WA CROP TECHNOLOGY CENTRE (ESPERANCE)

FAR AUSTRALIA

Industry Innovations

leading the way to a brighter grains industry

FIELD DAY

INCREASING PRODUCTIVITY & PROFITABILITY IN THE ESPERANCE PORT ZONE

Thursday 12th September 2024

SOWING THE SEED FOR A BRIGHTER FUTURE

Thanks to the GRDC for investing in some of the research to be discussed today

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Thanks to the following event sponsor:

20 YEARS AUSTRALIA AFGRI EQUIPMENT

Thanks to our host farmers: the Whiting family

VISITOR INFORMATION

We trust that you will enjoy your day with us at our WA Crop Technology Centre (Esperance Port Zone) Field Day. Your health and safety is paramount, therefore whilst on the property we ask that you both read and follow this information notice.

HEALTH & SAFETY

- All visitors are requested to follow instructions from FAR Australia staff at all times.
- All visitors to the site are requested to stay within the public areas and not to cross into any roped off areas.
- All visitors are requested to report any hazards noted directly to a member of FAR Australia staff.

FARM BIOSECURITY

- Please be considerate of farm biosecurity. Please do not walk into farm crops without permission. Please consider whether footwear and/or clothing have previously been worn in crops suffering from soil borne or foliar diseases.

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- We have a number of First Aiders on site. Should you require any assistance, please ask a member of FAR Australia staff.

LITTER

- Litter bins are located around the site for your use; we ask that you dispose of all litter considerately.

VEHICLES

- Vehicles will not be permitted outside of the designated car parking areas. Please ensure that your vehicle is parked within the designated area(s).

SMOKING

- There is No Smoking permitted inside any farm shed, marquee or gazebo.

Thank you for your cooperation, enjoy your day.

INCREASING PRODUCTIVITY AND PROFITABILITY IN THE ESPERANCE PORT ZONE

FEATURING INDUSTRY INNOVATIONS

On behalf of myself and the FAR Australia team, I am delighted to welcome you to our 2024 WA Crop Technology Centre (Esperance Port Zone) Field Day featuring Industry Innovations.

Industry Innovations (II) is a FAR Australia initiative which continues to engage with industry to provide innovative research solutions which are helping to create a more productive, profitable and sustainable future for the Australian grains industry. With our Crop Technology Centres (CTCs) operating nationally across the more productive growing regions of Australia, we provide the perfect platform to showcase new industry innovations, whether it be new crops, cultivars, agrichemicals, fertilisers or Ag technologies. More information on our Industry Innovations initiatives is available in the booklet.

Today will provide you with a unique ‘seeing is believing’ opportunity to experience the latest innovations in cereal germplasm, agronomy, and agrichemical usage. You will witness first-hand the impact of innovative treatments and techniques on enhancing crop performance and profitability.

Event Highlights:

- Cereal Trials: Explore a range of cereal trials featuring crops sown at different times, showcasing how timing can influence crop yields.
- Expert Presentations: Hear from industry leaders, who will share insights into the latest research and trends shaping the Australian grains industry.
- Interactive Discussions: Engage in group discussions on crucial topics such as fungicide management strategies and the future of crop profitability, particularly in light of the new GRDC Hyper Profitable Crops project.
- Innovative Research: Learn from the latest findings of the GRDC’s Hyper Yielding Crops high rainfall zone project, and explore opportunities to enhance the use of winter germplasm in the lower to medium rainfall zones.

To make the programme as diverse as possible, I would like to thank all our speakers who have helped to put today's programme together; in particular our keynote speaker Dr Fran Lopez who has made the trip down from Perth to join us today. Dr Lopez is based at the Centre for Crop and Disease Management (CCDM) at Curtin University where he leads the fungicide resistance group.

Finally I would like to thank the GRDC for investing in some of the research that may be featured in today's programme, and also a big thanks to our host farmers the Whiting family for their tremendous practical support given to the team, and to today's sponsor AFGRI.

Should you require any assistance today, please don't hesitate to contact a FAR Australia staff member. We hope you find the day informative, and as a result, take away new ideas which can be implemented in your own farming business.

Nick Poole Managing Director
FAR Australia

WA CROP TECHNOLOGY CENTRE (ESPERANCE)

FAR AUSTRALIA

TIMETABLE

WA CROP TECHNOLOGY CENTRE FIELD DAY (ESPERANCE PORT ZONE)
THURSDAY 12 SEPTEMBER 2024

In-field presentations	Station #	12:30	1:15	1:30	2:00	2:30	3:00	3:30	4:00
Dr Fran Lopez, CCDM *Fungicide resistance and management strategies – are we using too much fungicide in WA crops?*	1	Lunch kindly sponsored by AFGRI EQUIPMENT	Opening address by Nick Poole, FAR Australia's Managing Director followed by an introduction to the cereal research programme.	1	2				Closing address followed by refreshments kindly sponsored by AFGRI EQUIPMENT
Nick Poole and Deep Das, FAR Australia *Given a wetter autumn what would early sown winter wheats have looked like sown in late March?* GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION	2				1	2			
Dr Ben Jones, FAR Australia *The physiology of winter germplasm – are there opportunities to make more use of this germplasm in the L-MRZ as well as the high rainfall zone?*	3					1	2		
Darcy Warren and Daniel Bosveld, FAR Australia *What did we learn from the Hyper Yielding Crops project which finished in June - where to next?*	4						1	2	
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For the afternoon's presentations, we would be obliged if you could remain within your designated group number.

Thank you for your cooperation.

Group
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WA CROP TECHNOLOGY CENTRE (ESPERANCE)

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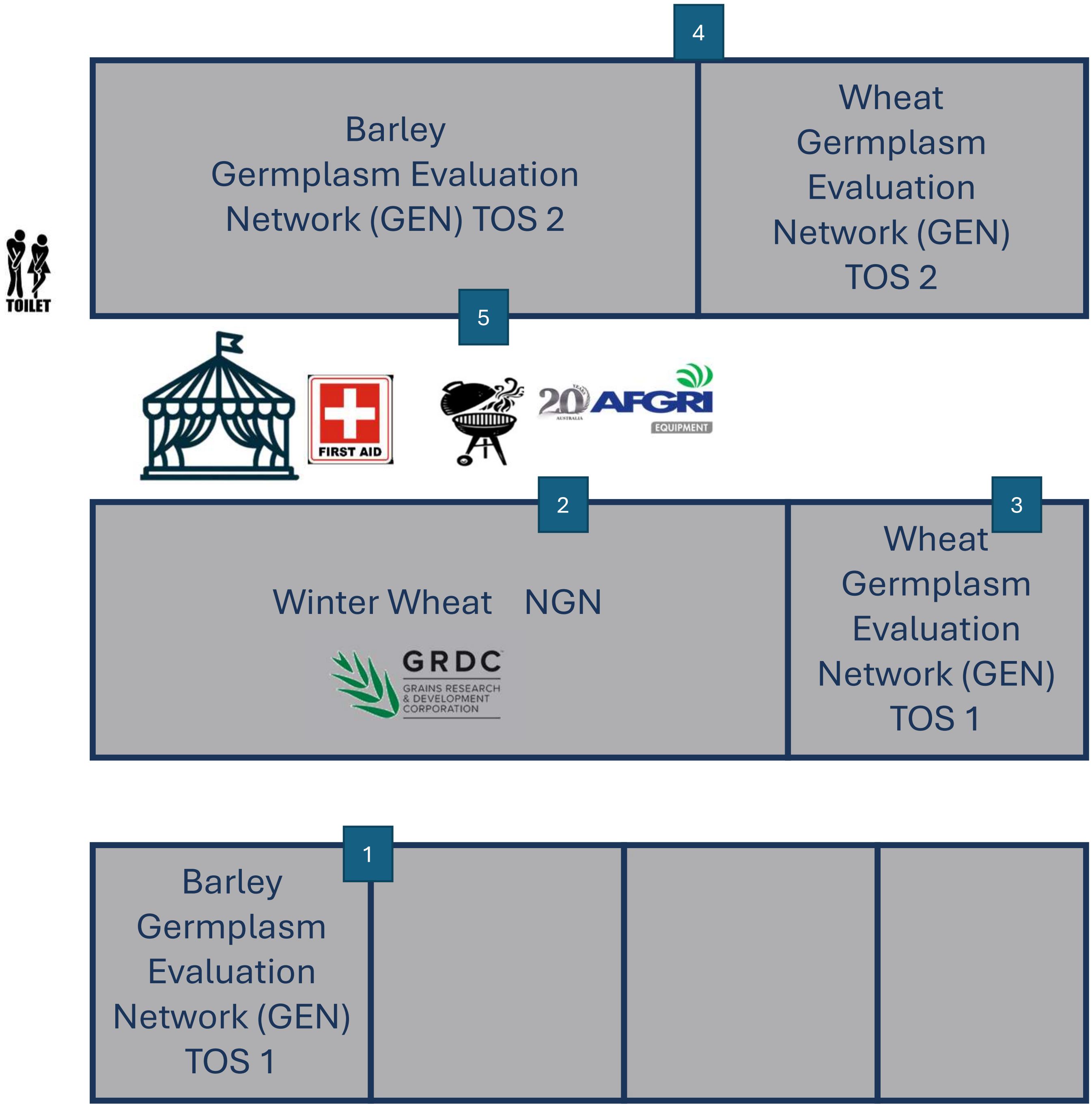


Thanks to our host farmers: the Whiting family

Fungicide resistance and management strategies – are we using too much fungicide in WA crops?

Fran Lopez, Centre for Crop and Disease Management, Curtin University, Perth

Since the introduction of the first commercial fungicide class in the decade of 1940, fungicides have continuously gained importance in the control of crop diseases and today they remain a basic component of existing integrated disease management (IDM) strategies in developed countries for most crops. With a protection benefit comparable to that of genetic resistance, fungicides have contributed to the steady yield increases seen over the last few decades and are considered to be an integral part of any strategies aimed at ensuring worldwide food security in the medium term.

Unfortunately, the high effectivity of fungicides in controlling diseases has led to their widespread application and the generalised relaxation of IDM practices. As a result of this, resistance to fungicides has quickly emerged in some cases challenging IDM programs while increasing pressure over other disease management tools. To date resistance to one or more key fungicide groups has been reported in most relevant broadacre diseases in Australia (https://afren.com.au/understanding/#fungicide-map).

When fungicide resistance develops, management strategies need to be rapidly adjusted to avoid fungicide control failure. In recent years, WA has acquired international relevance due to the rapid onset of fungicide resistance. The repeated application of fungicides from the same group and the use of crop varieties with low disease tolerance have been key drivers of the fast selection and spread of fungicide resistance in the state.

Data collected from 326 paddocks across the south-west WA grainbelt between 2020-2022 indicates an increment in applications of group 3 fungicides for the control of net blotch diseases over the years (Figure 1). In addition to this, multiple applications from fungicide groups 7 and 11, which have a higher risk of resistance selection, was common. During this period, 39-44% of the paddocks had a one-year rotation strategy and susceptible varieties dominated the programs. Lastly, 78% of the paddocks had been sown with farm retained seed, increasing the risk of net blotch seed transmission. These conditions have likely contributed to the rapid selection of resistance to fungicide groups 3 and 7 in net blotch pathogens.

To counteract this problem, The Australian Fungicide Resistance Extension Network (AFREN, https://afren.com.au/) was established with GRDC investment in 2019 to develop and deliver fungicide management resistance resources for growers and advisers across the country. It brings together regional plant pathologists, fungicide resistance experts and communications and extension specialists.

In this presentation, I will use WA examples to discuss relevant strategies aimed at slowing down the emergence of fungicide resistance.

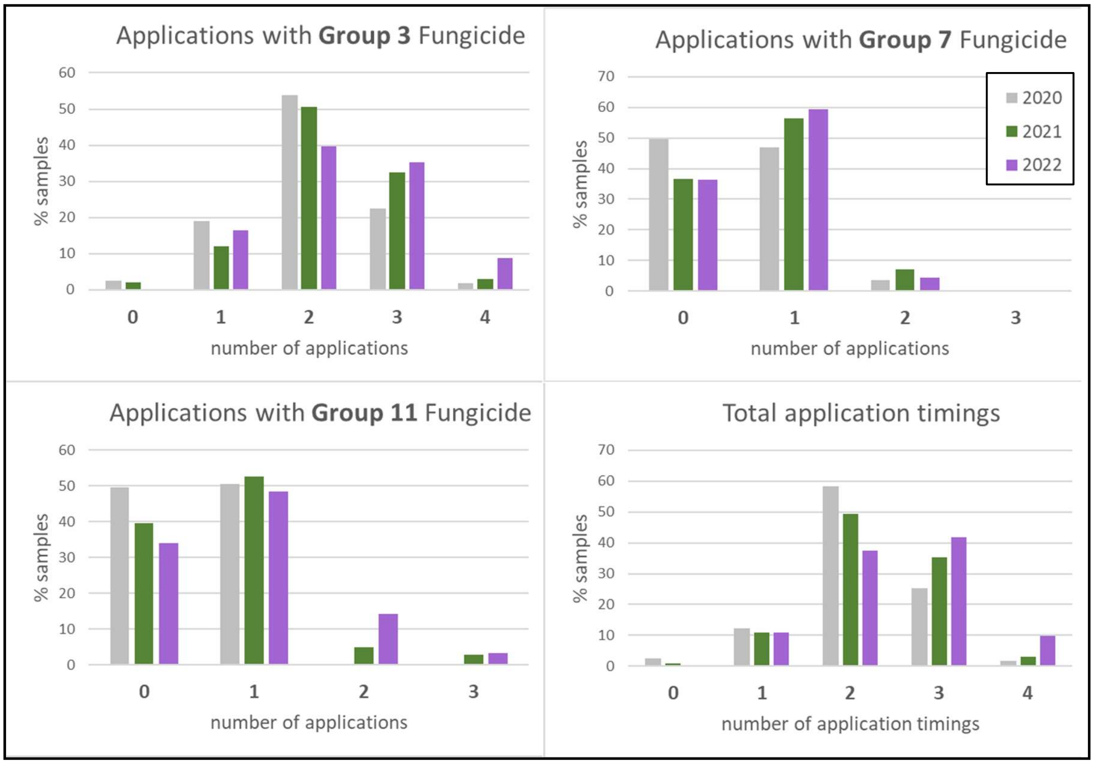


Figure 1. *Frequency of net form and spot form net blotch samples collected in the south-west WA grainbelt between 2020 and 2022 from paddocks receiving 0-4 applications of different fungicide groups.*

The vast majority of practical fungicide resistance detections derive from field observations. Typically, growers and agronomists are the first ones alerting when abnormal fungicide performance is observed in the field. Unfortunately, when this occurs growers are already having difficulties in controlling diseases and this often translates into yield or quality losses.

One of the key elements required in any sound IDM strategy is the ability to monitor pathogen populations so that disease control methods can be tailored to suit emerging management requirements. Fungicide resistance management is not an exception to this, and large efforts have been devoted to the monitoring of fungicide resistance populations in many different crops and countries (R4P network, 2021).

Key Learnings: Esperance Crop Technology Centre 2020 – 2022 & where to next? – Gibson, WA

Nick Poole & Deep Das – FAR Australia

Winter wheat NGN study - 2024

Over three years (2020 – 22) FAR Australia have run a series of wheat and barley trials investigating the performance of winter wheat versus spring wheat sown here in the HRZ of the Esperance port zone in a generally coastal frost-free environment on ameliorated sandplain (deep ripped 400-600mm). A summary of the results of that study is featured in this article. This research in the absence of frost delivered no yield benefit of winter wheats over longer season spring wheats, despite the winter wheats flowering later nearer the optimum flowering period. However, the research did not investigate winter wheat sowing dates earlier than mid-April (16th in all three years of the work). In this year's evaluation (a GRDC one year NGN project) the objective was to look at sowing dates earlier than mid-April. As a result, four trials have been set up with two in the Esperance port zone and two in the Albany port zone. The HRZ site here at Gibson was sown on the following dates with six varieties of wheat and two varieties of barley.

- 26th March (Irrigated 15mm at sowing) – emergence 2nd April
- 23rd April – emergence 4-10th May based on 1.8mm rain in late April and 4.8mm on the 3rd May
- 10th May – emergence 20th -25th May based on 9.2 mm (3 – 8 May)

The objectives of the one-year research programme are:

- To examine the role of winter wheat in rotations along the south coast of WA in the Esperance and Albany Port Zones.
- To explore this possible role in relation to sowing date and spring wheat germplasm with different phenology at the different sow dates covering late March to early comparing profitability and performance to spring barley germplasm.
- To evaluate the different management needs of winter wheat in relation to the other cereal groups being tested (two varieties per cereal classification).

Clearly there are no results from this project at this stage, however, there have been a number of significant observations regarding phenology. Scepter planted 26 March was in head and flowering on 3rd July whilst spring wheats RockStar and Denison were at earlier stage of head emergence, Mowhawk and Illabo were at GS31 and the long season winter wheat RGT Waugh had just finished tillering.

The previous research conducted 2020 – 22 on this farm courtesy of the Whiting family looked at mid-April sowing. The main results of this work are as follows.

Spring versus winter wheat germplasm sown mid-April Key point summary 2020-22
Despite initial modelling to the contrary, winter wheat germplasm could not be proven to be higher yielding than the spring wheat germplasm sown in mid-April in a coastal low frost risk environment.

The "sweet spot" for flowering in wheat in the Esperance region has been modelled as mid- September.

Over the three years (2020 – 2022), Scepter (spring wheat) and Illabo (winter wheat) gave similar yields despite flowering 4-6 weeks apart, with the winter wheat flowering nearer the more ideal mid-September window for the Esperance Port Zone.

However, winter wheat cultivars do extend the ability to sow early (early – mid April) on large acreages, and when combined with an early break, can offer grazing opportunities as well as grain yield.

In addition, for regions at risk from frost, winter germplasm reduces the risks of rapid development that can occur with spring cultivars, particularly in warm autumns.
Despite higher harvest dry matter, longer season winter cultivars such as RGT Accroc and Anapurna that have performed well in the eastern states flowered too late when sown in mid-April in the Esperance WA HRZ.

The shorter season winter wheat Mowhawk (LPB19-14343) has been similar or better than Illabo in terms of yield and has flowered 5-10 days earlier.

Over the three years of the project, whilst winter wheat produced more dry matter than spring wheats such as Scepter, their harvest indices tended to be lower, meaning that less biomass is partitioned into grain with the winter germplasm.

The slightly longer season spring wheat cultivars RockStar and Denison have been higher yielding than Scepter in this mid-April sowing window.

Grain Yields 2020 – 2022 FAR Esperance Crop Technology Centre

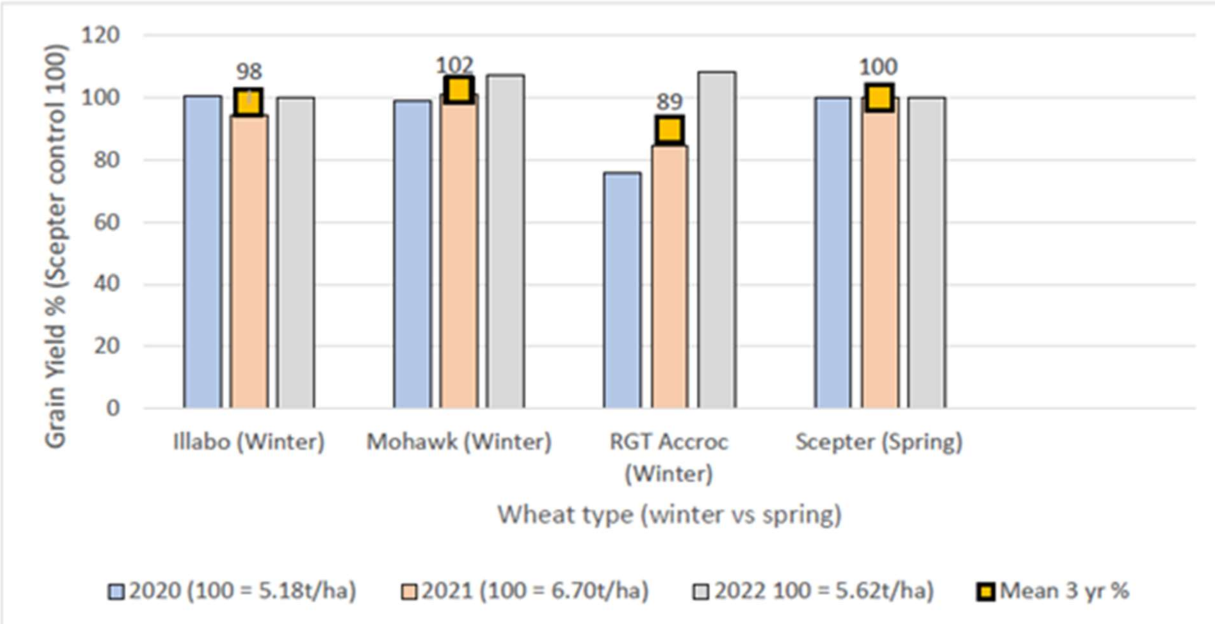


Figure 1. *Winter vs. spring germplasm grain yield (%) under high input management over three seasons – sown 16 April.*

At the Esperance Crop Technology Centre over the last three years (2020 – 2022), despite modelling to the contrary, there has been no advantage of winter wheat over spring wheat (Table 1).

Table 1. *Grain yield of winter vs. spring germplasm (expressed as % of the Scepter control = 100).*

Variety	2020	2021	2022	Mean
Illabo (Winter)	100	94	100	98
RockStar (Spring)		109	120	(114)
Mohawk (Winter)	99	101	107	102
Denison (Spring)		104	114	(109)
RGT Accroc (Winter)	76	84	108	89
Scepter (Spring)	100	100	100	100
	100=5.18t/ha	100=6.7 t/ha	100=5.62t/ha	

When does mid-April sown wheat flower?

Previous field research work has established that the ideal flowering window for wheat in the Esperance region is around mid-September. This flowering date balances frost risk against heat stress/soil water to optimise yield over the long term. In the coastal, low frost-risk region of the current research, the flowering window to establish optimum yields has been very wide with crops planted in mid-April yielding similarly despite flowering between late July and early September (Table 2). Longer season spring wheats flowering later than Scepter appear to be more productive both in terms of final harvest dry matter and grain yield. However long season winter wheats flowering later than mid-September, whilst often being associated with higher harvest dry matter, had a poor ability to convert the dry matter to yield (Figure 2). This has been particularly prevalent with RGT Accroc at Esperance but was less the case at Frankland River (Albany Port Zone). Lower temperatures and higher rainfall in this zone allowed winter wheat, especially the longer season cultivar RGT Accroc, to perform much more strongly compared to spring wheat sown at the same time (See Albany Crop Technology Centre key learnings).

Table 2. *Calendar date that the cultivar reached stem elongation (GS30) and the beginning – middle of flowering (GS61-65) in the 2020 season compared to 2022.*

2020

Cultivar (type)	Date GS30	Date GS61
Scepter (Spring)	8 June	3 August
Cutlass (Spring)	8 June	15 August
Illabo (Winter)	15 June	1 September
LPB19-14343 (Winter)	15 June	2 September
RGT Accroc (Winter)	3 August	15 October

2022

Cultivar (type)	Date GS30	DAS GS30	Date GS65	DAS GS65
Illabo (Winter)	28 June	73	14 September	151
RockStar (Spring)	10 June	55	28 July	103
LPB19-14343 (Winter)	25 June	70	3 September	140
Beaufort (Spring)	11 June	56	15 August	121
Denison (Spring)	8 June	53	11 August	117
RGT Accroc (Winter)	28 July	103	14 October	181
Scepter (Spring)	5 June	50	26 July	101

Is high harvest dry matter the route to higher yields?

The answer is both yes and no! As the figure below indicates from the Esperance data, higher harvest dry matter does not necessarily result in grain yield. It is the combination of higher harvest dry matter and higher harvest indices that result in more yield. In the HRZ trials at Esperance, if higher harvest dry matter came at the expense of late flowering past the optimum for the region, then the result was a poor harvest index and less conversion to grain yield. At Frankland River the harvest indices were lower for winter wheats than spring wheats, but the yields were similar not inferior.

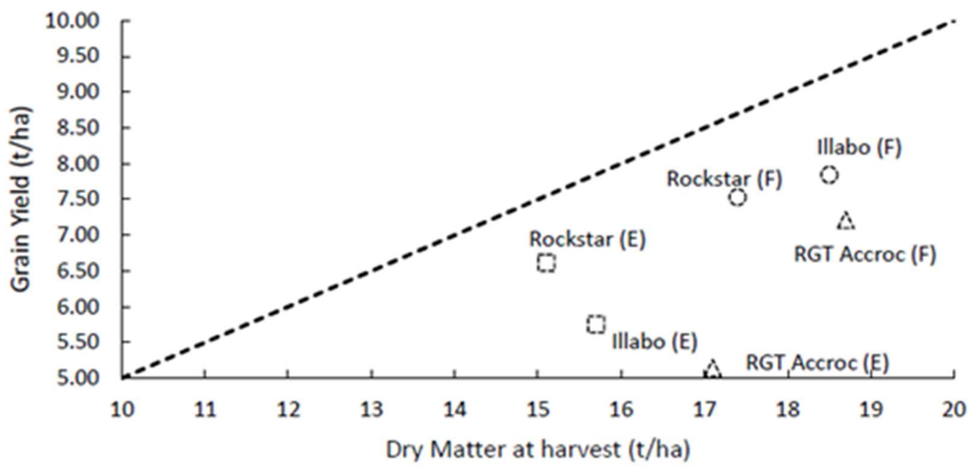


Figure 2. *Relationship between dry matter and grain yield (t/ha) at 0% moisture across spring and winter wheat types at Esperance (E) and Frankland River (F), FAR Australia WA Crop Technology Centres 2021. The dotted line represents aspirational yields that are possible with a harvest index of 50%.*

The influence of management strategy on wheat crop productivity and profitability sown in this mid-April sowing window.

Key point summary

Increased inputs, particularly nutrition have been the key to cost effective yield increases in wheat trials over the 2020 - 22 seasons of the project.

An additional 45-50kg N/ha on top of a standard N dose has provided profitable increases in productivity over the last three seasons based on yield increases of 0.98, 0.84 and 0.77t/ha and associated protein lifts (mean of seven cultivars).

The higher input approach (additional N, PGR and fungicide) has increased margins by $100 - 300/ha depending on variety and season (see results from individual seasons for more detail).

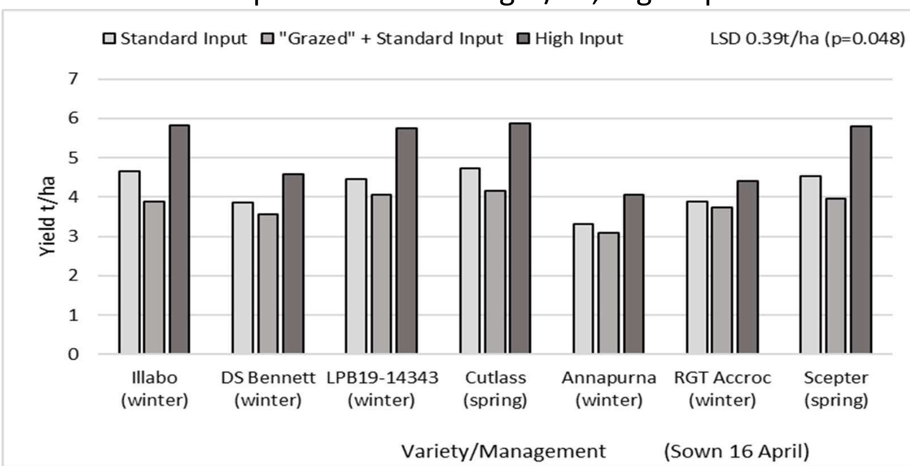
Although high input strategies have incorporated PGR application and greater fungicide input, there has been little lodging in the trials over the three years to justify good responses from PGR, and little evidence to suggest that higher cost disease management in wheat has been a key factor of the yield gap in the WA HRZ, as it has been in the eastern states.

The additional grain yield produced in the high input management approach was associated with higher dry matter at harvest and grain protein.

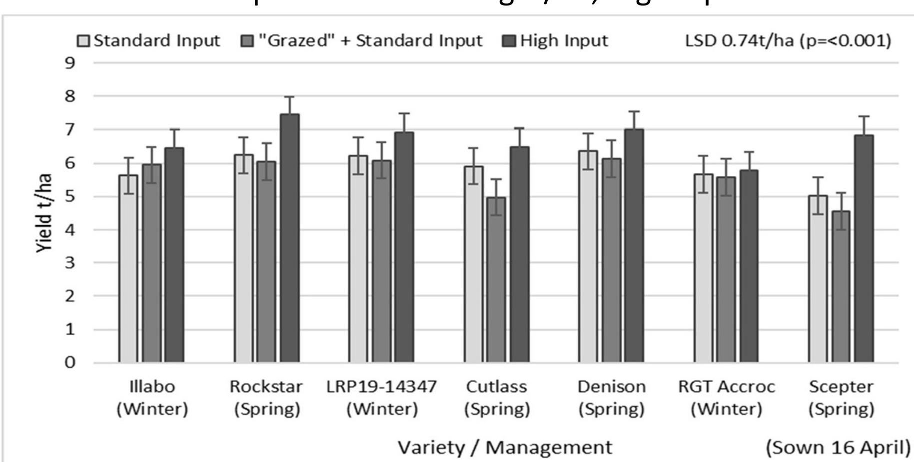
Long season winter wheats, that have been generally lower yielding, have been less responsive to the additional N compared to shorter season winter wheats and spring wheats.

Defoliation simulating grazing has invariably reduced grain yield but the effect on margin depends on the value of grazing to the farming system and tends to be more suited to winter germplasm.

2020 - Standard Input N – total 127kg N/ha, High Input N – total 173kg N/ha.



2021 - Standard Input N – total 169kg N/ha, High Input N – total 223kg N/ha.



2022 - Standard Input N – total 121kg N/ha, High Input N – total 167kg N/ha

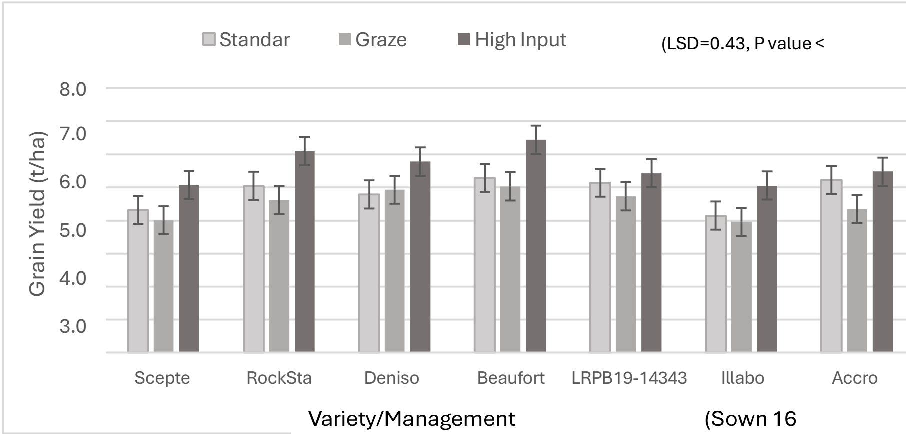


Figure 3. *Influence of management approach on wheat variety performance 2020 – 2022.*

Over the three seasons of the project, this trial was established on sand plain commercially deep ripped (600 – 800mm) in the autumn prior to the plots being established. Seven cultivars have been sown on the same day for the past three seasons (16th April) into good moisture and subsequently farmed under three levels of management input; i) Standard input ii) Standard with defoliation (GS30) to mimic grazing and iii) High input. Typical inputs over the three seasons are presented in Table 3.

Table 3. *Details of the three management levels applied over the three project years (kg, g, ml/ha).*

Plant pop’n: 180 seeds/m^2 (150 plants/m^2 target)

	Standard		Standard Grazed	High Input
Grazed:	----		(GS30)	----
Seed treatment:		Vibrance/ Gaucho (all managements)		
Basal Fertiliser:	16 April	100kg/ha 50% Vigour, 50% MAPZCS		
Nitrogen:				
Total N		121 -169kg N	121 – 169 kg N	167-223 - kg N
PGR:	GS31	----	----	Moddus Evo +
Fungicide:	GS00	----	----	Systiva
	GS31-32	+	+	+
	GS39	+	+	+
	GS59/61*			+

* 2022 only

Physiology of Winter Germplasm - are there opportunities to make more use of this germplasm in the L-MRZ as well as the HRZ?

Dr Ben Jones, Senior Research Manager, Field Applied Research (FAR) Australia

Take-home:

- Winter wheats have yielded better than spring wheats over a yield range from 4 to 15 t/ha in southern Australia, even with sowing times that better favoured spring wheat
- The same advantage has not been seen in Western Australia to date, and may relate to soil or nutrition
- Continue to consider winter wheat for early sowing opportunities. New projects in 2024 should help to better understand where winter wheat works and why in WA.

Introduction

Winter wheats require exposure to cool temperatures (range -2 to 15C) before they transition from the vegetative (tillering) to reproductive (spike growth and grain set) stages. In contrast to 'spring' wheats (which are less sensitive to cool temperatures), winter wheats can be sown early with less risk of early flowering and frost damage. The result is a longer vegetative period leading to several potential advantages:

- Deeper root growth (and access to nitrogen and water if there)
- More water used by the crop; less evaporated (or drained)
- Greater associated nutrient uptake, light interception and biomass accumulation
- Potential to graze excess biomass, or set more grains
- Less prone to waterlogging/better recovery
- Weed competition earlier in the season

There are also potential disadvantages, among which the tendency for winter wheats to be feed quality is a significant one. This requires higher yields, or at least equivalent yields with some systems-related advantages (for example, grazing, or lengthening the sowing window).

Recent developments

Interest in winter wheats increased considerably in the low- and medium-rainfall zone with interest in early sowing and dual-purpose crops following the millenium drought. James Hunt (2017) made an excellent review of the history of winter wheats in Australia and potential adaptations to these areas (as seen at the time).

Subsequently with interest in 'hyper-yielding' cereal crops in high rainfall zones, and the testing and subsequent introduction of a wide range of European winter germplasm, winter wheats have been widely tested in higher rainfall areas.

In 2024 FAR Australia are now part of two related GRDC projects: the first (with University of Melbourne) examines winter vs spring wheat growth in greater detail, with a particular focus on understanding the poor harvest index when sown early in low- and medium-rainfall environments (Porker et al., 2020), and also on whether there are intrinsic differences that might be related to European vs Australian breeding priorities. The second (a one-year NGN project) tests a range of winter wheats with early sowing in the Western Australian high rainfall zone. It is timely to review what has been learnt since then.

Winter vs spring wheat yield comparisons

Between 2016 and 2023, FAR Australia have grown winter and spring wheats together in 37 different comparisons across southern Australia (Figure 1). In 14 of these the sowing times have been relatively early (ie. before April 25; notionally better suiting winter wheats), but the remainder have been neutral (April 25 – May 2; 10 comparisons), or combined neutral or winter-suited sowing times with sowing times that would better suit spring wheat (>May 2; 12 comparisons).

Generally where winter and spring wheats have been sown early, winter wheats yield higher (Figure 1). This is not surprising, partly because early sowing forces the 'critical period' of the spring wheat into a less favourable light environment. There have, however, been enough comparisons where timing might have better favoured the spring wheats, and winters have still significantly out-yielded springs. This has happened across a yield range, with one notable exception: most comparisons sown in Western Australia, even with sowing times favouring winter wheats.

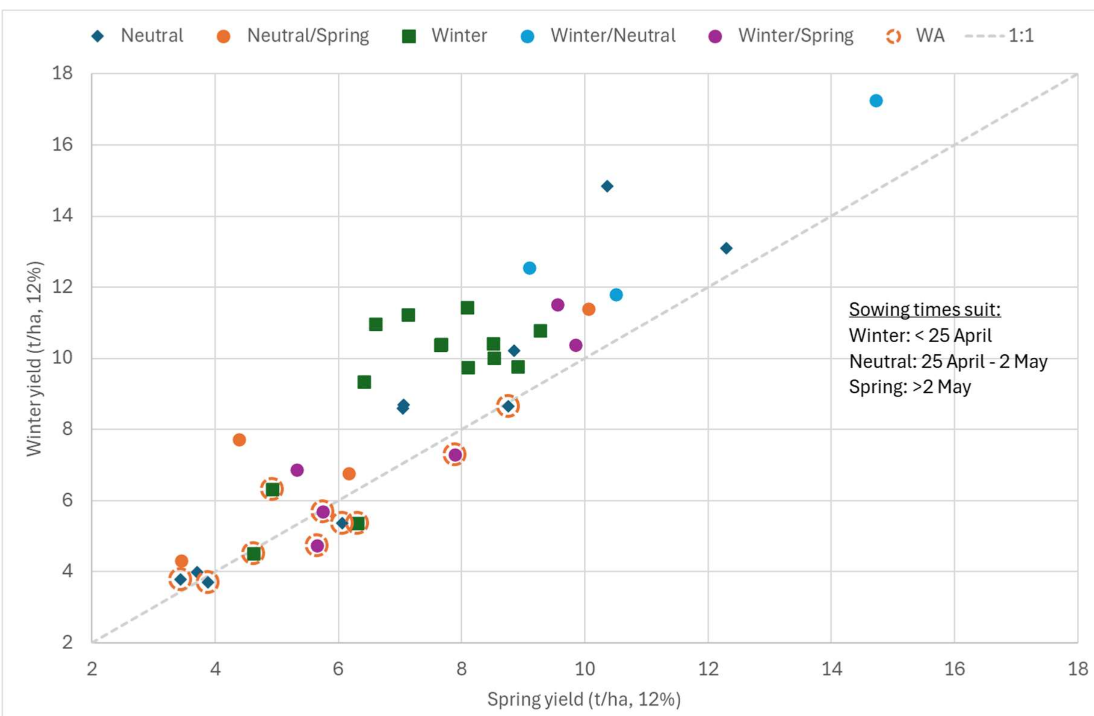


Figure 1. *Highest winter vs spring yield in comparisons in FAR Australia experiments, southern Australia 2016-2023. Points are coloured according to whether sowing times in the comparison favoured winter wheat, spring wheat, were neutral, or a combination. Points from Western Australian crops are circled in orange.*

TIMETABLE

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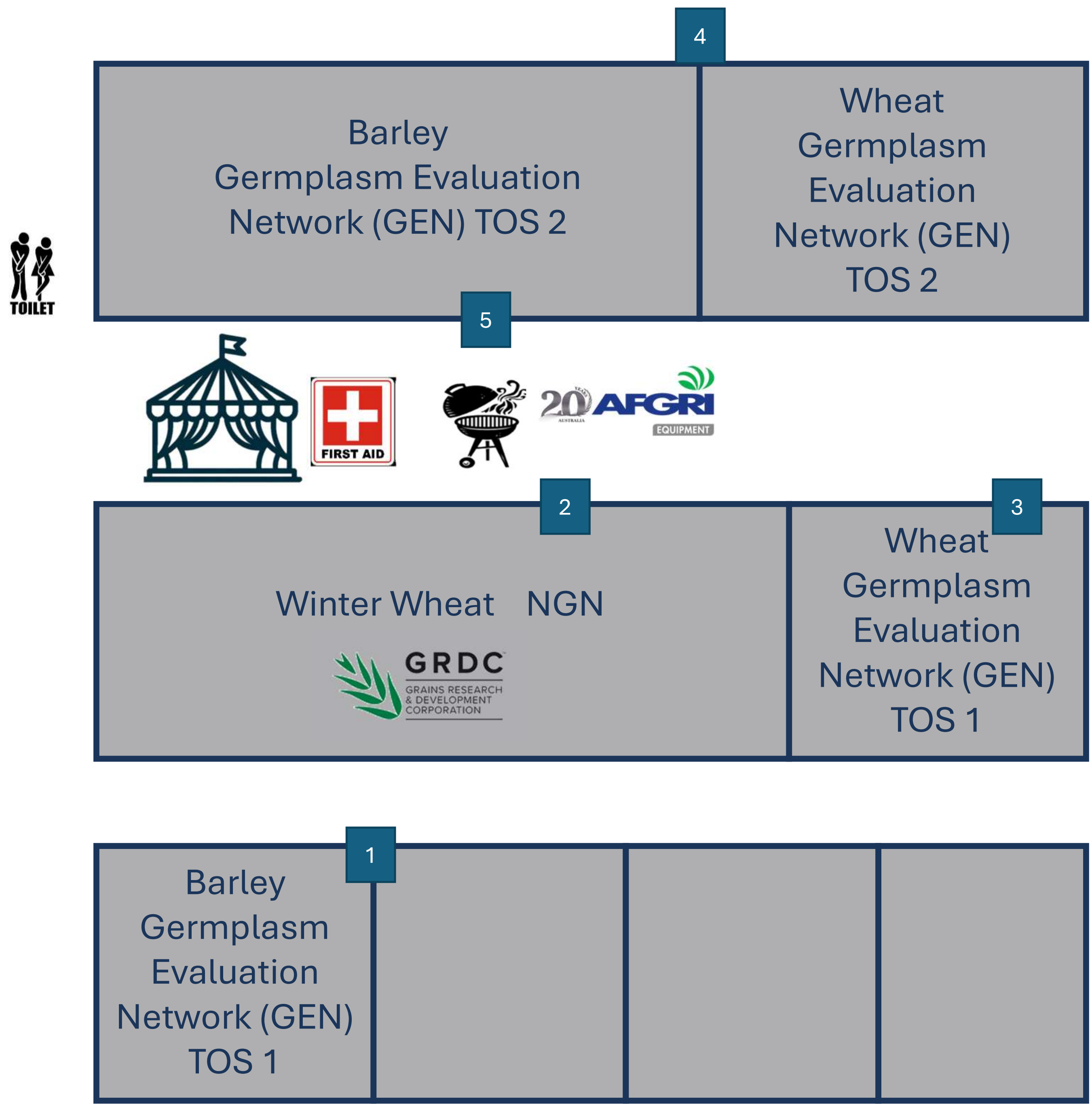


Thanks to our host farmers: the Whiting family

Differences in WA

There could be many reasons for winter wheats (even with early sowing) not out-yielding spring wheats in Western Australia; hopefully more can be said about the FAR comparisons at the time of the field days.

One thing that is conspicuous is that Western Australian winter wheat crops have also tended to have less favourable nitrogen nutrition. In other states, winter wheats are more likely to have more nitrogen harvested in grain (Figure 2), and by implication, have been able to access more nitrogen in soil.

It is possible that limited soil depth or inadequate nitrogen nutrition is the reason for this. There is no advantage to growing a deeper root system if the root depth is limited anyway, or there is little additional resource to access at depth. There still should be advantages to increasing water use by sowing early (given an appropriate break) in a winter-dominant rainfall environment like Western Australia; perhaps closer attention needs to be given to the nutrition requirements that go with it?

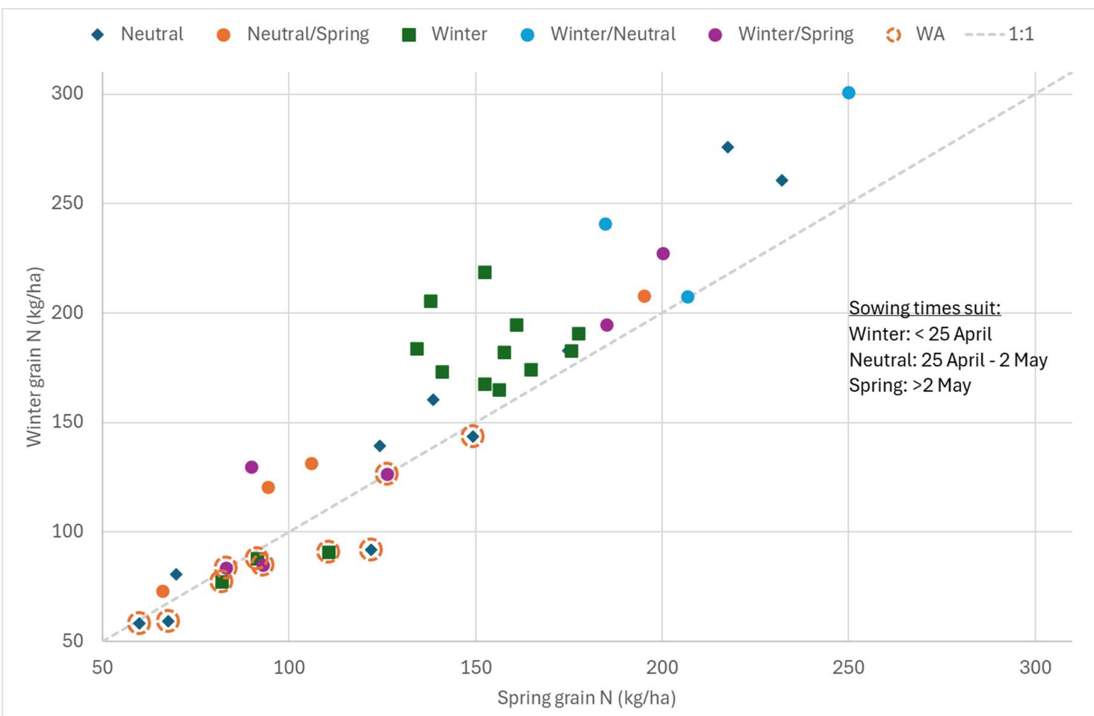


***Figure 2**. Nitrogen harvested in grain in highest yielding winter and spring wheats (comparisons in FAR Australia experiments, southern Australia 2016-2023). Points are coloured according to whether sowing times in the comparison favoured winter wheat, spring wheat, were neutral, or a combination. Points from Western Australian crops are circled in orange.*

Recommendations

Keep an eye on the possibilities offered by winter wheats and early sowing, particularly as adapted cultivars are tested in Western Australia. They have shown potential at a range of yields in other parts of Australia, and should have at least some of the same potential in seasons where there are early sowing opportunities, and system-related advantages such as spreading sowing time, or grazing.

References

Hunt, J.R., 2017. Winter wheat cultivars in Australian farming systems: a review. Crop Pasture Sci. 68, 501. https://doi.org/10.1071/CP17173

Porker, K., Straight, M., Hunt, J.R., 2020. Evaluation of G × E × M Interactions to Increase Harvest Index and Yield of Early Sown Wheat. Front. Plant Sci. 11, 994. https://doi.org/10.3389/fpls.2020.00994

GERMPLASM

evaluation network (GEN)

your trusted research partner for germplasm evaluation

HOW GOOD IS YOUR VARIETY? WHY NOT GET IT TESTED IN GEN?

FAR AUSTRALIA

An Industry Innovations (II) initiative

Industry Innovations
leading the way to a brighter grains industry

SOWING THE SEED FOR A BRIGHTER FUTURE

GERMPLASM EVALUATION NETWORK (GEN)

Background:

FAR Australia has been working with breeders to bring new products to the Australian Grains industry since its inception in 2012. It is a trusted development partner for many breeders, assisting with bringing in new germplasm to the marketplace, whilst ensuring the correct management to fulfil the genetic yield potential.

Industry Collaborations:

FAR Australia is partnering with industry to independently showcase ***germplasm*** performance in a series of high productivity ***evaluation*** trials across the country as part of its Industry Innovations (II) initiative.

FAR Australia has been delivering extremely successful germplasm evaluation network (GEN) pilot programmes across an established series of trial sites in order to test different germplasm in wheat and barley. The five Crop Technology Centres that test GEN are located in WA, SA, Vic, NSW and Tas.

What is Proposed:

Once again, the 2025 programme will focus on genetic yield potential and disease resistance. The trials, in wheat barley and canola, will be managed ‘plus and minus’ fungicide using FAR Australia’s expertise in disease management.

This independent initiative delivers a coordinated and independent network of high productivity trials in wheat and barley. The trials will be managed ‘plus and minus’ fungicide with control varieties provided by FAR Australia.

All trial results will be reported to the breeders within 21 days of harvest. FAR Australia will report results of all trials to the wider industry after all breeders have been informed of their results.

The breeders and FAR Australia will jointly own the results produced. Pre commercialisation breeding lines can be identified by the breeders or a FAR Australia code.

GERMPLASM
evaluation network
your trusted research partner for germplasm evaluation

FAR AUSTRALIA

FUNGICIDE FINGERPRINTING

an independent fungicide evaluation network

DO YOU WANT AN INDEPENDENT EVALUATION OF YOUR FUNGICIDE ACTIVE INGREDIENT OR STRATEGY?

SOWING THE SEED FOR A BRIGHTER FUTURE

An Industry Innovations (II) initiative

Industry Innovations

leading the way to a brighter grains industry

FUNGICIDE FINGERPRINTING - FIRST IN ITS FIELD

Fungicide Fingerprinting, developed by FAR Australia, was launched in 2021 and is the first coordinated and independent fungicide evaluation network in Australia. This initiative aims to generate an independent evaluation of existing and newly developed fungicide strategies to help growers and advisers make better decisions when managing disease. It is:

- Independent
- accurate
- consistent in the approach to disease assessment
- within the label stipulations and AFREN compliant control framework

Collaborating Industry Stakeholders

This industry initiative is of benefit to agrichemical manufacturers involved in both new active and generic, fungicide resellers with agronomists in the field, private advisers and regional farming groups.

Overall Objective:

Individual objectives specific to the trial are:

- To assess the efficacy of different fungicide strategies and active ingredients against foliar pathogens prevalent in the HRZ of Australia.
- To assess the most <u>cost-effective</u> fungicide strategies in different HRZ regions of Australia (long season and short season) using less expensive generic chemistry alongside the latest development material.
- To evaluate whether newer generation fungicide chemistry is more effective than DMI based standard controls.
- To determine the impact of introducing Group 7 and QoI Group 11 chemistry SDHI into two spray programmes.
- To allow development material to be entered under a FAR code (where it is pre commercial) which is revealed when the new active is commercialised.

The Fungicide Fingerprinting initiative is conducted at FAR Australia's Crop Technology Centres in the HRZ regions of Australia where disease is more prevalent, thus an important component of cereal crop agronomy.

Costs:

Should you wish to invest in entries into FAR Australia's Fungicide Fingerprinting Evaluation Network or Germplasm Evaluation Network (GEN), please contact Rachel Hamilton on 0428 843 456 or email rachel.hamilton@faraustralia.com.au

FUNGICIDE FINGERPRINTING
an independent fungicide evaluation network

High Rainfall Zone Farming Systems - Productivity performance of wheat and barley sown mid-April compared with a traditional mid-May sown wheat

Nick Poole, Field Applied Research (FAR) Australia

Key point summary

- Over the three project years 2020 – 2022, barley yields sown in the mid-April window in a relatively frost-free coastal environment at Esperance have been over 1t/ha higher yielding than wheat, despite the lack of adapted winter barley varieties for early sowing.
- This differential varied on what barley and wheat cultivars were chosen, but if the comparison was based on RGT Planet versus Scepter the average difference was 1.47t/ha (ranging from 1.06 -2.21t/ha).
- When comparing Planet to Rockstar instead of Scepter in 2021 and 2022, the differential fell to 0.91t/ha illustrating the better adaptation of the slightly longer season spring wheat to the mid-April sow window.
- Based on a conservative 1t/ha advantage to barley at grain prices of $250 - 400/t for barley, wheat grain prices would need to be $50 - $80/t higher to offset the yield difference.
- Higher input strategies over the three years of the project have given cost effective yield increases, particularly with the more net blotch susceptible varieties.
- To maximise the yield of barley sown in mid-April, disease management has been a key input to unlock the potential of the crop, particularly where RGT Planet was the cultivar of choice.
- Whilst higher nutrition levels cannot be discounted as being part of the success of higher input management in barley, green leaf retention and disease assessments indicate that higher fungicide input in mid-April sown barley is more important than using those same additional fungicide inputs in wheat.With spot form of net blotch (SFNB) in 2020 and 2021 and net form of net blotch (NFNB) in 2022, higher fungicide input based on three to four units of fungicide using all three modes of action (DMIs, QoIs and SDHIs) was noted to give superior disease control than two applications of DMI.
- The importance of disease management in the success of utilising higher inputs was further supported by observations that more disease resistant cultivars such as Laperouse only gave half the yield increase to additional fungicide, N and PGR input.
- Over the three years, the additional inputs associated with a high input programme (40-50 additional N, higher cost fungicide and PGR) was cost

effective with RGT Planet but would have been more marginal with Laperouse, particularly considering the cost of additional N input.

- There was no evidence produced by the project that mid-April sowing dates were more productive than the early – mid May sowing window, however it is noteworthy that spring barley cultivars were more productive than either winter or spring wheat sown in mid-April.
- When compared in adjacent trials (not statistically comparable), spring wheat grain yields were higher as a result of sowing in early to mid-May compared to mid-April sowing using the same management inputs.
- These later sown wheat crops flowered more in line with the regional optimum of mid- September with the critical stem elongation period coinciding with longer days and higher solar radiation. The result was higher harvest dry matters and increased yields.

Which is higher yielding from a mid-April sowing, wheat or barley?
After three project years with identical mid-April sowing dates at the Esperance site, wheat and barley yields have been compared in adjacent trials (Table 1).

Table 1. *Highest grain yield (t/ha) of Scepter (wheat) and Planet (barley) sown in mid-April (Yields taken from adjacent trials on the centre sown at the same time).*

Crop	**2020**	**2021**	**2022**	**Mean**
	t/ha	t/ha	t/ha	
Wheat cv Scepter	**5.80**	**6.85**	**5.07**	**5.91**
Barley cv RGT Planet	**6.86**	**8.00**	**7.28**	**7.38**
GSR mm (April – October)	346	510	600	

The results illustrated that Planet barley was on average 1.47t/ha higher yielding than Scepter planted in the mid-April sowing window. Where the slightly later flowering Rockstar was substituted for Scepter in 2021 and 2022, the difference was reduced by 0.91t/ha. Overall taking account of the highest yielding cultivar, the difference has been approximately 1t/ha. Considering that yield differential and input costs were similar over the three years, the following grain price differential would be needed for wheat to equal the margin achieved with a higher yielding barley crop (Table 2).

Table 2. *Grain price ($/ha) required in wheat to offset 1t/ha advantage to barley based on 6t/ha for barley with barley grain prices between $250 - $400/t.*

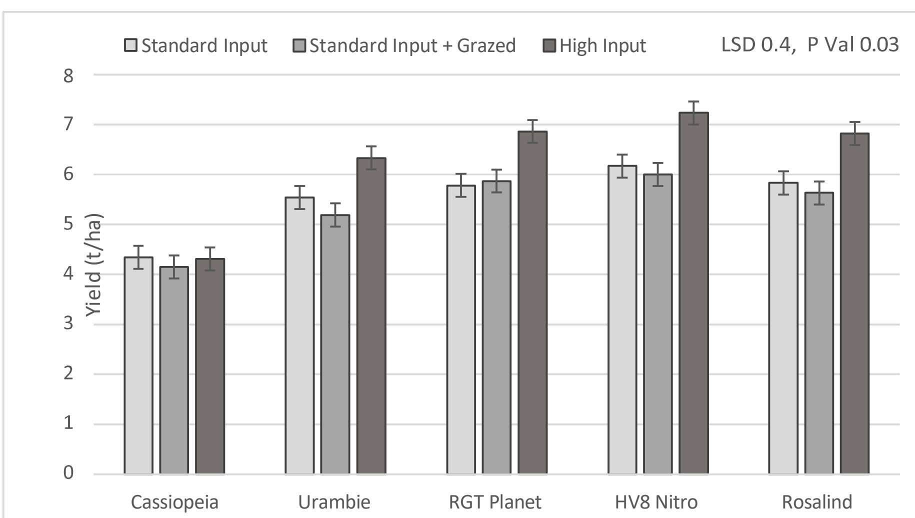
Crop (Grain price $/ha)				
Wheat	**$300**	**$360**	**$420**	**$480**
Barley	**$250**	**$300**	**$350**	**$400**

Note: This takes no account of other considerations such as the value of straw or subsequent rotational benefits.

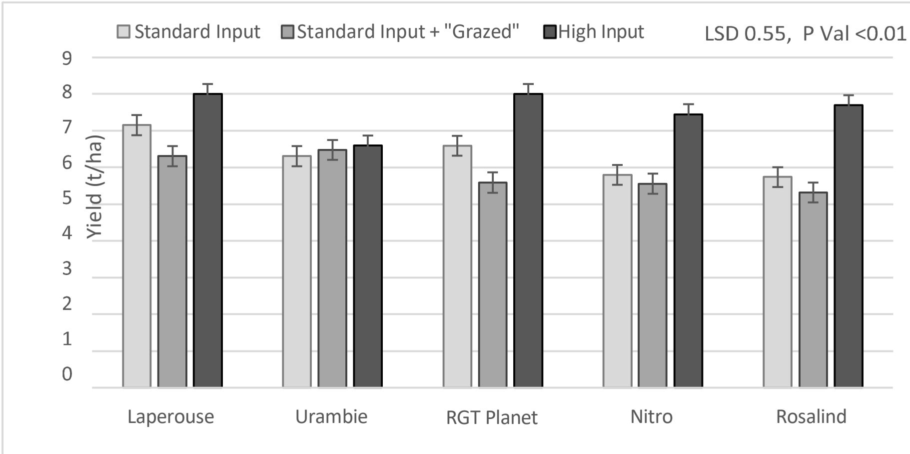
How do we maximise barley yields in the HRZ?
As was the case with the work conducted in wheat a range of varieties were tested with three levels of management. These management levels were i) Standard input ii) Standard input with defoliation at GS30 and iii) High input which incorporated PGR application, greater N input and a more robust fungicide package (Table 3).

Over all three seasons the results from the trials were similar with statistically significant lifts in productivity associated with the high input approach (Figure 6). The trials also revealed that there was a significant interaction between variety and management approach in all three years, meaning that the tested varieties responded differently to the management approaches tested. Although it is not possible to isolate exactly which additional input of the high input approach was responsible for the lift, it was clear from other trials on site and disease assessments that disease management played a much more important role in the success of lifting barley yields in comparison to wheat. With spot form of net blotch (SFNB) in 2020 and 2021 and net form of net blotch (NFNB) in 2022 higher fungicide input based on three-four units of fungicide (seed treatments and foliar sprays) using all three modes of action (DMIs, QoIs and SDHIs) was noted to give better disease control than two applications of DMI (see Table 3 for more details on specific inputs).

2020 - Standard Input N – total 127kg N/ha, High Input N – total 173kg N/ha



2021 - Standard Input N – total 169kg N/ha, High Input N – total 223kg N/ha



2022 - Standard Input N – total 121kg N/ha, High Input N – total 167kg N/ha

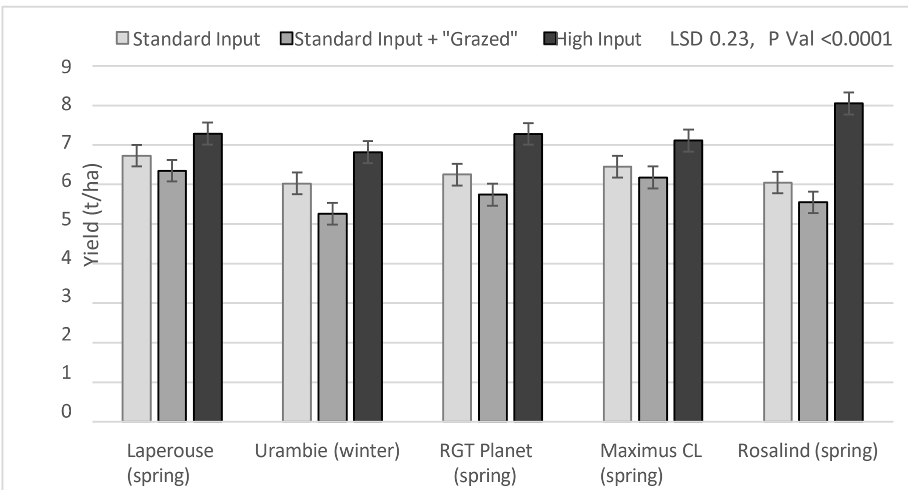


Figure 6. *Influence of management approach on barley variety performance 2020 – 2022.*

***Table 3**. Details of the typical management levels used over the three years of the project (kg, g, ml/ha).*

Plant pop'n:		200 seeds/m² (150 plants/m² target) sown 16 April		
		Standard	**"Grazed" Standard**	**High Input**
Grazed:		----	✓ (GS30)	----
Seed treatment:		Vibrance/ Gaucho		
Basal Fertiliser:		71kg Summit Vigour compound and 71kg Monoammonium Phosphate (MAP)		
K in crop		**10 kg K**	**10 kg K**	**10 kg K**
Nitrogen:		**121 - 169 kg N**	**121 - 169 kg N**	**167 -223 kg N**
PGR:	GS31	----	----	200mL Moddus Evo
	GS39	----	----	200mL Moddus Evo
Fungicide:	GS00	----	----	Systiva
	GS31	150mL Prosaro	150mL Prosaro	300mL Prosaro
	GS39	500mL Opus	500mL Opus	840mL Radial

So how does the productivity of mid-April sown crops compare to more traditional May sowing windows?

The focus of the project was to look at closing the yield gap of earlier sown cereals by evaluating performance superimposed on commercially ameliorated land. Whilst it cannot be statistically compared to the mid-April sowing for the three years 2020 – 22, an adjacent trial was planted looking at mid-May sown wheat in the same ameliorated scenario (Table 4).

***Table 4.** Comparison of grain yield (t/ha) between three spring varieties (Scepter, Rockstar and Denison) sown either early on the 16 April (all 3 years) or between 9 -14 May grown under the same standard management input.*

Variety	2020 Yield (t/ha)		2021 Yield (t/ha)		2022 Yield (t/ha)	
	April Sown	May Sown	April Sown	May Sown	April Sown	May Sown
Scepter	4.52	5.39	5.02	7.29	4.32	5.40
Rockstar	---	5.45	6.24	7.72	5.04	5.77
Denison	---	---	6.36	8.06	4.79	5.14
****Note that as these results are across two trials, they cannot be directly compared hence the lack of statistical significant values.***						

Although not statistically comparable, there have been sound trends in all three years to indicate that delaying seeding of spring wheats until the traditional early – mid May sowing period produced higher dry matter content at harvest, higher head numbers and overall higher grain yields. This later sowing date better aligned to the ideal mid-September flowering window and meant that the period of stem elongation (when grain number formation is occurring) was taking place in longer days that produced higher solar radiation than the equivalent development periods for the same varieties sown in mid-April.

Hyper Yielding Crops project – update on lessons for WA High Rainfall Zone

Darcy Warren[1], Nick Poole[1], Daniel Bosveld[1], Max Bloomfield[1] & Rajdeep Sandhu[1]
[1] Field Applied Research (FAR) Australia

Key point summary

- *Drier conditions in September and October reduce yield potential and grain quality particularly in crops flowering later in the season, this was the case in 2023.*
- *In 2023 earlier sown crops (29 April) on average yielded more than those sown later (17 May) and spring varieties out yielded slower developing winter types.*
- *Grain yields of the highest yielding wheats (5t/ha) were almost 1t/ha **lower** than highest yielding barleys (approx. 6t/ha) sown at the same time, on the same site.*
- *Economic analysis of the Germplasm x Environment x Management (GEM) trials in HYC showed that the 2023 season on average better suited a strategic or tactical management approach in barley, but higher input costs in wheat paid off where higher classification of the grain was achieved.*

Yield

The 2023 Frankland River Crop Technology Centre (CTC) was host to two Germplasm x Environment x Management (GEM) trials, part of a national HYC trial series. These trials, in wheat and barley, looked at the interaction between five cultivars across four management regimes – low input (minimalist approach), high input (no expenses spared), strategic input (tailored approach based on pre-season forecasts/expectations) and tactical (tailored approach based on strategic with in-season adjustment guided by climate and in-season triggers).

Yield in the wheat trial indicated there was no strong influence of management on results (Table 1). There was no interaction between management and cultivar and no significant differences between management means, likely driven by the lack of disease and lodging in the trial and drier weather during stem elongation and grain fill. There was however a significant impact of variety choice on yield with Rockstar and Denison yielding significantly higher than all other cultivars, while the long season winter red wheat RGT Accroc yielded significantly less.

Table 1. *Influence of management strategy and cultivar on wheat grain yield (t/ha) in the GEM trial.*

	Yield (t/ha)									
	Low Input		High Input		Strategic		Tactical		Mean	
Scepter	5.29	-	5.47	-	5.28	-	5.02	-	**5.26**	**b**
RGT Accroc	4.61	-	4.94	-	4.76	-	4.74	-	**4.76**	**c**
Mowhawk	5.40	-	5.36	-	5.24	-	4.97	-	**5.24**	**b**
Illabo	5.49	-	5.47	-	5.21	-	5.28	-	**5.36**	**b**
Rockstar	5.70	-	6.19	-	6.03	-	5.88	-	**5.95**	**a**
Denison	5.87	-	6.01	-	5.72	-	5.82	-	**5.86**	**a**

Mean	**5.39**	**-**	**5.57**	**-**	**5.37**	**-**	**5.29**	**-**	**5.41**	
LSD Cultivar p = 0.05			0.18				**P val**		<0.001	
LSD Management p = 0.05			ns				**P val**		0.227	
LSD Cultivar x Man. p = 0.05			ns				**P val**		0.526	

In contrast, barley results showed significant interaction between management and cultivar (Table 2). Disease susceptible cultivars such as RGT Planet (SVS to NFNB and S to SFNB) and Rosalind (S to SFNB) showed greater response to more robust fungicide input. Inversely, the more disease resistant Laureate showed little response to changes in management. Overall the quick spring variety Rosalind and mid spring variety Neo CL yielded highest, both averaging 6.66 t/ha.

Table 2. *Influence of management strategy and cultivar on barley grain yield (t/ha) in the 2023 HYC GEM trial.*

	Yield (t/ha)									
	Low Input		**High Input**		**HYC Strategic**		**HYC Tactical**		**Mean**	
RGT Planet	5.75	k	6.13	ghi	6.25	f-i	6.21	ghi	**6.09**	**c**
Rosalind	6.31	e-h	6.76	abc	6.63	bcd	6.92	a	**6.66**	**a**
Laureate	5.83	jk	6.08	hij	5.99	ijk	5.74	k	**5.91**	**d**
Minotaur	6.39	d-g	6.05	hij	6.89	ab	6.54	cde	**6.47**	**b**
Neo	6.52	c-f	6.77	abc	6.83	ab	6.51	c-f	**6.66**	**a**
Mean	**6.16**	**b**	**6.36**	**ab**	**6.52**	**a**	**6.38**	**a**	**6.35**	
LSD Cultivar p = 0.05				0.14			**P value**		<0.001	
LSD Management p = 0.05				0.22			**P value**		0.030	
LSD Cultivar x Man. p = 0.05				0.27			**P value**		<0.001	

Economic analysis

Despite yields in wheat being similar across management strategies, that was not the case with grain classification (results not shown). While costing less on average, the low and tactical inputs which cut back on N nutrition and saw no PGR application showed lower partial net margins (taking into account the variable costs in each strategy) when compared to high and strategic inputs in the wheat GEM trial (Figure 1). The upside potential of achieving higher grain classifications offset the additional input costs involved. For example under low input Mowhawk, Illabo and Rockstar only achieved feed standard to receive a price of $350/t (averaging a partial net margin of $1,593/ha) compared to high input where the same three varieties achieved AUH2/H3 classification at $402/t (and an average partial net margin of $1,799/ha).

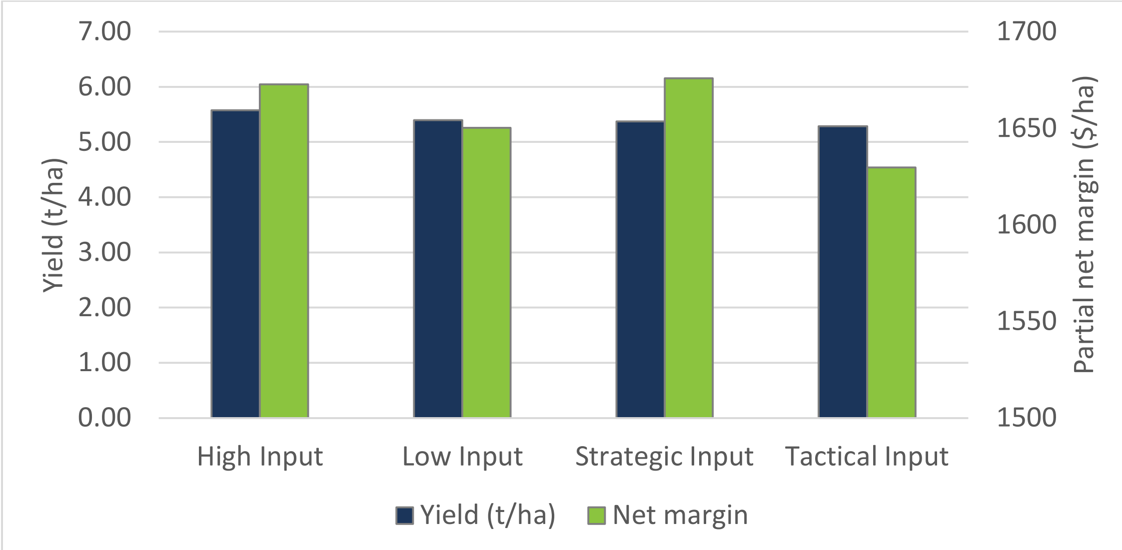


Figure 1. *Influence of management strategy on wheat yield (t/ha) and partial net margin ($/ha).*

Prices based on AUH2/H3 $402/t, APW1 $407/t, SFW1 $350/t, CT spraying $16.2/ha, CT spreading $9.2/ha, high input cost average - $473.2/ha, low input cost - $338.7/ha, strategic input average - $402.3/ha and tactical input average - $404.2/ha. Includes cost of seed treatment, foliar fungicides, PGR, nutrition, freight and grain.

Inversely barley varieties struggled to achieve proteins low enough to reach malt standards. Therefore the cost of the strategies had a larger effect on the partial net margins. In this case Rosalind, which was significantly lower yielding under 'low' management, the net partial net margins were improved by adopting a strategic or tactical approach. The variety Laurate, which gave little yield response to different management scenarios meant that the cheaper managements (low and strategic) gave better partial net margins.

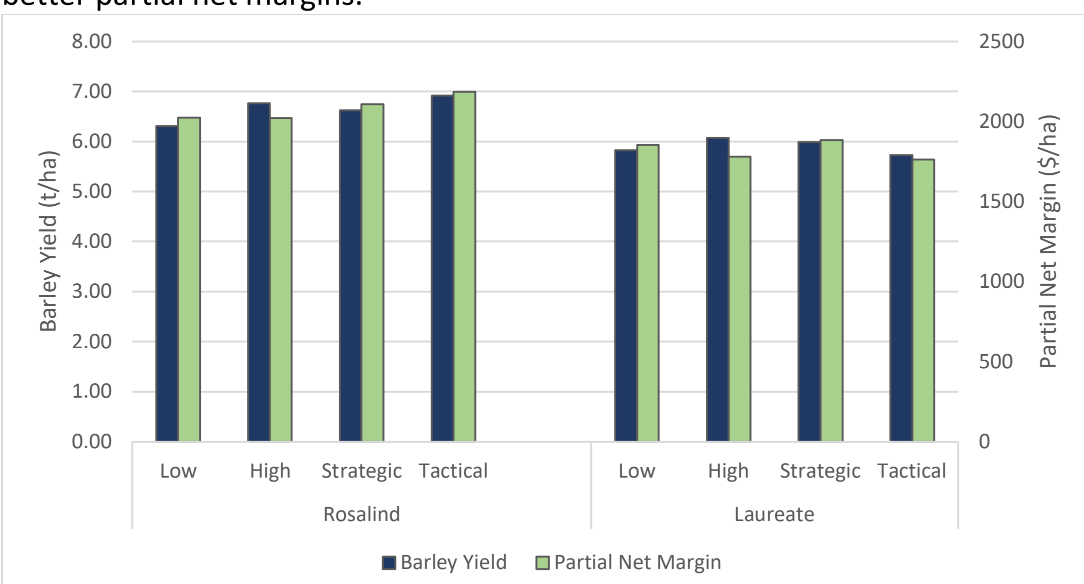


Figure 2. *Influence of management strategy on barley yield (t/ha) and net margin ($).*

Prices based on Malt $376/t, Feed $351/t, CT spraying $16.2/ha, CT spreading $9.2/ha, high input cost average - $517.7/ha, low input cost - $351.0/ha, strategic input average - $386.9/ha and tactical input average - $404.6/ha. Includes cost of seed treatment, foliar fungicides, PGR, nutrition, freight and grain.

Cereal phenology

It was noted in 2021 research that barley yields were 2t/ha higher in HYC trials than in 2022. Through investigation into photothermal quotient (PTQ) the 2022 earlier sowing (April 21st) resulted in crops flowering in early August as opposed to late August/early September when conditions for growth in the "*critical period*" were far better, as was the case in 2021 (crops in 2021 were sown on April 30th). It is now known through the work of HYC over the last four seasons that good solar radiation and cooler temperatures during the critical period are essential to maximise grain number in both wheat and barley (Porker et al. 2024, in review). Grain number is determined in the period of approximately 3 weeks before flowering. Maximising growth of the crop in this window is associated with higher yield potential (as a result of higher grain number per unit area) provided the crop is not subject to other stresses such as frost, heat stress or moisture stress.

In contrast to 2022, wheat and barley varieties in 2023 that developed quicker were the ones that eventually went on to yield higher. With higher-than-average maximum temperatures in August, September and October and higher-than average minimum temperatures in September and October, PTQ yield potential was reduced.

Furthermore, the drier than average conditions throughout spring made for a more hostile critical period for many varieties (Figure 5). When assessing the phenology stages of the varieties tested in FAR Australia's Industry Innovation Germplasm Evaluation Network (GEN) trial, the wheat varieties that had developed further on the 22nd September were amongst those that ended up being the highest yielding (Figure 3).

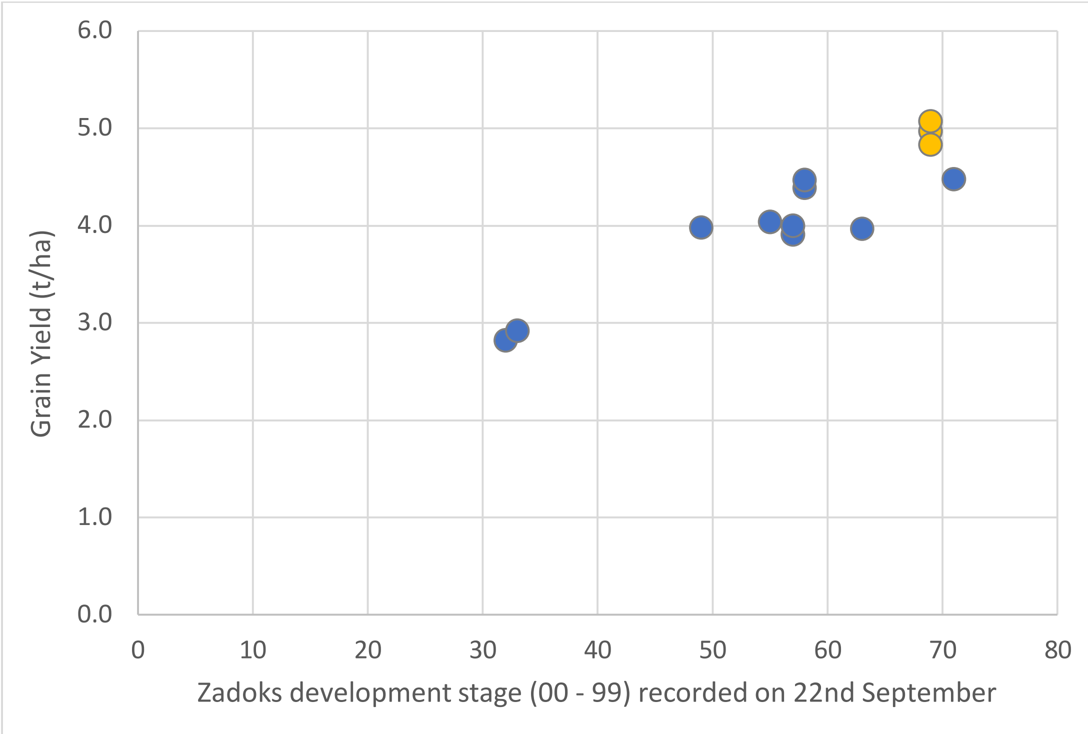


Figure 3. *Influence of development stage in 2023 (recorded on 22nd September) on final grain yield (t/ha). (three orange markers – Denison, Kinsei and Genie (tested as IGW6754) the three highest yielding varieties).*

Cereal disease
With wheat disease only found at very low levels across the 2023 site, much of the disease story developed in the barley trials at the Frankland River CTC. With increased areas of the high yielding barley RGT Planet being sown in the region, so has the prevalence of Net Form Net Blotch (NFNB). RGT Planet is rated SVS to the Oxford virulent, S to the Beecher virulent and MS to the Beecher avirulent pathotypes of the disease. Therefore NFNB has shifted from being an uncommon barley disease in WA to very prevalent. This disease, which is now widespread in both the west and eastern states, has reduced sensitivity and resistance to DMI chemistry in WA and increasing reports of resistance issues to SDHI chemistry in the east of Australia as well as WA. With the risk of resistance to fungicide on the rise, it is vitally important to consider integrated disease management (IDM) approaches, and being a stubble and seed borne disease, seed and paddock hygiene as well as variety selection are imperative.

On site the most dominant disease was NFNB in barley. Despite the susceptibility of RGT Planet, the dry spring kept levels of the disease to a minimum with 10% of untreated Flag-2 showing infection when tested on the 20th September at early grain fill (Figure 4). Most two, three and four fungicide unit programs were sufficient in controlling the disease with between 60% and 70% control. Single applications of fungicides showed less control, especially in the case of a single application of propiconazole (Tilt 500) which showed no significant difference in severity or incidence when compared to the untreated. Due to the low levels of disease experienced and drier conditions than average reducing yields, there was no response to fungicides on final grain yields (Figure 5).

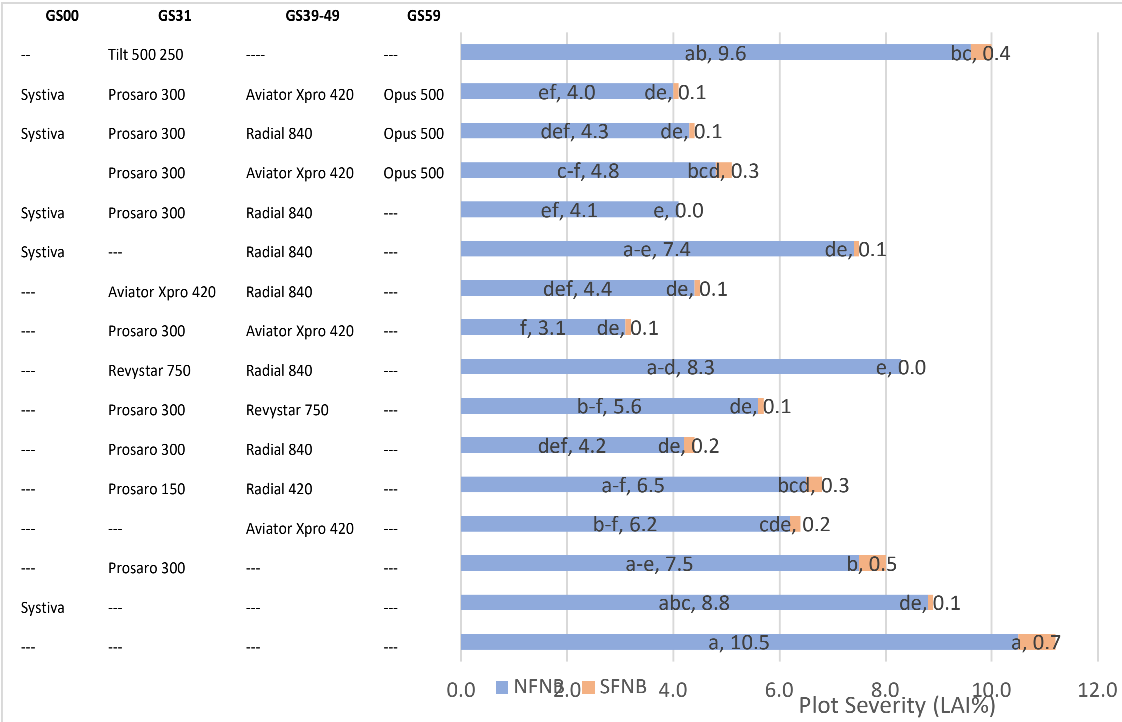


Figure 4. *Net Form Net Blotch (NFNB) and Spot Form Net Blotch (SFNB) severity on Flag-2 tested on 20 September, Z73. Fungicide rates expressed at mL/ha.*

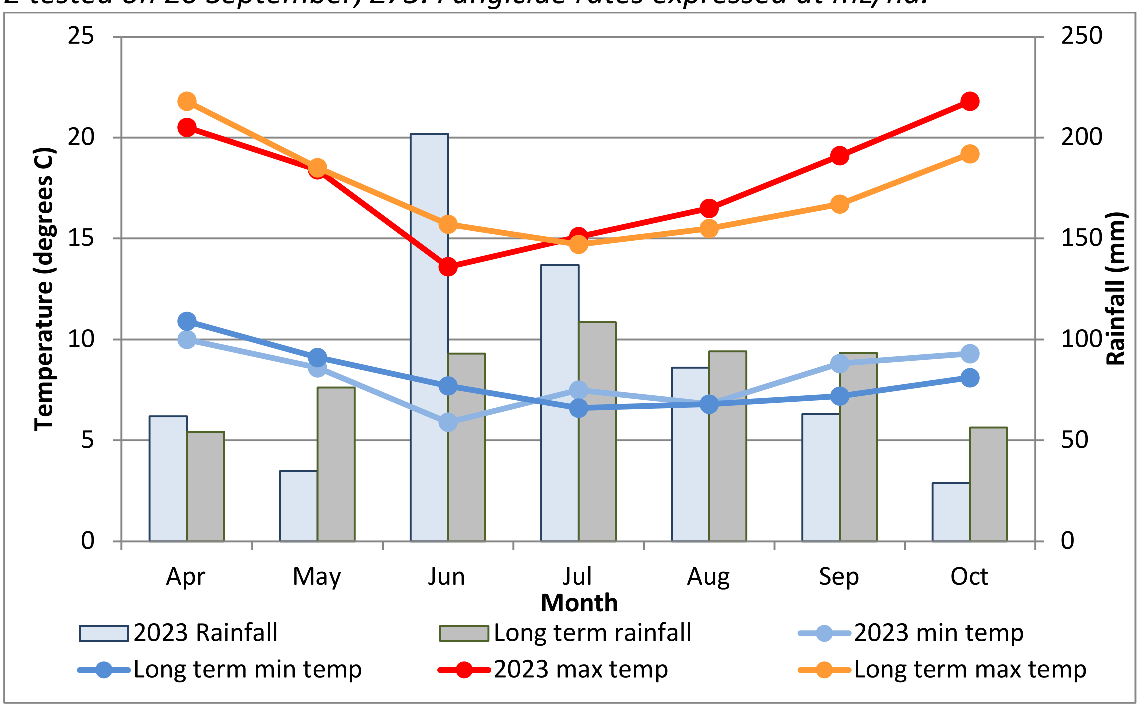


Figure 5. *2023 growing season rainfall and long-term rainfall and long-term min and max temperatures recorded at Rock Gully (1995 to 2023) for the growing season (April to October). Rainfall April to October= 613.4mm.*

‘Growers Leading Change’
Hyper Profitable Crops

Rachel Hamilton and Nick Poole, FAR Australia and David Cook, SEPWA

Overview:
the Hyper Profitable Crops (HPC) initiative is a new GRDC investment aimed at significantly boosting on-farm profitability for wheat and barley growers in Australia's high rainfall zones. Despite the progress made by previous research initiatives, a considerable gap remains between actual crop yields and the potential profitability in these regions. The HPC initiative seeks to bridge this gap by putting cutting-edge research into practice on the farm, enabling a wide range of growers to enhance their profitability.

Project Goals:
Building on the success of earlier GRDC Hyper Yielding Crops investment, which demonstrated improved crop water use efficiency and higher yields through informed decisions on variety, sowing date, fertiliser, and disease management, the HPC initiative will focus on translating this knowledge into actionable strategies for growers. The ultimate goal is to equip wheat and barley growers in high rainfall environments with the motivation, agronomic support, and expertise needed to close the yield gap while maximising profit by April 30, 2027.

Innovation and Benchmarking Hubs:

Central to the initiative are seven innovation and benchmarking hubs strategically located across key high rainfall zones, including the South Coast of Western Australia, South-eastern South Australia, Southern Victoria, Tasmania, and Southern New South Wales. These hubs will act as centres for knowledge exchange, facilitated discussions, and hands-on crop inspections. They will enable growers to learn from each other and explore and implement innovative agronomic practices that can lead to increased on-farm profitability.

Discussion Groups and On-Farm Benchmarking:
As part of the HPC initiative, 17 discussion groups have been established across the high rainfall zones. These groups aim to not only boost on-farm profitability but also build confidence among Generation Y growers and advisors, who will play a pivotal role in leading change within their regions. Through on-farm benchmarking of paddock performance and smaller HPC-specific trial programs, growers will have the opportunity to refine their management practices, optimise crop yields, and achieve more profitable outcomes.

Collaboration and Support:
FAR Australia has partnered with regional farming systems groups to provide dedicated project officers in each region. These officers will work closely with farmers and agronomists to collect input and operational data, which will be costed generically per region using the Agworld data platform. Importantly, no individual financial data will be requested from participating growers. In addition to this support, the initiative will produce a comprehensive high rainfall zone cropping manual, offering valuable insights and case studies to guide future decision-making.

How to get Involved:
To become involved in the Hyper Profitable Crops initiative, growers can contact the HPC Project Officer in their respective region:

- South East Premium Wheat Growers Association (SEPWA): David Cook (david@sepwa.org.au)
- Farmlink: Caroline Keeton (caroline@farmlink.com.au)
- Riverine Plains Inc: Kate Coffey (kate@riverineplains.org.au)
- Southern Farming Systems:
  - (VIC) Ashley Amourgis (aamourgis@sfs.org.au) or Greta Duff (gduff@sfs.org.au)
  - (TAS) Brett Davey (bdavey@sfs.org.au)
- Mackillop Farm Management Group: Gina Kreeck (research@mackillopgroup.com.au)
- Stirlings to Coast Farmers: Dan Fay (dan.fay@scfarmers.org.au)

Project Leadership:
The HPC initiative is led by Rachel Hamilton of FAR Australia, supported by a technical team including Dr. Ben Jones, Darcy Warren, Tom Price, and Nick Poole.

For further information, please contact Rachel Hamilton at rachel.hamilton@faraustralia.com.au.

FAR Australia has collaborated with the following organisations:

FAR AUSTRALIA

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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