TASMANIA HYC RESEARCH CENTRE

FAR AUSTRALIA

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

FIELD DAY

INCREASING PRODUCTIVITY & PROFITABILITY IN THE HRZ OF TAS

Thursday 23rd November 2023

Thanks to the following premier sponsor:

R·A·G·T

Thanks to the following lunch and refreshments sponsor:

Elders

The GRDC Hyper Yielding Crops project is led by FAR Australia in collaboration with:

MFMG, Stirlings to Coast Farmers, FAR Australia, RiverinePlains, SFS, Department of Primary Industries and Regional Development, CSIRO, CeRDI Federation University Australia, BRILLAG Agronomy & Research, TechCrop

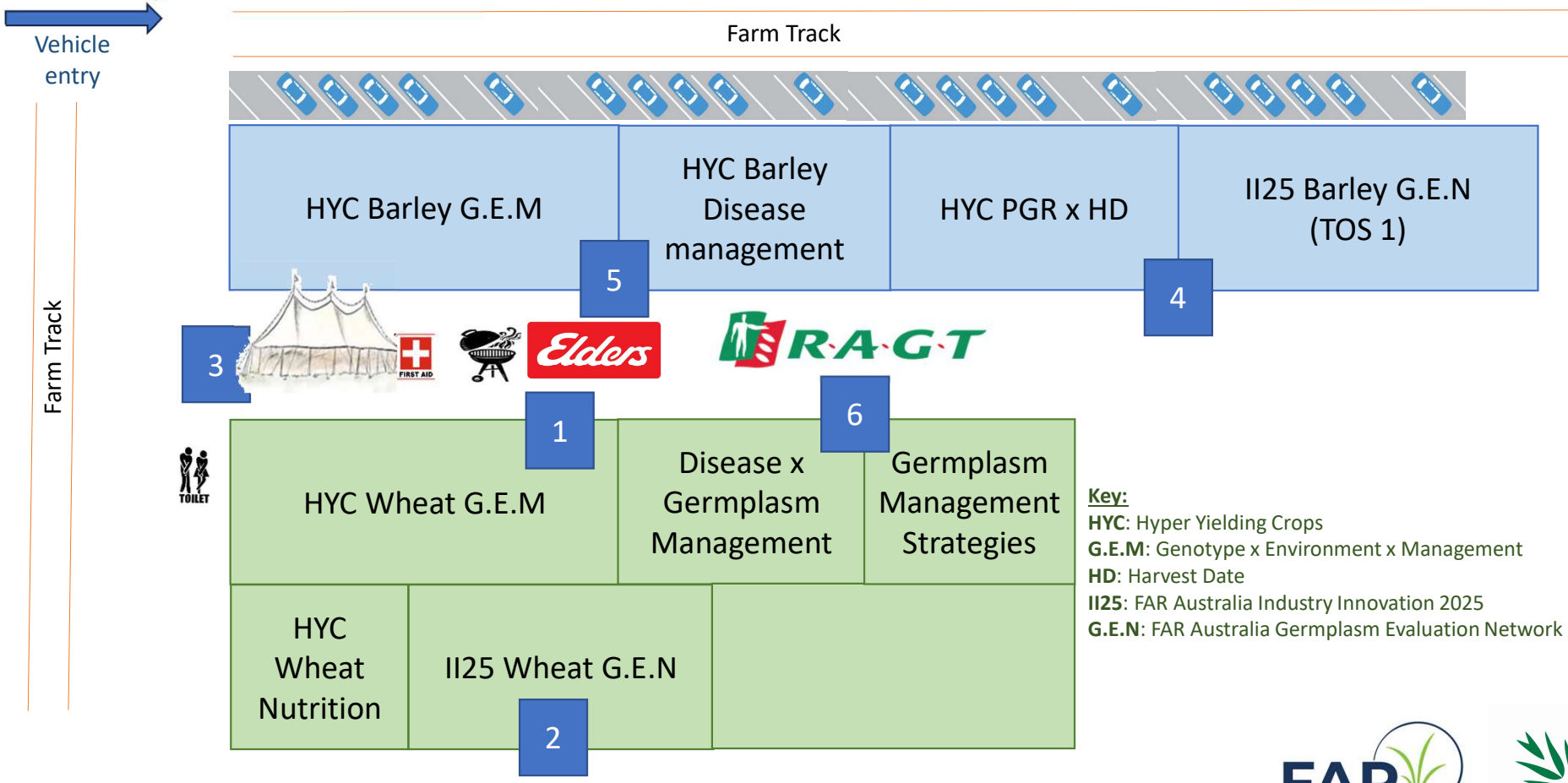
Thanks to the following host farmer:
Botanical Resources Australia

SOWING THE SEED FOR A BRIGHTER FUTURE

TASMANIA HYC RESEARCH CENTRE

2023 SITE MAP: TASMANIAN CROP TECHNOLOGY CENTRE (Hagley)

Featuring the GRDC's Hyper Yielding Crops



Key:

HYC: Hyper Yielding Crops
G.E.M: Genotype x Environment x Management
HD: Harvest Date
II25: FAR Australia Industry Innovation 2025
G.E.N: FAR Australia Germplasm Evaluation Network

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GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

TASMANIA HYC RESEARCH CENTRE

FAR AUSTRALIA

TIMETABLE

TASMANIA CROP TECHNOLOGY CENTRE FIELD DAY:

THURSDAY 23 NOVEMBER 2023

Featuring the GRDC's Hyper Yielding Crops

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

In-field presentations	Station No	10:30	11:00	11:30	12:00	12:30	1:30	2:00	2:30	3:00
Prof. Victor Sadras (SARDI) *The physiology of wheat yield and its consequences for management*	1	Coffee followed by opening address by Fiona Chilvers, Grower; Craig Baillie, GRDC General Manager Applied Research, Development & Extension and Nick Poole, FAR Australia's Managing Director and HYC Project Lead for an introduction to the HYC research programme	1			Lunch at the marquee kindly sponsored by: Elders				Informal tour of plots and closing refreshments kindly sponsored by: Elders
Nick Poole (FAR Australia) *Genetics for stable high yields in Tasmania*	2			1						
Dr Ben Jones (FAR Australia) *Spring sun and heat as limits to high wheat yields in Tasmania*	3				1					
Darcy Warren (FAR Australia) *Maximising spring sown barley yields in Tasmania*	4						1			
Jon Midwood (TechCrop) *Agronomic benchmarking for the HYC awards programme*	5							1		
Brett Davey (Southern Farming Systems) & Darcy Warren (FAR Australia) *Combatting stripe rust: insights from wheat disease management trials*	6								1	
In-field presentations	**Station No.**	**10:30**	**11:00**	**11:30**	**12:00**	**12:30**	**1:30**	**2:00**	**2:30**	**3:00**

Thanks to our principal event sponsor: R·A·G·T

VISITOR INFORMATION

We trust that you will enjoy your day with us at the Tasmania Crop Technology Centre 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.

FIRST AID

- 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 marquee or gazebo.

Thank you for your cooperation, enjoy your day.

INCREASING PRODUCTIVITY AND PROFITABILITY IN THE TASMANIA HRZ

FEATURING THE GRDC'S NATIONAL HYPER YIELDING CROPS (HYC)

On behalf of our investor, the **Grains Research & Development Corporation,** along with the Hyper Yielding Crops (HYC) project collaborators, I am delighted to welcome you to our 2023 Tasmania Crop Technology Centre Field Day featuring HYC.

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.

I would also like to thank the GRDC for investing in this research programme. Also a big thanks to Botanical Resources Australia, our host farmer for their tremendous practical support given to the team, and to today's sponsors RAGT and Elders.

Should you require any assistance throughout the day, 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 into your own farming business.

Nick Poole
FAR Australia Managing Director and HYC Project Lead

Hyper Yielding Crops

Hyper Yielding Crops (HYC) has been built on the success of the GRDC's four-year Hyper Yielding Cereals Project in Tasmania which attracted a great deal of interest from mainland HRZ regions. The project demonstrated that increases in productivity could be achieved through sowing the right cultivars, at the right time and with effective implementation of appropriately tailored management strategies. The popularity of this project highlighted the need to advance a similar initiative nationally which would strive to push crop yield boundaries in high yield potential grain growing environments.

With input from national and international cereal breeders, growers, advisers and the wider industry, this project is working towards setting record yield targets as aspirational goals for growers of wheat, barley and canola.

In addition to the research centres, the project also includes a series of focus farms and innovative grower networks, which are geared to road-test the findings of experimental plot trials in paddock-scale trials. This is where in the extension phase of the project we are hoping to get you, the grower and adviser involved.

HYC project officers in each state (Ashley Amourgis here in Tasmania) are working with innovative grower networks to set up paddock strip trials on growers' properties with assistance from the national extension lead Jon Midwood.

Another component of the research project is the HYC awards program. The awards aim to benchmark the yield performance of growers' wheat paddocks and, ultimately, identify the agronomic management practices that help achieve high yields in variable on-farm conditions across the country. This season, HYC project officers are seeking nominations for 50 wheat paddocks nationwide (about 10 paddocks per state) as part of the awards program.

For more details on the project contact:

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Ashley Amourgis - TAS and VIC HYC Project Officer, Southern Farming Systems
Email: aamourgis@sfs.org.au

Scan the QR code for 2022 HYC project results

WHEN IT COMES TO HIGH CROP YIELDS, OUR VARIETIES ARE KNOCKING 'EM FOR SIX!

Our white winter wheat, RGT Waugh, like its namesake, is smashing it out of the ground when it comes to high yields and quality production.

In addition, we have our big hitting red winter wheats, RGT Cesario and RGT Accroc, plus always in demand RGT Planet barley.

And coming off the long run, RGT Baseline TT spring canola and RGT Clavier CL and Nizza CL winter canola's, to name just a few.

Get the runs on the board from our world-renowned products, with plenty more in RAGT's nets getting ready for market.

Talk to your local RAGT representative to find out more.

CULTIVATING LIFE

RAGT

think SOLUTIONS think RAGT

The physiology of wheat yield and its consequences for management

Victor Sadras, South Australia Research and Development Institute (SARDI)

Take home messages

1. Yield is a function of grain number, and grain number is defined in a species - specific critical window.
2. The critical window is from late stem elongation to 10 days after flowering in cereals, and shifts to pod set in canola and pulses.
3. Yield depends on three traits: duration of the critical period, growth rate during the critical period, and partitioning to spikes.
4. These principles apply irrespective of soil, climate, and management.

Grain yield depends on grain number

Yield is the product of grains per m^2 and average grain weight. Relatively small variation in yield (5-10%) can be related to either grains per m^2 or grain weight. Large variation in yield (50% or more) is necessarily associated with grain number (Fig. 1). This relates to the universal principle that crops accommodate environmental variation by adjusting grain number. This principle is as strong as it gets. It applies to all cereals, pulses, and oil-seed crops, irrespective of soil, climate, and management. Of course, we don't want screenings, and grain size is an important quality attribute, but we should not be distracted from the main game – to get the numbers (Fig. 1).

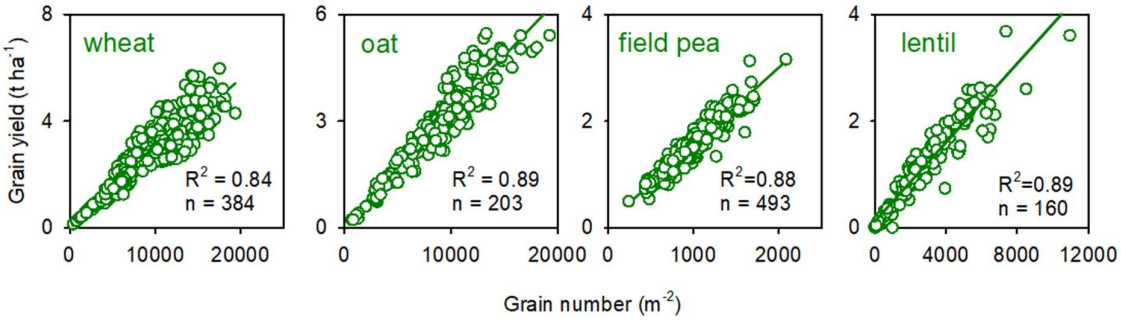


Figure 1. *Crop yield is primarily related to grain number. Source: Sadras (2021) Proceedings of the Royal Society B: Biol Sci 288, 20211259.*

Grain number is defined in a crop-specific critical window

Grain number in cereals is defined in a critical developmental period from late stem elongation to 10 days after flowering, with a most sensitive stage about two weeks before flowering (Fig. 2, top). The most critical period is displaced to pod set in pulses and canola (Fig. 2, top). The critical window does not depend on soil, climate, or management. We found the same window for locally adapted Australian oat varieties in a 3.2 t/ha environment in SA, and locally adapted Chilean varieties in a 7.5 t/ha environment in southern Chile.

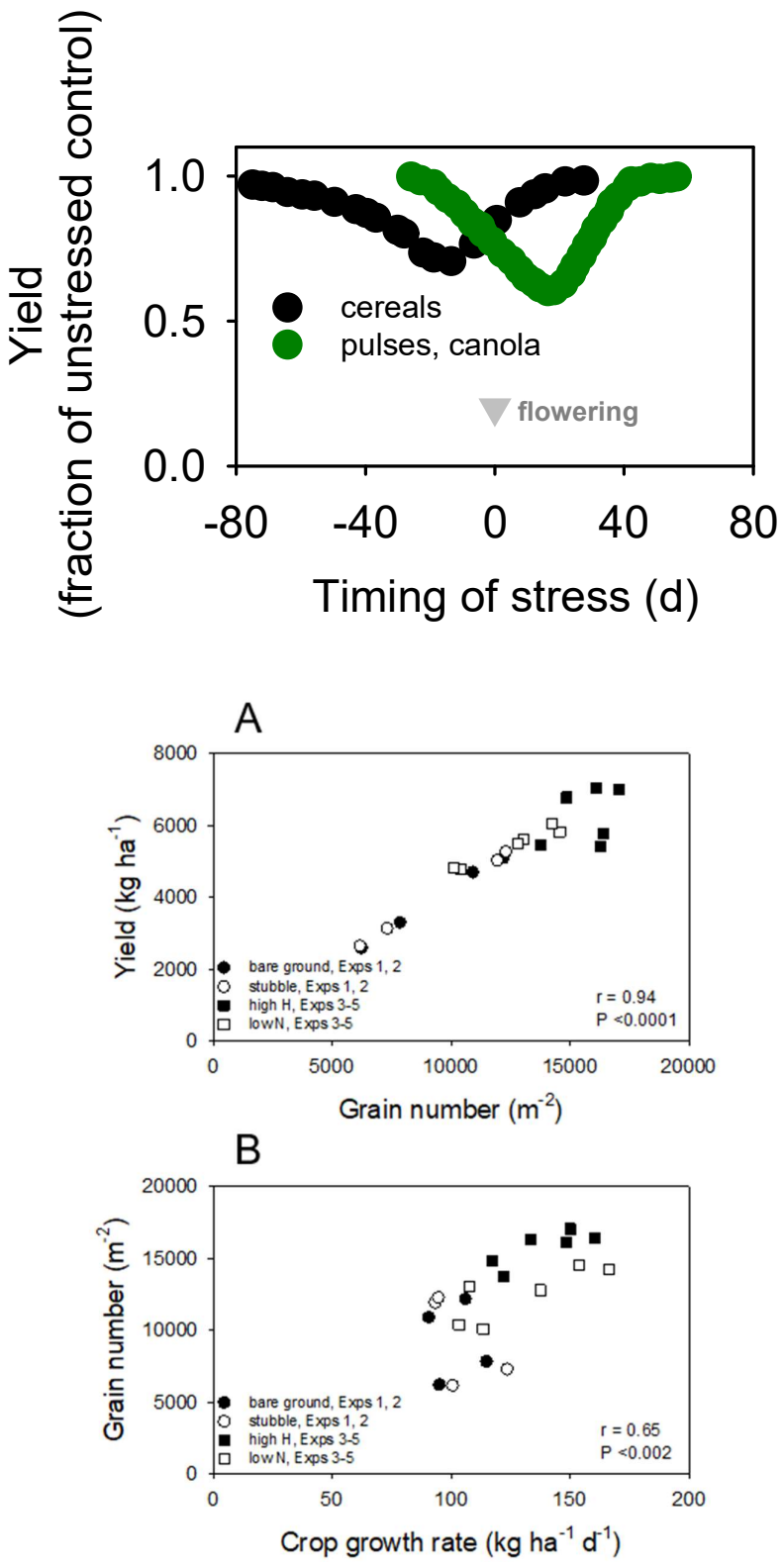


Figure 2. *TOP. Species-specific critical windows for grain number and yield. BOTTOM. Relations between (A) yield and grain number and (B) grain number and growth rate in the critical period of wheat crops at Roseworthy, SA. Source: TOP: Sadras & Dreccer (2015) Crop Past Sc. 66, 1137. BOTTOM: Sadras et al (2012) Eur J Agron 36, 41.*

Management should primarily focus on the critical period

Because yield is a primary function of grain number, and grain number is determined in a species-specific critical window, management should aim at high growth rate in the critical period, a long critical period, and avoiding stress (drought, heat, frost, nitrogen deficiency) in the critical period. Plenty of experimental and modelling work focuses on matching variety-sowing date for stress avoidance. Fig. 2 (bottom) illustrates the relation between yield and grain number of wheat and the relation between grain number and crop growth rate in the critical period.

High yield of long-season, winter wheat in the northern hemisphere has been misinterpreted. What matters is not the duration of the cycle from sowing to harvest, but the duration and conditions during the critical period (Fig. 3). Spring-sown wheat in southern Chile can reach 12 t/ha with a much shorter season, provided the crop is not stressed during the critical period. The same applies to high yielding environments of Tasmania.

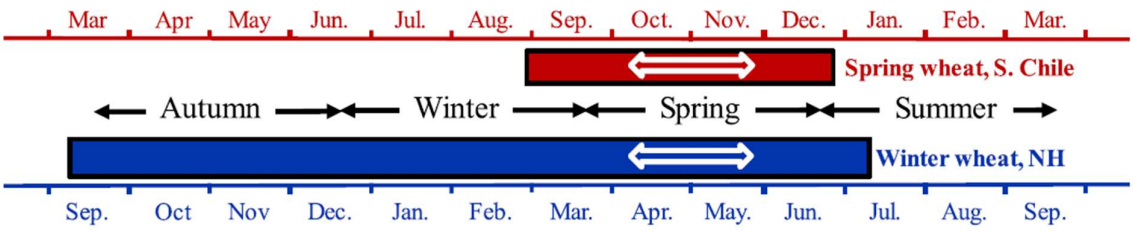


Figure 3. *Crop cycles from sowing (start of the rectangle) to maturity (end of the rectangle) for typical winter wheat grown in the Northern hemisphere (NH) and so called "spring" wheat (actually sown in late winter) in Southern Chile. The double arrows show the critical period. Source: Slafer et al 2023 Eur J Agron 148.*

Genetics for stable high yields of wheat in Tasmania – HYC Project findings 2016 – 2022

Nick Poole[1], Darcy Warren[1] & Brett Davey[2]
[1] Field Applied Research (FAR) Australia, [2]SFS Tasmania

Key point summary

- Over the last six years, the HYC project has been looking to identify the genetic traits for high yield under irrigation in wheat from April sowing.
- Over that period, it has been shown that late April sowing has provided the sweet spot for yield with the correct management input.
- As a result of irrigation, the optimum flowering window is generally wider than dryland scenarios covering the period from late October to mid-November.
- As result there has been some flexibility in the genetics in terms of phenology (rate of development) to produce stable high yields.
- The most important characteristics to achieve high yields of wheat (10-15t/ha) are the ideal phenology flowering at the right time, good disease resistance, good straw strength and of course upper end yield potential.
- Currently it is winter wheats as opposed to spring wheats that fill this niche in Tasmania, with Stockade being the highest yielding spring white wheat identified.
- Over the last four-year period some varieties have become disease susceptible, particularly to new pathotypes of stripe rust, these have been principally RGT Cesario, RGT Accroc and Tabasco.
- A number of red wheat winter varieties have shown good disease resistance to **Septoria tritici blotch (STB)**, in particular Longford (AGF WH04818), AGTW0005 (to be commercial in 2025), Big Red, RGT Cesario, Anapurna, RGT Waugh (white winter feed), Tabasco and Reflection.
- The resistance to STB has slipped with RGT Accroc compared to its year of introduction in 2017. To a lesser extent this has also been the case with Anapurna.
- Of those varieties that still show reasonable genetic resistance to stripe rust, and have proven 12t/ha plus yield pedigree, **Big Red, Longford (AGFWH004818), AGTW0005 and RGT Waugh** (white wheat) have been the most consistent.
- With a full fungicide package RGT Cesario has been the highest yielding wheat (15.20t/ha) in the period from 2020 – 2022, **but it is very susceptible to stripe rust (and so are its volunteers giving rise to high regional stripe rust pressure via green bridge).**
- Of the white wheats Stockade and RGT Waugh have been the most consistent in HYC trials but with slightly less disease resistance and grain yield.

HYC Genetics Screening from Australia and overseas 2016 - 2022

One of the key objectives of the Hyper Yielding Cereal and Crops projects has been to identify new germplasm lines that are more productive in an irrigated Tasmanian environment, when crops are sown in April with best management practice. ***So what traits are needed in order to maximise productivity in this sowing window?***

In order to successfully achieve high yielding grain crops from April sowing, cultivars must have four key attributes.

i) Very high yield potential

New germplasm selected for increasing productivity had to be proven to be higher yielding than commercial cultivars grown in the state over the initial screening period.

ii) Excellent resistance to diseases prevalent in the region

Tasmania has the longest growing season in Australia with wheat crops frequently being in the paddock for 9-10 months. This longer season, combined with its naturally wetter climate makes disease resistance in germplasm more important than anywhere else in Australia, particularly against diseases such as scald, net blotch and Ramularia in barley, and stripe rust and Septoria tritici blotch in wheat.

iii) Good standing power to support 10t plus grain yields

On the mainland crops yielding 4-6t/ha may not expose weaknesses in standing power to the same degree as Tasmanian wheat crops yielding in excess of 10t/ha. Therefore, good standing power is essential to exploit the higher yield potential afforded by this long season irrigated environment. If all other traits suggest high yield potential, but standing power is inadequate, the correct canopy management approach (sowing date, plant population and nutrition) will be essential, along with plant growth regulation.

iv) Slower rate of development or phenology that better matches a longer growing season

Screening nurseries, with and without fungicide (HYC screening stage 1 & 2) conducted in the project identified winter wheat lines/cultivars sourced from all over the globe as having more yield potential than spring wheats when crops were sown in April, this was particularly the case if the grower wished to leave the crop un-grazed.

Historical stable highfliers in the Tasmanian environment

Historically the project identified a group of four winter wheats (RGT Relay, RGT Calabro, Anapurna and RGT Accroc) that looked to perform strongly over a number of seasons in comparison to the weaker strawed control variety Manning. Phenology differed amongst the four with Anapurna and RGT Accroc tending to flower earlier (30 Oct – 5 Nov) with flexibility that has seen them successfully adopted in HRZ regions on the mainland. None of these higher yielding cultivars screened in the 2016-2019 period were disease resistant enough to be grown without fungicide input. but overall the genetic resistance was sufficient to avoid large disease blowouts, with fungicide response running at a return of approximately $3-4 for every dollar spent (Figure 1). Unfortunately, as we are all aware, genetic disease resistance slips over time as varieties are more widely adopted and pathogen changes allow greater adaption to these successful varieties. This has been the case in Tasmania because of new exotic stripe rust pathotypes brought in from overseas, firstly with the 198 pathotype affecting Trojan and DS Bennett, and now the 239 pathotype affecting RGT Cesario and

RGT Accroc. Unfortunately, RGT Accroc no longer shows good resistance to STB, stripe and leaf rust both in Tasmania and on the mainland. Anapurna has shown more stable yields on the mainland over the last three years with 2022 disease pressure providing the stiffest test in recent years in terms of stable yields under high disease pressure (Figure 2).

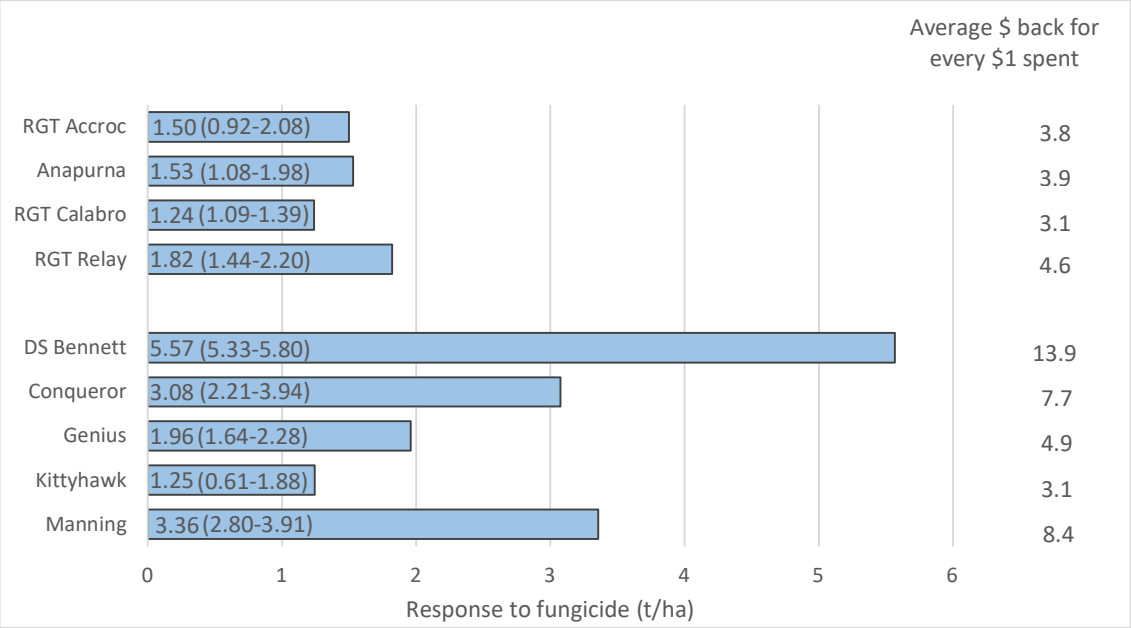
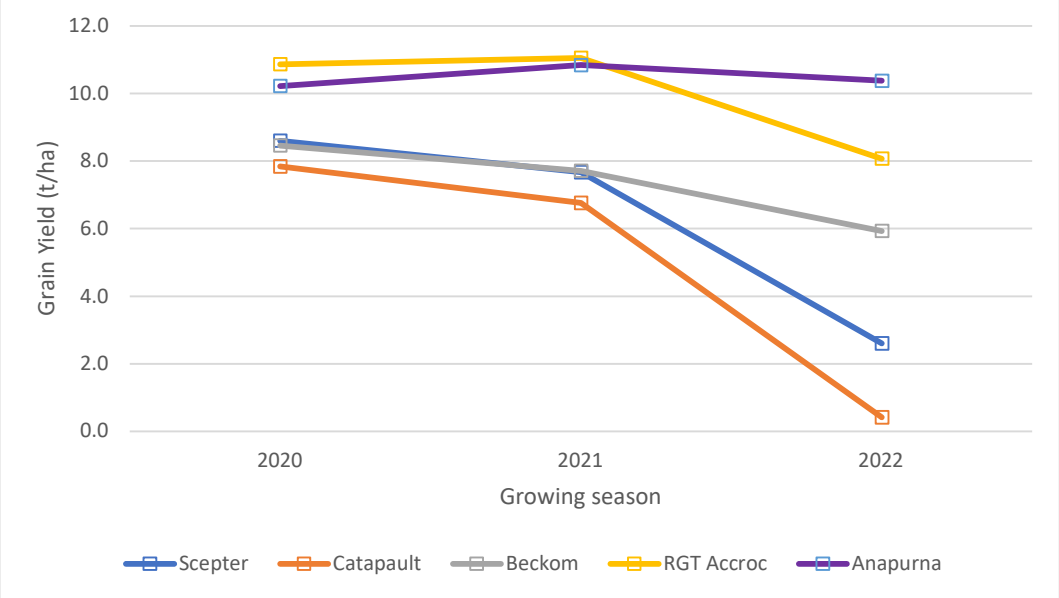


Figure 1. *2018 and 2019 average response to fungicide (t/ha), sown late April (25th -26th April). Economic return from fungicide (two-year average of dollar back for every dollar spent) calculated based on $350/t price for feed wheat and costs of fungicide at $95/ha and applications at $45/ha.*

Single fungicide at flag leaf (GS39).



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

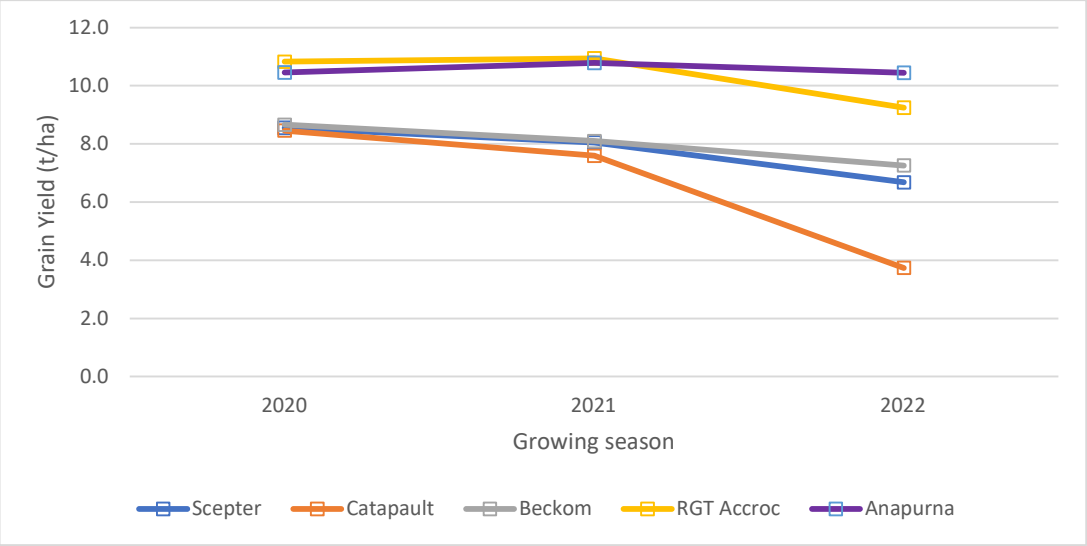


Figure 2. *HYC NSW – Wallendbeen (mainland)Yield stability under two levels of fungicide input.*

So what has given us stable yields since 2021 and is still showing good genetic resistance to disease in Tasmania?

Since 2021 when winter wheat screening in HYC re commenced in Tasmania, a number of varieties have illustrated excellent yield potential and good disease resistance to STB and stripe rust. In 2021 a raft of cultivars illustrated 14t/ha potential dependent on the level of fungicide input (Figure 3).

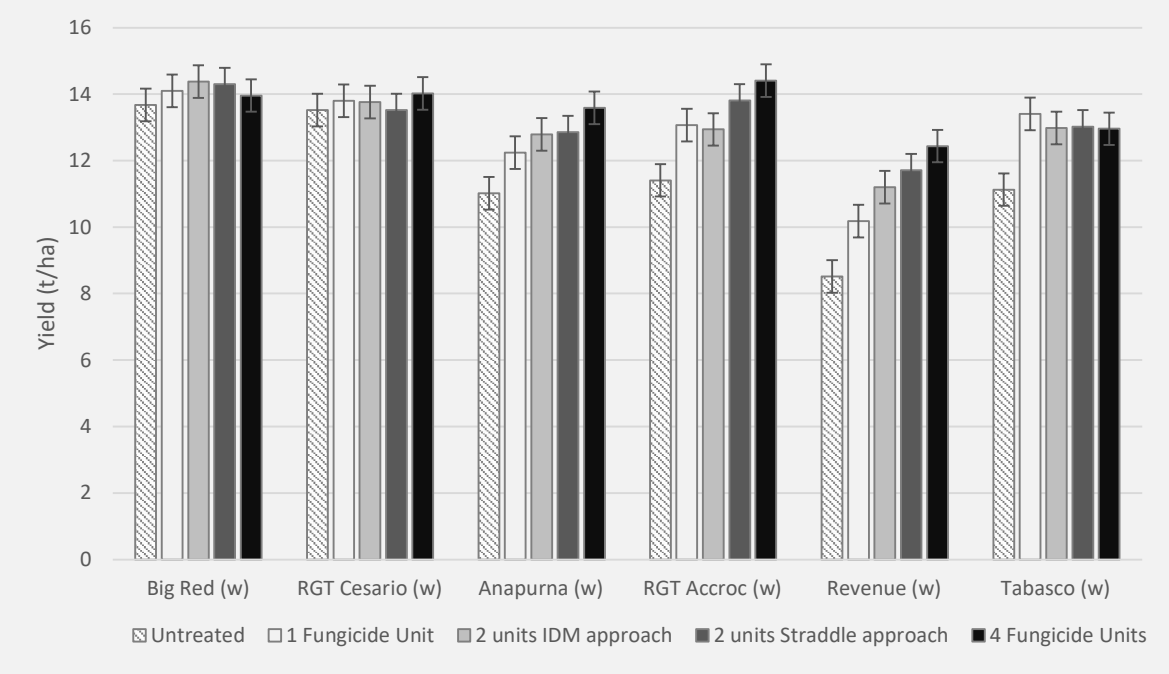


Figure 3. *Grain yield of winter wheats late April sown with different levels of fungicide input –* ***HYC Tasmania Protocol 4 2021****.*

Unfortunately, the susceptibility of some of the European feed winter wheats to the new pathotype of stripe rust is so great that yield stability can only be achieved with a full four-unit fungicide programme as a minimum. This pathotype has significantly affected genetic resistance available to growers in 2023/24 with RGT Cesario being is one of the worst affected varieties. However, the disease pressure, particularly early in the season (July) has been much greater in Tasmania than on the mainland, and other varieties have also been affected (Figure 4 & 5).

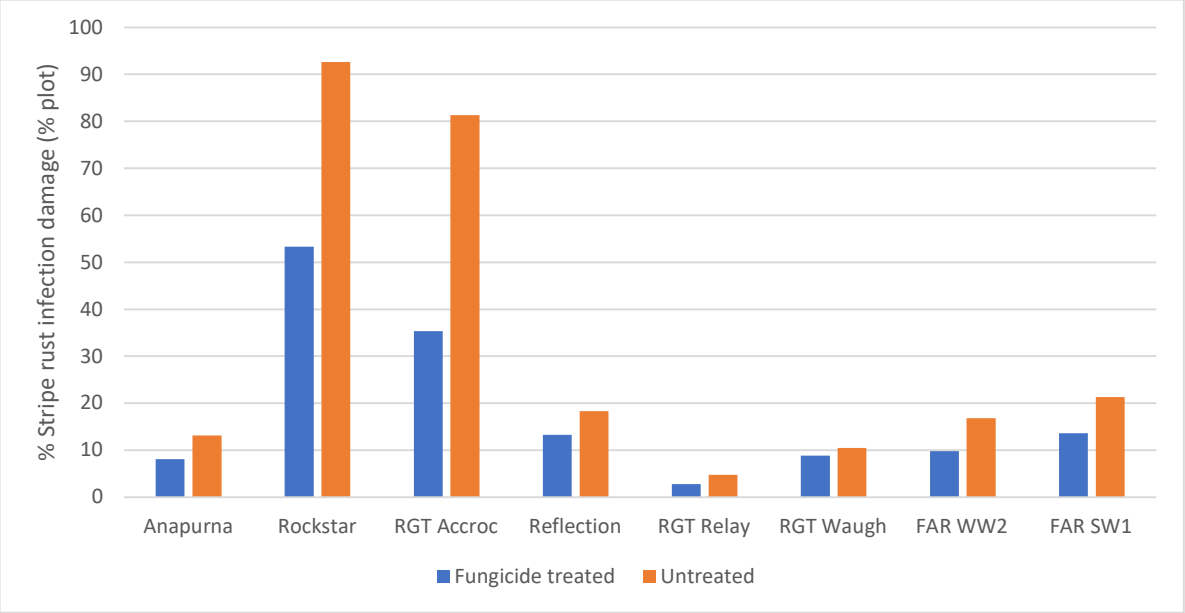


Figure 4. *FAR Australia Industry Innovations – Germplasm Evaluation network 2023 – wheat screening with and without fungicide and its effect on stripe rust damage (% plot infection damage combination of % active and inactive infection on all leaves).*

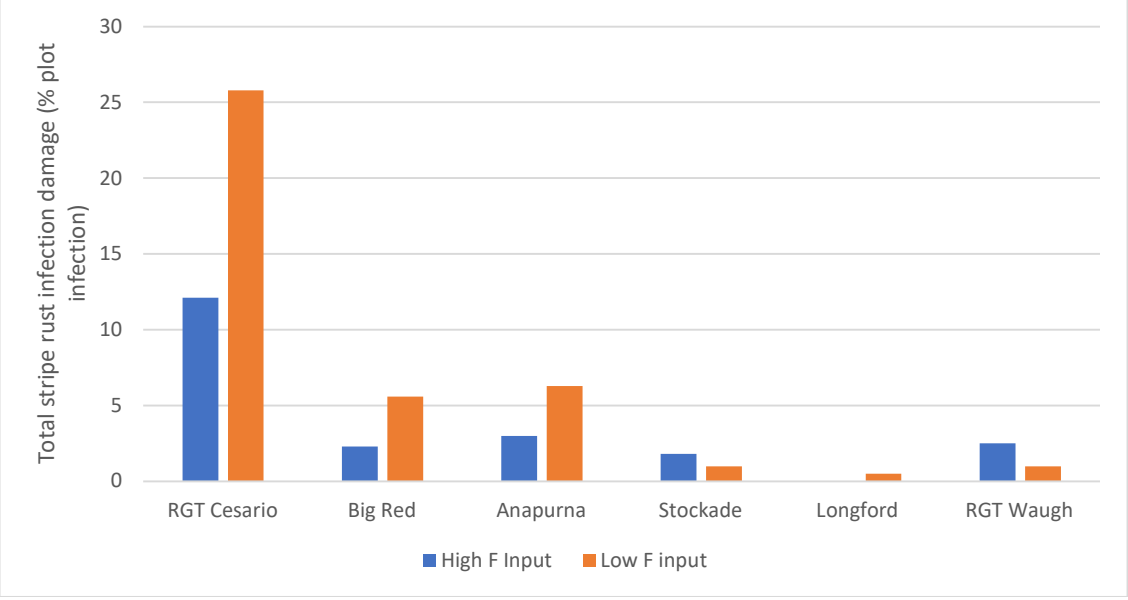


Figure 5. *HYC Tasmania Germplasm x Management x Environment trial 2023 – High fungicide input management versus low fungicide input management and its effect on % stripe rust damage (% plot infection damage).*

So of those varieties that still show reasonable genetic resistance to stripe rust and have proven 12t/ha plus yield, **Big Red, Longford (AGFWH004818), AGTW0005 and RGT Waugh** (white wheat) currently have the best pedigree for stable high yielding genetics in a Tasmanian environment (Tables 1 & 2)**. Anapurna** as shown on the mainland has maintained its high yields and still has some resistance to stripe rust although its resistance to STB has faded compared to its initial screening results in 2016 HYC trials. Stockade spring wheat which is classed as APW in some of the mainland regions has also been a consistent performer, but be aware its STB resistance is noticeably weaker under high pressure. In 2022 the standout variety for both genetic resistance and high yield was AGTW005 which is expected to be commercialised in 2025. This is a French red wheat with proven high yields on the mainland as well as Tasmania. It has a shorter season length than say Longford, which might give it more scope for use in dryland scenarios in Tasmania. Reflection is a UK variety that has not been possible to commercialise so far. It is generally too long a season variety for the mainland unless the spring conditions are very mild. Keep an eye on the progress of FAR WW2, another red feed wheat that has not previously been tested in Tasmania. In 2022 at the Victoria Crop Technology Centre, it was the highest yielding wheat on the research site, almost a full tonne higher yielding than other varieties.

Table 1. *Grain yields under standard management and irrigation – HYC Tasmania 2021 (Note this table is a selection from* ***2021*** *HYC Elite Screen and statistics apply to the larger original table).*

	Yield			Quality					
	Yield (t/ha)		% of Mean	Protein (%)		Test Weight (kg/hl)		Screenings (%)	
Scepter (spring)	6.87	g	59.1	14.9	a	79.7	bcd	0.6	de
Trojan (spring)	7.27	g	62.5	14.8	a	77.0	efg	0.6	cde
Anapurna (spring)	12.62	b-e	108.5	12.7	bc	80.1	abc	0.8	cde
RGT Accroc (winter)	13.40	a	115.2	11.3	ef	77.4	ef	0.5	e
Stockade (spring)	12.28	de	105.6	10.9	f	80.7	a	0.9	c
RGT Waugh (winter)	12.54	b-e	107.8	11.5	def	79.1	cd	0.8	cde
Big Red (winter)	13.20	ab	113.5	11.4	ef	79.6	bcd	0.7	cde
Longford (winter)	12.61	b-e	108.4	11.5	def	78.0	e	0.7	cde
Mean	11.63		100.0	12.2		78.1		0.9	
LSD 0.05	0.67		5.8	1.1		1.0		0.4	
P Val	<0.001		<0.001	<0.001		<0.001		<0.001	
CV	3.5								

Table 2. *Yield (t/ha) and grain quality assessment- protein (%), test weight (kg/hL) & screenings (%) Mean of treated and untreated – HYC Elite Screen Tasmania* ***2022****.*

		Yield		Grain quality assessments					
	Cultivar	**Yield (t/ha)**		**Protein (%)**		**Test Weight (kg/hL)**		**Screenings (%)**	
	Full Fungicide Program								
1.	RGT Accroc	9.85	d	10.0	g	75.2	ghi	1.0	gh
2.	Reflection	12.37	a	8.7	j	76.5	efg	3.1	b
3.	Beaufort	8.22	e	11.1	bcd	73.7	hi	2.6	c
4.	**SFR86-085 (RGT Waugh)**	11.99	ab	11.0	b-e	78.4	cde	0.9	gh
5.	GS-18-105-W	10.19	cd	10.6	ef	80.1	a-d	1.3	fgh
6.	**AGTW0005**	11.59	ab	10.8	de	79.2	b-e	0.8	h
7.	**Big Red**	11.66	ab	9.5	hi	81.1	ab	1.2	fgh
8.	**AGFWH004818**	11.61	ab	9.9	gh	78.6	b-e	1.2	fgh
9.	**LRPB16-0598 (Stockade)**	11.39	ab	10.6	def	82.0	a	1.7	def
	No Fungicide								
1.	RGT Accroc	7.44	e	10.8	de	72.6	i	1.4	efg
2.	Reflection	11.16	bc	9.1	ij	75.0	ghi	3.6	b
3.	Beaufort	4.70	f	12.9	a	64.8	j	4.7	a
4.	**SFR86-085 (RGT Waugh)**	9.46	d	11.4	bc	75.6	fgh	1.4	fgh
5.	GS-18-105-W	7.66	e	11.5	b	78.5	b-e	1.9	de
6.	**AGTW0005**	11.45	ab	10.9	cde	78.0	def	0.9	gh
7.	**Big Red**	10.00	d	10.2	fg	80.1	a-d	1.3	fgh
8.	**AGFWH004818**	11.51	ab	10.0	g	78.7	b-e	1.4	efg
9.	**LRPB16-0598 (Stockade)**	9.75	d	10.8	de	80.8	abc	2.1	cd
	LSD 0.05	1.11		0.52		2.76		0.56	
	p-Value	<0.001		0.001		0.002		<0.001	

References

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

Acknowledgements

The research undertaken as part of these projects is made possible by the significant contributions of growers through both trial cooperation and the levy support of the GRDC, the authors would like to thank them for their continued support. FAR Australia gratefully acknowledges the support of all of its research and extension partners in the Hyper Yielding Crops project. These are CSIRO, the Department of Primary Industries and Regional Development (DPIRD) in WA, Brill Ag, Southern Farming Systems (SFS), Techcrop, the Centre for eResearch and Digital Innovation (CeRDI) at Federation University Australia, MacKillop Farm Management Group (MFMG), Riverine Plains Inc and Stirlings to Coast Farmers.

Spring sun and heat as limits to high wheat yields in northern Tasmania

Dr Ben Jones, Field Applied Research (FAR) Australia

Key points

- Light and heat set potential grain number (and hence yield) for a particular flowering date.
- Weather data is limited, but potential yield calculated from it should be conservative in northern Tasmania.
- Optimum flowering date range is quite broad, particularly at cooler locations.
- There is only a small risk of heat stress for December flowering in warmer locations.
- Potential yields may be above 15t/ha in 50% of years at cooler locations.

The choices that will determine crop flowering time are all made before sowing: which variety, which paddock, when you start, the order you sow in, how hard you go. Traditionally in dryland Australia the choice is a balance between the risk of frost (too early), and terminal drought (too late).

In better seasons in medium and high rainfall zones, or with irrigation, sunlight and temperatures through the critical grain set period (about 30 days before flowering) set an upper limit on grain number, and hence potential yield. Understanding how these limits work together with rainfall in particular locations, helps guide what needs to be done to capture the upsides of wetter seasons and/or irrigation, without creating more risk if they turn out dry.

In this paper 'wet' seasons are those where July-September rainfall is higher than the 2010-2022 average.

PTQ: high light and low temperature = more grains, more yield

The Photo Thermal Quotient (PTQ) is light received per day, divided by average temperature, during the period grains are being set (about 30 days before flowering). Higher PTQ is given by more light, and/or less temperature (above freezing). More grains are set if the crop grows more during this period. Assuming the crop has enough nutrition and water, growth is determined by whether the leaves intercept all the light, and how much light there is. In cool conditions this period takes longer, and so the crop has longer to photosynthesise and grow.

The PTQ can be directly converted into a PTQ-limited yield potential, which is how it has been presented here.

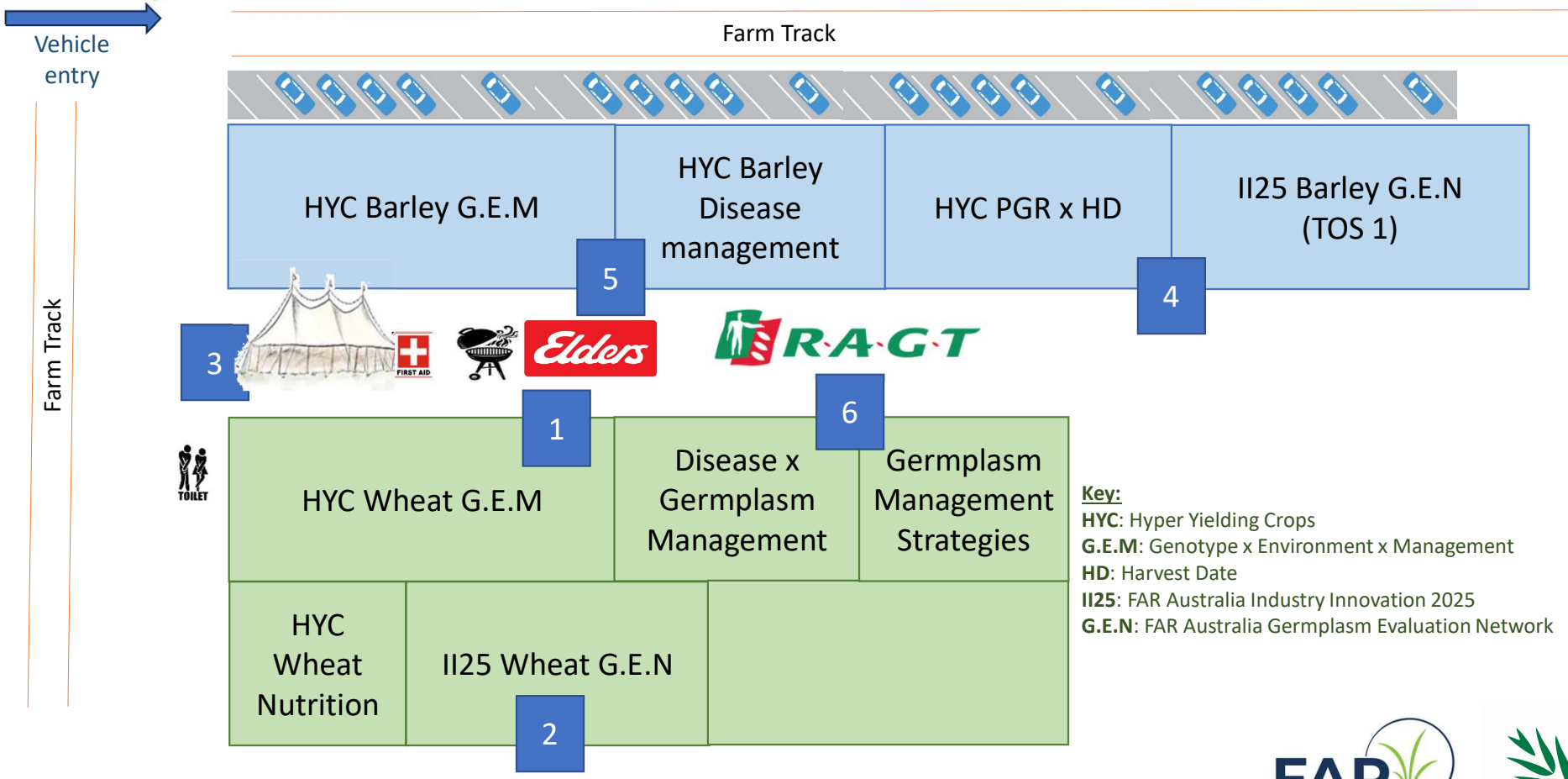
Radiation and temperature – Tasmanian data challenges

Ideally field weather station data would be used for these analyses. It's difficult to obtain over long periods, so we tend to use SILO interpolated weather data. It is based

TASMANIA HYC RESEARCH CENTRE

2023 SITE MAP: TASMANIAN CROP TECHNOLOGY CENTRE (Hagley)

Featuring the GRDC's Hyper Yielding Crops



Key:

HYC: Hyper Yielding Crops
G.E.M: Genotype x Environment x Management
HD: Harvest Date
II25: FAR Australia Industry Innovation 2025
G.E.N: FAR Australia Germplasm Evaluation Network

FAR AUSTRALIA

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

TASMANIA HYC RESEARCH CENTRE

FAR AUSTRALIA

TIMETABLE

TASMANIA CROP TECHNOLOGY CENTRE FIELD DAY:

THURSDAY 23 NOVEMBER 2023

Featuring the GRDC's Hyper Yielding Crops

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

In-field presentations	Station No	10:30	11:00	11:30	12:00	12:30	1:30	2:00	2:30	3:00
Prof. Victor Sadras (SARDI) *The physiology of wheat yield and its consequences for management*	1	Coffee followed by opening address by Fiona Chilvers, Grower; Craig Baillie, GRDC General Manager Applied Research, Development & Extension and Nick Poole, FAR Australia's Managing Director and HYC Project Lead for an introduction to the HYC research programme	1			Lunch at the marquee kindly sponsored by: Elders				Informal tour of plots and closing refreshments kindly sponsored by: Elders
Nick Poole (FAR Australia) *Genetics for stable high yields in Tasmania*	2			1						
Dr Ben Jones (FAR Australia) *Spring sun and heat as limits to high wheat yields in Tasmania*	3				1					
Darcy Warren (FAR Australia) *Maximising spring sown barley yields in Tasmania*	4						1			
Jon Midwood (TechCrop) *Agronomic benchmarking for the HYC awards programme*	5							1		
Brett Davey (Southern Farming Systems) & Darcy Warren (FAR Australia) *Combatting stripe rust: insights from wheat disease management trials*	6								1	
In-field presentations	**Station No.**	**10:30**	**11:00**	**11:30**	**12:00**	**12:30**	**1:30**	**2:00**	**2:30**	**3:00**

Thanks to our principal event sponsor: RAGT

on temperature measured at Bureau of Meteorology Automatic Weather Stations, of which there are few in Tasmania. Where we have field weather station data to compare it to (Hagley in 2019, 2020 and 2022) it is quite good until later in spring, when the SILO data under-estimates radiation and over-estimates temperature, leading to lower PTQ-limited yield estimates (Figure 1). PTQ-limited yield calculated from SILO data is sometimes lower than actual yield of crops estimated to have flowered at the same time. When PTQ-limited yield is calculated from the weather station data, few of the actual yields exceed the range of the PTQ-limited yields.

Of the other locations chosen for this analysis, Relbia (near Launceston Airport) data should be quite good. Both it and Meander have the potential to be checked against the recently installed AgLogic weather station data.

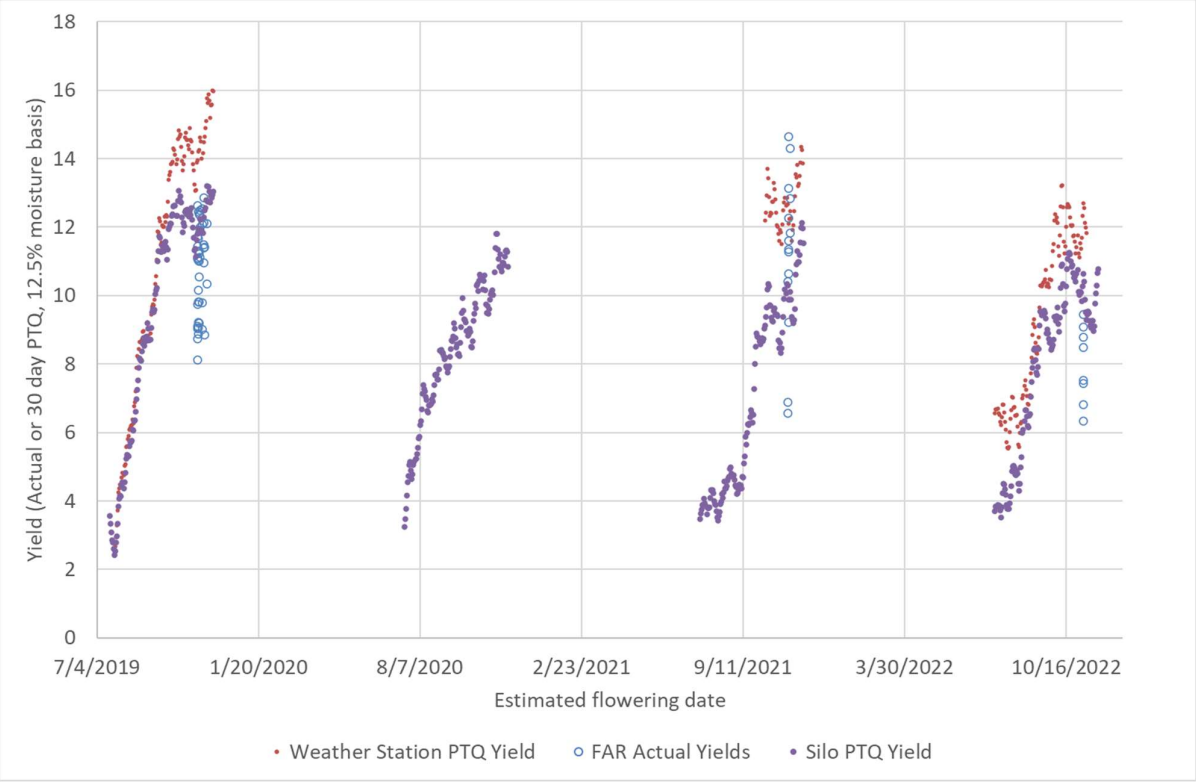


Figure 1. *Actual wheat yields from FAR experiments compared to PTQ-limited potential yield estimated using average Photo Thermal Quotient for the 30 days before flowering, either from the on-site weather station (2019, 2020 and 2022) or "Silo" interpolated weather data. Flowering dates have been estimated from prior observations on the same varieties sown at Hagley at similar dates. No wheat crops were sown in 2020.*

In northern Tasmania the main trend influencing PTQ is for areas to the west and south to be cooler, particularly in spring. There is also considerable variation in radiation from year to year, a consequence of cloud patterns (which appear to be quite spatially variable). The effect of the cool temperatures can outweigh reduced light from cloud and leads to higher PTQ-limited yields.

Optimum flowering

When potential (PTQ-limited) yields are calculated for different flowering dates for the years since 2010, there are some clear differences between the locations chosen

(Figure 2). About 2/3rds of years at Hagley are drier than average, whereas at Relbia and Meander it's more even. PTQ-limited potential yields are higher at Meander, with up to half of years having >15t/ha yield potential for flowering dates in November and even December. Low PTQ-limited potential yield is more likely at Relbia with early flowering dates; this relates to the higher temperatures. PTQ-limited potential yields are likely under-estimated using SILO data at Hagley (see Figure 1) and potentially Meander.

Optimum flowering periods are generally later with wet springs. The optimum flowering period (from a PTQ-limited yield point of view) is late October through late November at Hagley; at Relbia, all of November, although December flowering is equally good in seasons with drier springs. At Meander there is a broad optimum from late October on. December flowering has more frequent (and higher) upside yield potential, but also some risk of low PTQ limited yield potential (compared to November flowering).

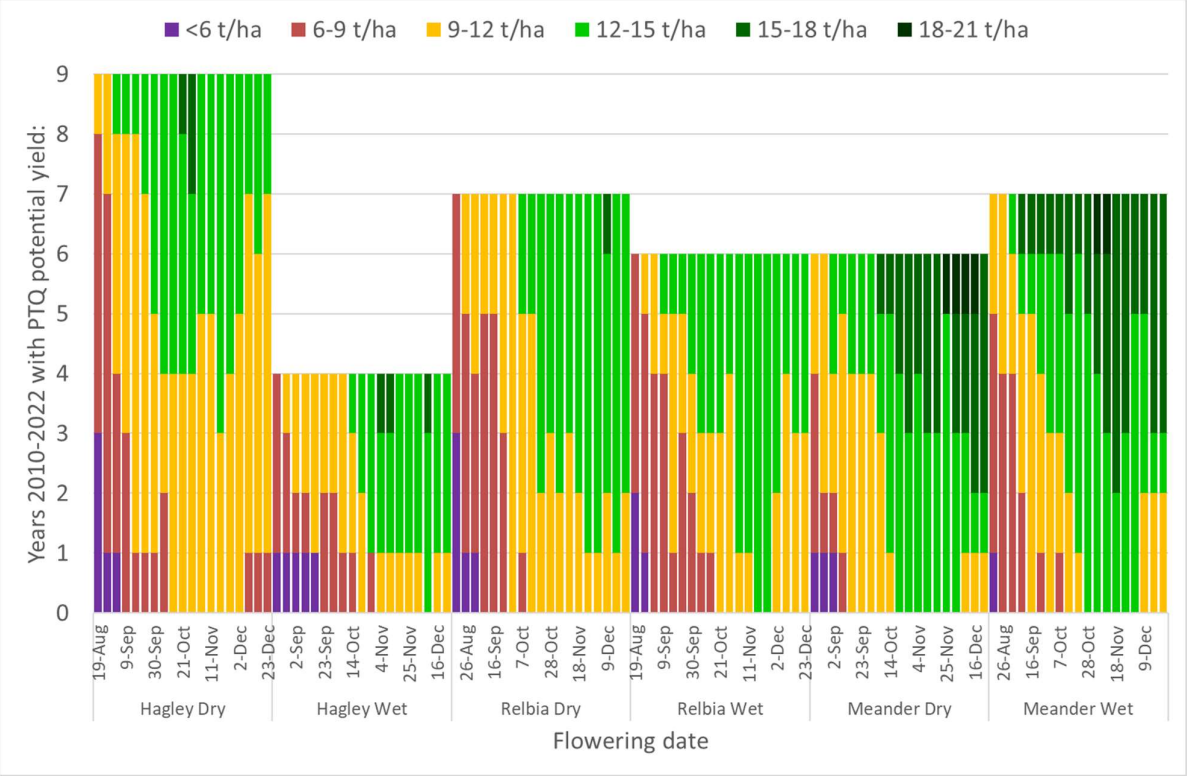


Figure 2. *Frequency of PTQ-limited potential yield for different flowering dates in years with drier or wetter-than average July-September, at Hagley, Relbia and Meander sites. Colours show the PTQ-limited potential yield range (legend at top). Average July-September rain is 191 mm at Relbia, 221 mm at Hagley, and 341 mm at Meander.*

Heat stress

Higher (>30 C) temperatures during grain-filling are less of a risk compared to mainland high rainfall zone sites. Relbia is the only site with any risk of more than one day with a maximum greater than 30˚C in the 30 days after flowering: 1 year in 7 for December flowering dates (data not shown).

Managing for high yield opportunities

Given the uncertainty in the temperature data, local experience with frost should be given priority when considering optimum flowering periods. Apart from frost, there is a relatively broad optimum flowering period which growers can exploit with a broader range of sowing date or variety choice to reduce risk. In cooler locations (such as Meander), potential yields are quite high in many years. Growers should consider managing for these opportunities on paddocks where irrigation is available and a high yielding cereal would make sense in the rotation. High yields would also be a possibility with wetter springs on dryland paddocks with appropriate soils.

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

Maximising spring sown barley yields in Tasmania – Hagley, Tas

Darcy Warren[1], Nick Poole[1], Daniel Bosveld[1], Brett Davey[2] & Dr Kenton Porker[3]
[1] Field Applied Research (FAR) Australia, [2]Southern Farming Systems (SFS) & [3]CSIRO

Key point summary

- Newer barley germplasm has contributed to increased yields over control varieties (RGT Planet and Rosalind) in 2022.
- Although slightly lower yielding than the best preforming variety Neo, cultivars/ lines such as AGTB0244 and RGT Planet have performed strongly over the course of the project and show very favourable 3-year yield averages.
- Spring sown barley has again shown to be a very low input crop with no significant yield increase with fungicides (Table 1) and variable results around canopy management and PGR use (data not shown).
- Sowing RGT Planet (SVS to NFNB) in spring demonstrates a stark contrast to disease management for an Autumn sown scenario where mainland sites or Tasmanian data from the original HYC project (Hyper Yielding Cereals, 2016-2019) show a very robust fungicide package is needed.

New genetics key to increasing yields

2022 saw another record-breaking year in Tasmania with the highest barley yield in the Hyper Yielding Crops (HYC) project being achieved at the Hagley site. The variety IGB22102T, now known as Neo, yielded 12.35t/ha in the Elite Screening trial and was significantly higher yielding than the control varieties, RGT Planet (11.57t/ha) and Rosalind (10.46t/ha) (Figure 1). As well as being the highest yielding on the Tasmania site, Neo also was the best performer in the Victoria and South Australia Germplasm Evaluation Network trials (as part of FAR Australia's Industry Innovation 2025 initiative). New germplasm sourced from Europe also performed well with the varieties coded as FAR SB5 and FAR SB4 yielding 11.81t/ha and 11.70t/ha respectively (Figure 1). These varieties again support the findings that European germplasm with less sensitivity to photoperiod are better suited to the spring sown system in Tasmania compared to the quicker Australian developed cultivars.

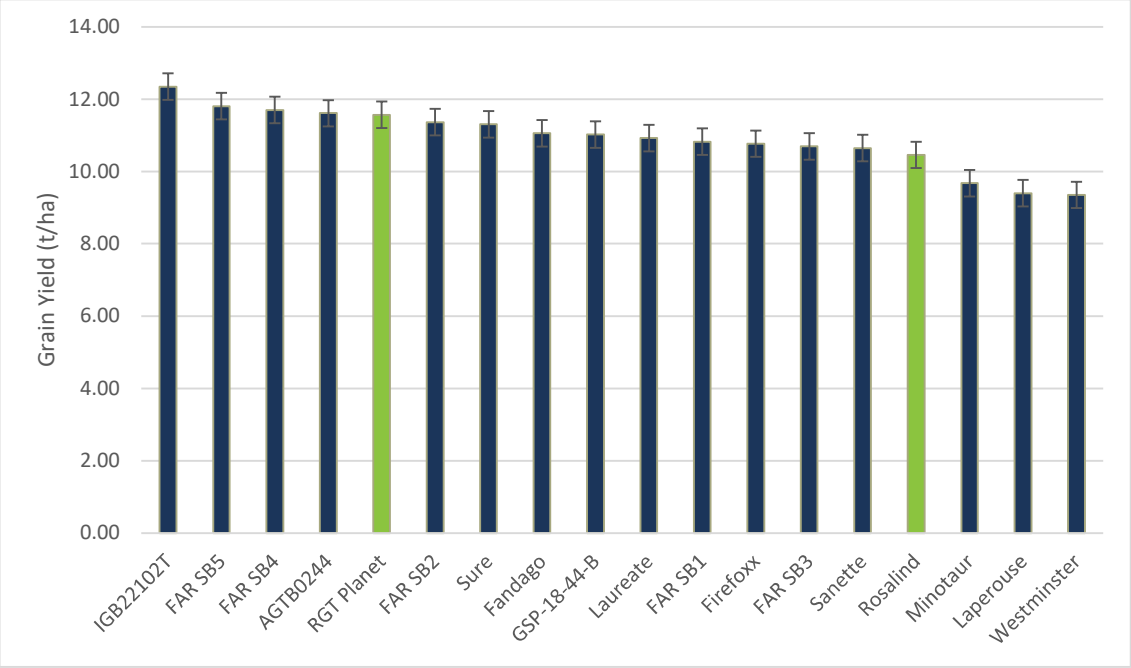


Figure 1. *2022 Elite Screening trial grain yield (t/ha). Control varieties in green.*

The AGTB0244 line again yielded well in 2022 and has averaged 11.04t/ha over the last 3 years of spring sown barley trials in Tasmania (Figure 2). Exciting as it is to see newer varieties yield over 12t/ha, we are limited in the amount of data produced by these in HYC research. It has perhaps been just as encouraging that varieties such as AGTB0244, RGT Planet and Laureate have been strong yielders since 2020 and can be grown with more confidence.

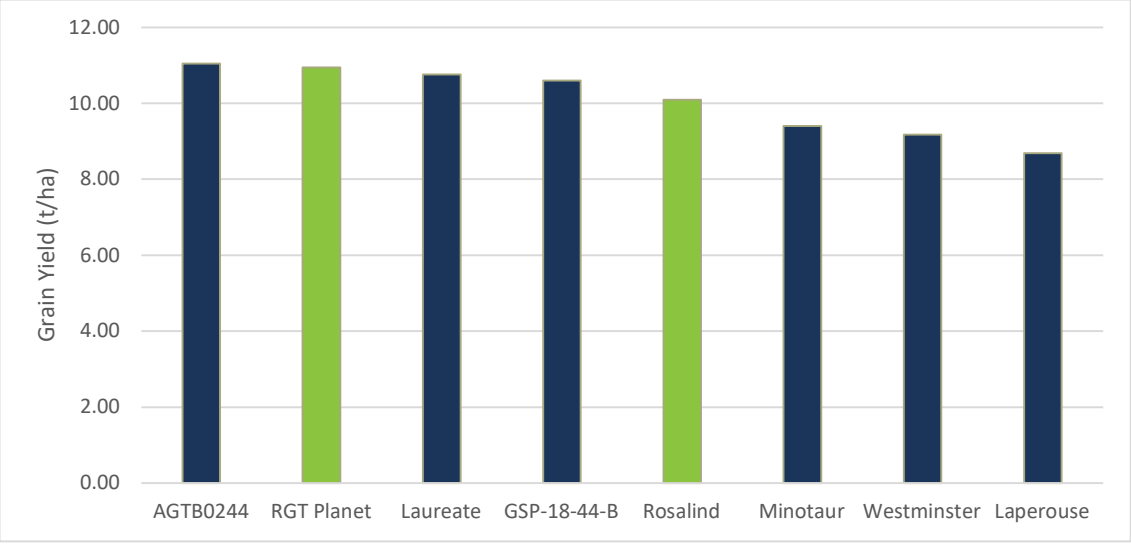


Figure 2. *3-year (2020-2022) grain yield average (t/ha) for germplasm tested in the Elite Screen trials.*

Disease management a major driver in barley yields

A quick look at results in HYC from around the country across the previous three seasons show that disease management is a major lever to pull to increase barley yields. With warm and wet conditions experienced in 2020, 2021 and 2022, most of the HYC sites had high yield potential, but also very high disease pressure. These climatic conditions coupled with the most dominant barley variety in the HRZ of Australia being SVS to Net Form of Net Blotch (NFNB) in RGT Planet, has meant disease management has been at the forefront of HYC barley research. Even in 2023, where a much drier than average season is being felt in the HRZ, a robust four-unit fungicide program at the Autumn sown Victoria site has done very little to protect RGT Planet from the high NFNB pressure.

Then consider Tasmania results, with the backdrop of susceptible varieties, high disease pressure and difficult fungicide management, a spring sown barley system is providing a solution for these issues. There is a clear contrast between the Autumn sown sites on the mainland, where some plots have no green leaf area left due to disease, compared to Tasmania results that show no significant difference between fully treated and untreated fungicide plots. In 2022, untreated RGT Planet yielded 11.90t/ha which statistically was no lower (or higher) than managements that used combinations of DMI, strobilurin and SDHI chemistry (Table 1). Although NFNB and scald were still recorded in assessments during the 2022 season, these were at low enough levels to not influence yield. The results from the previous three years suggest that at the very least, single applications of fungicides, lower rates of chemistry or inexpensive products can be successfully used to control disease in spring sown barley.

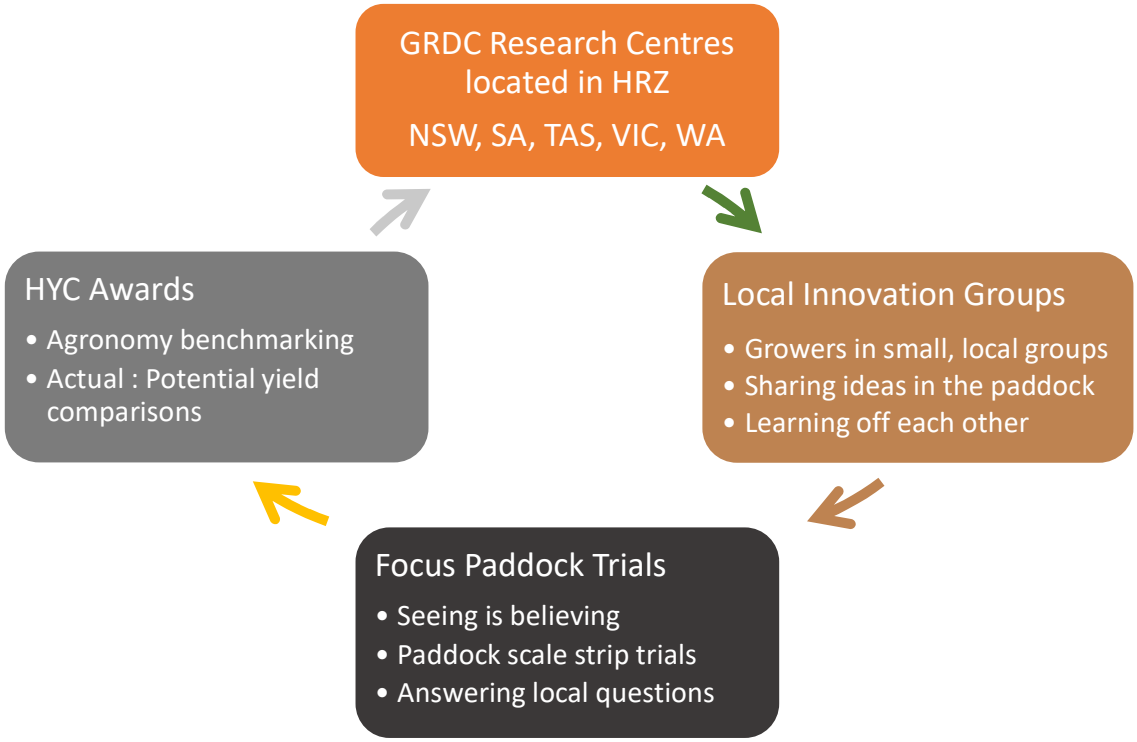
Table 1. Influence of fungicide management on grain yield (t/ha), cv RGT Planet.

	Treatment				Yield		% of mean
	GS00	**GS30**	**GS39-49**	**GS59**	t/ha		%
1	---	---	---	---	11.98	-	100.2
2	Systiva	Prosaro 300 mL/ha	Radial 840 mL/ha		12.02	-	100.5
3	Systiva	Prosaro 300 mL/ha	Radial 840 mL/ha	Opus 500 mL/ha	12.01	-	100.4
4	---	Prosaro 300 mL/ha	Aviator Xpro 420 mL/ha		11.78	-	98.5
5	---	---	Aviator Xpro 420 mL/ha		11.77	-	98.5
6	---	Prosaro 300 mL/ha	FAR F1-19 750 mL/ha		11.83	-	99.0
7	---	FAR F1-19 750 mL/ha	Radial 840 mL/ha		12.05	-	100.8
8	---	Prosaro 300 mL/ha	----		11.77	-	98.4
9	--	Tilt 500 250 mL/ha	----		11.96	-	100.0
10	Systiva	---	Radial 840 mL/ha	---	11.94	-	99.9
11	---	Prosaro 300 mL/ha	Radial 840 mL/ha	---	12.12	-	101.4
12	---	Prosaro 300 mL/ha	Aviator Xpro 420 mL/ha	Opus 500 mL/ha	12.07	-	100.9
13	---	Aviator Xpro 420 mL/ha	Radial 840 mL/ha		11.87	-	99.3
14	---	Prosaro 150 mL/ha	Radial 420 mL/ha		12.11	-	101.2
15	Systiva	Prosaro 300 mL/ha	Aviator Xpro 420 mL/ha	Opus 500 mL/ha	12.09	-	101.1
				Mean	11.96		100.0
				LSD (P=0.05)	ns		ns
				P-Value	0.329		0.332

GRDC Hyper Yielding Crops TAS

Jon Midwood, TechCrop

In 2020 the GRDC Hyper Yielding Crops project started. The project is being conducted in Victoria, Tasmania, South Australia, New South Wales and Western Australia, with each state hosting a GRDC Centre of Excellence. These sites have been selected to run research trials to help determine some of the major factors growers and advisors can use, in their specific environment, to achieve optimum yields through variety and agronomic management of wheat, barley and canola. The following graphic shows the various outputs from the project and how they are inter-related with each other:



In combination with the research centres there is a large emphasis on local grower involvement in the project and so in the TAS, Southern Farming Systems (SFS) have been contracted to run this part of the project. As the graphic above shows, this involves the setting up of local grower led innovation groups, facilitating and setting up Focus paddock scale trials and gathering information and measurements for the local HYC Award paddocks. Jon Midwood (TechCrop) oversees this part of the project, in a national role, alongside Nick Poole as project leader.

HYC Awards

Award paddocks were nominated from the Innovation groups initially, with the aim being to collect and record specific wheat paddock information and to provide an agronomic benchmarking report which compares that paddock to all the others entered, both regionally and nationally. Nominated paddocks have their validated yields compared to a biophysical 'potential yield' for that paddock, which allows for the

variability of soil types, rainfall, temperature and radiation across all regions. All agronomic information such as sowing dates, variety, crop development timings, soil data – pH, soil organic carbon, N, P, K etc., and in-season applications are collected by the project officer from SFS. Paddock yields, harvest maturity samples, harvest index calculations and grain samples are also collected for analysis. Reports were sent out to all participating growers allowing them to benchmark their agronomy from over 50 factors and compare it to other growers in their region, whilst maintaining total confidentiality of their specific input information.

The winner for the highest yield in TAS in 2022 was Hamish Yaxley with a 12.8t/ha crop of Cesario wheat sown on 4 May, following processing peas in 2021.

The winner for the highest yield as a percentage of the potential yield in TAS was John Heard. His 12.04t/ha crop of Accroc wheat was 111% of the 10.9 t/ha calculated potential for his paddock.

The following are an example of some of the agronomic benchmarks produced in the HYC Awards report for TAS in 2022:

Agronomic Factor	**Top 25% Award paddocks**	**Remaining 75%**
Yield (t/ha)	12.4	10.0
N applied (kg N/ha)	112	148
N applied per tonne yield (kg N/t)	9	15
Fungicides ($/ha)	87	54
Fungicides ($/t)	7.0	5.5
Crop biomass (t/ha)	26	27
Harvest index	48%	46%
Head count (m2)	722	651
Grains per head	33	37
1000 grain weight	49	47

2023 HYC Wheat Disease Trial Update – Hagley, Tas

Darcy Warren[1], Brett Davey[2] & Nick Poole[1]
[1] Field Applied Research (FAR) Australia & [2]Southern Farming Systems (SFS)

Key Points

- The dominant wheat disease on site in 2023 is stripe rust, caused by the pathogen Puccinia striiformis f. sp. Tritici, with Septoria tritici blotch (STB) and powdery mildew (PM) also present in select varieties.
- Early stripe rust infections have shown the value of well-timed fungicide applications in more susceptible varieties.
- Varieties such as AGTW0005 and Longford (AGFWH004818) have again showed elite disease resistance early this season, as was seen in 2022 both in Tasmania and several mainland Hyper Yielding Crops (HYC) sites.
- Stockade has shown very good resistance to stripe rust, however, is still showing signs of STB (Table 2) and PM (data not shown) infection in a year that's not favourable to wet weather diseases.

Trial 4. HYC Disease Management strategies (FAR TAS W23-04)

The dominant disease in this trial, conducted in BigRed, was found to be Stripe Rust (Puccinia striiformis f. sp. Tritici), and was found on all assessed leaf layers in untreated plots at GS 39 (flag leaf emergence). Although historically BigRed has shown good natural resistance to stripe rust and is listed as 'resistant' (provisional rating) in the 2023 crop sowing guide, new exotic strains of the disease are likely contributing to higher infection rates (pathotype '239 E237 A- 17+ 33+'). Although Septoria tritici blotch (STB) is often problematic on the HYC Tasmania site, no incidence was recorded in this assessment. Big Red, rated MRMS to STB, is likely demonstrating its genetic resistances to the disease while being aided by a drier than average season, with only the more susceptible varieties on site showing higher severity of STB in 2023.

The assessment completed at flag leaf emergence shows the relative effectiveness of fungicides and their placement in the crop canopy (Figure 1). As the flag leaf application had only just been applied days before the assessment, the effect of this spray is unlikely to have been seen in this assessment and therefore is not represented by green arrows in Figure 1. Similarly, the single fungicide at GS39 treatment is not represented in the graph for the same reason.

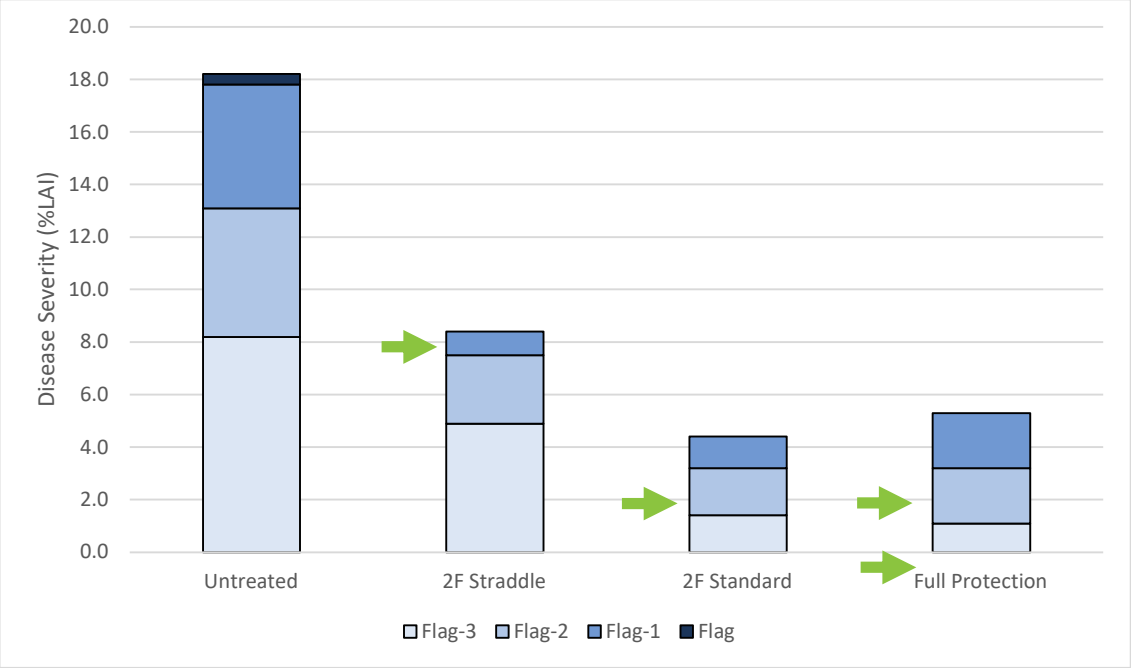


Figure 1. *Stripe Rust severity (%LAI) of fungicide managements when assessed at GS39 (flag leaf emergence) 10 October 2023, cv Big Red. Green arrows denote fungicide timings relative to leaf layer.*

With flutriafol treated MAP applied to 'Full Protection' plots, this treatment showed the least amount of stripe rust on the lowest leaf layer assessed, flag-3 (Figure 1). The first foliar fungicide application was an early stem elongation (GS31) application of Prosaro 300mL/ha and targeted the emergence of the first 'money leaves' (the leaves that contribute the most to grain yield), flag-3 and flag-2. This was applied to both the full protection and '2 fungicide standard' treatments, which showed no statistical difference in stripe rust severity. Not surprisingly, the 2 spray 'straddle' approach, which looks to delay the first fungicide application until later stem elongation (GS33) and targets the Flag-1 and Flag-2 leaf layers, showed no statistical difference in severity to untreated on the Flag-3 leaf layer. However, once applied, this application which consisted of a DMI and SDHI chemistry mixture, showed much better disease control on the flag-1 leaf layer compared to the untreated.

Trial 4a. HYC Disease Management germplasm interaction (FAR TAS W23-04a)

The other dedicated wheat disease trial on site looks to assess a small range of cultivars under three of the managements seen in the 'HYC Disease Management strategies' trial above. They include untreated, a single flag leaf spray and full protection treatments. The assessments outlined in Table 1 and Table 2 were again conducted at flag leaf emergence (GS39) and therefore the single fungicide management treatment has been omitted for the same reasons given above.

This trial demonstrates differences in cultivar's response to different diseases. Like BigRed, RGT Cesario is listed as having good resistance to Stripe Rust in the 2023 Crop Sowing Guide (rated RMR), however the effect of the newly introduced strip rust strains has had a much more dramatic influence on severity. For this variety, there was an average of 57.0% leaf area infected (LAI) on the flag-3. Fungicide management, which at this stage of the season included flutriafol treated MAP at sowing and a Prosaro 300 mL/ha spray at early stem elongation (GS31), was able to reduce severity from 66.0% LAI to 48.0% LAI, albeit still a high severity for fungicide treated plots. This is in stark contrast to AGTW0005 and the newly named Longford (tested under AGFWH004818) which show excellent resistance to both stripe rust (Table 1) and STB (Table 2). In 2022, when grown in the 'Elite Screen' trial in Hagley, AGTW0005 and Longford were the only two varieties to show no yield response to fungicide when grown with either a four-unit fungicide program or untreated with fungicide, yielding an average of 11.52 t/ha and 11.56 t/ha respectively. Both these varieties give the opportunity to show flexibility with disease management where the use of fungicides could be delayed and/or number of applications reduced.

Table 1. *Influence of cultivar and management on Stripe Rust severity (%LAI) on Flag-1, assessed GS39 – 10 October 2023.*

	Stockade		**RGT Cesario**		**AGTW0005**		**Longford**		***Mean***	
Cultivar	0.0	b	57.0	a	1.3	b	0.0	b	**14.6**	
			LSD		3.9		***p-Value***		**<0.001**	
Fungicide Management Regime										
Untreated	0.0	c	66.0	a	1.5	c	0.0	c	**16.9**	**a**
Full Protection	0.0	c	48.0	b	1.2	c	0.1	c	**12.3**	**b**
Fungicide Management Regime			***LSD***		4.5		***p-Value***		0.048	
Cultivar x Fung Mgmt Regime			***LSD***		6.7		***p-Value***		0.002	

Although showing good resistance to stripe rust, Stockade is one of the only varieties on site showing STB infection. Although levels of STB are low for Stockade on flag-4 in Table 2, levels are statistically higher than all other varieties. While the lower-than-average rainfall helped prevent STB moving up the canopy (as Septoria asexual spores are released from pycnidia when leaf is wet and spread by being splashed onto other leaves), this disease will need to be monitored closely in Stockade in a more disease favourable year.

Table 2. *Influence of cultivar and management on Septoria tritici blotch (STB) severity (%LAI) on Flag-2, assessed GS39 – 10 October 2023.*

	Stockade		**RGT Cesario**		**AGTW0005**		**Longford**		***Mean***	
Cultivar	2.5	a	0.0	b	0.8	b	0.1	b	**0.9**	
			LSD		1.1		***p-Value***		**0.002**	
Fungicide Management Regime										
Untreated	2.5	-	0.0	-	0.7	-	0.1	-	**0.8**	-
Full Protection	2.6	-	0.0	-	0.9	-	0.1	-	**0.9**	-
Fungicide Management Regime			***LSD***		0.8		***p-Value***		0.828	
Cultivar x Fung Mgmt Regime			***LSD***		ns		***p-Value***		0.998	

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.

Scan the QR codes on the next page to download our latest eProducts

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