SA CROP TECHNOLOGY CENTRE

Thursday 22 October 2020

11:00am – 4:30pm

MILLICENT, SA

Trial site courtesy of Brett and Mel Gilbertson

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

VISITOR INFORMATION

We trust that you will enjoy your day with us at our SA Hyper Yielding Crops (HYC) 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 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).

Thank you for your cooperation, enjoy your day.

WELCOME TO THE SOUTH AUSTRALIA CROP TECHNOLOGY CENTRE (CTC)

On behalf of the project team, I am delighted to welcome you to the 2020 South Australia Hyper Yielding Crops (HYC) field day here at the Crop Technology Centre (CTC) Hatherleigh, near Millicent.

Led by the Foundation for Arable Research (FAR) Australia, the Hyper Yielding Crops (HYC) Project is a new initiative funded by the Grains Research and Development Corporation (GRDC) which aims to push the economically attainable yield boundaries of wheat, barley and canola. HYC builds on the success of the GRDC's four-year Hyper Yielding Cereals project in Tasmania, which demonstrated that it is possible to significantly increase yields through sowing the right cultivars and effective implementation of appropriately tailored management strategies. Whilst the project team is clearly aware that Tasmania is not South Australia, they believe there are some common threads to the research that could benefit our new mainland project HYC initiative. The first is the ability to explore a research centre that can look at the latest developments in germplasm whilst at the same time examine all the major agronomic inputs. This has already been established in the first two years of research run at the SA CTC with germplasm such as Anapurna wheat performing well in both Tasmania and SA. This may not appear very unique but when laid out across a number of different research sites, this can be rather powerful. The second point is that across Australia, sowing dates are moving forward, and as a consequence, our germplasm requirements are changing. For the first time, the SA Crop Technology Centre features research conducted over two sowing dates for wheat and barley – mid-April (April 16 -18th) and mid-May (May 12 -13th) and as a result we are screening both winter and spring germplasm in order to establish whether longer season germplasm has higher potential in a South Australia HRZ environment. In some cases, we are looking to see if overseas bred material offers any steps forward in the way that RGT Planet and Accroc did in 2016. We also have a strong focus on disease control, since fungicide technology along with fungicide resistance has developed considerably over the last decade.

As well as the five HYC Research Centres across the higher yielding regions of southern Australia (NSW, WA, SA, VIC and TAS) the project wants to engage with you to scale up the results and create a community network aiming to lift productivity. If you are interested in getting involved in the project then please get in touch with Jen Lillecrapp, your regional HYC Project Officer.

What's happening on the SA Crop Technology Centre in 2020?
The SA Crop Technology Centre this season has a wheat, barley and canola focus and is exploring germplasm and agronomic input:

- Elite germplasm screening - the phenology, disease resistance and standing power of new wheat, barley and canola germplasm including new Australian as well as overseas germplasm that might offer advances in productivity – is there something to reliably outperform our current standards?
- HYC G.E.M. (Genotype. Environment. Management) trials - what are the management package combinations (winter vs spring germplasm, N, PGR's and Fungicide) that deliver the highest final harvest dry matters, harvest indices and grain yields?
- What level of fungicide input is appropriate for germplasm sown in mid-April and mid-May?
- In addition, the project team is looking at how high you can push nutrition in the higher yielding regions? For example, in the Hyper Yielding Cereals project in Tasmania, 15t/ha crops did not respond to very high inputs of applied nitrogen (over 220-225kg N/ha) indicating that the fertility of the farming system is as equally important to meet the needs of the crop as well as the artificial fertiliser applied.

Should you require any assistance throughout the day, please don't hesitate to contact a member of the FAR Australia team who will be more than happy to help.

Thank you once again for taking the time to join us today; we hope that you find the presentations useful, and as a result, can take away new ideas which can be implemented in your own farming business.

Finally, I would like to thank the GRDC for investing in the Hyper Yielding Crops project, without this funding nothing of what you see today would be possible. Also many thanks to the SARDI team, led by Amanda Pearce and Ian Ludwig, for all their input into the research site and to all of our speakers for travelling such long distances to make today possible. Last but in no way least, I would like to thank Brett and Mel Gilbertson for hosting us on the farm, their support has been invaluable.

Nick Poole, Managing Director, FAR Australia

Funding Acknowledgements
The Hyper Yielding Crops project team would like to place on record its grateful thanks to the Grains Research & Development Corporation (GRDC) for its funding support for this event and featured projects.

What is the Hyper Yielding Crops project aiming to achieve and how did it originate?

Hyper Yielding Crops (HYC) builds 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 made through sowing the right cultivars, at the right time and with effective implementation of appropriately tailored management strategies. The popularity of the original 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.

Focus farm projects in the region have been set up by Jen Lillecrapp of McKillop Farm Management Group working with industry. We will be looking to secure a small number of wheat entries this harvest for the HYC awards, which have been set up as part of the efforts to try and lift interest across the board in higher productivity.

The HYC 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 of 50 wheat paddocks nationwide (about 10 paddocks per state) as part of the awards program.

For more details on the project contact:

Rachel Hamilton – HYC Communications and events, FAR Australia (rachel.hamilton@faraustralia.com.au)
Nick Poole – HYC Project Leader and wheat crop research lead, FAR Australia (nick.poole@faraustralia.com.au)
Rohan Brill – HYC Canola crop research lead, Brill Ag (rohan@brillag.com.au)

Kenton Porker – HYC Barley crop research lead, SARDI (kenton.porker@sa.gov.au)
Jon Midwood – HYC Extension coordinator, Techcrop (techcrop@bigpond.com)
Jen Lillecrapp – HYC Project officer (SA), McKillop Farm Management Group (jen@brackenlea.com)

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

Disease Management in Wheat

Nick Poole, Kat Fuhrmann & Tracey Wylie
Foundation for Arable Research (FAR) Australia, Bannockburn, Victoria 3331, Australia

Stripe rust is more widespread in the east this season as a result of a new pathotype

Stripe rust caused by the pathogen P. striiformis var. tritici has been more problematic as a result of a change of pathotype (pt. 198 E16 A+ J+ T+ 17+) and the susceptibility of some widely grown cultivars, particularly DS Bennett and LPB Trojan. This pathotype was first detected near Wagga Wagga in late August 2018, and in 2019 it was the most common pathotype isolated from eastern Australia having spread to Victoria and Tasmania in the south and Queensland in the north. This pathotype poses an increased threat to several wheat varieties (e.g. DS Bennett and LPB Trojan and to a lesser extent Devil, Illabo, DS Darwin, Emu Rock and Hatchet CL Plus), several durum varieties (e.g. DBA Artemis, DBA Bindaroi, DBA Lillaroi, DBA Spes, DBA Vittaroi and EGA Bellaroi), and several triticale varieties (Astute, Joey and Wonambi) (Source: University of Sydney Cereal Rust Report 2020 Vol 17, Issue 2).

Septoria tritici blotch (STB) and late leaf rust control

These two diseases have been very destructive in April sown wheat crops over the last two years in research conducted at the SA CTC Given the yield potential this season, growers in the South East region will need to consider a third fungicide for susceptible cultivars, which is unusual for mainland crops. A “head wash” fungicide where needed has two roles in wheat crops; firstly, it protects the newly emerged head and secondly and more importantly with late leaf rust it “tops up” the protection of the flag leaf that was sprayed earlier at flag leaf emergence (GS39). It is important to remember that these fungicide applications are generally better to be employed at head emergence/early flower rather than late flowering/early grain fill. There are two reasons for this; firstly, fungicides applied after flowering are generally less economic and in danger of breaking withholding periods or timing window restrictions; secondly, some head diseases can only be protected against provided the application is made before the disease is visible in the head e.g. stripe rust in the head.

Last season in SQP Revenue a combination of STB and leaf rust reduced the yield of the untreated crop to under 4t/ha, and with the best two spray programme (GS31 & GS39 – no head wash), yields were increased to just shy of 9t/ha. A 2019 trial at the SA CTC looking at the influence of product and timing revealed a number of important points with regards to disease control and yield response (Figure 1).

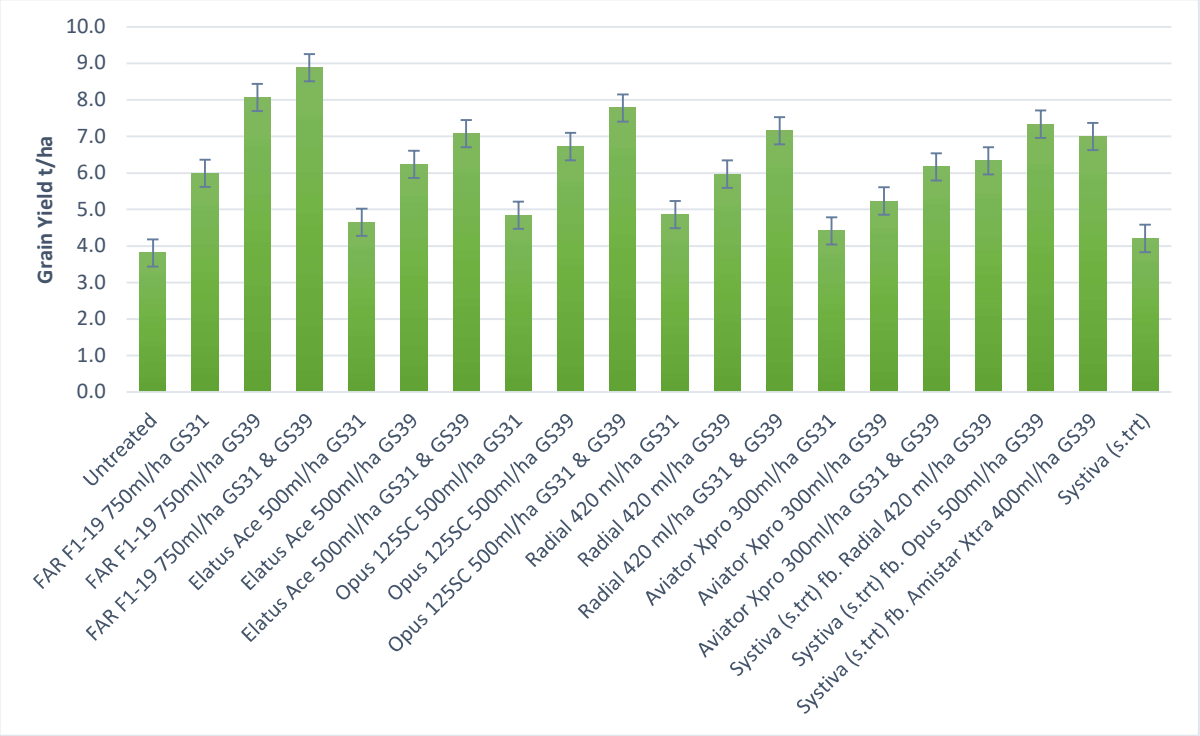


Figure 1. Yield (t/ha) of fungicide treatments – SQP Revenue, SA CTC 2019

FAR Australia gratefully acknowledges the funding support of Nutrien Ag Solutions (formally Landmark) in order to generate this independent research in the region and the collaborative input of SARDI and Brett Gilbertson in managing this research trial.

Note that from the perspective of reducing fungicide resistance risk it is always advisable to avoid repeating the application of the same fungicide product at two consecutive timings. In this case it has been done for experimental reasons to establish the strengths and weaknesses of products.

Key points

- Throughout the trial all fungicide products demonstrated a similar pattern of yield response with the greatest response as a result of two applications.
- Results indicated that GS31 fungicides whilst effective for STB on lower leaves do not control disease on the flag leaf in HRZ long season scenarios.
- When only one fungicide application was made the flag leaf spray was more effective than a single spray at stem elongation, particularly for leaf rust control, however both together were superior.

Clearly not all cultivars are as susceptible as SQP Revenue but be vigilant for active leaf rust, since this can be a major yield robber. The results in 2019 in a susceptible cultivar indicated that yield can be lost by depending on lower rates of fungicide applied at flag leaf (e.g. comparison of Radial 420ml/ha – lower rate on label compared to Opus 500ml/ha). New chemistry such as Radial or Aviator Xpro whilst extremely effective will still be subject to lower levels of persistence in a longer season with higher disease pressure. Therefore, do not rule out a head wash spray where flag sprays have been

made with lower label rates and make sure head wash product has good activity on leaf rust (Figure 2).

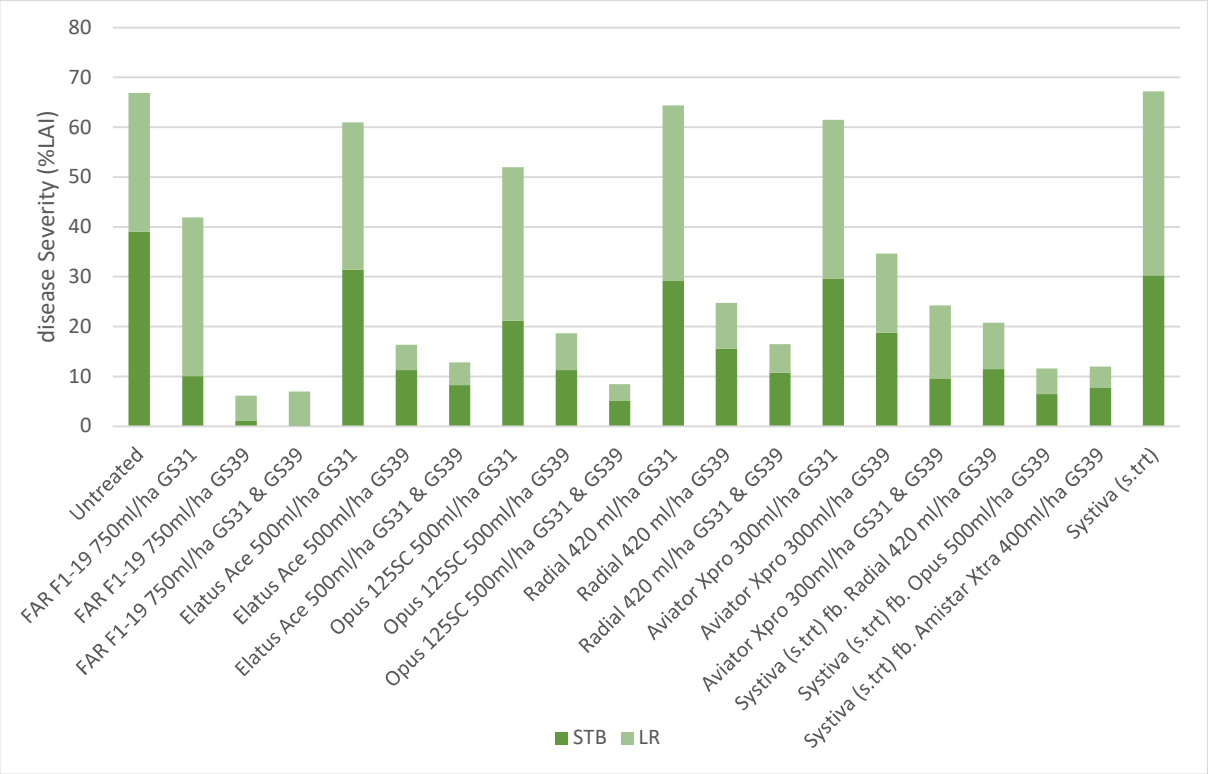


Figure 2. Septoria tritici blotch (STB) and Leaf Rust (LR) disease severity on flag leaf on 5 November at the end of flowering 81DA-A and 42DA-B – SQP Revenue, SA CTC 2019.

Fungicide Resistance

There has been a number of reports of wheat powdery mildew (WPM) head infection in Scepter in NSW and the Vic border region. In terms of fungicide application for this disease and other diseases such as stripe rust head infection remember head wash sprays are most effective shortly after the main stem heads have emerged or just prior to flowering (GS59-61). WPM strains resistant to strobilurin or Group 11 QoI fungicides (azoxystrobin, pyraclostrobin) have now been identified in Victoria, NSW and SA. Where these strains are present strobilurins will not be effective. With the geographic spread of these resistant strains it would be sensible to assume that it is only the triazole component of formulated fungicide mixtures that will be effective for control of the disease. For example, if you were using Radial against WPM on the head it would be the epoxiconazole component of the mixture that would be most effective or if was Amistar Xtra only the cyproconazole component not the strobilurin azoxystrobin. In these cases, remember that the rate of the triazole component would be important to maintain activity against the disease.

"Erect Head" Control in April Sown Wheat

[1]Nick Poole, Kat Fuhrmann, Tracey Wylie[1], [2]Amanda Pearce & Ian Ludwig, [3]Brett Davey
[1]Foundation for Arable Research (FAR) Australia, Bannockburn, Victoria 3331, Australia
[2]SARDI, Struan Research Centre, Naracoorte SA 5271,
[3]Southern Farming Systems, Longford, TAS, 7301

Over the last two seasons there have been a number of observations indicating that shortly before harvest wheat crops at our SA Crop Technology Centre (CTC) and the Hyper Yielding Cereals research site in Tasmania produce a number of erect heads with poor grain fill. These symptoms show up only 3 -4 weeks before harvest, before which the crop can appear generally healthy.

In 2018 it was noted that the cultivars Manning and DS Bennett had lower levels of these erect heads at harvest, suggesting that there was a genetic basis to their protection. There are a number of possible causes (frost effects, poor pollination, stem base disease) that Hyper Yielding Crops (HYC) research is investigating, however it is our understanding that Manning and DS Bennett are the only wheat cultivars with BYDV tolerance that are commercially available in Australia (formerly also MacKellar). In 2019, research was established in Tasmania and SA to look at this in more detail to pin down whether BYDV was linked to erect heads at harvest and whether BYDV tolerant wheat offered a significant advantage. Lower levels of BYDV at the SA CTC led to inconclusive results in 2019 but in Tasmania BYDV tolerance conferred dramatic effects with an early April sown Manning crop compared to a non-tolerant cultivar RGT Relay. In the non-tolerant cultivar where different insecticide regimes (Table 1) were employed, it was clear that where BYDV was fully controlled the number of erect heads at harvest was reduced (Figure 1). The effect of controlling BYDV and erect heads at harvest had significant effects on grain yield (Figure 2) indicating the value of this trait in wheat germplasm grown in the HRZ.

Table 1. Trial treatment list (ml/ha) conducted on BYDV tolerant (cv Manning) and non-tolerant (cv RGT Relay) cultivars.

TRT	Product and Rate (ml/ha)				
	Seed trt	**GS12**	**GS12+2 weeks**	**GS12+4 weeks**	**GS31**
1 & 10					
2 & 11		Karate Zeon 40	Transform 100	Dominex Duo 125	
3 & 12		Karate Zeon 40	Transform 100	Dominex Duo 125	Dominex Duo 125
4 & 13	Pontiac				
5 & 14	Pontiac		Transform 100		
6 & 15	Pontiac		Transform 100	Dominex Duo 125	
7 & 16	Pontiac		Transform 100	Dominex Duo 125	Dominex Duo 125
8 & 17	Pontiac	Karate Zeon 40	Transform 100	Dominex Duo 125	
9 & 18	Pontiac	Karate Zeon 40	Transform 100	Dominex Duo 125	Dominex Duo 125

Please note that the treatment list for this trial was established to identify whether viral issues were the cause of erect heads at harvest. This level of insecticide input was adopted purely for research purposes and presentation of results is not in any way a recommendation.

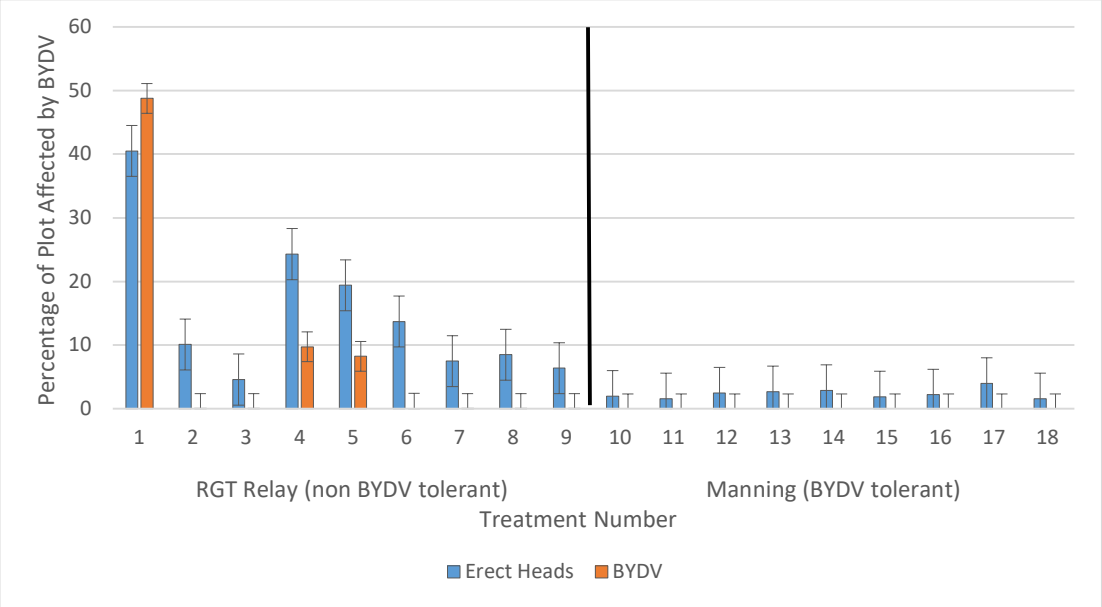


Figure 1. Percentage of plot showing erect heads at crop maturity (GS99) compared to plot BYDV infection, assessed on October 25 (GS37) - HYC Research site, Tasmania 2019.

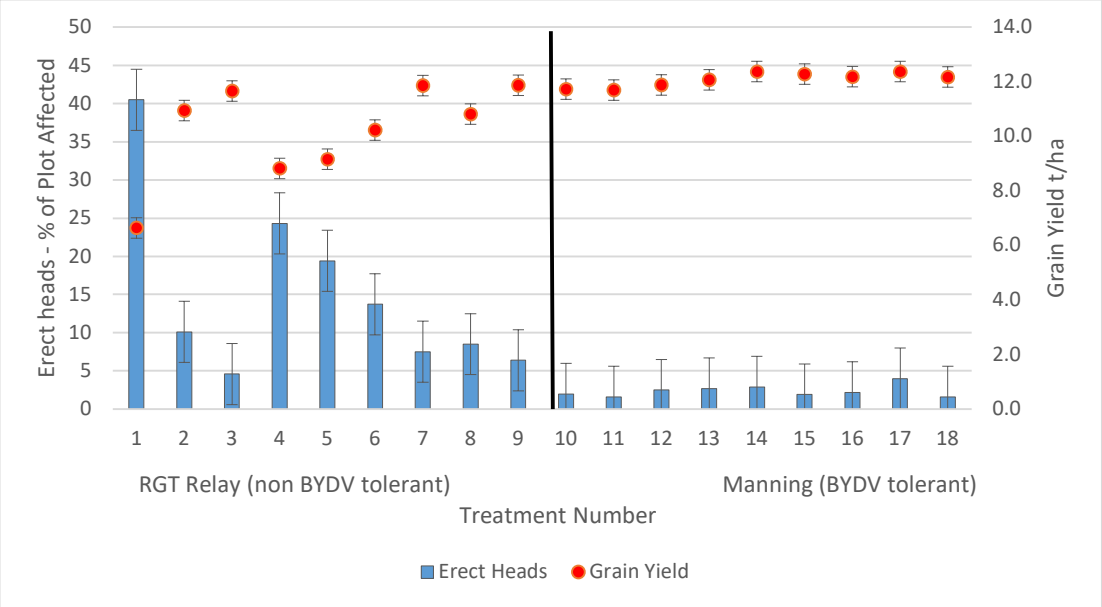


Figure 2. Percentage of plot showing erect heads at crop maturity (GS99) in relation to final grain yield (t/ha) – HYC Research site, Tasmania 2019.

With the introduction of BYDV tolerance into the UK with wheat cultivar RGT Wolverine (first European BYDV resistant cultivar to be released), it is ironic that the only other breeding programmes to achieve this anywhere else in the world was the CSIRO HRZ wheats' programme (now discontinued). The ban on neonicotinoid seed treatments in Europe has made this wheat trait even more important. It is our understanding that the technology used in Europe that has resulted in BYDV tolerance is the same as that

originally developed here in Australia by CSIRO. The CSIRO BYDV tolerance involved translocating a genetic segment from *Thinopyrum intermedium* (a distant relative of wheat*)* containing Bdv2 onto a wheat chromosome, via a research line. Recent advances in molecular markers have fast tracked some of these developments. With the prevalence of the green bridge in HRZ regions this breeding trait is ideally suited to maximising HRZ grain production without the use of insecticides.

N.B. Please note that the high levels of insecticide usage in this experimentation was adopted to assess whether virus transmitted by aphids was indeed one of the principal causes of erect head issues in HRZ wheat production.

SA CROP TECHNOLOGY CENTRE

SA CROP TECHNOLOGY CENTRE 2020
FEATURING HYPER YIELDING CROPS

WC

TOS 1: Wheat Erect Heads Control	TOS 1: Wheat Disease Management x Germplasm	TOS 2: Wheat Germplasm, Environment, Management (GEM)	TOS 2: Wheat Elite Screen	TOS 2: Wheat First Stage Screen	TOS 2: Barley First Stage Screen	TOS 2: Barley Elite Screen	TOS 2: Barley Disease Mgmt x Germplasm	TOS 2: Barley Nutrition	TOS 2: High Protein Barley and Planet Seed Rate	TOS 2: Barley Fungicide Development

1 5 2 4 3

TOS 1: Wheat Nutrition	TOS 1: Wheat Spring 'Reset'	TOS 1: Wheat Fungicide Development	TOS 1: Wheat Germplasm, Environment, Management (GEM)	TOS 1: Wheat Elite Screen	TOS 1: Wheat First Stage Screen	TOS 1: Barley First Stage Screen	TOS 1: Barley Elite Screen	TOS 1: Barley Disease Mgmt x Germplasm	TOS 1: Barley Nutrition	TOS 1: Barley PGR x Harvest date interaction	TOS 1: Barley Novel Management Strategies	TOS 1: Barley Germplasm, Environment, Management (GEM)	TOS 1:Barley Fungicide Development

Car Parking Car Parking Car Parking Car Parking **To the Canola**

NOT TO SCALE

SA CROP TECHNOLOGY CENTRE

TIMETABLE

In-field presentations	Station No.	11:10	11:15	12:30	1:15	1:30	2:00	2:30	3:00	3:30	4:00
Rohan Brill, Brill Ag	Canola	Welcome and opening address - canola	ALL	LUNCH	Welcome and opening address - cereals						Closing address and refreshments
Kat Fuhrmann and Tom Price, FAR Australia	1					1	2	3			
Jen Lillecrapp, McKillop Farm Management Group	2						1	2	3		
Dr Kenton Porker, SARDI	3							1	2	3	
Dr Hugh Wallwork and Dr Tara Garrard, SARDI	4					3			1	2	
Amanda Pearce and Ian Ludwig, SARDI	5					2	3			1	
In-field presentations	**Station No.**	**11:10**	**11:15**	**12:30**	**1:15**	**1:30**	**2:00**	**2:30**	**3:00**	**3:30**	**4:00**

We would be obliged if you could remain within your designated group number throughout the day.

Thank you for your cooperation.

1	GROUP 1
2	GROUP 2
3	GROUP 3

Wheat Germplasm Management April Sown

[1]Nick Poole, Kat Fuhrmann, Tracey Wylie, [2]Amanda Pearce & Ian Ludwig
[1]Foundation for Arable Research (FAR) Australia, Bannockburn, Victoria 3331, Australia
[2]SARDI, Struan Research Centre, Naracoorte SA 5271, Australia

With funding from Landmark in 2018 and the GRDC in 2019, the last two seasons has seen the SA Crop Technology Centre (CTC) establish research looking at the management of early sown wheat planted between the 16 – 18th April. This work has shown that mid-April sowings of popular spring wheat germplasm is too early to maximise potential and that sowing crops in this period is more suited to winter wheat germplasm, since spring wheat cultivars suffered significant frosting. At the SA CTC in 2020, thanks to the GRDC's funding under the new Hyper Yielding Crops project, we have been able to introduce a mid-May sowing date in order to assess the best combinations of management for both mid-April and mid-May sowing.

Influence of germplasm on yields, final harvest dry matter and harvest index

In 2019, and for the first time at this research site, two cultivars yielded just over 11 t/ha, these were the red grained winter feed cultivars RGT Accroc and Anapurna (Table 1). Encouragingly both cultivars topped the same germplasm management trial in 2018 (Table 2). In both seasons these cultivars produced final crop dry matters over 20t/ha (approximately 22t/ha in 2019 and 25t/ha in 2018). In 2019 although Conqueror and Tabasco produced higher harvest dry matters they had significantly lower grain yields. The indications were that the later flowering date (11th November) and physiological maturity of Conqueror and Tabasco significantly reduced the harvest index (proportion of the final dry matter partitioned into grain) compared to the highest yielding cultivars which flowered in later October (Accroc & Anapurna had a harvest index of 54-55% & Conqueror & Tabasco 42-44%) even though their final harvest dry matters were larger.

Table 1. 2019 Grain yields (t/ha) under three management levels

	Management Level								
	High Input		**Standard Input**		**"Grazed" Input**		**Mean**		
Cultivar	**Yield t/ha**		**Yield t/ha**				**t/ha**		
Manning (Winter control)	10.44	c-f	9.88	fgh			9.86	fgh	**10.06**
Beaufort (Spring control)	6.74	l	5.35	m			4.60	n	**5.56**
DS Pascal (Spring)	5.01	mn	4.94	mn			4.74	mn	**4.90**
Anapurna (Winter)	11.20	a	10.86	a-d			9.98	efg	**10.68**
Conqueror (Winter)	9.35	hi	8.71	jk			8.58	jk	**8.88**
RGT Accroc (Winter)	11.07	ab	10.93	abc			9.75	gh	**10.58**

RGT Calabro (Winter)	10.29	d-g	10.58	b-e			8.62	jk	**9.83**
Tabasco (Winter)	10.08	efg	10.09	efg			8.93	ij	**9.70**
Trojan (Spring)	3.73	o	3.51	o			3.14	o	**3.46**
DS Bennett (Winter)	9.03	ij	8.16	k			8.29	k	**8.49**
LSD Cultivar p = 0.05	0.36 t/ha				P val		<0.001		
LSD Management p=0.05	0.56 t/ha				P val		0.011		
LSD Cultivar x Man. P=0.05	0.62 t/ha				P val		<0.001		

Table 2. 2018 Grain yield (t/ha) under three management levels

	Management Level						
	High Input		**Standard Input**		**"Grazed" Input**		**Mean**
Cultivar	**Yield t/ha**		**Yield t/ha**		**Yield t/ha**		**t/ha**
Manning (Winter control)	9.23	efg	9.33	efg	8.36	h	**8.97**
Beaufort (Spring control)	7.83	hi	7.53	i	8.04	hi	**7.80**
DS Pascal (Spring)	5.27	l	6.02	jk	6.43	j	**5.91**
Anapurna (Winter)	10.61	a	10.61	a	9.12	fg	**10.11**
Conqueror (Winter)	9.13	fg	9.05	g	9.25	efg	**9.14**
RGT Accroc (Winter)	10.49	ab	10.52	ab	9.27	efg	**10.09**
RGT Calabro (Winter)	10.23	abc	10.05	a-d	8.36	h	**9.55**
AGTW0002 (Winter)	9.53	d-g	10.44	ab	9.67	c-f	**9.88**
Trojan (Spring)	5.49	kl	5.59	kl	6.23	j	**5.77**
DS Bennett (Winter)	10.01	bcd	9.81	cde	9.58	d-g	**9.80**
LSD Cultivar p = 0.05			0.33 t/ha		**P val**		<0.001
LSD Management p=0.05			0.88 t/ha		**P val**		0.450
LSD Cultivar x Man. P=0.05			0.57 t/ha		**P val**		<0.001

Influence of Management

Higher levels of input include additional N, fungicides and split timings of PGRs. In both seasons the indications were that neither Accroc or Anapurna required high levels of input to achieve results over 10t/ha, with yields under standard input showing no statistical difference from yields under high input. This is primarily because both cultivars represent a step forward in genetic *Zymoseptoria tritici* (Septoria tritici blotch (STB) resistance compared to cultivars such as Revenue or Beaufort. However with both these cultivars it will be important to put in place robust PGR programmes in fertile HRZ scenarios where yield potentials of 7 -11t/ha exist as neither Accroc or Anapurna are particularly stiff strawed.

In terms of overall N input, it is important to recognise that high yields are not purely dependent on artificial fertiliser. In the Hyper Yielding Cereals project in Tasmania it is interesting to note that yields of 15t/ha were supported by a history of pasture legumes and pulse crops and no more than 200-225kg N/ha applied as urea, indicating that the fertility of the farming system is vitally important to achieving high yields. See Tables 3 and 4 for the levels of input and available soil N reserve described for the yield achieved in Tables 1 and 2.

Table 3. Details of the three management levels (kg, g, ml/ha).

Plant population:		**180 seeds/m^2 (150 plants/m2 target) - all three managements**		
		Standard Input (grazed*)	**Standard Input**	**High Input**
Grazing:		✓	----	----
Seed treatment:		Vibrance/Gaucho	Vibrance/Gaucho	As standard + Systiva
Basal Fertiliser:	16 April	145kg MAP	145kg MAP	145kg MAP
Nitrogen:**	11 July – 1 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	16 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	26 August – 30 August	87 kg Urea (40 N)	87 kg Urea (40 N)	87 kg Urea (40 N)
	3 September – 9 September	---	---	87 kg Urea (40 N)
Total N Applied:		120 N	120 N	160 N
PGR:**	30 Jul – 3 September		Mod. 200ml + Errex 1.3L	Mod. 200ml + Errex 1.3L (split GS30 & GS32)
Fungicide:**	GS31-32	Prosaro 300ml	Prosaro 300ml	Opus 500ml
	GS39	Radial 840ml	Radial 840ml	Radial 840ml
	GS65	Prosaro 300ml	Prosaro 300ml	Prosaro 300ml

All other inputs of insecticides and herbicides were standard across the trial. Mod. – Moddus Evo

** Grazed crops were Mechanically defoliated, **Timings of PGRs and fungicides were adjusted to take account of the differences in spring (s) and winter wheat (w) phenology (development).*

Available Soil Nitrogen (10th April) – 445.1 kg N/ha (0 – 60cm) prior to sowing

Table 4. 2018 Details of the three management levels (kg, g, ml/ha).

Plant pop'n:		**180 seeds/m² (150 plants/m2 target) - all three managements**		
		Standard Input (grazed*)	**Standard Input**	**High Input**
Grazing:		✓	----	----
Seed treatment:		Rancona Dimension/Gaucho	Rancona Dimension/Gaucho	As standard + Systiva
Basal Fertiliser:	18 April	80kg MAP	80kg MAP	80kg MAP
Nitrogen:	1 August	----	----	87 kg Urea (40 N)
	16 August	130 kg Urea (60 N)	130 kg Urea (60 N)	130 kg Urea (60 N)
	29 August	130 kg Urea (60 N)	130 kg Urea (60 N)	130 kg Urea (60 N)
	30 August	---	----	87 kg Urea (40 N)
PGR:**	1 – 28 August	Mod. 200ml + Errex 1.3L	Mod. 200ml + Errex 1.3L	Mod. 200ml + Errex 1.3L (split)
Fungicide:**	GS30	----	----	Opus 500ml
	GS31-32	Prosaro 300ml	Prosaro 300ml	Prosaro 300ml
	GS39	Radial 840ml	Radial 840ml	Radial 840ml
	GS65	Prosaro 300ml	Prosaro 300ml	Prosaro 300ml

All other inputs of insecticides and herbicides were standard across the trial. Mod. - Moddus

** Grazed crops were mechanically defoliated, **Timings of PGRs and fungicides were adjusted to take account of the differences in spring and winter wheat phenology (development). Split applied GS30 & 32, single application at GS31-32.*

Available Soil Nitrogen (1st August) – 132 kg N/ha (0 – 60cm) prior to fertiliser application

Hyper Yielding Barley

Raising yield and its stability from season to season

The best performing wheats are yielding higher than barley in cool finishing high rainfall zones. In field trials, wheat grain yields are consistently greater than 10t/ha, this has not been the case for barley. Barley has greater season-to-season variability in yield, and unlike wheat, the faster developing spring barley varieties suited to low – medium rainfall zones such as Rosalind and RGT Planet are the highest yielding.

The HYC centres have created a platform in order to develop a new barley system to address the challenges and constraints outlined in Table 1. Yield increases in barley are possible but are likely to come from a combination of new management and genetic solutions such as different phenology patterns, row types, improved and sustainable use of fungicides, plant growth regulation (chemical and defoliation), increased nutrition and sowing date.

Table 1. Summary of the main challenges and key comparisons in our current understanding of spring barley versus winter barley in hyper yielding environments

Crop traits and challenges	Spring Barley	Winter Barley
Phenology for Mid-April sowing	Poor	Good
Phenology for Mid-May Sowing	OK	???
Disease package	Poor	Good
Biomass production for grazing	Poor	Good
Biomass production at flowering	OK	Good
Conversion of biomass into grain yield	Good	Poor
Lodging (stand ability)	OK	Poor
Headloss risk	OK (variety dependent)	Poor
Grain yield	OK (variable)	OK (variable)
Grain Quality	Good	???

Maximising spring barley yields:

A major constraint to many current spring varieties (ie Rosalind and Planet) is poor disease resistance, and as with most faster spring types they do not capture all the resources (water, light) to build adequate biomass for 10t/ha yields and are more prone to yield loss from frost than slower developing varieties. However, they do convert more of their biomass into yield (high harvest index) and currently yield similar or greater than slower developing barley lines that accumulate more biomass. It may be possible to better adapt current spring varieties to the environment with improved management of disease and techniques such as defoliation to delay flowering.

Raising yields beyond spring barley

Raising the yield frontier in barley is reliant on increasing biomass (which increases grain number potential), however increased grain yield will only be realised if more of that extra biomass is converted into grain yield. While grain number can be manipulated with nitrogen and plant density, the simplest way to increase it is to lengthen the crop life cycle. This can be achieved with sowing date and genetics such as sowing a slower developing variety early.

Developing Winter Barley, is it possible?

Unlike wheat, there are no winter barleys commercially available suitable for the HRZ. We have introduced a series of new 2 row winters from Europe into the HYC program and for the first time included 6 row winters. This is a new way to increase grain number beyond the current two rows and spring barleys. 6 row winters are faster to mature and have a plant type more similar to wheat. Head loss and grain size may be an issue, but this is largely unknown.

Previous results have shown when sowing before the 1st of May slower developing 2 row winter genetics perform similar or less than the best performing spring barley sown at the same time. The winter genetics to date have had excellent disease packages and accumulated more biomass but were more prone to lodging and head loss. This opens opportunity for canopy management to improve harvest index and yield utilising tools such as defoliation, PGRs, and delayed N inputs.

For the winter barley system to be successful, it is likely to require vastly different management to spring barley.

Hyper Yielding Canola

The main aims of the canola research in the Hyper Yielding Crops project is to determine how best to build crop yield potential, convert biomass into grain (harvest index) and protect crops from losing yield from disease (mostly blackleg and sclerotinia). The research focus in 2020 includes:

- Cultivar choice – a focus on identifying elite cultivars within variety groups. Choosing the right cultivar in Hyper Yielding Crop zones is imperative as this will have implications for biomass accumulation, conversion of biomass to grain and disease management. Also, there are major differences in standability of cultivars.
- Crop nutrition – a focus on managing nitrogen fertiliser so that the crop grows enough biomass for a high yield potential and at the right time to ensure a high harvest index.
- Disease management – a focus on fungicide management for diseases (especially blackleg and sclerotinia) and cultivar resistance (especially for blackleg).

An important component of getting the best out of a canola variety is to ensure it flowers at the right time. A challenge for south-east South Australia is that optimum flowering dates for canola are not clearly defined. 20 Tips for Profitable Canola (https://grdc.com.au/resources-and-publications/all-publications/publications/2019/20-tips-for-profitable-canola-south-australia) reports an optimum start of flowering date of 28 July for Naracoorte and 11 August for Bordertown – but the abiotic conditions of a coastal environment such as Millicent are quite different. The graph below shows the flowering date of spring cultivars sown on 8 May at Millicent in 2020. Flowering date is driven mostly by temperature and is also regulated by vernalisation, even in spring cultivars. Slower developing cultivars generally have a vernalisation 'handbrake' which slows them down when sown early into relatively warm conditions. It is usually colder when sowing later (e.g. May instead of April) so the vernalisation 'handbrake' will be released earlier. Although Millicent has cold daytime temperatures in winter, night-time minimums are warmer than further inland, so cultivars develop rapidly, especially Nuseed Diamond which has no vernalisation response. The Hyper Yielding Crops project will determine the optimum cultivar types for a range of high yielding environments across Australia.

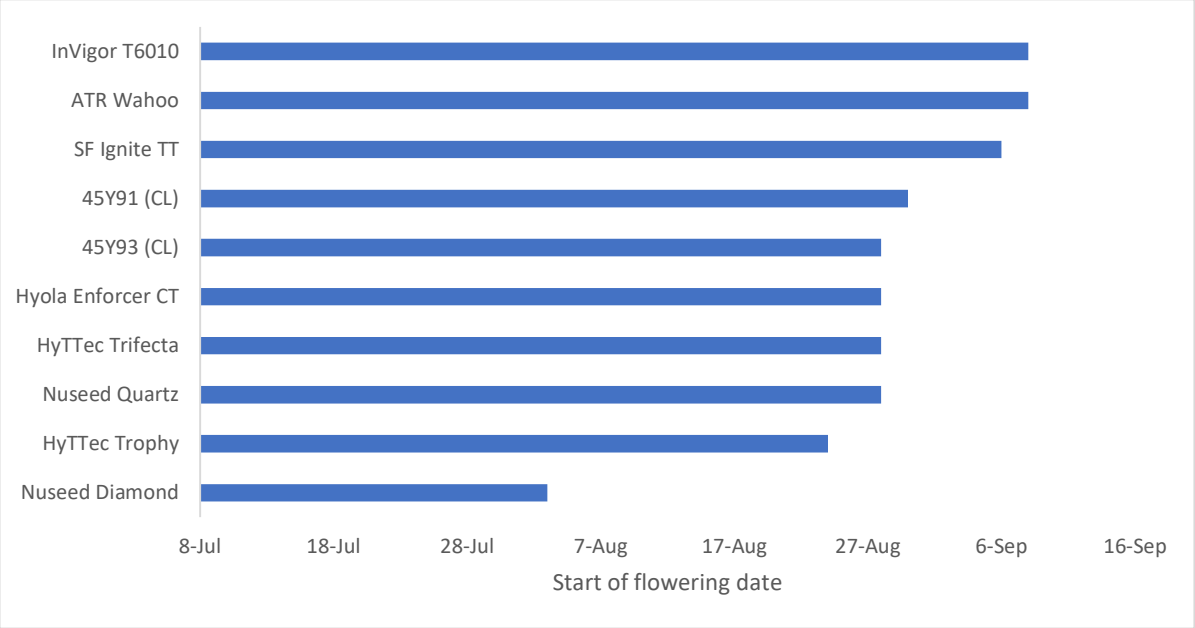
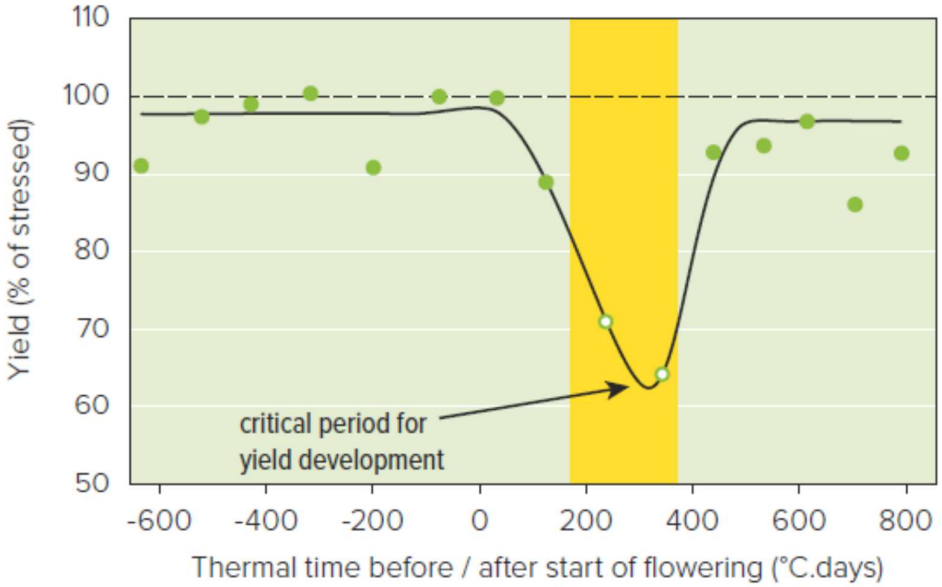


Figure 1. Flowering date of spring cultivars sown on 8 May at Millicent in 2020.

Once flowering date is optimised, it is important to apply crop nutrition so that growth is maximised through the 'critical period'. The critical period occurs roughly between one and four weeks after the start of flowering and is the time when grain number is set (see below image). Generally grain number is a more important determinant of grain yield than grain size. Research throughout the Hyper Yielding Crops project will focus on determining crop nutrition strategies (especially for nitrogen) that ensure that there is ample N available for the crop through the critical period to maximise yield potential.



**Source: 20 Tips for Profitable Canola*

Figure 2. Critical period in development (°C days) for canola grain number production.

2020 SA Crop Technology Centre, Millicent, SA

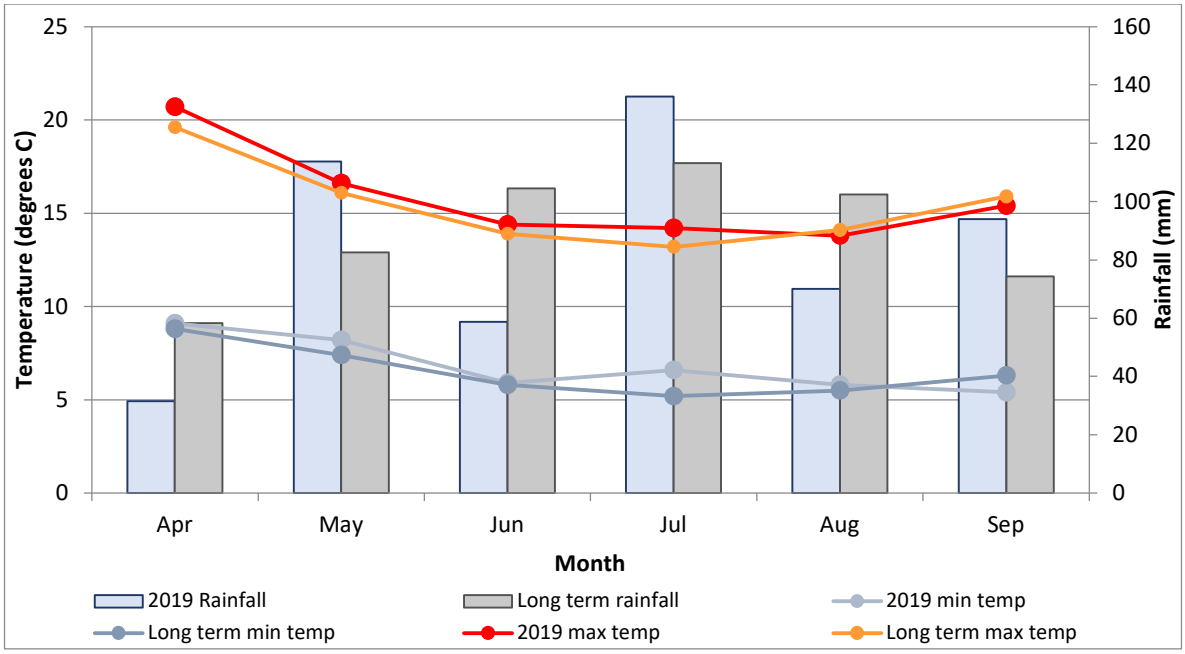


Figure 1. 2020 growing season rainfall and long-term rainfall (1877-2020) (recorded at Millicent), 2020 min and max temperatures and long-term min and max temperatures (1941-2020) (recorded at Mount Gambier airport) for the growing season so far (April-September). *Rainfall April to October 12= 576.2mm.*

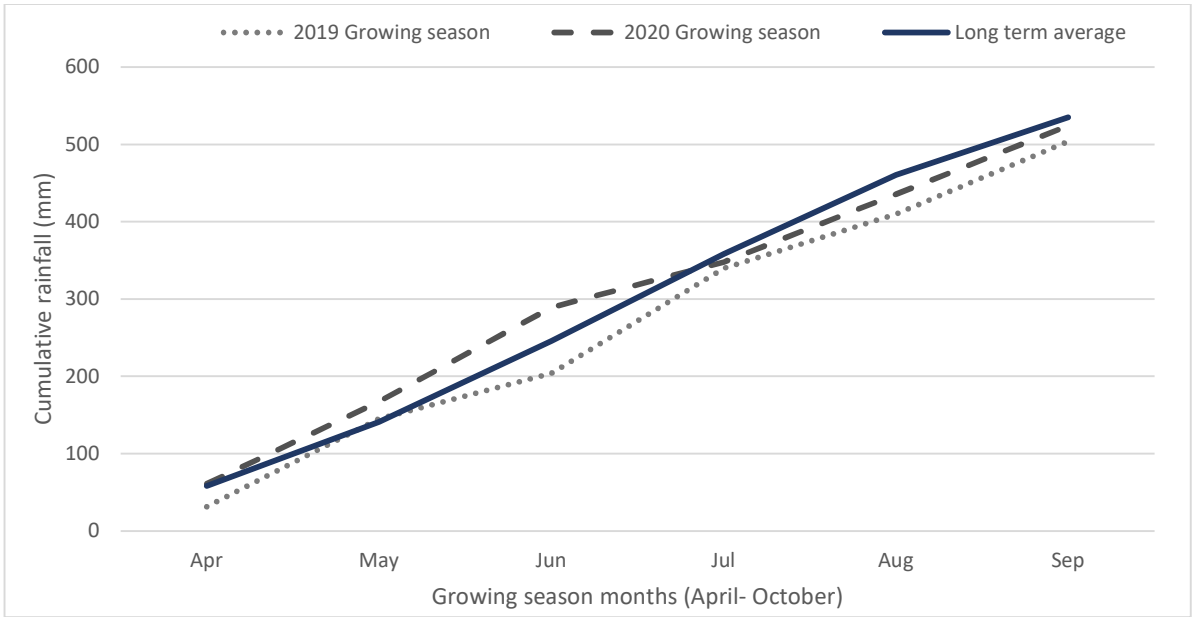


Figure 2. Cumulative growing season rainfall for 2019, 2020 and the long-term average for the growing season so far (April- September).

COVID–19 Event Operating Protocols

For the health and safety of all staff and field day attendees, please ensure that you read and comply with the following COVID-19 operating protocols, in accordance with current SA Health Orders.

- You have completed and signed an event COVID-19 Self Declaration form upon arrival.
- You understand and will adhere to the SA Government and Health Department COVID-19 health orders. Hygiene and social distancing requirements are extensively encouraged around the site.
- All participants are strongly requested to advise FAR Australia immediately should they feel or become unwell within 14 days of attending this event.

Our nominated First Aid responder for the event is Kat Fuhrmann 0447 025 055.

Social Distancing and Hygiene
Please ensure that you continue to maintain a minimum of 1.5m between individuals.

- We are applying the minimum 2sq. meters per person.
- Hand sanitiser will be available at the entrance / exit to the site and at other various well marked locations around the site.

Field Day Access
Please ensure that you only enter and exit, within your vehicle, via the designated gate(s).

Thank you for your understanding. We appreciate your attention and co-operation in helping us to deliver an educational and safe event.

FAR Australia

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