Welcome to the GRDC's

HYPER YIELDING CROPS: RESULTS AND AWARDS (SA)

What did we learn in year one?
Which award paddocks came out on top and why?

Regional Project Partner:

MFMG
www.mackillopgroup.com.au

HYPER YIELDING CROPS (FAR2004-0025AX)

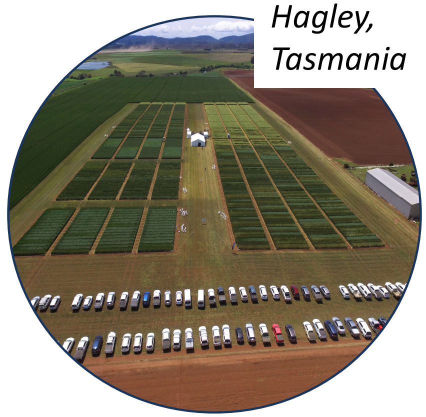
A national initiative striving to push crop yield boundaries in high yield potential grain growing environments.

- A GRDC Investment (over 4 years) – 2020 to 2024
- Applied research, development and extension project co-ordinated and led by Field Applied Research (FAR) Australia.
- Collaborating with the following project partners:

SOWING THE SEED FOR A BRIGHTER FUTURE

HYPER YIELDING CROPS

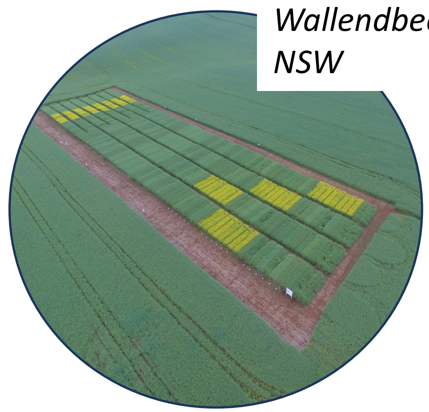
5 HYC Research Centres



Hagley, Tasmania

Millicent, South Australia

Green Range, WA (2020) & Frankland 2021



Wallendbeen, NSW

Gnarwarre, Victoria

SOWING THE SEED FOR A BRIGHTER FUTURE

Project investment

- To screen for high yield potential cultivars suited to local environments.

- Appropriate agronomic management tactics – including paddock selection and preparation, canopy management, disease, weed and pest control, and crop nutrition strategies – will be explored to assist grower and adviser decision making.

- Focus farms and HYC awards programme to encourage growers to become involved and enable a seeing-is-believing participatory approach.

Septoria tritici blotch (STB) resistance – what does it mean for management?

Nick Poole – FAR Australia

AUSTRALIAN
FUNGICIDE RESISTANCE
EXTENSION NETWORK

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

BEWARE!
Long latent period makes STB difficult to control

- A long latent period (250 ^{0}C days or 14 – 42 days) disguises disease advance. Optimum temp 15-20 ^{0}C
- With STB infection in spring the crop appears to grow away from the disease, when clean leaves are already infected. But if it is wet infection is hidden by the long latent period.

Use knowledge of thermal time for leaf emergence to better manage STB

- A wheat leaf takes approximately 110-120 Day ^{0}C (Cd) to emerge.
- Therefore during stem elongation (as the top three leaves emerge) if conditions are conducive the disease will be approximately two clean leaves below the newest emerging leaf.

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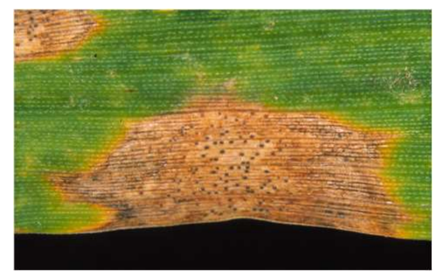
What has been found and why is it important?

- What has been discovered?
- Which fungicides are affected by this discovery?
- Why is it important?
- How can we adjust our management?



AUSTRALIAN FUNGICIDE RESISTANCE EXTENSION NETWORK

Strobilurin QoI Group 11 Resistance found in Septoria tritici blotch (STB) pathogen of wheat

1. The single step mutation (G143A) found in Southeast SA in the Septoria tritici blotch (STB) pathogen population may reduce fungicide performance of QoI Group 11 fungicides strobilurins over the next 2-3 years in the field.

2. In Europe (2002 – 2004) and NZ (2011 – 2013) the same mutation meant that after 3 years strobilurins did not control this disease.

3. The strobilurin fungicides that we currently use for STB control are azoxystrobin (e.g. present Amistar Xtra, Radial Tazer Xpert) and pyraclostrobin (e.g. present in Opera).

4. Note these actives will remain very effective against rusts but we may find that there effectiveness against STB reduces in the years to come.

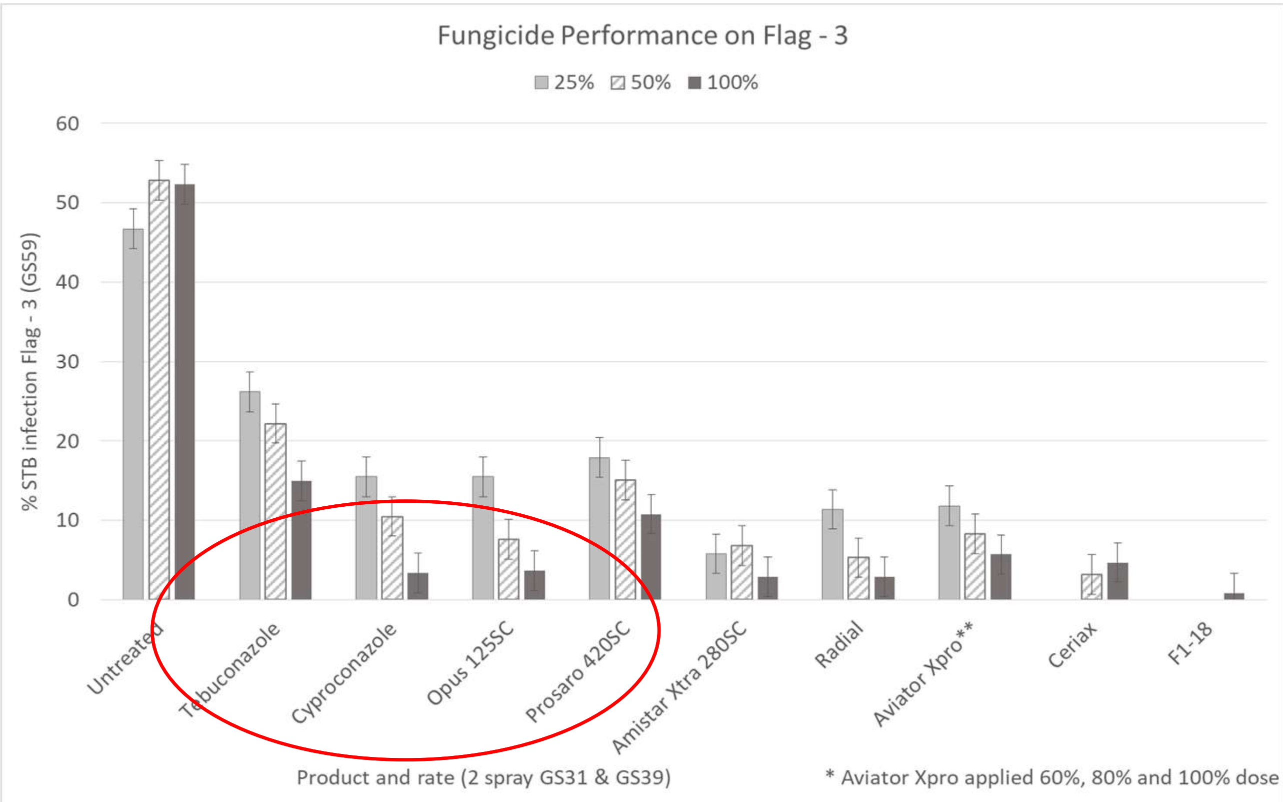
We also know that are DMI Group 3 triazoles are already affected by reduced sensitivity (partial resistance) in the STB pathogen

1. From 2017 survey data (NSW DPI) in SE Australia we know that DMIs are affected by partial resistance but the effect on DMI efficacy is not equal amongst DMIs.

2. Tebuconazole efficacy in research trials appears to have be more affected by reduced sensitivity mutations in the STB pathogen.

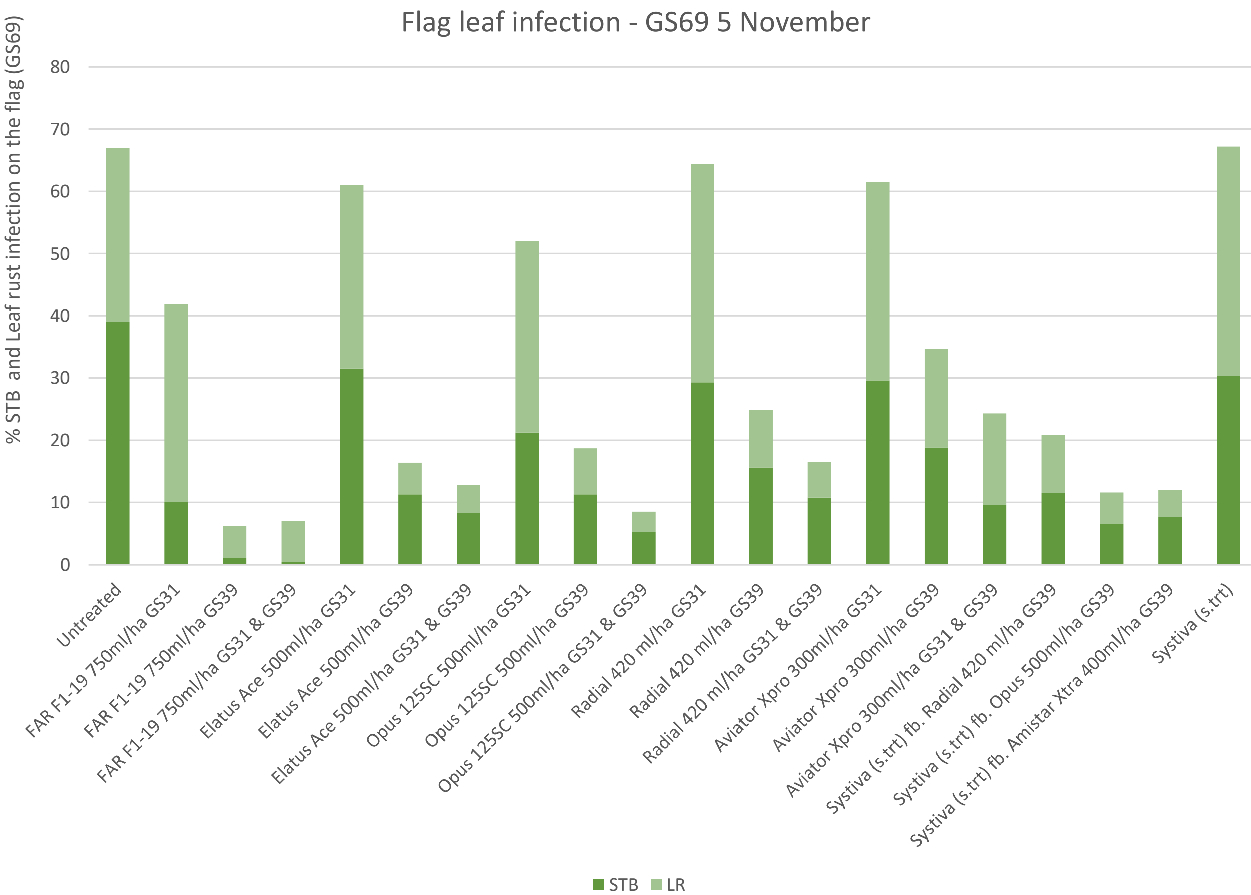
3. From research work conducted in the region where QoI resistance has been found DMIs were still very effective against STB in 2018 & 2019, particularly at higher label rates.

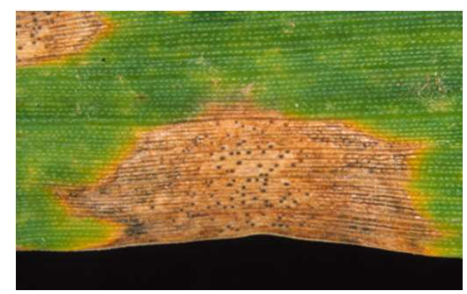
Fungicide efficacy against STB



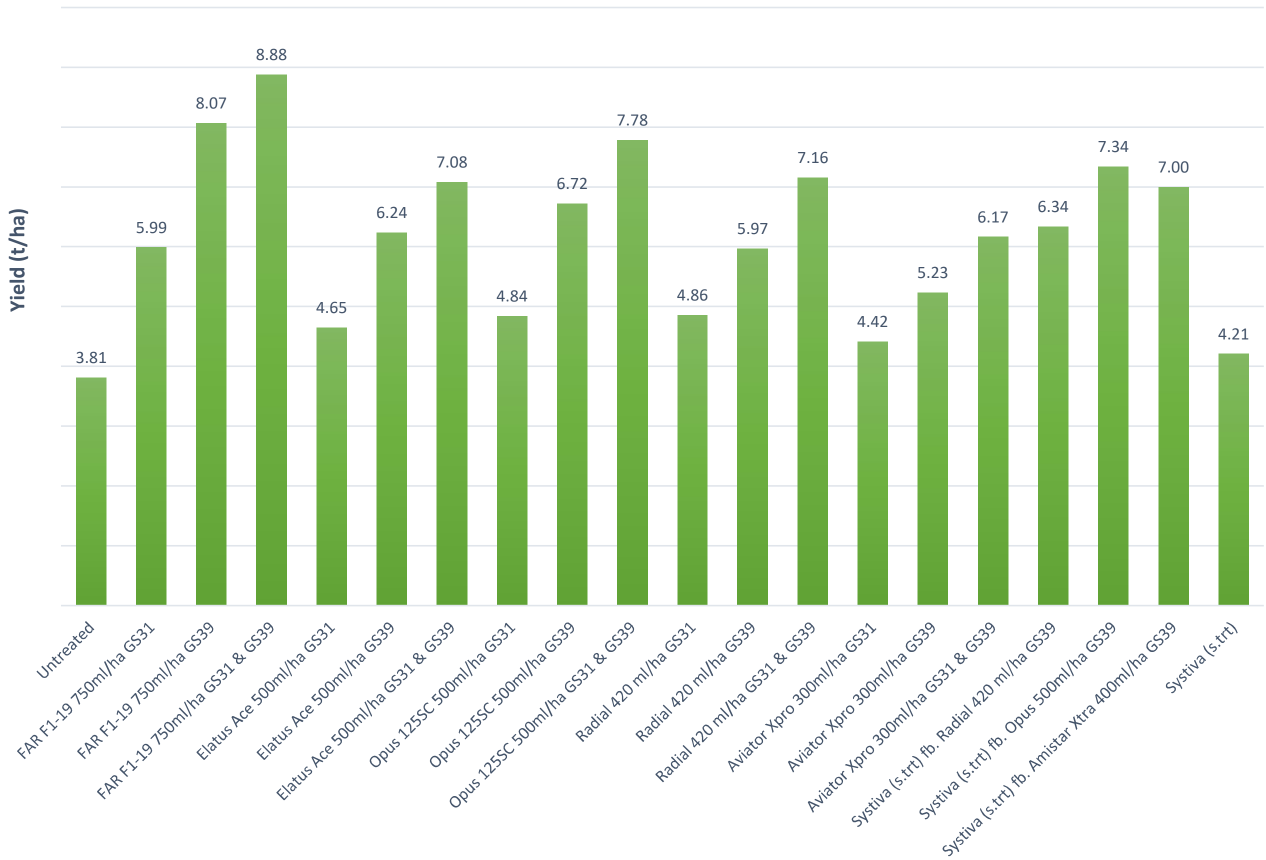
Epoxiconazole, prothioconazole cyproconazole were more effective than tebuconazole alone on STB (2018).

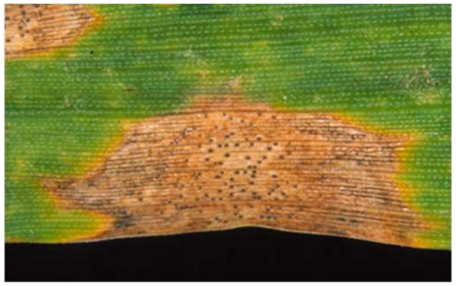
Control of Septoria tritici blotch (STB) and leaf rust (LR) in wheat – cv Revenue, SA Crop Technology Centre, Millicent, 2019





STB & leaf rust control –Influence of treatment on Yield t/ha – cv Revenue, Millicent, SA CTC Results 2019





Key Points

- A long latent period (250 degrees C days or 14 – 42 days) disguises Septoria tritici blotch (STB) advance in new leaves.
- Strobilurin QoI Group 11 (e.g. azoxystrobin, pyraclostrobin) resistance has been found in the STB pathogen in Southeast SA (Millicent).
- Until we know how widespread the QoI resistance mutation is in the STB population, make sure if you are using mixtures with Group 11 chemistry that the Group 3 DMI partner (e.g epoxiconazole, prothioconazole) is at rate that would control STB on its own.

- For More information: https://afren.com.au

https://youtu.be/5W_fuynzVvc

Generating Hyper Yielding Barley – What does a Hyper Yielding crop look like

Kenton Porker, Nick Poole (FAR Australia)

HYC Results and Awards Evening

What does a hyper-yielding barley crop look like at the end of the season?

	Grain Yield (t/ha)	Harvest Index (%)	Dry Matter t/ha	Heads/ m^2	Grains per spike	Grain Weight (mg)
M-HRZ	8	>50	14.5	650	26	48
SE Australian	**10**	**>50**	**18**	**600**	**32**	**50**
TAS Spring	12	>50	22	800	28	55

What's different about these environments?
Is it different enough to change management?
How can we hit these numbers?

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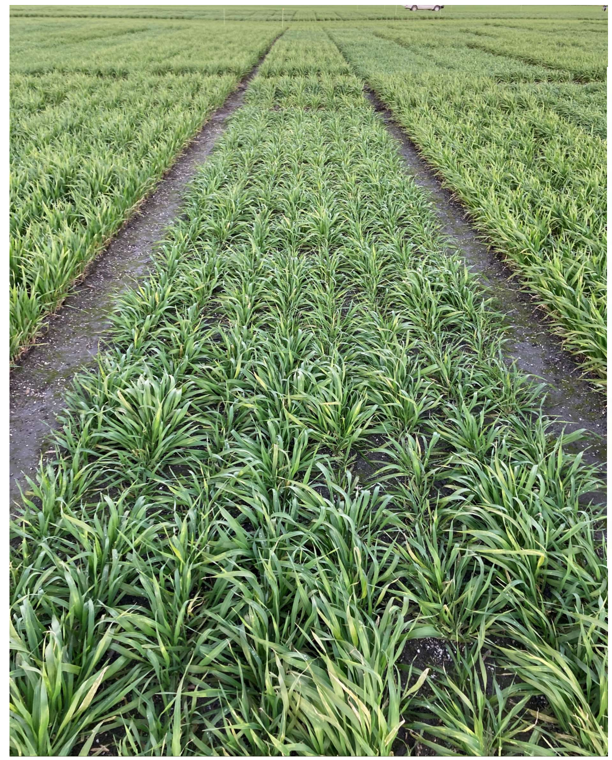
What does your crop look like at Z30, and the start of the critical period (1st September)

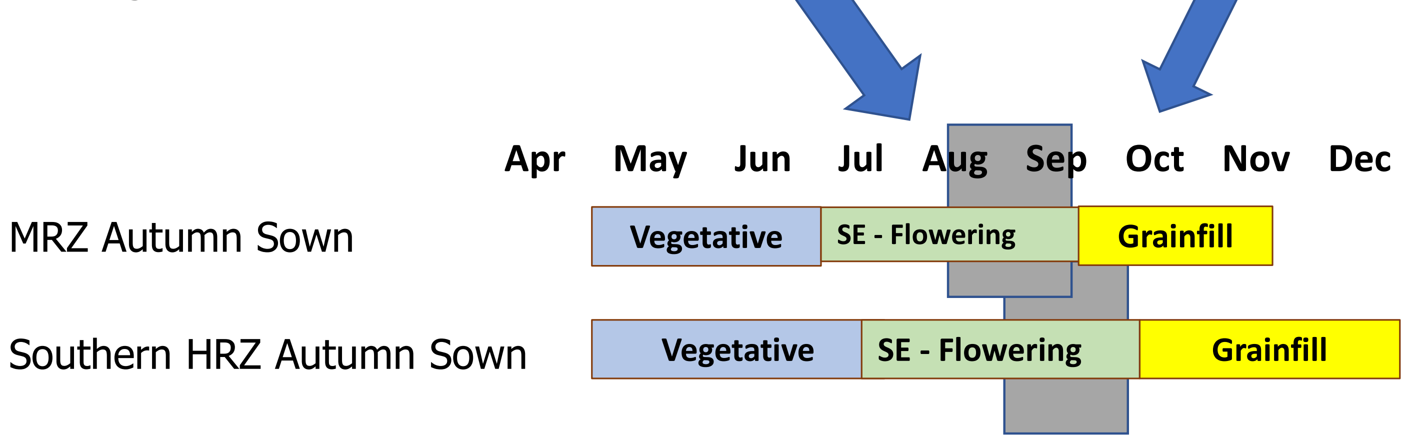





Crop Physiology rules for the Med - High Rainfall Zone

2. **Manage your crop** so that it is intercepting 90 – 95% radiation with green leaves by the start of the critical period (before flag leaf emergence)

1. Flower during the optimum period



RGT Planet - 28th April Sown
GS30 (Onset of Stem Elongation) - 29th Jun

Photo source: Kenton Porker

Flag minus 1 (GS33)

1cm

Photo source: Kenton Porker

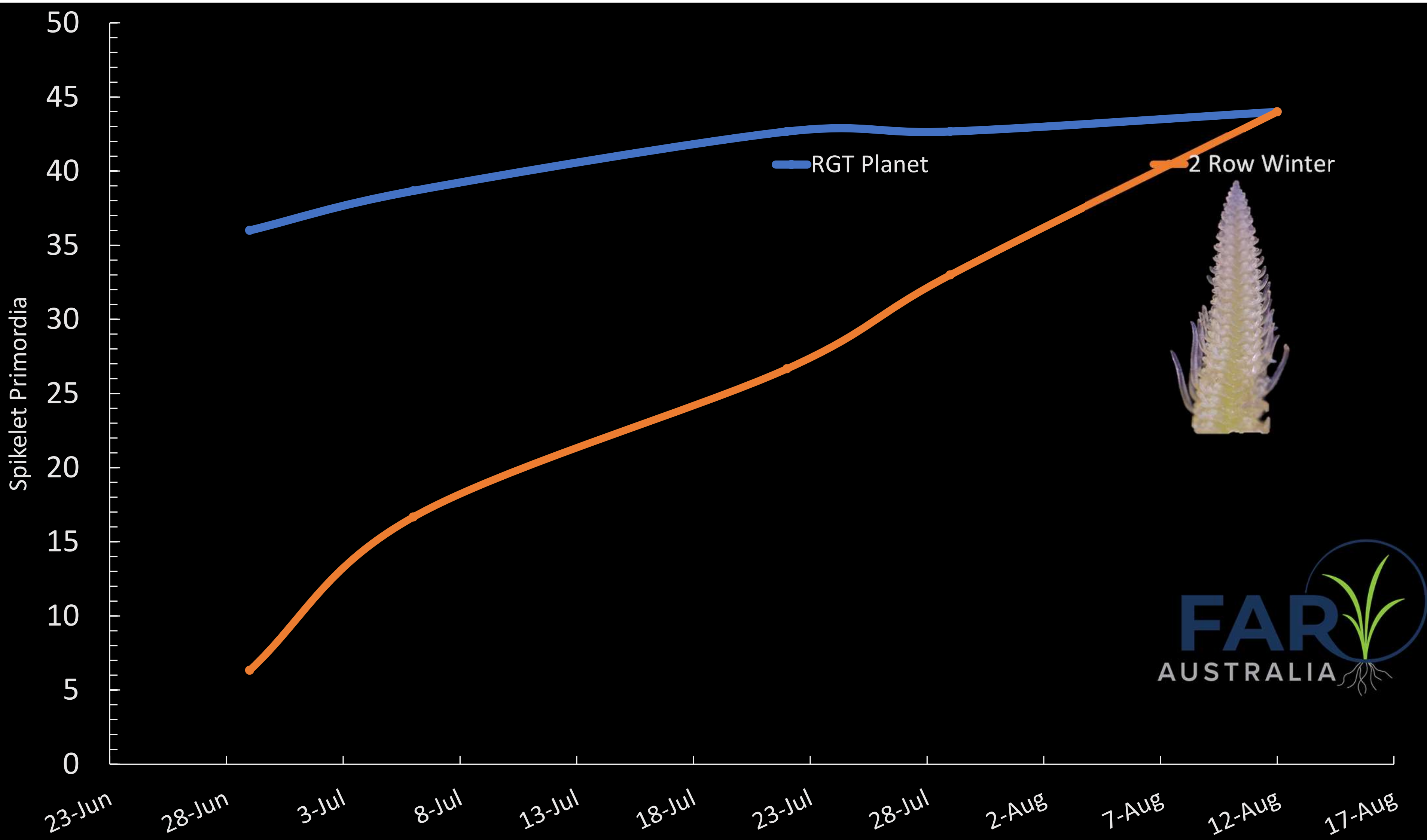


Photo source: Kenton Porker

Management and genetics go hand in hand to increase yields

- Increasing grain number potential, its survival and size will increase yields
  - Trying to achieve 40 grains per spike
  - Introduced 6 row for first time in Australia (in coordinated trials)
  - Keep important leaves greener for longer – fungicides/genetics
  - Keep crops standing and heads on the plant – PGR/genetics

Genetics and management are improving

CTC	Rosalind (quick spring)	RGT Planet (spring control)	Best Spring Alternative		Best 2 Row Winter		Best 6 Row Winter	
SA TOS1[1]	**8.3**	**8.7**	**9.7**	**AGTB0245**	**7.4**	**Newton**	**7.1**	**Pixel**
SA TOS2[1]	**8.9**	**9.6**	**9.8**	**Laureate**	**7.3**	**Cassiopee**	**---**	
Vic[2]	8.3	7.8	8.2	GSP1727-B	8.4	Madness	8.5	Pixel
WA[1]	4.8	4.6	4.9	Laperouse	3.9	Urambie	2.9	Pixel
Tas (spring)[1]	9.2	10.4	11.4	Laureate	---		---	

[1]sites received one PGR, [2] sites received 2 PGR.

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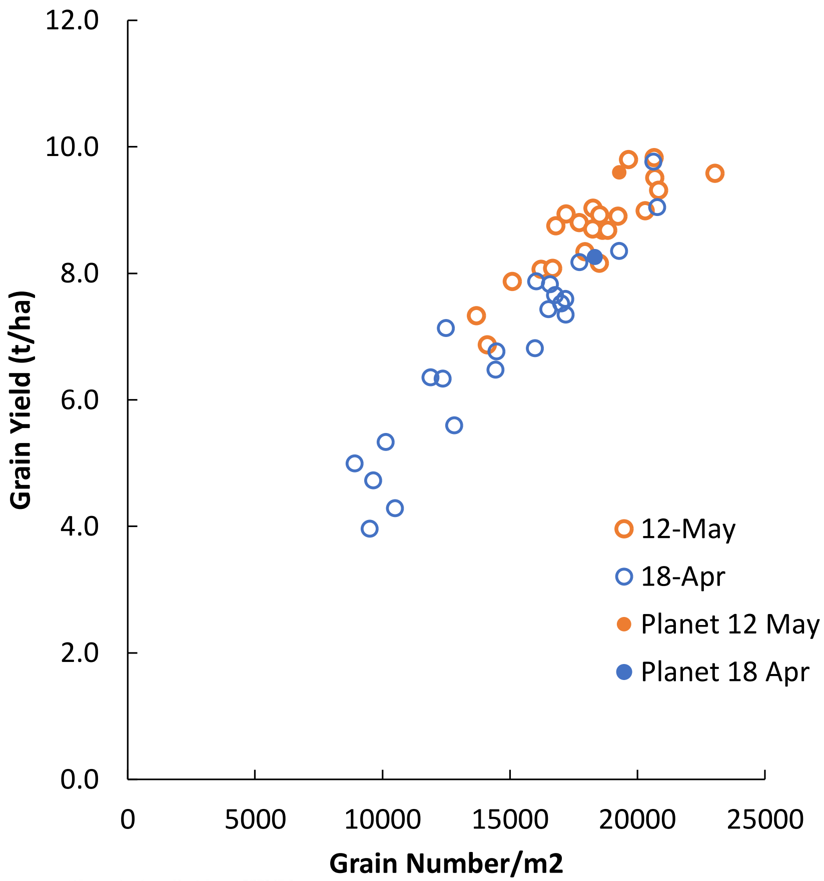
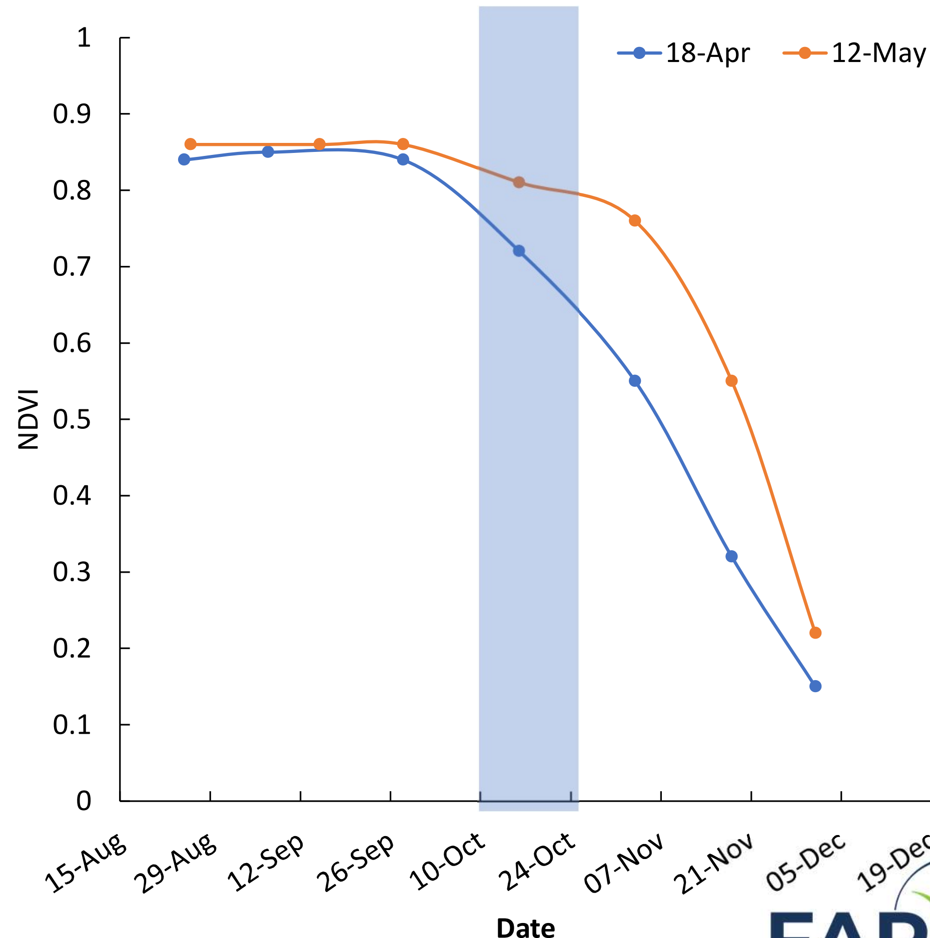
Millicent HYC 2020 Results: Manage your crop so that it is intercepting 90 – 95% radiation with green leaves by the start and duration of the critical period (before flag leaf emergence)





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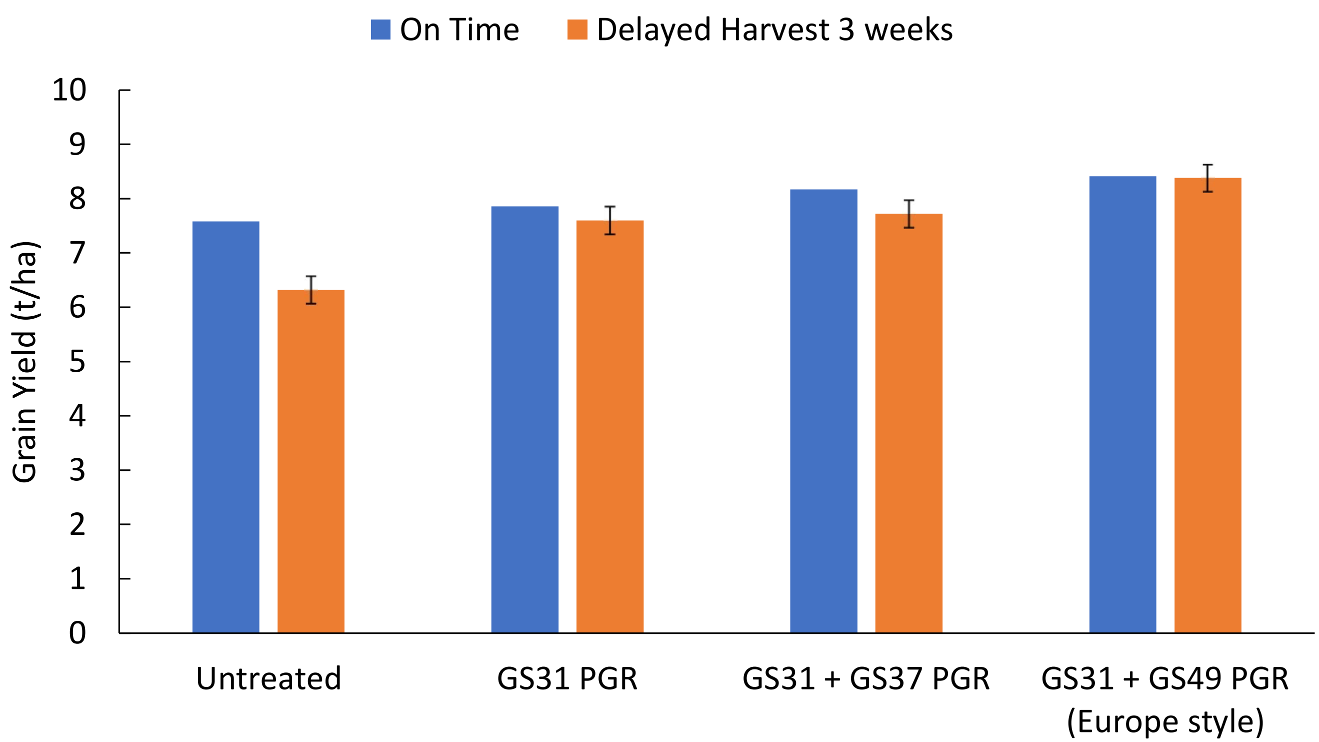
Strengthening the winter barley agronomic system

PGR, Delayed N, Grazing

PGRs buy time at harvest



Moddus Evo total application = 400ml/ha

Delayed sowing and grazing also works

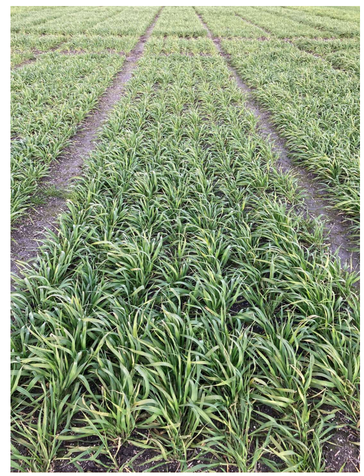
What about seeding rates and nutrition? Limited responses in 2020

60 seeds/m^2 ~

320 seeds/m^2 ~

But look at them now!!!!!!




60 Seeds/m2

Winter story is far more successful in wheat

But yields were still optimised at the may planting date in 2020

Current HYC national benchmark

Laureate Barley

Sown 1st September (Hagley)

Yield = 11.42t/ha
Protein = 13.3%
TestWeight = 65.9kg/hL
Retention = 98.5%
Screenings = 0.4%

- Good disease management is essential in all regions when yield potential is higher due to spring rainfall!
- Genetics and management of barley are improving and screening for high yielding germplasm with good genetic resistance (and standing power) is central to HYC research.
- Key foliar fungicide timings for barley disease control to protect the top four leaves are GS31 (1st node), GS39-49 (flag leaf – 1st awns emerging). Flag-1 is the most important leaf to protect in barley.
- Where possible look to minimize the use of fungicide application and where possible minimize the use of QoI (Group 11) and SDHI (Group 7) applications to one per season.

Thank you to GRDC and collaborating colleagues

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HYC Wheat Results – Performance of mid May sowing at Millicent

Nick Poole FAR Australia

HYC Results and Awards Presentation

18th August, 2021

FAR Australia SA Crop Technology Centre 2020
Location for GRDC SA HYC Project (courtesy of the Gilbertson family)

So how did wheat perform from mid May sowing under different management?

		Low Input, High Seed Rate	Standard Input	High Input
Plant pop'n:		300 seeds/m^2	180 seeds/m^2	180 seeds/m^2
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As standard + Systiva
Basal Fertiliser:	12 May	100kg MAP	100kg MAP	100kg MAP
Nitrogen*:	29 July	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	11 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (80 N)
	2 September	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (80 N)
Total N Applied:		120 N	120 N	160 N
PGR:**	GS30	---	---	Mod. 100ml + Errex 650ml
	GS32	---	---	Mod. 100ml + Errex 650ml
Fungicide*:	GS31-32	---	Opus 500ml	Prosaro 300ml
	GS39	Radial 840ml	Radial 840ml	Radial 840ml
	GS59-61	---	---	Opus 500ml

So how did winter wheat perform from mid May sowing?

	Management Level (Yield t/ha)						
Cultivar	**Low Input High Seed Rate**		**Standard Input**		**High Input**		**Mean**
Trojan (spring)	7.51	mno	7.94	k-n	8.37	f-k	**7.94**
Scepter (spring)	6.93	pq	7.97	j-n	8.04	i-m	**7.65**
Nighthawk (facultative)	8.17	g-k	8.57	e-i	8.71	efg	**8.48**
Anapurna (winter)	9.50	cd	9.40	d	10.60	a	**9.83**
RGT Acrocc (winter)	8.39	f-k	8.71	efg	9.96	bc	**9.02**
Catapult (spring)	6.68	q	7.45	nop	8.14	h-l	**7.42**
Beaufort (spring)	8.66	e-h	8.97	de	9.02	de	**8.88**
Rockstar (spring)	8.13	h-l	8.51	e-j	8.79	ef	**8.48**
Zanzibar (spring)	7.61	l-o	8.74	ef	10.05	ab	**8.80**
Cobra (spring)	7.34	op	7.89	k-o	7.93	k-n	**7.72**
LSD Cultivar p = 0.05	0.32 t/ha		P val		<0.001		
LSD Management p=0.05	0.52 t/ha		P val		0.007		
LSD Cultivar x Man. P=0.05	0.55 t/ha		P val		<0.001		

1.25 – 2.0 t/ha advantage to feed wheats (winter and spring) over best milling wheat – Growing milling wheat has to offset value of the yield difference ($312 – 500/ha at $250t for feed

Note the differences in response to input

- Zanzibar (feed) 2.5 t/ha
- Rockstar (milling) 0.66t/ha

Influence on protein?

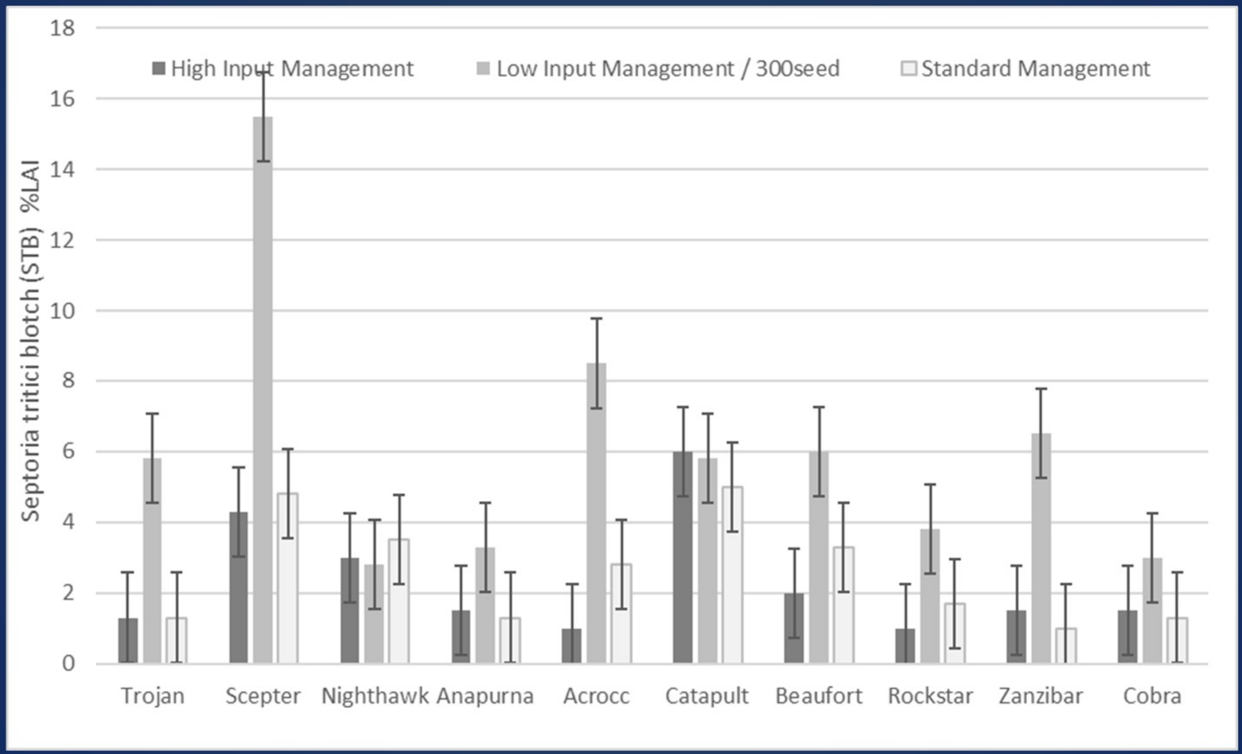
	Management Level (Protein %)						
Cultivar	Low Input High Seed Rate		Standard Input		High Input		
Trojan (spring)	12.8	cd	12.7	de	13.0	c	
Scepter (spring)	12.8	cd	12.8	cd	13.1	c	
Nighthawk (facultative)	12.2	f-i	12.3	fgh	12.3	fg	
Anapurna (winter)	11.1	o	11.7	klm	12.0	i-l	
Acrocc (winter)	11.3	no	11.6	mn	11.7	lm	
Catapult (spring)	12.2	f-i	12.2	f-i	12.4	ef	
Beaufort (spring)	11.9	j-m	12.0	i-l	12.0	h-k	
Rockstar (spring)	12.0	g-j	12.0	i-l	12.1	g-j	
Zanzibar (spring)	12.1	g-j	12.0	h-k	12.0	h-k	
Cobra (spring)	14.7	a	14.4	b	14.7	ab	
LSD Cultivar p = 0.05		0.18 %		P val		<0.001	
LSD Management p=0.05		0.19 %		P val		0.065	
LSD Cultivar x Man. P=0.05		0.32 %		P val		0.028	

Proteins of milling wheats not significantly different under high input at 160 kg N/ha.

Standard input <u>most cost effective for milling wheats</u> sown mid May based on two fungicides (GS31 & 39) and 120kg N/ha

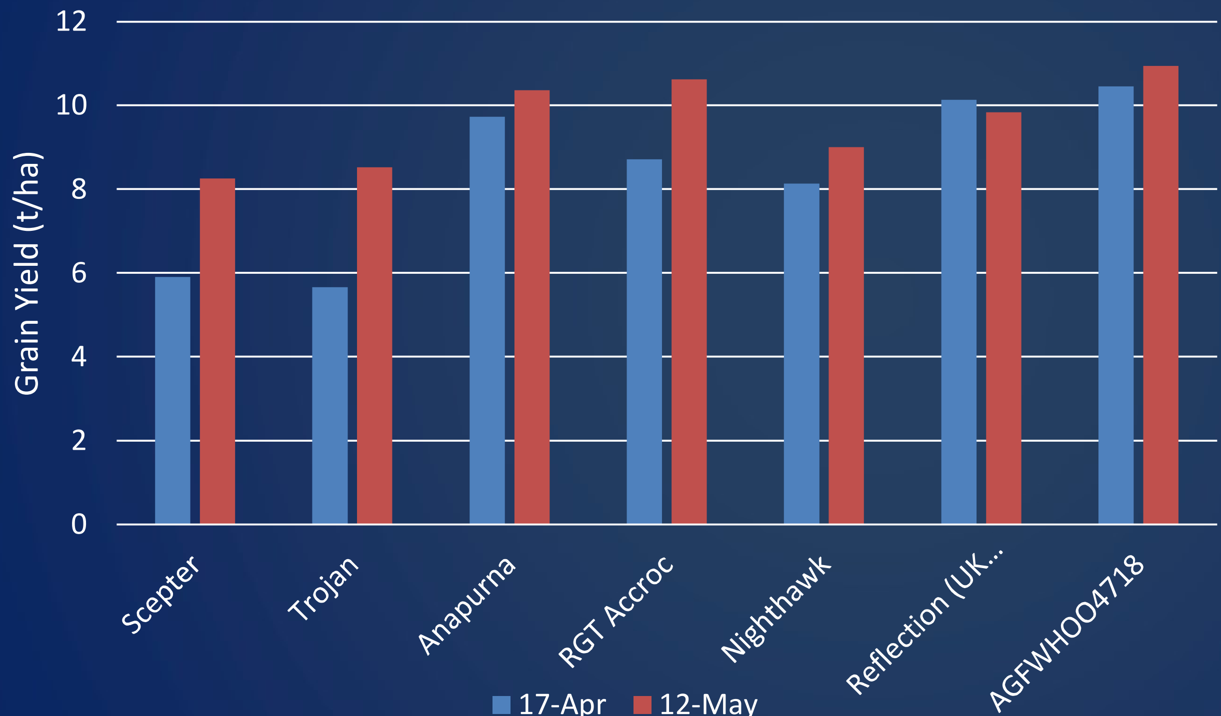
Hyper Yield Crops Project barley research Protocol 3 – SA Crop Technology Centre, Gnarwarre, Victoria, October 2020

Large differences in cultivar resistance to Septoria



SOWING THE SEED FOR A BRIGHTER FUTURE

So how did winter wheat perform from mid May sowing?



Observations of grain yield of spring (Scepter & Trojan) and winter wheats grown in two separate trials on the same site approximately one month apart (t/ha) – sown 12 May.

Hyper Yield Crops Project Wheat research Protocol 3 – SA Crop Technology Centre, Millicent , SA October 2020

SOWING THE SEED FOR A BRIGHTER FUTURE

So how did winter wheat perform from mid May sowing?

- During 2020 at Millicent the feed wheats (both spring and winter germplasm) were outyielding the milling wheats by 1 – 2t/ha when sown on 12 May.
- Further north in the region we would expect the yield difference to narrow.
- The surprise result was that the yields of longer season winter wheats RGT Accroc and Anapurna were greater sown in 12th May than mid April. Flowering sweet??
- Standard management based on 2 fungicides (GS31 & 39), no PGR and 120N as opposed to high input (4 fungicides, 160N and PGR) was the most cost effective management for the milling wheats.
- This was not the case with the feed wheats which gave 1t/ha responses to higher input.

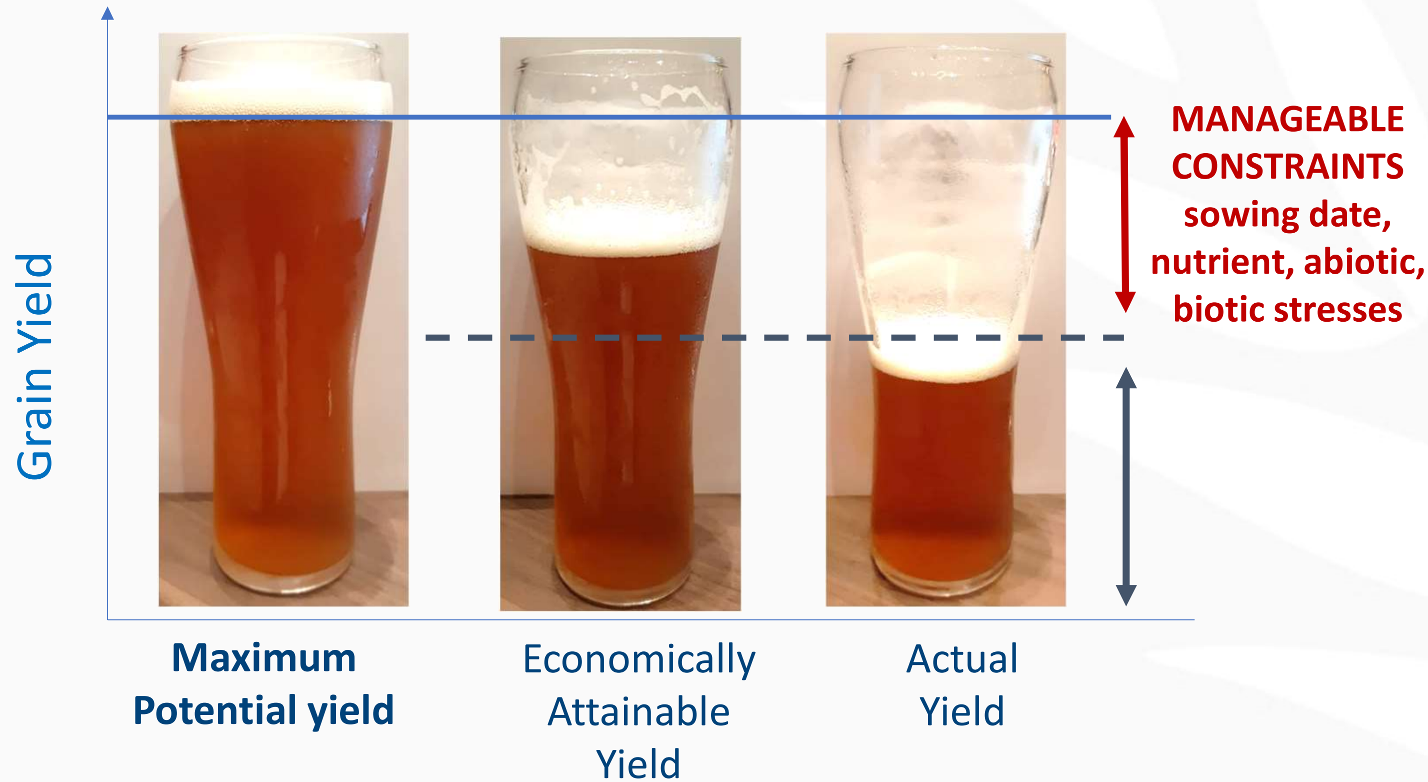
Defining Grain Yield

HYC Awards Vic/NSW

John Kirkegaard (CSIRO), **Kenton Porker (FAR),** Nick Poole (FAR), Jon Midwood (TechCrop)

How should we think about yield?

Potential Yield - Under best practice water and climate are the only factors limiting crop growth.



Award 2:

<u>% of potential</u>

= exploitable yield gap

Award 1:

<u>Actual Farm Yield</u>

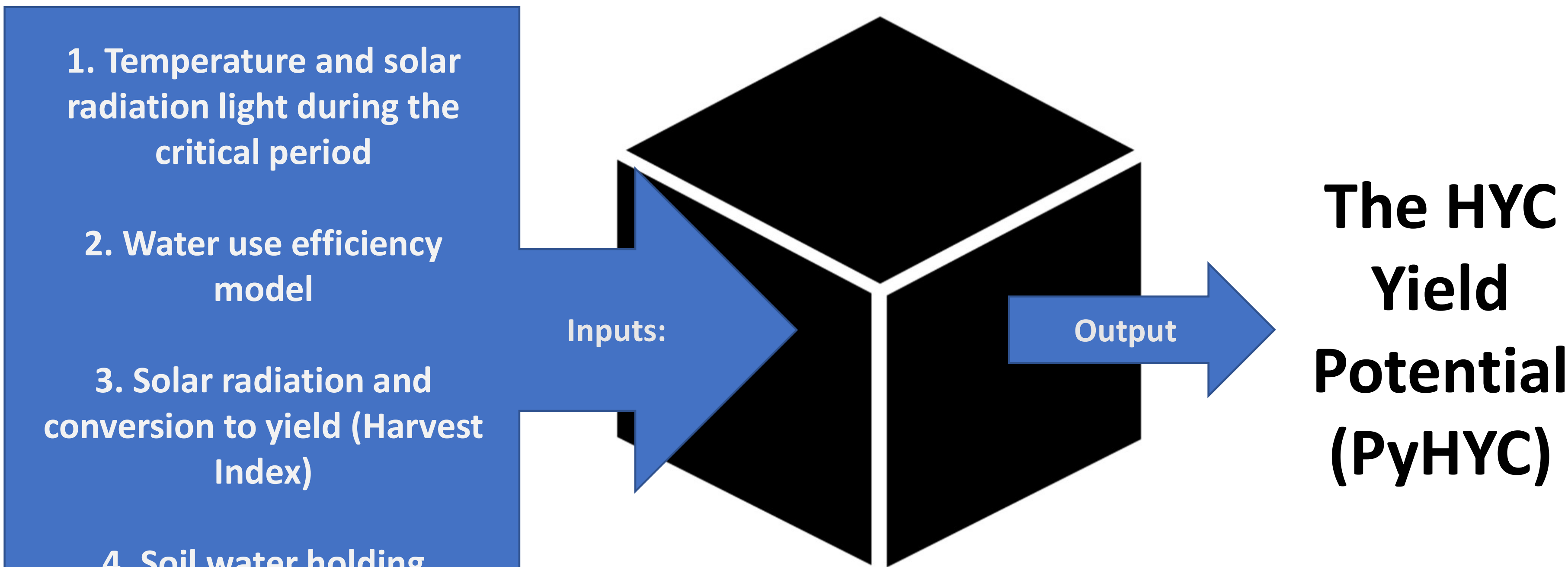
The HYC Awards Community

Lets **close the yield gap**

and **raise the yield frontier** together

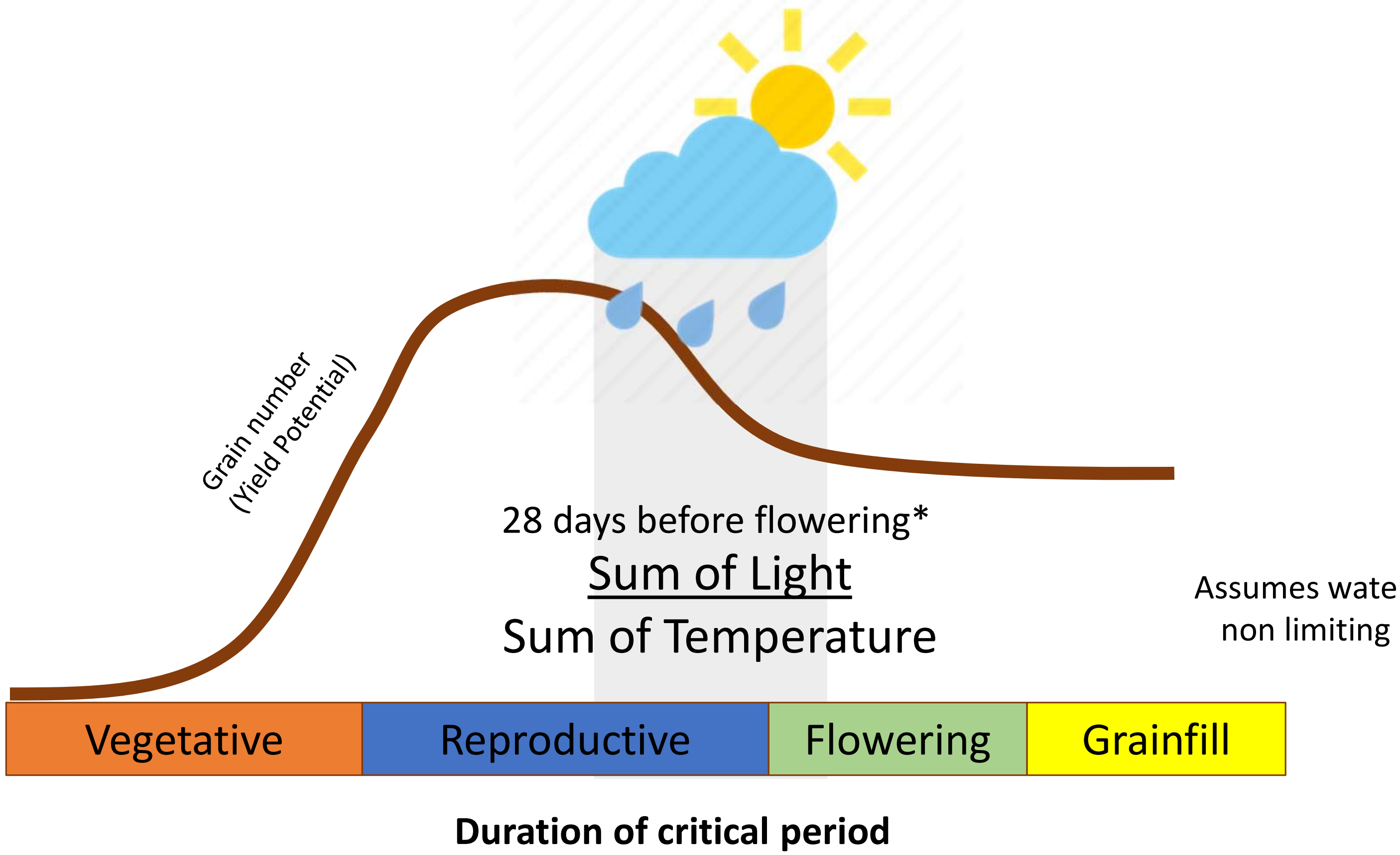
(get closer to 100% of potential yield)

HYC Yield Potential Calculation - Built on the fundamental principles of crop growth



Black Box assumptions
published methods

Potential yield is primarily determined by growth during the critical period (photothermal quotient)



* Modified based on (Rawson et al., (1988))

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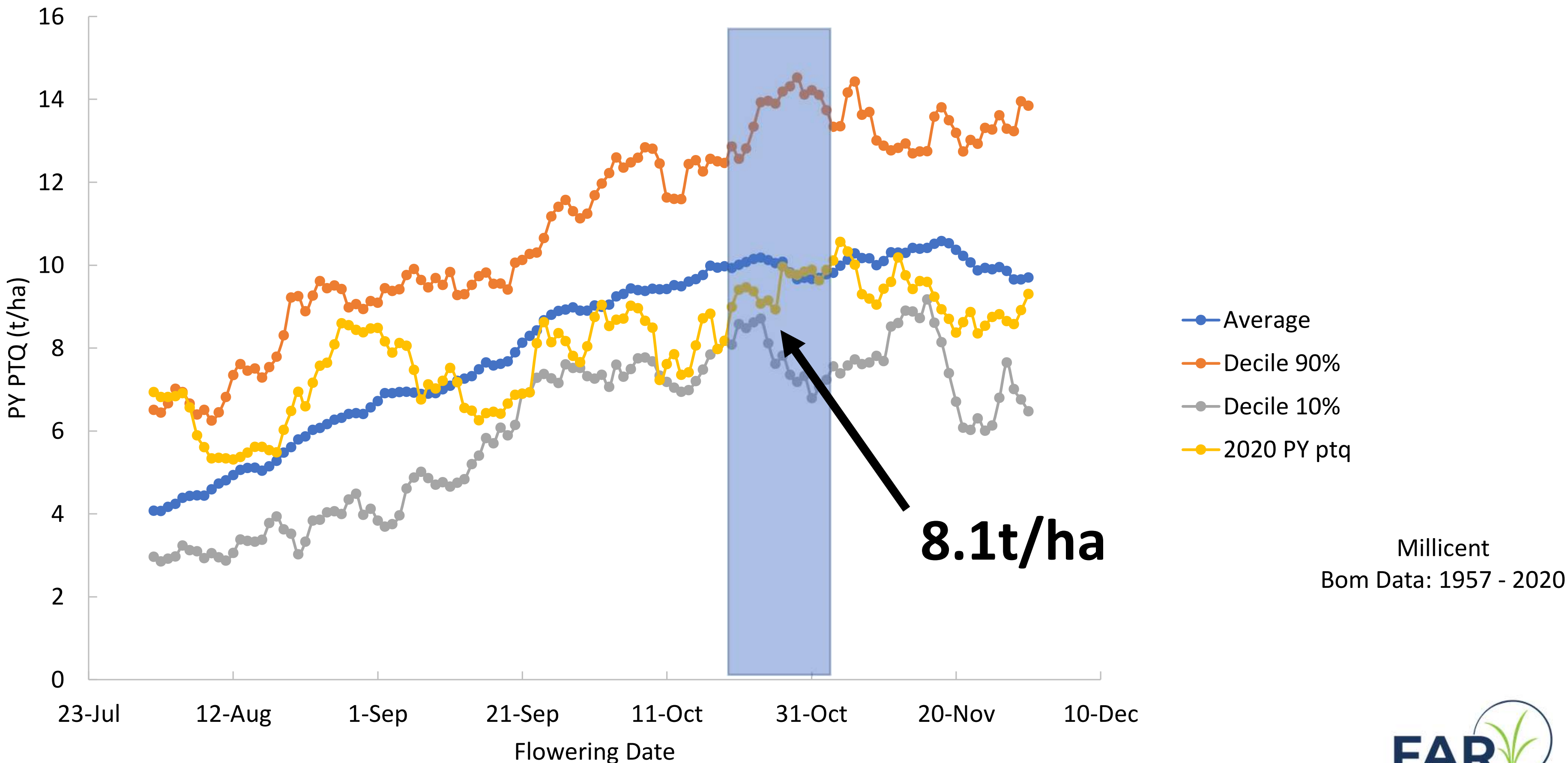
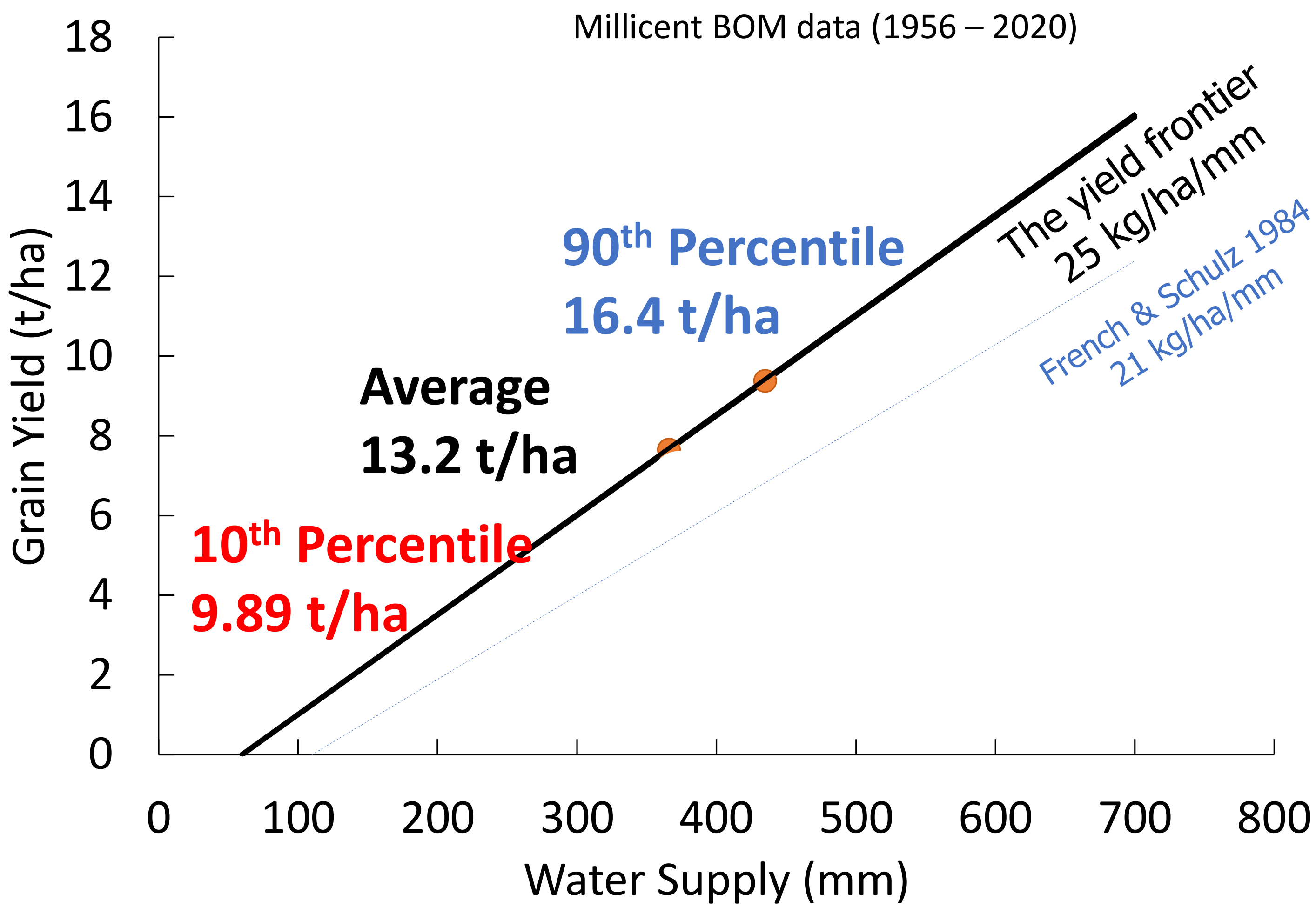
In high rainfall zones the PTQ may limit yield potential as often as water supply to the crop (coastal, cloudy areas) – **This is highly likely in lower SE**



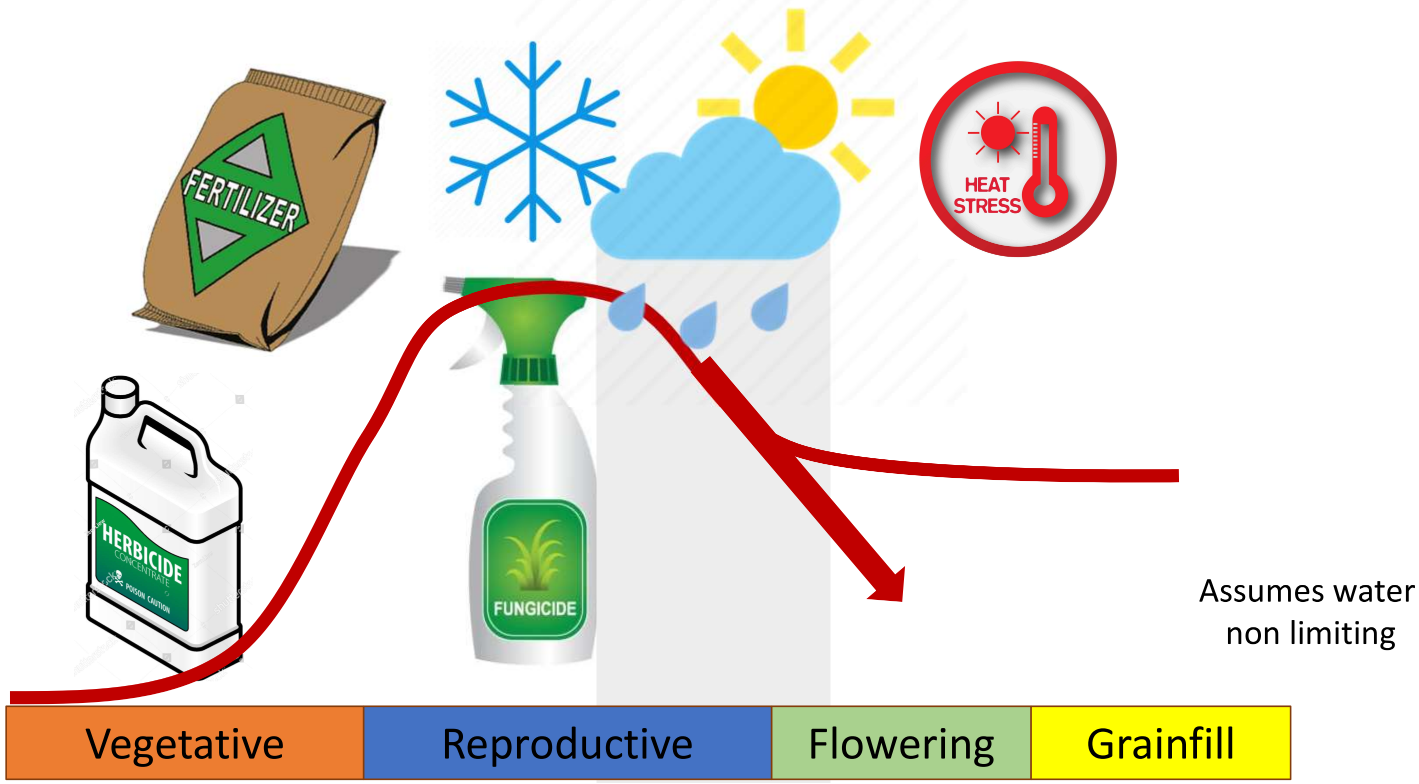
Water limited yield frontier (WUE) – Aspirations
Not likely to be water limited



Other factors considered in HYC Yield Potential

- **Soil water holding capacity** – soil type/rooting depth/incident rainfall
- **Growing season solar radiation and harvest Index –** conversion of dry matter to grain yield (Harvest Index of 55%)

Other manageable factors (including heat and frost stress) lower actual yield not yield potential



Duration of critical period

*modified by (Rawson et al., (1988))

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Lets **close the yield gap**

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(get closer to 100% of potential yield)

HYPER YIELDING CROPS AWARDS

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Highest HYC Award Yield in SA

James Fitzgerald from Hatherleigh with a 10.59 t/ha crop of Accroc wheat

99.3% of 10.67 t/ha potential

FAR AUSTRALIA

MFMG

TechCrop

Highest % of Potential Yield in SA at 99.3% of 10.67 t/ha.

2nd highest % of potential nationally!

James Fitzgerald from Hatherleigh

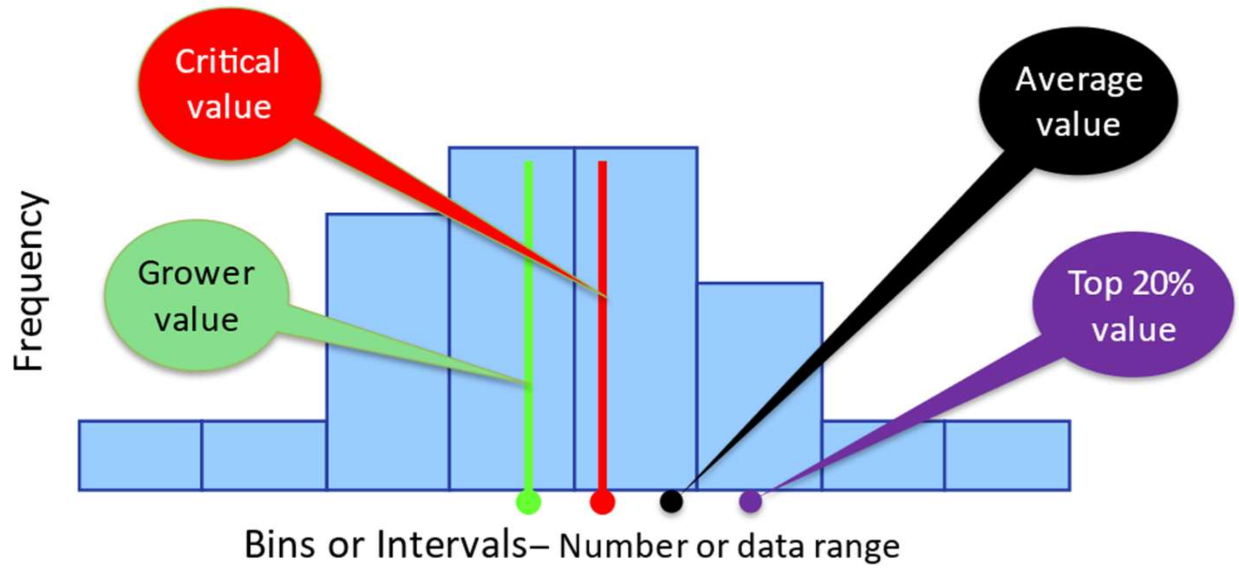
10.59 t/ha crop of Accroc wheat

HYC AWARD REPORT

- 20 page report with over 50 comparative metrics with wheat paddocks in your region
- Crop and paddocks details
- Detailed annual inputs record
- Growing season weather – Rainfall, temperature and radiation
- Actual v Potential yield

HYC AWARDS

Use of histograms for to display the range of comparative data



HYC AWARDS 2020 Report

Hyper Yielding Crops

HYC Award report - 2020

FAR2004-0025AX

SA

The details shown below are a record of the inputs you applied to your crop of wheat during the growing season. Your agronomic decisions will have been made based on crop development, the seasonal variations in the weather and your judgement on the crops yield potential. This data plus additional information has been used in this report to compare your individual agronomy and management to the other Award growers in your region.

The data provided allows us to benchmark your key agronomy decisions with the other Award growers in your region and by comparing this data we're able to see the agronomic benchmarks of the top 20% in your region, the average and where you sit in comparison to the rest. Where appropriate we also add in critical levels, like soil test levels for example, for you to further benchmark your decisions.

This report will help you identify different agronomic decisions you made and the growing conditions that you had during the season that you could consider when looking at closing the yield gap on what you achieved compared to the potential for your paddock.

Crop details 2020

Crop	Cereal: Wheat
Variety	DS Bennett
Area	40.00ha
Sow Rate	90.00 kg/ha
Sow Date	22-05-20
Harvest Date	08-01-21
Harvest Yield	8.07T/ha
Harvest Yield Method	Harvester (Direct)
Stubble Management 1	Grazed
Stubble Management 2	
Seeder type	12" split paired rows 3" apart
Seeder name	
Row spacing	305mm

Location

Key growth stages

Date	Band	Growth Stage
22-09-20	Stem elongation	39: Flag leaf fully emerged
26-10-20	Anthesis	65: Mid flowering

Paddock history

Season	Crop	Variety
2020	Cereal: Wheat	DS Bennett
2019	Pulse: Faba Beans	

Soil

Type and texture

Soil order	Dermosol
Soil texture	Clay Loam

National Soil Grid estimates 95% EV

Depth	BD	AWC	Clay	Silt	Sand
0-5cm	1.3g/cm3	16.5%	35.1%	6.4%	51.4%
5-15cm	1.3g/cm3	16.7%	40.4%	6.1%	47.4%
15-30cm	1.3g/cm3	16.9%	43.8%	5.9%	44.2%
30-60cm	1.3g/cm3	16.8%	44.7%	5.7%	42.5%
60-100cm	1.3g/cm3	16.4%	44.9%	5.7%	44.4%

Crop details 2020

Crop	Cereal: Wheat
Variety	DS Bennett
Area	40.00ha
Sow Rate	90.00 kg/ha
Sow Date	22-05-20
Harvest Date	08-01-21
Harvest Yield	8.07T/ha
Harvest Yield Method	Harvester (Direct)
Stubble Management 1	Grazed
Stubble Management 2	
Seeder type	12" split paired rows 3" apart
Seeder name	
Row spacing	305mm

Location

Key growth stages

Date	Band	Growth Stage
22-09-20	Stem elongation	39: Flag leaf fully emerged
26-10-20	Anthesis	65: Mid flowering

Paddock history

Season	Crop	Variety
2020	Cereal: Wheat	DS Bennett
2019	Pulse: Faba Beans	

Soil

Type and texture

Soil order	Dermosol
Soil texture	Clay Loam

National Soil Grid estimates 95% EV

Depth	BD	AWC	Clay	Silt	Sand
0-5cm	1.3g/cm3	16.5%	35.1%	6.4%	51.4%
5-15cm	1.3g/cm3	16.7%	40.4%	6.1%	47.4%
15-30cm	1.3g/cm3	16.9%	43.8%	5.9%	44.2%
30-60cm	1.3g/cm3	16.8%	44.7%	5.7%	42.5%
60-100cm	1.3g/cm3	16.4%	44.9%	5.7%	44.4%

Inputs

Seed

Date	Product	AI	Rate	Units
22-05-20	DS Bennett		90	kg/ha

Seed treatment

Date	Product	AI	Rate	Units	Growth Stage
	Cruiser 350 FS	Thiamethoxam (350 GAI)	200	mL/100kg	
	EverGol Energy	Metalaxyl (61 GAI) Penflufen (38 GAI) Prothioconazole (77 GAI)	260	mL/100kg	

Fertiliser

Date	Product	AI	Rate	Units	N	P	K	S	Zn	Mn	Cu	Mo	B
22-05-20	MAP		100	kg/ha	10	22	0	2	0.0	0.0	0.0	0.0	0.0
10-08-20	UREA		200	kg/ha	92	0	0	0	0.0	0.0	0.0	0.0	0.0
11-08-20	Wilchem		3	L/ha	0	0	0	0	0.1	0.1	0.1	0.0	0.0
			Cumulative total		**102**	**22**	**0**	**2**	**0.1**	**0.1**	**0.1**	**0.0**	**0.0**

Herbicide

Date	Product	AI	Rate	Units	Growth Stage
22-05-20	Sakura 840 WDG	Pyroxasulfone (850 GAI)	118	g/ha	IBS (Incorporated by sowing)
15-07-20	Lontrel Advanced 600	Clopyralid (600 GAI)	0.06	L/ha	GS23 (Main shoot and 3 tillers)
15-07-20	Starane Advanced	Fluroxypyr (333 GAI)	0.3	L/ha	GS23 (Main shoot and 3 tillers)
15-07-20	Triathlon	Diflufenican (25 GAI) Bromoxynil (150 GAI) MCPA ester (250 GAI)	1	L/ha	GS23 (Main shoot and 3 tillers)

Fungicide

Date	Product	AI	Rate	Units	Growth Stage
11-08-20	Epoxiconazloe 125	Epoxiconazole (125 GAI)	0.5	L/ha	GS31 (1st node detectable)
22-09-20	Epoxiconazloe 125	Epoxiconazole (125 GAI)	0.5	L/ha	GS39 (Flag leaf fully emerged)
22-09-20	Amistar Xtra	Azoxystrobin (200 GAI) Cyproconazole (80 GAI)	0.4	L/ha	GS39 (Flag leaf fully emerged)
15-10-20	Prosaro 420	Prothioconazole (210 GAI) Tebuconazole (210 GAI)	0.3	L/ha	GS59 (Emergence of inflorescence completed)

Insecticide

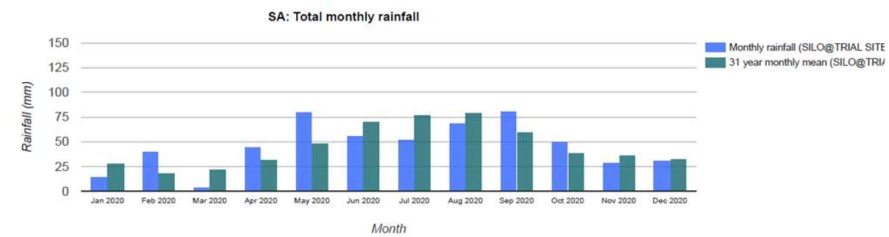
Date	Product	AI	Rate	Units	Growth Stage
	Alpha Duo 100	Alpha Cypermethrin (100 GAI)	200	Ml/ha	GS24 (Main shoot and 4 tillers)

Growing Season

The following graphs show the monthly rainfall, accumulated growing season rainfall, minimum and maximum temperatures and monthly solar radiation for your paddock in 2020 compared to your regional long-term average.

Each HYC Award paddock has it's own individual weather data using SILO from your paddock GPS location points. All weather data will be referred to as SILO in the report. SILO uses mathematical interpolation techniques from ground based weather data to construct spatial grids and infill gaps in time series dataset to provide a database of Australian climate data from 1889 to the present. It provides daily meteorological datasets for a range of climate variables in ready-to-use formats. SILO provides point datasets at approximately 8000 station locations and approximately 280,000 grid cell locations across Australia.

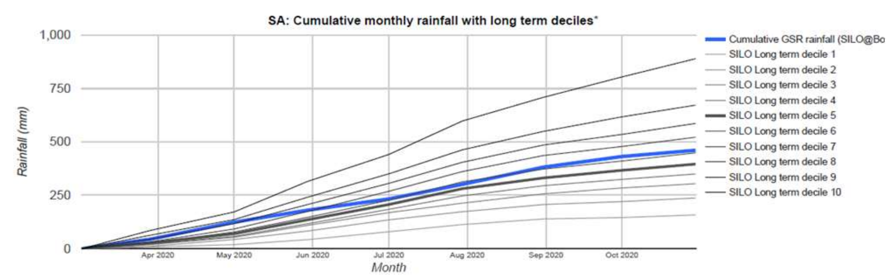
More information can be found here https://www.longpaddock.qld.gov.au/silo/



Early opening rains, a dry winter and mild spring temperatures provided an almost ideal season in 2020. Above average rain in April and May provided the opportunity to sow crops early or on-time. Sowing into good soil moisture and while temperatures remained relatively warm provided favourable conditions for good plant establishment and early crop growth.

A drier than average winter period limited the area affected and duration of any waterlogging and allowed for timely application of crop inputs. Many of the Award growers applied higher rates of nitrogen fertiliser than usual to capture the above average yield potential in 2020. The consequence of crop growth not being significantly impacted by waterlogging, combined with early sowing, increased nitrogen rates and some varieties with weaker straw, increased the risk of lodging. Plant growth regulators (PGR's) were applied to reduce the risk of crop lodging in most Award paddocks.

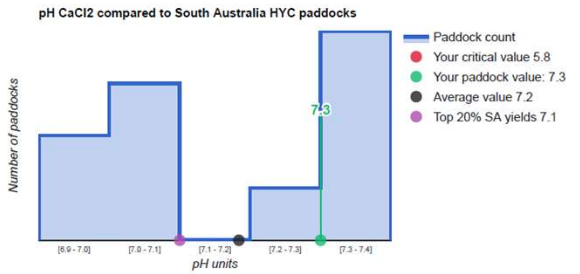
Spring rainfall was ideal with above average levels for September and October, development and control of cereal diseases was good. Frequent rain events and cooler temperatures caused regular delays throughout the harvest period. Yields and the quality of grain, which is predominantly destined for livestock feed markets, didn't appear to be affected by the rain and delayed harvest.



HYC AWARD REPORT

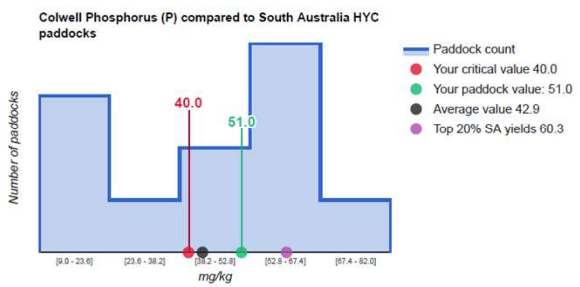
- Detailed soil test analysis (0 – 10cm)
- Agronomy benchmarks
- Key cost comparisons
- Analysis of yield components
- Grain nutrient benchmarking

Topsoil pH



Soil pH(CaCl2) is the standard method of measuring soil pH in southern Australia. A soil pH (CaCl2) of 5.2–7.5 provides optimum conditions for most wheat varieties and at these levels the greatest amount of microbial activity occurs. Where extremes of acidity or alkalinity occur, various species of earthworms and nitrifying bacteria disappear. Soil pH also affects the availability of nutrients, and affects how the nutrients react with each other. At low pH, beneficial elements such as Mo, P, Mg, S, K, Ca and N become less available and others may become toxic.

Topsoil P - Colwell P



Adequate P is essential for the early growth of wheat. In most cropping systems, the Colwell-P soil test is the benchmark soil P test used in Australia.

A soil-test critical value is the soil-test value required to achieve 90% of crop yield potential. The critical value indicates whether nutrient supply is likely to result in a crop yield response. If the soil test value is less than the lower limit of the range, the site is highly likely to respond to an application of the nutrient.

Topsoil K - Colwell K

Potassium deficiency is more likely to occur on light soils and with high rainfall, especially where hay is cut and removed regularly. Factors such as soil acidity, soil compaction and waterlogging will modify root growth and the ability of crops to extract subsoil K.
Colwell K will measure extractable K in soil solution. The critical values for surface soils are generally around 80-250 mg/kg (ppm). The levels can be significantly lower on sandier soils.

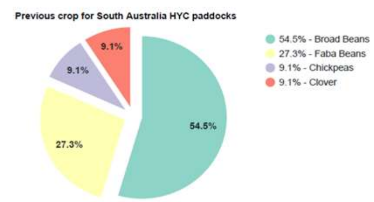
AGRONOMY

One of the advantages of the HYC Awards is that as a participating grower you can learn from the top 20% highest yielding growers in your region by seeing how your specific agronomy benchmarks compare with what they are doing. There will be agronomic practices that can be taken back to your business that could well lead to improvements in yield and profitability. Based on these paddocks and 2020 experimental data from the GRDC HYC research sites some of the key indicators we have noted this season are:

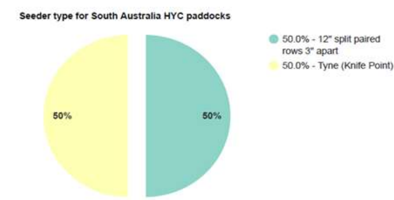
1. High yields are not achievable by simply applying more nitrogen fertiliser above approx. 225 - 250kg N/ha. Effective rotations using break crops and legumes are the key.
2. Applying adequate nitrogen, including the use of multiple applications.
3. Timeliness of operations is vital if you are to get the best out of your agronomic inputs. This starts with good planning at the start of the season, and continues with all inputs right through to harvesting.
4. Attention to detail.

The following charts show how your agronomy compared to all other HYC Award growers in your region.

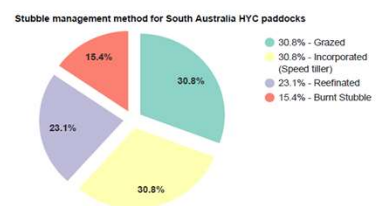
Previous crop



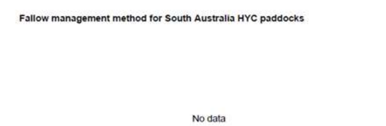
Seeder type



Stubble management method

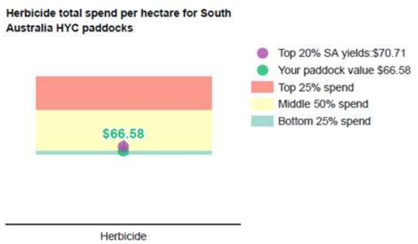


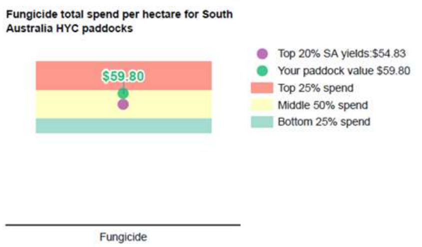
Fallow management method

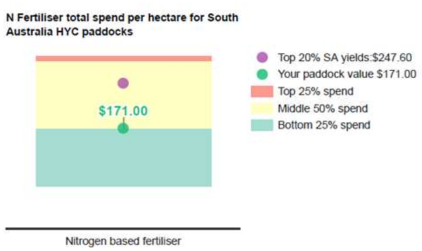


Key input costs per ha

Three key variable costs - herbicides, fungicides and nitrogen fertiliser have been put into individual charts. The total input cost per hectare, by State, has been divided into four: The minimum value, the 25th percentile value, the 75th percentile value and the maximum value. This determines the lowest 25%, middle 50% and top 25% spend.



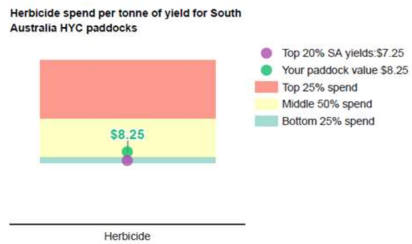


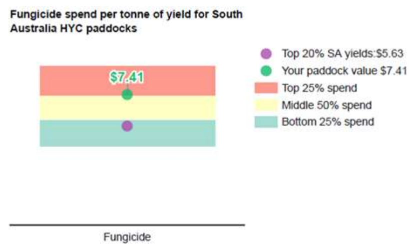


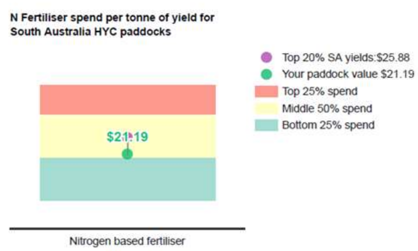
Input cost per tonne of production

The figures below have been derived from the use of standardised pricing across all HYC Award paddocks. The data came from the GRDC 2020 Farm Gross Margin and Enterprise Planning Guide.

These charts are probably of more importance than input cost per hectare as they give a better idea of your return as; cost per tonne produced.



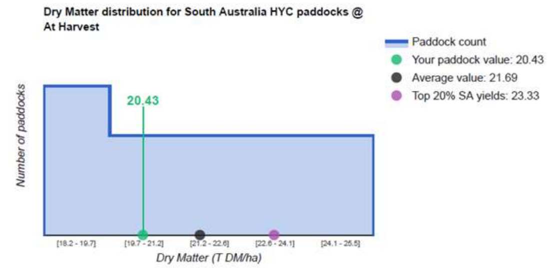




Their values are related to the success of different growth phases of the crop during the season:
Head number is a reflection of growth from the start of tillering to flag leaf appearance (GS39). Grain number/head is a reflection of the growth from GS39 to the start of flowering (GS61) and is deemed the critical period. Individual grain weight is the impact of the growth after flowering.

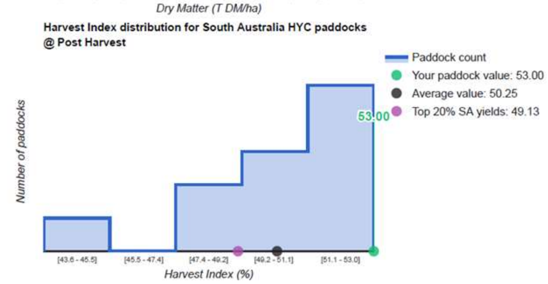
Each phase partially compensates for the outcome of earlier phases. A crop with a sparse shoot density tends to produce more grains/head and heavier grains than a thick crop. Conversely, poor performance in one phase increases reliance on good growing conditions in later phases.

Crop management and climate variables radiation and rainfall, soil type, soil depth will all affect grain yield. Grain yield is the principal product of crop growth, especially during the spring. Yields, therefore, depend on the condition the crop is in and how well it has been set up, leading into this period and then the growing conditions during this period.



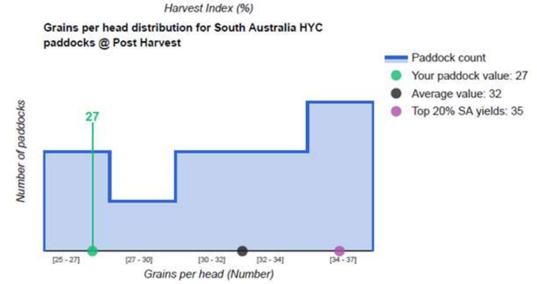
Harvest Dry Matter

Dry matter production at harvest is a reflection of your crops ability to convert the radiation, rainfall and soil water into biomass.



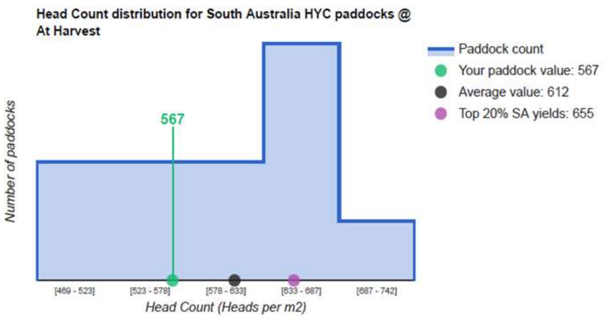
Harvest Index

The Harvest Index is the proportion of the total harvest dry matter that is harvested as grain. Therefore a harvest index of >50% has a greater % of grain compared to biomass present at harvest maturity.



Grains per head

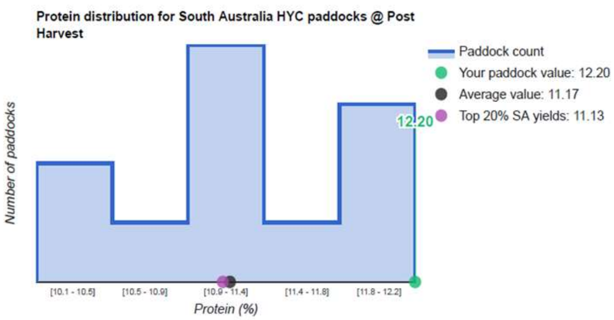
Grain number per head is largely controlled by survival of the florets while the last leaves and head are emerging, which is during the critical period just prior to flowering



Head Count

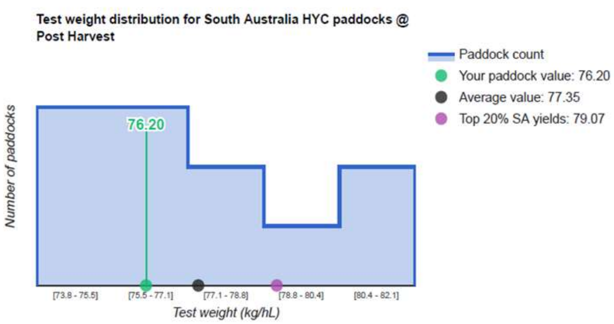
Head number starts at sowing by the number of plants/m2 that are established. Then numbers are influenced by management and growth from the start of tillering until flag leaf appearance (GS39)

Physical grain tests



Grain Protein

Protein content is one of the important factors influencing the end uses and markets of wheat; consequently, wheat is graded according to protein content. Protein content is assessed by using near-infrared (NIR) technology on delivery at the silo, and payment is based on protein content. Wheat with 11–13% protein is used for pan bread, 10.5% for udon noodles and 8.5–9.5% for biscuits and cakes.

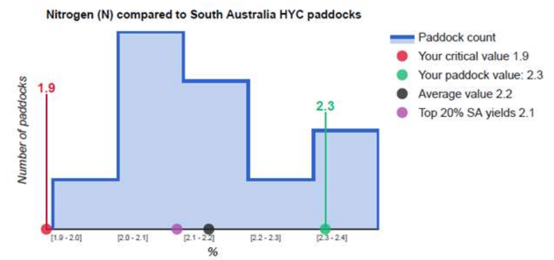


Test Weight

Test weight is also known as 'hectolitre weight' and assessed by weighing a fixed volume of grain. Hectolitre weight informs the miller of the wheat's cleanness, plumpness and packing density, and guides the miller in predicting flour yield. Test weight differs between varieties, owing to their differences in size and shape. Shrivelled and rain-damaged grains reduce test weight.

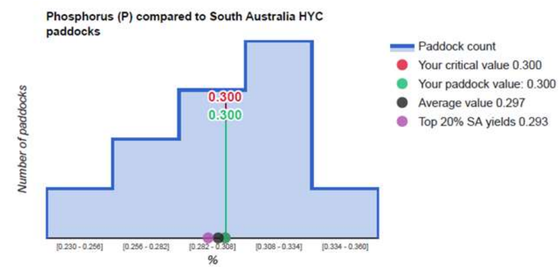
- Value of grain analysis
  - Allows you to measure P, K etc offtake
  - Allows you to cross check your soil analysis
  - Allows you to gauge possible nutrient deficiency
- Most research and confidence in N, P, S and Mn
- Less research work and so less information at present for K, Mg, Zn, Cu

Data and critical grain nutrient levels provided by Australian precision ag laboraotory (APAL) who are undertaking the lab analysis for this GRDC project.



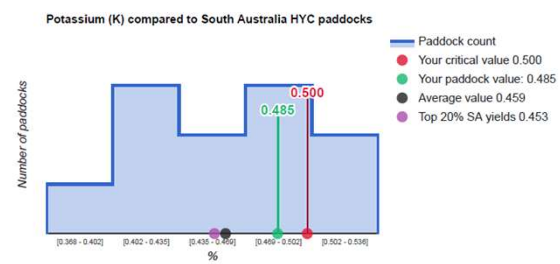
Grain N

Grain Nitrogen content relates directly to the grain protein, with a ratio of 1 to 5.7. So a grain N content of 1.75% equates to 10% protein. High concentrations of grain protein can arise either from large N uptake or poor starch formation during grain filling. Protein contents of wheat crops grown after a break crop are usually diluted by their greater yields. Conversely, factors that reduce yield without affecting N transport to grain, such as drought, early lodging or some diseases, may raise protein.



Grain P

Grain P levels of less than 0.3% indicate that the crop would have produced a worthwhile yield response if extra P uptake could have been achieved. Grain P levels of more than 0.3% indicate that responses to extra P uptake would be small and probably uneconomic.



Grain K

Values less than 0.5% indicate a need for further checks on your K nutrition, especially by looking at your most recent soil analysis.

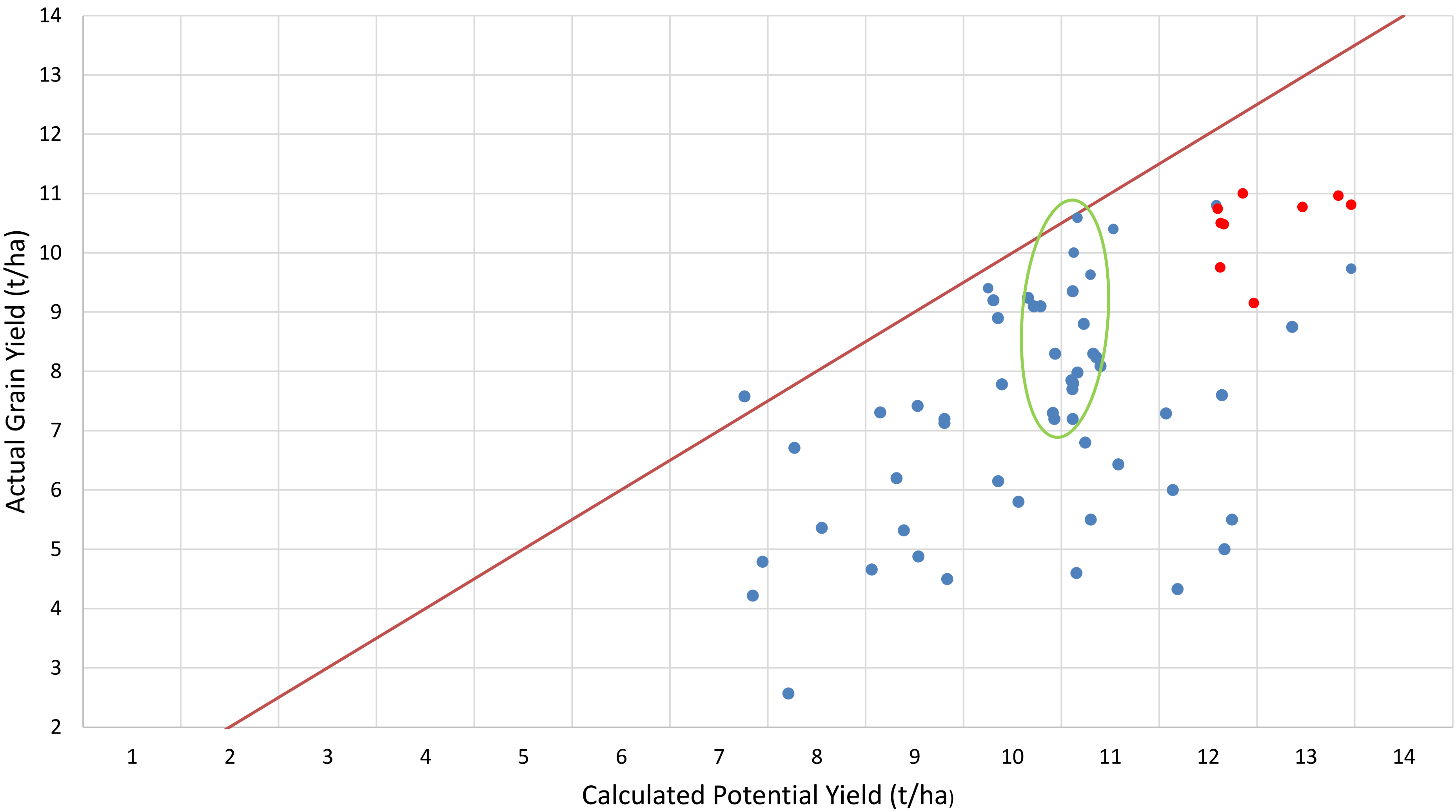
WHERE WE ARE TODAY AND WHAT WE SHOULD BE THINKING TOMORROW?

Focus is currently on dealing with specific problems

- Weed control – Ryegrass and Wild radish
- Fungicides for control for disease
- Nitrogen rates and timings
- Not much focus on soil structure and rooting depth
- Yield expectations are conservative based on historic results

What we should be thinking?

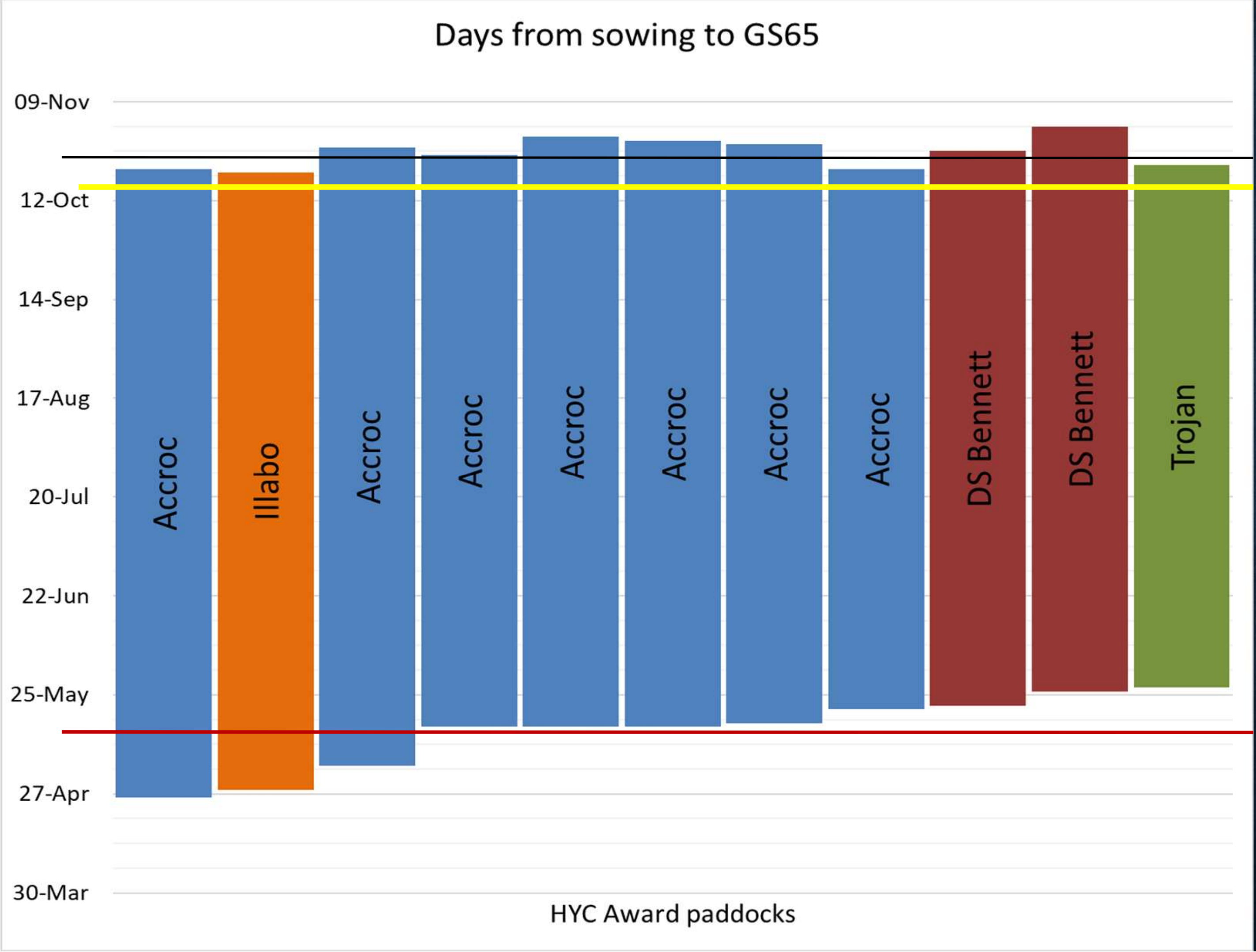
- Optimise capture of water, light & nutrients
- Crop canopy size, structure and longevity
- Resilience of our cropping systems
- It's not all about the weather! Consider management, timing and attention to detail
- Raise the expectations of yield potential both water and light limited.



14
13
12
11
10
9
8
7
6
5
4
3
2
Actual Grain Yield (t/ha)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
Calculated Potential Yield (t/ha)

CROP DEVELOPMENT AND RELATIONSHIP WITH YIELD

Metric	Top 25% Yield: 9.7 t/ha	Remaining 75% Yield: 8.0 t/ha
Sowing date	19 May 2020	12 May 2020
Mid Flowering	28 Oct 2020	24 Oct 2020
Harvest	8 Jan 2020	10 Jan 2020



Average sowing date (red line): 14 May

Average GS65 (black line): 25 October

Optimum start flowering : 15 Oct (Millicent) 7 Oct (Bordertown)

SOWING AND IN CROP GRAZING MANAGEMENT AND RELATIONSHIP WITH YIELD

Metric	Top 25% Yield: 9.7 t/ha	Remaining 75% Yield: 8.0 t/ha
Tine seeders (%)	100%	100%
Stubble burnt	0%	50%
Stubble incorp’	100%	50%
Reefinated	67%	12%

CROP MANAGEMENT AND RELATIONSHIP WITH YIELD

Metric	Top 25% Yield: 9.7 t/ha	Remaining 75% Yield: 8.0 t/ha
N applied (kg N/ha)	140	139
Number of applic’	4	4
Cost of N / tonne yield	$26/t	$25/t
P applied (kg P/ha)	36	20
K applied (kg K/ha)	0	3

CROP AGRONOMY AND RELATIONSHIP WITH YIELD

Metric	Top 25% Yield: 9.7 t/ha	Remaining 75% Yield: 8.0 t/ha
Fungicides ($/ha)	$55	$57
Fungicides ($/t)	$5.6	$7
Number of applic’	3.7	3
Head Fungicide	100%	50%

SOIL FACTORS AND RELATIONSHIP WITH YIELD

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Metric	Top 25% Yield: 9.7 t/ha	Remaining 75% Yield: 8.0 t/ha
pH (CaCl)	7.1	7.2
Soil Org carbon (%)	4.4	3.5
Colwell P (mg/kg)	60	36.4
Colwell K (mg/kg)	860	724

FAR AUSTRALIA MFMG TechCrop

SOIL FACTORS AND RELATIONSHIP WITH YIELD

Metric	Top 25% Yield: 9.7 t/ha	Remaining 75% Yield: 8.0 t/ha
Soil Texture	33% Clay, 67% C. Loam	25% Clay, 75% C. Loam
Available Water capacity to 100cm	165 mm	161 mm
GSR (1 April – 30 Nov)	520 mm	504 mm

YIELD COMPONENTS AND RELATIONSHIP WITH YIELD

Metric	Top 25% Yield: 9.7 t/ha	Remaining 75% Yield: 8.0 t/ha
Dry Matter (t/ha)	21.7	21.1
Harvest index	51%	51%
Head count (m^2)	655	590
Grains per head	36	31
Grains per m^2	23,397	18,372
1000 grain weight	41.6	40.9

GRAIN NUTRIENTS AND RELATIONSHIP WITH YIELD

MFMG

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

FAR AUSTRALIA

Metric	Top 25% Yield: 9.7 t/ha	Critical Values	maining 75% ield: 8.0 t/ha
Grain P	0.29	0.3	0.30
Grain K	0.45	0.5	0.46
Grain S	0.14	0.17	0.14
Grain Cu	3.2	2.5	4.2
Grain Zn	15.7	21	22.1
Grain Mn	11.3	21	14.9

TechCrop

WHERE TO FROM HERE?

JOIN ONE OF THE INNOVATION GROUPS IN SA AND GET INVOLVED IN CROP WALKS, IN PADDOCK DISCUSSION AND FOCUS TRIALS
PLUS
HYC WHEAT AWARDS FOR 2021

Growers, advisers and others wishing to become involved in the HYC project can contact their respective state project officer:

SA – Jen Lillecrapp jen@brackenlea.com

or Jon Midwood of TechCrop, jon@techcrop.com.au