 seeds/m2 (29 plants/m^2)	7.04	a
Mean	6.88	
P val	<0.001	
LSD P=0.05	0.35	

Where letters against treatments are different, treatments are significantly different (P<0.005)

Final harvest dry matter

Higher plant populations (20-30 plants/m^2) resulted in high dry matter by the early flowering stage and in general were associated with more stems per unit area at harvest. This early biomass is associated with pod formation higher up the stem compared to less dense crops, but pod number per stem is usually inversely related to the number of stems per unit area such that more stems per plant results in fewer pods per stem. Examining the yield components of 7t/ha crops has revealed that populations of approximately 20-30 plants/m^2 with 55 or more stems and 450 or more pods/m^2 resulted in 7t/ha or greater yield. While these parameters build yield potential of 7+t/ha, sufficient rainfall or irrigation is required to fulfill the potential as evident in table 2.

Table 2. *Yield components of high yielding 7t/ha plus faba bean crop.*

Cultivar - location	**System**	**Population (plants/m^2)**	**Harvest dry matter (t/ha)**	**Stems/m^2**	**Pods/m^2**	**Grain yield (t/ha)**
PBA Amberley ⓟ **2020 – Finley***	Irrigated	20	13.59	60	453	7.45
PBA Amberley ⓟ **2021 - Finley**	Irrigated	21	11.66	60	490	7.18
Fiesta VF 2020 – Finley	Irrigated	27	15.15	70	557	7.06
Fiesta VF 2021 – Finley	Irrigated	23	13.68	60	624	7.23
PBA Amberley ⓟ **2020 – Finley****	Irrigated	32	9.05	61	351	5.17
PBA Samira ⓟ**2021 – Bundalong** GSR 504mm	Dryland	18	14.17	56	474	7.66
PBA Samira ⓟ**2020 – Dookie** GSR 341mm	Dryland	29	8.58	77	310	4.62

PBA Samira ⓓ2019 – Dookie GSR 254mm	Dryland	28	6.90	92	434	2.74

The two 2020 trials on PBA Amberley were identically managed except for irrigation. (**) received 150mm irrigation through an overhead lateral compared to 240mm surface irrigation (*)

Harvest index

In both dryland and irrigated trials, higher yielding crops with higher plant populations had higher harvest indices. However, it is generally higher dry matter at harvest that correlate strongly with 7t/ha + yields.

Soil amelioration

In another component of the OIG project, FAR Australia and the Irrigated Cropping Council (ICC) have been working in collaboration with NSW DPI on soil amelioration. At Finley under irrigation, a red/brown duplex soil was ameliorated with a number of soil ameliorants treatments following deep ripping in March 2020. The first crop sown after amelioration was faba beans. The trial was followed with canola in 2021 and durum wheat in 2022. In 2020, all amelioration treatments significantly increased the yield of faba beans (Table 3). In all cases, amelioration increased water use efficiency.

Table 3. *Influence of soil amelioration and soil amendments on faba bean cv PBA Samiraⓓ crop yield at Finley, NSW in 2020.*

Treatment No	Treatment	Grain yield (t/ha)	
1	Nil (Control)	4.85	c
2	Deep rip (tillage control)	5.87	ab
3	Surface applied organic amendment (15t/ha)	5.51	b
4	Deep rip; Deep applied organic amendment	6.03	ab
5	Deep rip; Deep applied organic amendment; Deep applied gypsum	6.17	a
6	Deep applied gypsum	5.68	ab
	Mean	**5.65**	
	LSD	0.54	
	P val	0.002	

Notes: Organic amendment based on lucerne pellets applied at 15t/ha, gypsum applied at 5t/ha, deep ripping conducted to a depth of 35-40cm after 3 passes.

Where letters against treatments are different, treatments are significantly different (P<0.05, LSD 0.54) Trial subject to 244mm GSR and 6 applications of 25mm of irrigation applied with a lateral overhead irrigator. Total water (GSR and irrigation) = 394mm.

Nitrogen fixation and removal

Faba beans can produce large quantities of dry matter and typically the dry matter of well nodulated legumes correlate with N fixation (Brill et al. 2022). Allowing for root factors Brill et al. (2022) found faba beans fix ~30kg N/t of dry matter. However, it should be noted that high grain yields also export a proportion of the fixed N from the paddock and that the N balance (N-fixed less N off-take in grain) is the most important consideration. Nitrogen off-take in a 7t/ha crop with ~40kg of N per tonne of grain, results in N off-take of 280 kg N/ha. In the work undertaken by Brill et al (2022) they found faba bean had an average N balance of 194kg N/ha across five sites with an N balance range of 86 to 343kg N/ha. In this research (Table 2 and 4) N balance ranged from 65 to 172 kg N/ha with a mean of 102 kg N/ha which is 94 kg N/ha less than the mean reported by Brill et al (2022). These results highlight nitrogen contributions can be variable and are dependent on the amount of dry matter produced and N off-take in grain.

Value of nitrogen and grain

The total value of nitrogen ($1.7/kg) and grain ($350/t) is provided in Table 4. The highest value ($/ha) site years for faba bean (i.e., >$2,600/ha total value) were equivalent to growing 3.7 to 4.0 t/ha of canola valued at $700/t. The nitrogen legacy from faba bean was enough to grow between 1.1 to 3.0 t/ha of canola assuming an efficiency of labile organic matter derived nitrogen of 70% (Peoples et al 2017) and 40 kg N/ha of shoot nitrogen required per tonne of canola grain production. At this efficiency only 57 kg of soil N is required per tonne of canola grain production, while for fertiliser nitrogen typically 80 kg of soil N/ha is required and assumes a soil N efficiency factor of 50%.

Table 4. *Estimated nitrogen fixation, nitrogen removal in grain (N offtake), nitrogen balance (net N contribution) and value of nitrogen balance and grain yield take. Assumptions include: 30 kg nitrogen fixed per tonne of peak dry matter, 40 kg N/t nitrogen in faba bean grain. Dry matter and grain yield is used from table 2, prices assumptions include $1.70/kg for nitrogen and $350/t for faba bean on-farm.*

Cultivar - location	System	N fixed (kg N/ha)	N removal (kg N/ha)	N balance (kg N/ha)	N value ($/ha)	Grain Value ($/ha)	Total value ($/ha)
PBA Amberley 2020 – Finley*	Irrigated	408	298	110	$186	$2,608	$2,794
PBA Amberley 2021 - Finley	Irrigated	350	287	63	$106	$2,513	$2,619
Fiesta VF 2020 – Finley	Irrigated	455	282	172	$293	$2,471	$2,764
Fiesta VF 2021 – Finley	Irrigated	410	289	121	$206	$2,531	$2,737
PBA Amberley 2020 – Finley**	Irrigated	272	207	65	$110	$1,810	$1,919
PBA Samira 2021 – Bundalong GSR 504mm	Dryland	425	306	119	$202	$2,681	$2,883
PBA Samira 2020 – Dookie GSR 341mm	Dryland	257	185	73	$123	$1,617	$1,740
PBA Samira 2019 – Dookie GSR 254mm	Dryland	207	110	97	$166	$959	$1,125

Nutrition

At Bundalong, Samira⦶ produced exceptional yields in 2021 with the nutrition trial set up in a commercial paddock averaging 7.7 t/ha under dryland conditions. The trial examined different lime applications pre sowing and different post sowing nutrition treatments (Table 5). Although the application of lime (top dressed and incorporated by sowing) did not increase yield, a number of the post sowing treatments significantly increased yield relative to the limed and non-limed controls (Figure 3).

***Table 5**. Nutrition treatments, products and nutrient contents, and application rates and timings at Bundalong, Victoria cv PBA Samira⦶. STT = Spraygro® Smartrace Triple, Boly = Spraygro® Boly, Combi 7 = Rapisol® Combi 7 pH site - 5.3*

Treatment no	**Treatment**	**Pre-Sowing (20 April)**		**6-8 leaf (28 June)**		**Early flowering (29 Aug)**	
		Product	Rate	Product	Rate	Product	Rate
1.	**Untreated + lime Control**	Lime	1 t/ha				
2.	**Micronutrients (standard) +lime**	Lime	1 t/ha	STT Boly	2.5L/ha 2L/ha	STT Boly	2.5L/ha 2L/ha
3.	**Micronutrients (standard) + N+ lime**	Lime	1 t/ha	STT Boly Nitrogen	2.5L/ha 2L/ha 50kg N/ha	STT Boly Nitrogen	2.5L/ha 2L/ha 50kg N/ha
4.	**100N split + lime**	Lime	1 t/ha	Nitrogen	50kg N/ha	Nitrogen	50kg N/ha
5.	**100N early + lime**	Lime	1 t/ha	Nitrogen	100kg N/ha		
6.	**100N late + lime**	Lime	1 t/ha			Nitrogen	100kg N/ha
7.	**Untreated**						
8.	**Micronutrients (standard)**			STT Boly Nitrogen	2.5L/ha 2L/ha 50kg N/ha	STT Boly Nitrogen	2.5L/ha 2L/ha 50kg N/ha
9.	**Micronutrients (regional)**	Lime	1 t/ha	Rapisol 321	1kg/ha	Rapisol 321	1kg/ha
10.	**Micronutrients (regional)**	Lime	1 t/ha	Rapisol 321 Combi 7	1kg/ha 1.5kg/ha	Rapisol 321 Combi 7	1kg/ha 1.5kg/ha

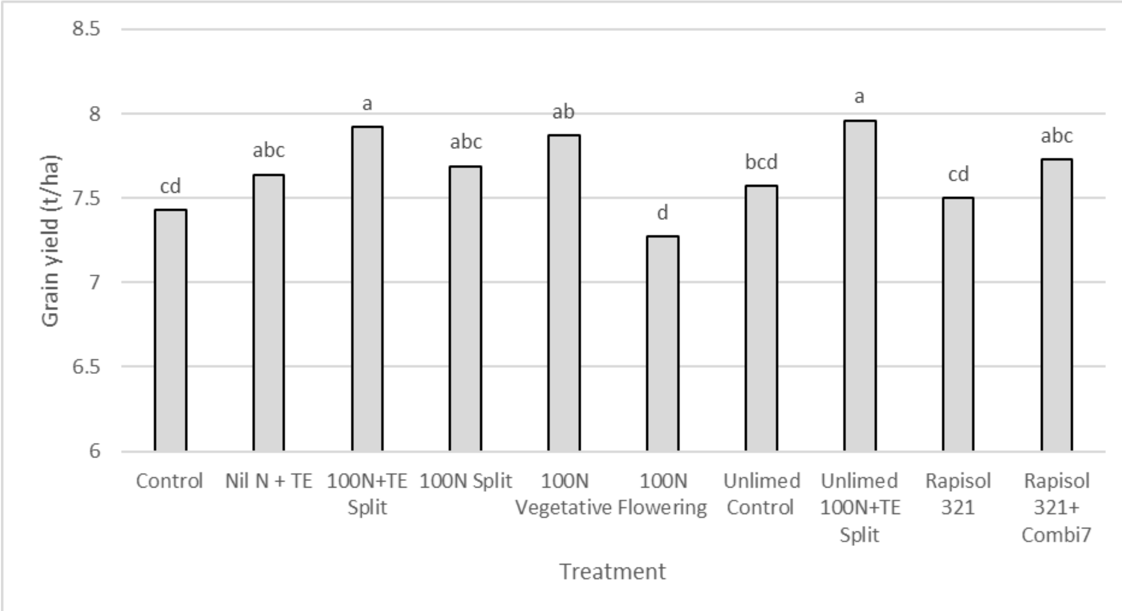

Figure 2. *Influence of different nutrition treatments on faba bean yield at Bundalong, Victoria. P=0.005, LSD=0.34t/ha. Notes: N = Nitrogen, TE = Trace elements, Rapisol® 321 = Mn + Cu + Zn, Rapisol® Combi 7 = Fe + Cu + Zn + Mg + Mo + B + Mn. Split = different timings at 6-8 leaf and early flowering.*

The application of additional nitrogen at the vegetative stage produced significantly higher yields compared to the control treatments (Figure 2). However, when N was split or applied at flowering there was no increase in grain yield. The application of trace elements didn't influence yield, although highest yields were observed when trace elements and nitrogen were applied together or nitrogen by itself at the 6 to 8 leaf stage (e.g., end of June).

Disease risk

Do bigger crop canopies under irrigation show much greater yield responses to disease management? Initial results generated in 2020 and 2021 at Finley using the more disease resistant cultivar PBA Amberley⦶ revealed little additional yield response to higher fungicide input based on more-expensive chemistry under irrigation at Finley. In 2022, excessive rainfall in the spring at the same site, resulted in significant reductions in yield with positive results in terms of yield, disease control and profit with greater fungicide input (data still being analysed at the time of publication).

While irrigation increased the canopy size at Finley in 2021, the conditions for disease were not as conducive for disease as those in the longer growing season of the southern Victorian HRZ near Geelong, despite similar yields (6 to 7t/ha).

Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the author would like to thank them for their continued support. FAR Australia would also like to acknowledge the support of Southern Growers from whom we leased land and water on their Finley Irrigation Complex, our 2022 host farmers Adam Inchbold, and Denis Tomlinson.

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Hyper Yielding Canola – more than just urea and fungicide

Rohan Brill, Brill Ag

Key Points

- 2020 and 2021 Hyper Yielding Canola trials have shown that yield potential can be raised through increased attention to nutrient management and variety choice.
- At Hyper Yielding Canola sites in four states in 2021, canola yield was improved where animal manure (chicken or pig) was applied.
- 2022 trials will provide a better understanding of the reasons for the manure response and if the response can be replicated with the application of inorganic nutrition alone.
- 45Y95 CL was the standout variety at Wallendbeen in 2021, it grew a high amount of biomass with a high conversion of that biomass to grain yield.
- The use of fungicide has limited yield loss from disease at Wallendbeen in both 2020 and 2021, with the best value application being the 20-30% bloom timing.
-

Importance of nutrition for Hyper Yielding Canola

The aim of the canola component of the Hyper Yielding Crops project is to determine management practices that achieve 5 t/ha canola grain yield in high yield potential environments. Nitrogen management has been prioritised as one management strategy that is important for canola yield. At Wallendbeen in 2021 there was no response to applied N (as urea) with rates applied up to 300 kg/ha. This was largely due to the very high fertility of the paddock following a pasture phase, with 340 kg/ha N stored in the top 90 cm soil plus 2% Organic Carbon. Over and above N application (at the 225 kg/ha N rate) there was a response to the application of chicken litter at 3 t/ha (dry basis). This supplied 110 kg/ha N, 30 kg/ha P and 105 kg/ha K and increased yield by 0.5 t/ha. Animal manure may not be readily available and/or the cost may be prohibitive, so 2022 trials are looking further into the reasons for the response to manure. The trials will determine if a similar response can be achieved by matching the nutrition supplied in manure with inorganic inputs. Is it a matter of simply increasing the NPK inputs to match or is there a benefit from manure beyond just the nutrient content? Does the manure increase nutrient supply when it is most required, i.e., through the crop critical period?

The positive response from manure application was mirrored at all four HYC Canola sites in 2021, including:

- Gnarwarre, Victoria (pig manure)
- Millicent, SA (pig manure)
- Kojonup, WA (chicken manure)

There was a range in yield response from 0.5 t/ha at Wallendbeen to 0.8 t/ha at Gnarwarre and Kojonup.

Variety Choice 2021

Once nutrition is optimised, a variety needs to be chosen that will capitalise on the investment in soil fertility. In a Genotype * Environment * Management (GEM) Trial at Wallendbeen in 2021 the standout for grain yield was 45Y95 CL, being at least 0.8 t/ha higher yielding than all other varieties (Table 1).

Table 1. *Yield of spring canola varieties at four national HYC canola sites in 2021.*

	Gnawarre Vic	Kojonup WA	Millicent SA	Wallendbeen NSW
ATR Wahoo	3.5	1.8	3.3	3.6
HyTTec Trifecta	3.9	2.7	4.4	5.2
45Y95 CL	*	*	6.4	6.4
45Y93 CL	*	*	5.7	5.6
45Y28 RR	4.5	2.9	5.1	4.9
Condor XT	3.9	3.4	5.1	5.2
l.s.d. (p<0.05)	0.21	0.13	0.34	0.36

Detailed assessment of 45Y95 CL at the Wallendbeen site showed that it had high biomass at maturity but also a high harvest index, with 36% of final biomass being grain (Figure 1). 45Y95 CL had a high number of seeds per pod (21) with a high number of pods/m² (8422) (Table 2), the only variety that was above average for both components. Experiments and measurements will be completed again in 2022 as subtle differences in final biomass and harvest index can magnify into large differences in crop profitability.

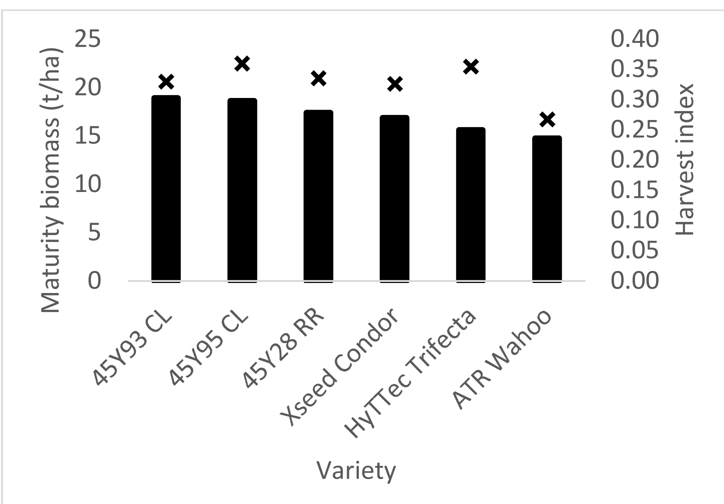

Figure 1: *Maturity biomass (bars) and harvest index (X) of six canola cultivars in Wallendbeen GEM trial 21.*

Table 2. *Seeds/pod and pods/m² of six spring canola varieties in Wallendbeen HYC GEM trial 2021.*

	Seeds/pod	Pods/m²
ATR Wahoo	21	5240
HyTTec Trifecta	17	8003
45Y95 CL	21	8422
45Y93 CL	18	8692
45Y28 RR	18	7628
Condor TF	15	8263
Mean	*18*	*7708*

There was also a winter version of the Hyper Yielding Canola GEM site, where the highest yielding variety was Hyola Feast CL at 3.8 t/ha. The high fertility at the site led to very tall winter canola plots and whiched lodged badly by harvest time. Further grazing treatments have been included in 2022 to evaluate the response of new winter canola varieties to grazing and the value that may bring for forage and grain yield.

YieldMax Trial 2022

The YieldMax Trial was sown in 2022 which gives an opportunity to evaluate the best varieties with a strong nutrition package. The nutrition treatments include:

- High Input – 40 kg/ha P, 225 kg/ha N, 3 t/ha (dry basis) Chicken Manure
- Low Input – 15 kg/ha P, 150 kg/ha N.

Biomass samples were taken at flowering to determine the differences between varieties and treatments. The difference between varieties was generally greater than the difference between nutrition treatments (Figure 2). TT varieties had the least biomass and Xseed Condor (Truflex) had the most biomass. Biomass samples will be taken again at crop maturity as growth between the start of flowering and maturity has a much stronger correlation with grain yield than growth pre-flowering. Will the high input treatment increase growth during the crop critical period and which varieties will use this high nutrition the most efficiently?

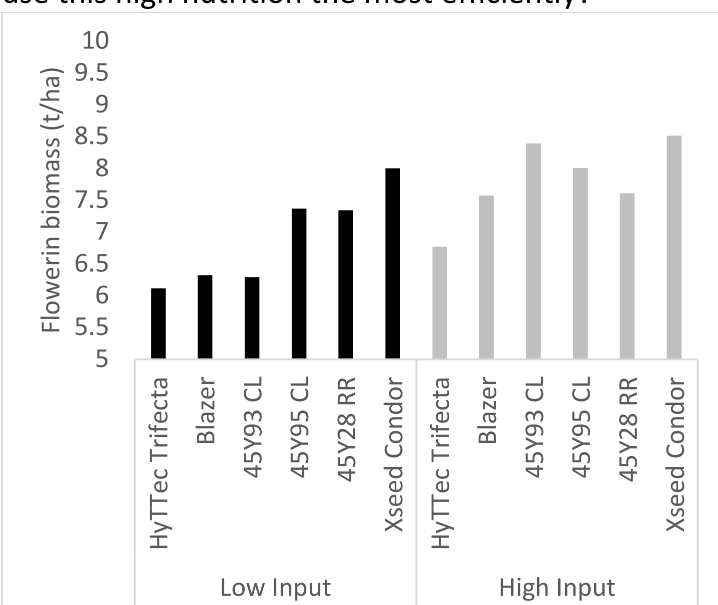

Figure 2: *Effect of nutrient management on flowering biomass of six canola varieties at Wallendbeen 2022.*

HYC Canola Disease Management

With large biomass canola crops in high yield potential environments, it might be expected that growers would need to increase fungicide inputs to protect crops from disease. However, across the project in 2021 the yield response to fungicide (difference between Intensive and Nil fungicide program) ranged from nil in four (of seven) trials to 0.9 t/ha in a trial at Wallendbeen in 45Y28 RR canola (Figure 3). Intensive fungicide program included Saltro Duo on seed, Prosaro at 4-leaf stage, Aviator Xpro at 20% bloom stage and a follow up Prosaro at 50% bloom stage. The single best value fungicide application in 2021 was the use of an SDHI product (e.g. Aviator Xpro, Miravis Star) at 20-30% bloom stage.

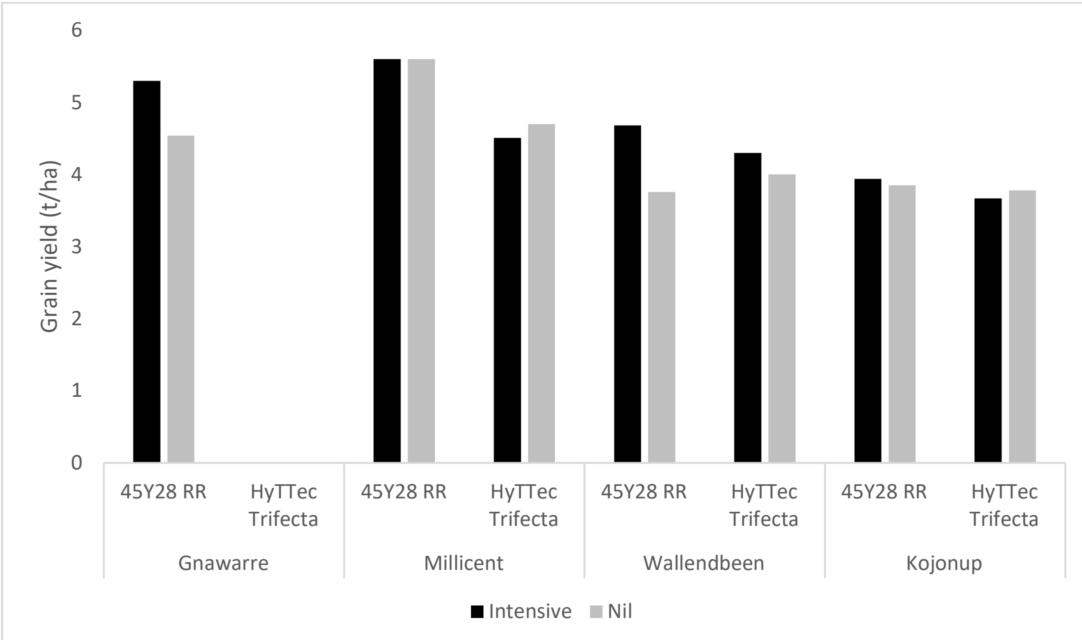

Figure 3*: Effect of fungicide program (Intensive versus Nil) on grain yield of 45Y28 RR at Gnarwarre, Millicent and Wallendbeen and on HyTTec Trifecta at Millicent and Wallendbeen in 2021.*

Hyper Yielding canola results

Full results from 2021 are available at https://faraustralia.com.au/wp-content/uploads/2022/04/HYC-2021-Results-FINAL.pdf. Results from 2022 will also be made available through the FAR Australia website and various other channels such as through social media and GRDC Updates.

Hyper yielding cereal agronomy - key levers and their interactions: Varieties, Nitrogen and lessons learnt

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Photothermal quotient (PTQ), red grained feed wheats, yield potential, disease management strategies

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Take home messages:

- At the HYC Wallendbeen site in 2022, fungicide management strategies for stripe rust and Septoria control combined with variety choice was shown to take yield from 1t/ha to 10t/ha . The hyper yielding crops (HYC) project has successfully demonstrated new yield benchmarks for productivity of cereals in the more productive regions of Australia over the last three years.
- Maximum wheat yields in southern NSW (Wallendbeen) were achieved by red grained feed wheats and modern fungicide chemistry.
- Hyper yielding cereal crops require high levels of nutrition; rotations which lead to high levels of inherent fertility and judicious fertilizer application underpin high yields and the large nutrient offtakes associated with bigger crop canopies.
- The biggest agronomic lever for hyper yielding wheat and closing the yield gap over the last three years has been the correct disease management strategy which had elevated importance in the very wet conditions of 2022.

Hyper yielding crops research and adoption

The Hyper Yielding Crops (HYC) project with assistance from three relatively mild springs has been able to demonstrate new yield boundaries of wheat, barley and canola both in research and on commercial farms in southern regions of Australia with higher yield potential. Five HYC research sites with associated focus farms and innovation grower groups have helped establish that wheat yields in excess of 11t/ha are possible at higher altitudes in southern NSW (Wallendbeen), in the southern Victoria and South Australian high rainfall zones (HRZ) (Gnarwarre and Millicent) and Tasmania (Hagley). In the shorter season environments of WA, 7-9t/ha has been demonstrated at FAR's Crop Technology Centres in Frankland River and Esperance.

Yield potential

Over the last three years, the relative absence of soil moisture deficit stress at HYC locations has allowed the project team to look more closely at yield potential from the perspective of solar radiation and temperature. **High yielding crops of wheat and barley are about producing more grains per unit area.** This has been demonstrated in several projects and is a key factor in producing very high yields. Whilst head number clearly contributes to high yields, there is a limit to the extent to which head number can be used to increase yields. In most cases with yields of 10-15t/ha, 500 – 600 heads/m^2 should be adequate to fulfil the potential.

So how do we increase grains per m^2?

Whilst more heads/m^2 contribute to yield outcomes, it is typically larger numbers of grains per head at harvest that generates high yields and increases the overall number of grains per unit area in HRZ regions. It's been acknowledged for several years that increasing grain number is related to growing conditions prevalent in the period from mid-stem elongation to start of flowering (approximately GS33 – 61). This window of growth in cereals covers the period approximately three – four weeks (~300 ^{0}C.days) prior to flowering and is described as the 'critical period' (Dreccer et al 2018). This critical period encompasses when the grain sites are differentiating, developing and male and female parts of the plant are forming (meiosis). If conditions during this period of development are conducive to growth with high solar radiation and relatively cool conditions (avoiding heat stress), then more growth goes into developing grain number per head and therefore per unit area for a given head population. The Photothermal Quotient (PTQ) or 'Cool Sunny Index' is a simple formula (daily solar radiation/average daily temperature) that describes how conducive conditions are for growth and when applied to the critical period, it assists in determining the yield potential. When applied to the critical period a high PTQ means more photosynthesis for more days and more grain and more yield. The relative importance of PTQ is increased in seasons where soil moisture stress is not a factor (since soil moisture stress limits the ability of the crop to grain fill and fulfil its potential). Based on an optimum flowering date of 10 October, the PTQ for 2022 was considerably lower (PTQ 1.27) than 2021 (PTQ 1.49) at our southern NSW HYC site. Using the graphed relationship established between yield and PTQ (PTQpY = 10.099*PTQ-4.3053), it indicated that yield potential was significantly reduced in 2022 (Figure 1) and this is without taking account of the effects of waterlogging and management of the crop more generally, indicating that yield potential was much lower relative to 2021 and the long-term average.

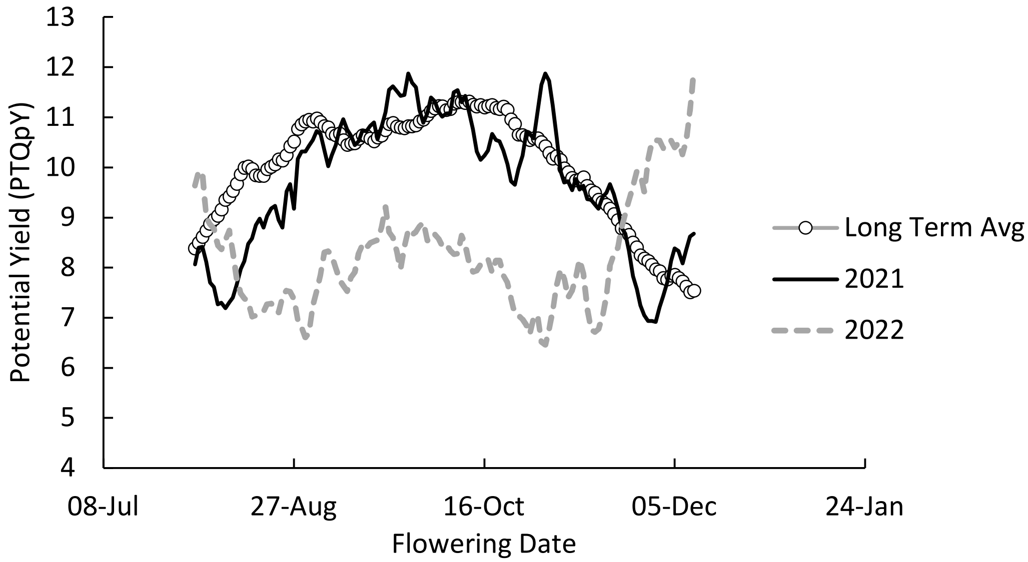

Figure 1. *Long term (last 20 years based on Cootamundra BOM data) yield potential and relationship with flowering date at Wallendbeen based on the photothermal quotient (PTQ) compared to 2021, and 2022 YTD. Note this is the upper ceiling of yield potential and does not factor in frost and heat risk and assumes water is non limiting. Critical period based on 28 days in this calculation.*

Advisers we are already aware of the importance of cereal flowering date in order to minimise frost risk and heat stress/moisture stress, however in high yielding crops where moisture and heat stress are less problematic, optimising the flowering date enables us to maximise growth in the critical period for generating grain number per unit area.

Realising yield potential

It is one thing to create yield potential by maximising grain number per unit area, however higher grain numbers established during the critical period still must be realised during grain fill. For example, a very late developing wheat variety could benefit from better growing conditions associated with a later flowering date and critical period i.e., longer sunny days that are not excessively hot. This might well maximise final harvest dry matter and growth during the critical period, but not the final grain yield as the crop does not have a sufficiently high photothermal quotient (PTQ) to maximise growth during grain fill post flowering (i.e., it's too hot post flowering with later development and the crop has a low harvest index). This has been observed at all the HYC sites relative to the optimum flowering period for those sites.

Interestingly, in 2021 the highest yield recorded in the HYC project so far (12.74t/ha), was achieved with a wheat variety that originated from the UK cv Reflection (a red grained winter wheat). Traditionally this variety is considered too long season (i.e., very slow developing) for an Australian mainland HRZ environment. However, in 2021 the mild spring and summer grain fill period allowed this variety to complete grain fill under more optimal conditions, something not typically observed. The indication that the higher yield was underpinned by more grains per unit area, was indicated by considerably smaller seeds and lower thousand grain weight (TGW; Figure 2). Whilst grains per head in this case were not assessed, it was clear that to have achieved such a high yield with such small grains, there must have been a high number of grains per unit area.

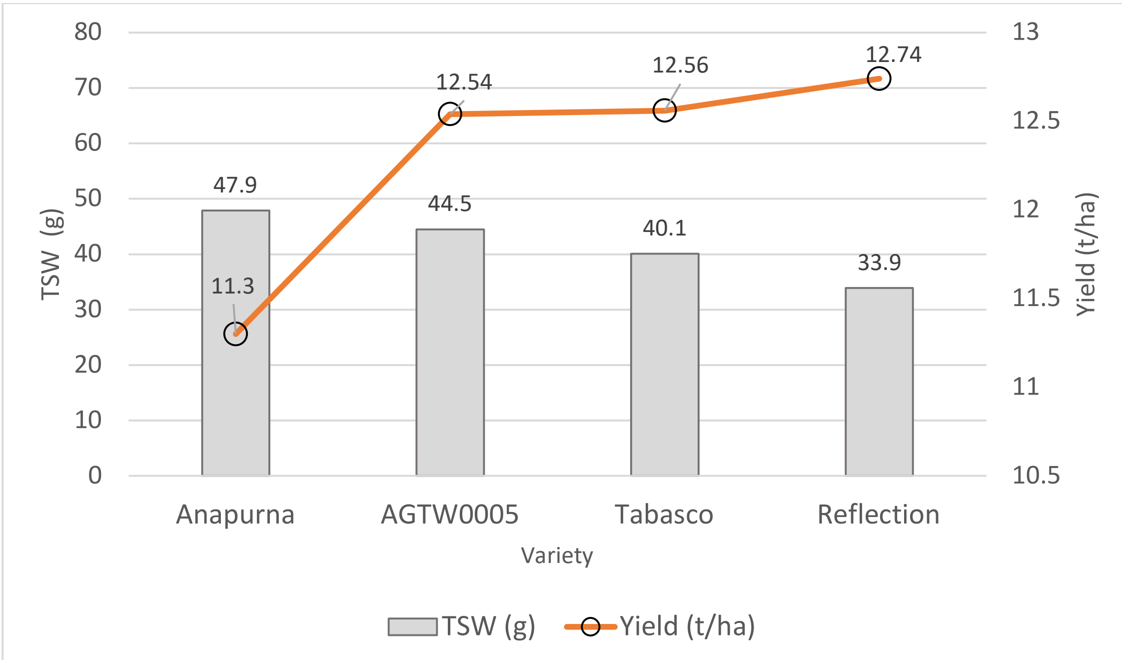

Figure 2. Relationship between highest yielding wheat varieties in the HYC elite screen and thousand seed weight (TSW) – Millicent SA 2021

Nutrition and rotation for hyper yielding wheat – farming system fertility to establish yield potential

The most notable results observed in the HYC project to date relate to nitrogen fertiliser. However, simply applying high rates of N fertiliser is not always the best option to achieve hyper yields. Nitrogen fertiliser rates should consider (i) N mineralising potential of the soil, (ii) spared N from previous years, (iii) starting mineral N and other factors such as (iv) crop lodging potential that may impact radiation efficiency. It should be emphasised however that replacing N removal (N off-take in grain or hay) has to be an objective if we are to maintain a sustainable farming system. Results from our southern NSW site at Wallendbeen provide an example of the conundrum with hyper yielding wheat crops. Established in a mixed farming system based on a leguminous pasture in rotation with a cropping phase, winter feed wheat cv RGT Accroc⌽ achieved a yield of approximately 9t/ha, however the application of N above 120 kg N/ha in this scenario only served to reduce profit while higher rates ≥160kg N/ha also reduced yield (Figure 3). This confirmed a result observed in previous high yielding trials. Despite an application of PGR Moddus Evo® 0.2L/ha + Errex™ 750 at 1.3L/ha at GS31, higher applied N fertilisers increase head numbers but also increased lodging during grain fill (data not shown) which led to reduce yield.

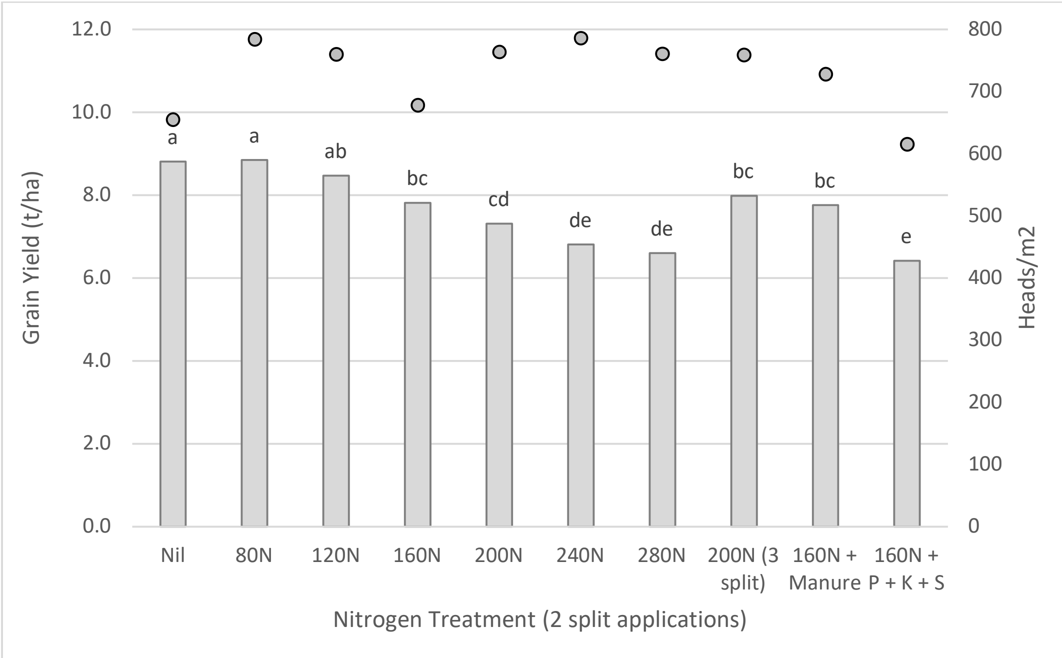

Figure 3. *Influence of applied nitrogen, manure and other nutrients on yield and head number – HYC Wallendbeen, NSW 2022. Columns denote grain yield and dots show heads/m^2.*

Notes: N applied as urea (46% N) was timed at tillering (21st June) and GS31 (27th August)
Soil available N in winter (4 Jul) - 0-10cm 39kg N, 10-30cm 56kg N, 30-60cm 46kg N
Chicken manure pellets applied at 5t/ha with an analysis of N 3.5%, P 1.8%, K 1.8% and S 0.5%. Columns with different letters are statistically different P = 0.05, LSD: 0.79t/ha

Table 1. *160 kg/N ha, with additional N, P, K & S was applied as follows to replicate the addition of manure as in the 160N + P + K + S column in Figure 3 above.*

Product	kg/ha	**N**	**P**	**K**	**S**	**Date Applied**
Mono potassium phosphate	315	0	90	72	0	Sowing
MOP	36	0	0	18	0	21 June
Ammonium sulphate	104	21	0	0	25	21 June
Urea	335	154	0	0	0	21 June
Total		**175**	**90**	**90**	**25**	

The results serve to illustrate that given non-limiting water conditions; fertile soils with high soil N supply have the potential to mineralise enough N to achieve potential yield. This is illustrated by the nil fertiliser rate in Figure 3. In fact, since 2016 in HYC trial work, optimum applied fertiliser N levels have rarely exceeded 200kg N/ha for the highest yielding crops, even though the crop canopies that these yields are dependent on are observed to remove far more N than that (assuming N is baled or burnt at harvest). This indicates N supply in the hyper yielding sites is most likely provided by the mineralisation of N from soil organic matter (SOM) pre-sowing and in-crop. The 8.8 t/ha yield from the nil N treatment for example requires 250kg of soil N/ha at an assumed N efficiency of 70% for humic SOM (Baldock 2019) and a similar efficiency for labile SOM contributions (Peoples et al, 2017). These crop N recovery efficiencies are typically much higher than those achieved with fertiliser N which is often reported at 44% (Vonk et al. 2022; Angus and Grace 2017). Consequently, the same yield (8.8t/ha) supplied entity by N fertiliser would require 400kg N/ha assuming an N efficiency of 44%.

Protecting yield potential

Many regions experienced just how important it is to protect yield potential in 2022. With many growers describing the stripe rust epidemic in 2022 as the worst in 20 if not 50 years. Disease management over the last three years has been shown to be one of if not the most important factors in securing high yielding crops in HYC project trials. It has also been demonstrated to be one of the most important factors in securing higher yields and closing the yield gap in better seasons in L-MRZ regions. In Wallendbeen HYC trials, grain yield was increased from 1t/ha to 10t/ha by combining the best disease management strategy with the best germplasm (variety) (Figure 4). Seven wheat varieties (three milling wheats and four red grained feed wheats) were grown with four levels of fungicide protection. The four levels of fungicide were as follows.

1. Nil – untreated control
2. A single flag leaf fungicide applied at GS39 – FAR F1-19
3. A two-spray approach at GS33 (3rd node) FAR F1-19 & GS59 (head emergence) Opus® 500mL/ha
4. A four-unit approach combining at sowing flutriafol on the MAP with three foliar sprays – GS31 Prosaro® 300mL/ha, GS39 and GS59 (as stated above)

Table 2. *Dates for key stages of crop phenology for spring and winter wheat varieties in the Wallendbeen HYC trial in the cool and very wet season of 2022*

	GS31	GS33	GS39	GS59
Spring wheats	14-Jul	9-Aug	26-Aug	20-Sep
Winter wheats	26-Aug	20-Sep	3-Oct	30-Oct

With the principal diseases being stripe rust and *Septoria tritici* blotch caused by the pathogens *Puccinia striiformis f.sp. tritici.* And *Zymoseptoria tritici,* the levels of infection in 2022 at this site were so severe that not even the four-unit approach to disease management gave full control in the more stripe rust susceptible varieties.

None of the varieties had sufficient genetic resistance to be farmed more profitably with no fungicides. In Scepter⑩, the response to the four-unit approach was almost 6t/ha whilst with RGT Accroc⑩ it was nearly 4t/ha. For the third year in succession, despite low level infection, the varieties Anapurna, RGT Cesario⑩ and Big Red⑩ showed no significant yield advantage to four units of fungicides compared to one. With RGT Cesario⑩, stripe rust resistance was not complete and a spray at GS31 did reduce disease levels. It should be noted that with these higher yielding feed wheats, the response to fungicide was still between 1.5 – 3t/ha.

Whilst fungicides can only be considered an insurance (i.e., we don't know what the economic return will be when they are applied), it is clear that when the stem elongation period is wet as the principal upper canopy leaves emerge (flag, flag-1, flag-2), fungicide application is essential to protect yield potential. Infection was so severe in 2022, that fungicide timing and the strength of the active ingredients being used made profound differences in productivity. Long 'calendar gaps' of over four weeks between fungicides (as was the case in own our work) resulted in many crops losing control of the epidemic as unprotected leaves became badly infected in the period between sprays and applications became more dependent on limited curative activity rather than protectant activity. The wider issue the success of fungicide management raises is that pathogen resistance to fungicides is primarily driven by the number of applications of the same mode of action. This is why it is imperative for HYC research to incorporate the most resistant, high yielding and adapted germplasm available in order to reduce our dependence on fungicide agrichemicals.

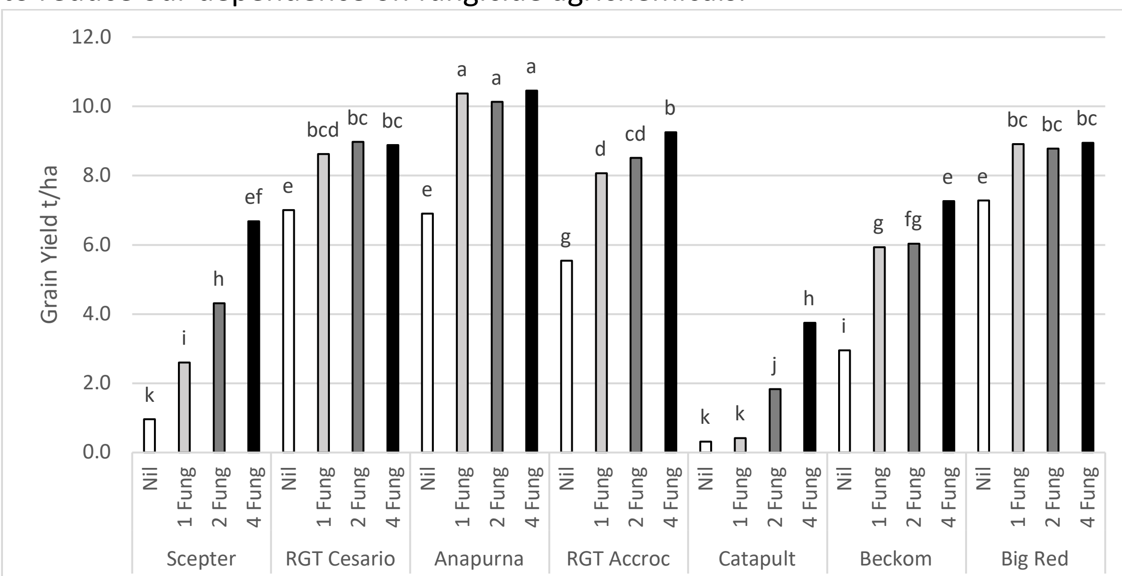

Figure 4. *The influence of the number of applied fungicide sprays on different varieties at the HYC trial at Wallendbeen, NSW 2022. All varieties presented are protected by plant breeders rights.*

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More results from previous HYC research can be found on the FAR website https://faraustralia.com.au/resource

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Yield stability under reduced fungicide input – HYC Wallendbeen, NSW 2020 – 2022

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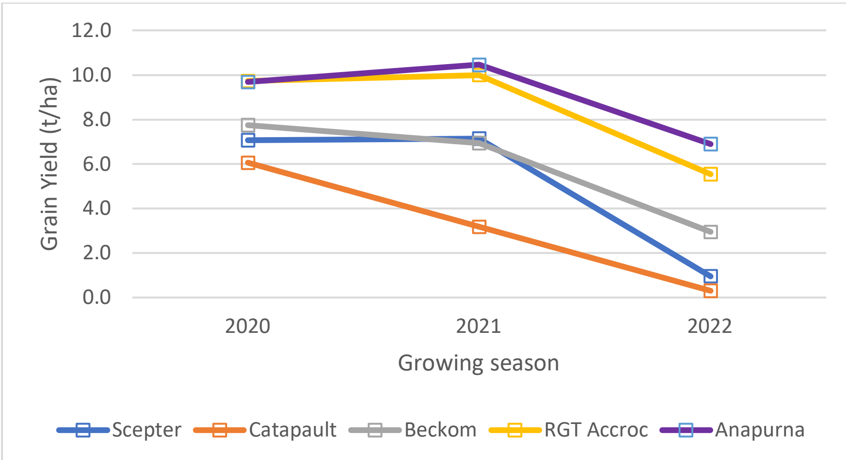
Key point summary

- Over the last three years, under La Nina weather patterns, the highest yields achieved at the HYC site in Wallendbeen have been more consistent than any other site on the mainland.
- Over the same period, the red feed wheats (RGT Accroc and Anapurna) have been 2-3t/ha higher yielding than our best milling wheats, principally advantaged by longer growing seasons and milder springs.
- Looking at disease management x germplasm interaction, it has been clear that there have been significant differences in yield stability over the three years as a result of cultivars breaking down to disease.
- Anapurna, whilst showing higher susceptibility to Septoria tritici blotch (STB) in recent years, has been the most consistent performer grown with reduced fungicide input at Wallendbeen.
- Although using four units of fungicide creates greater yield stability and higher yields, it is not a substitute for high yielding varieties that have good genetic resistance.
- However, as a general observation in HYC, genetic resistance is gradually eroded over time by the pathogen population, resulting in higher fungicide requirement in order to produce the most profitable crops.
- Lower disease pressure, higher spring temperatures and greater moisture stress will be interesting contrasts in 2023 HYC trials.

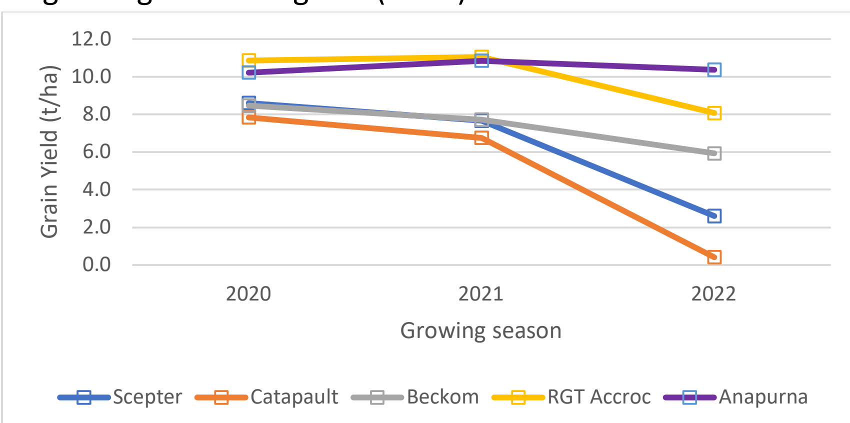
Cultivar yield stability with a single flag leaf fungicide (reduced input)
Over the last three seasons, a group of milling wheat and red feed wheat varieties have been compared at HYC research sites around the HRZ and at higher altitude in Wallendbeen, NSW. In the research with a disease management focus, the varieties have been compared under three levels of fungicide input (untreated, a single flag spray (1 unit), and with four units of fungicide (flutriafol plus three foliar sprays GS31/32, GS39, GS59/61) for three years. The objective of this work was to identify whether there were high yielding varieties that could be grown with lower or even no fungicide input. **Over this period of more disease prone seasons none of the varieties could be grown most profitability without the use of fungicide input (Figure 1 – 3)**.

Although 2022 was unlikely to be typical of fungicide response, all three seasons showed profitable returns from the use of at least one fungicide unit. However, interestingly some varieties have shown much greater yield stability over the project years than others. This stems from the effect of changes in stripe rust susceptibility and increased disease pressure from STB. Over the three-year period, the most stable yields with reduced fungicide input have been observed in Anapurna, which despite the poorer solar radiation in 2022 still produced over 10t/ha in all three years of experimentation at the Wallendbeen site.

Untreated with fungicide.



Single fungicide at flag leaf (GS39).



Four units of fungicide (flutriafol plus three foliar sprays GS31/32, GS39 and GS59/61).

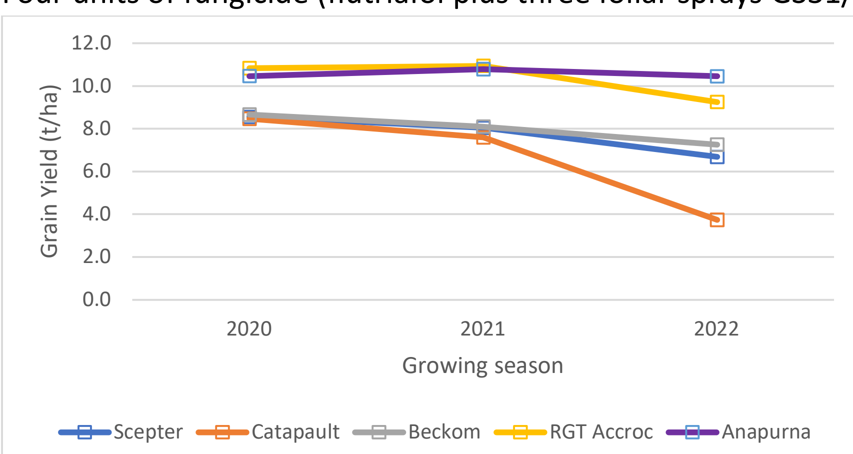


Figure 1 – 3. *Grain yield of five varieties under two levels of fungicide input compared to the untreated.*

The primary role of Field Applied Research (FAR) Australia is to apply science innovations to profitable outcomes for Australian grain growers. Located across three hubs nationally, FAR Australia staff have the skills and expertise to provide 'concept to delivery' applied science innovations through excellence in applied field research, and interpretation of this research for adoption on farm.

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SOWING THE SEED FOR A BRIGHTER FUTURE

MEDIA
RELEASE

Tuesday 5th September 2023

FAR Australia adds value to the Australian grains industry with innovative e-Products

Australian based field applied researcher, developer and extension provider proudly announces the launch of its cutting-edge suite of e-Products, a series of written, audio and visual extension and education aids designed to assist growers and industry in making good agronomic management decisions throughout the growing season.

With decades of expertise in the grains industry, FAR Australia has continually pioneered advancements to enhance the productivity and sustainability of farming practices. This latest range of e-Products marks a significant milestone in the organisation's commitment to driving innovation and excellence in the Australian grains industry.

The newly launched e-Products includes 1. 'inGRAINed' a branded series of Cropping Strategies, written to cover different management strategies which will be mailed to subscribers and published online; 2. FARmacy Podcasts, a series of audio content; and 3. FARmacy YouTube videos, a series of visual content.

FAR Australia's e-Products are designed to cater to the specific needs of the Australian grains industry, harnessing the latest field observations and research results to address the complexities and demands faced by growers and advisers throughout the growing season.

"We are thrilled to unveil e-Products that we trust will provide the Australian grains industry with new independent references around key management decisions being considered on farm," said Nick Poole, FAR Australia's Managing Director. "The release of e-Products follows an extensive strategic review by the board of FAR Australia activities, who felt that these independent educational and extension tools should be a key part of the organisation's future."

Updates based on the latest findings from the field will be produced, these will aim to assist growers in the drive for efficiency and productivity gains on farm, ultimately contributing to a more resilient grains industry.

The launch of these e-Products is a testament to FAR Australia's commitment in creating solutions that have a positive and lasting impact on the Australian grains industry. The company remains dedicated to supporting growers in their pursuit of excellence and sustainability.

Issues 1 and 2 of inGRAINed Cropping Strategies have been published on the FAR Australia website. These talk about disease management in wheat and faba beans 2023 and can be found on the FAR Australia website at https://faraustralia.com.au/resource

Should you wish to receive FAR Australia's e-Products, please email info@faraustralia.com.au advising you wish to be added to its mailing list.

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inGRAINed Cropping Strategy: Issue 1 – Disease Management in wheat (2023)

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