NEW SOUTH WALES HYC
RESEARCH CENTRE

Thursday 8 October 2020

1:30pm – 4:30pm

Wallendbeen, NSW

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 NSW 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.

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 NSW Health Orders.

- You have completed and signed an event COVID-19 Self Declaration form upon arrival.
- You understand and will adhere to the NSW Government and Health Department COVID-19 health orders. Hygiene and Social Distancing requirements are extensively promoted around the Site.
- All participants arrive, tour and then leave. There is to be no socialising on the site after the event.
- All participants are asked to bring their own food and refreshments.
- 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 4sq. meters per person and maximum attendance of 60 people for the event.
- All attendees are recommended to bring their own sanitiser, mask and hygiene products. FAR Australia will also have a supply of hand sanitiser on the day.
- 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

WELCOME TO THE NEW SOUTH WALES HYPER YIELDING CROPS FIELD DAY

On behalf of the project team, I am delighted to welcome you to the 2020 NSW Hyper Yielding Crops (HYC) project Field Day here at Wallendbeen.

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 in no way like southern NSW, 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 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. Both NSW research sites were mid-late April sown and as a result we are screening both winter and spring germplasm in order to establish whether longer season germplasm has any fit in a southern NSW 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. Combined with a return to a wetter season we also have a strong focus on disease control, since fungicide technology along with fungicide resistance has developed considerably since the major stripe infections of 2003-2005 in the region.

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 (see contact details in this booklet).

What's happening on the NSW HYC Centre in 2020?
Hyper Yielding Crops (HYC) Research Centre this season has both a canola and a wheat focus and is exploring germplasm and agronomic input:

- Elite germplasm screening - the phenology, disease resistance and standing power of new canola and wheat 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 April?
- In addition, the project team is looking at how high you can push nutrition in the higher yielding regions? For example, in 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 important to meet the needs of the crop as well as the fertiliser applied.

Speakers at today's event
The event will feature a range of research trial demonstrations in canola and wheat and a line-up of speakers who will discuss various aspects of the climate effect on productivity in NSW, improved germplasm and agronomy, fungicide management and new varieties.

We are fortunate to have secured the following speakers who will share their expertise in covering topics relevant to NSW farming systems:

John Kirkegaard, CSIRO (keynote speaker)
Rohan Brill (HYC Canola crop lead), Brill Ag
Charlie Baldry (NSW HYC Host and Focus farmer)
Chris Duff, Delta Ag
Kat Fuhrmann, FAR Australia
Tom Price, FAR Australia

Should you require any assistance throughout the day, please don't hesitate to contact a member of the FAR Australia and Brill Ag 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. Have a great day and we look forward to seeing you again at future project events.

Finally, I would like to thank the GRDC for investing in the Hyper Yielding Crops project, Charlie Baldry for hosting us on the farm and to our speakers for their attendance today.

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 have been set up by John Kirkegaard working with industry and 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)
John Kirkegaard – HYC Focus Farm projects & HYC award yield potentials, CSIRO (john.kirkegaard@csiro.au)

Increase the yield potential of canola in Hyper Yielding Crops

Rohan Brill, Brill Ag

The main aim of 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 for disease management.
- 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 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.

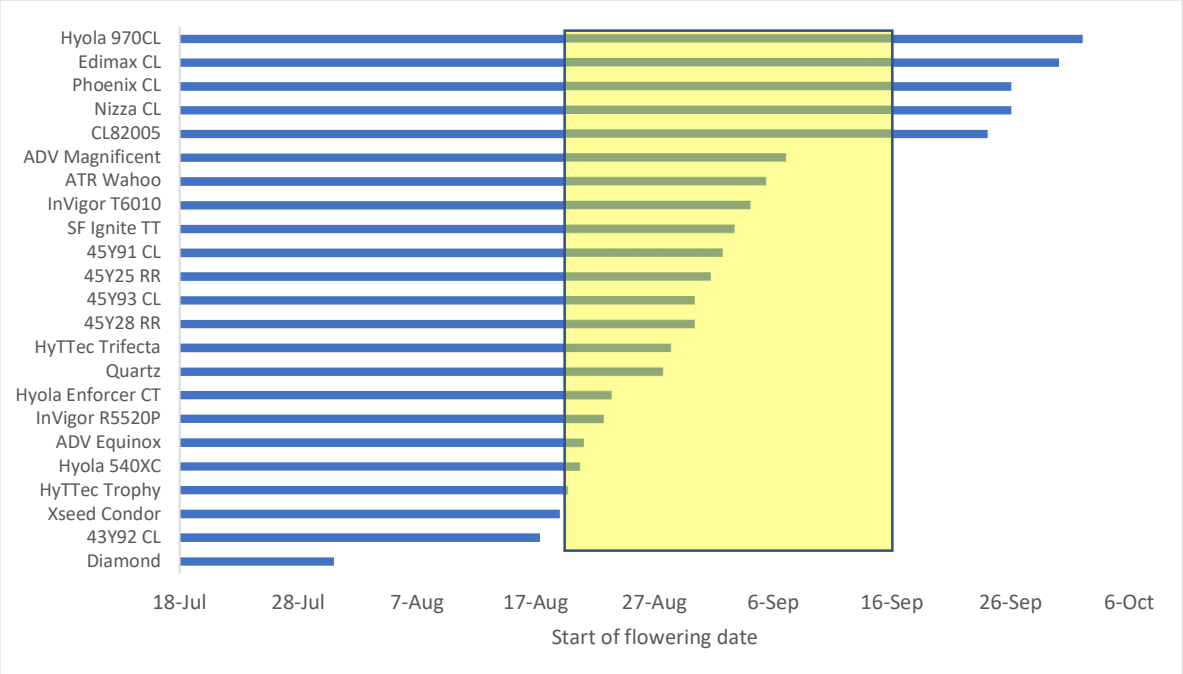

Figure 1. Flowering date of winter and spring cultivars sown on the 17 April at Wallendbeen in 2020. Overlaid onto it is the optimum start of flowering window that has been defined for nearby Young.

A range of nitrogen rates and timings was applied in a trial to 45Y28 RR. Biomass was measured at the start of flowering. Early applications (135 and 225 kg/ha at sowing) had the highest biomass at flowering (>8 t/ha) while split and flowering applications had biomass closer to 7 t/ha. The aim is to determine if nitrogen applied at flowering will be used more efficiently by the plant as the flowering stage is the critical period for crop growth.

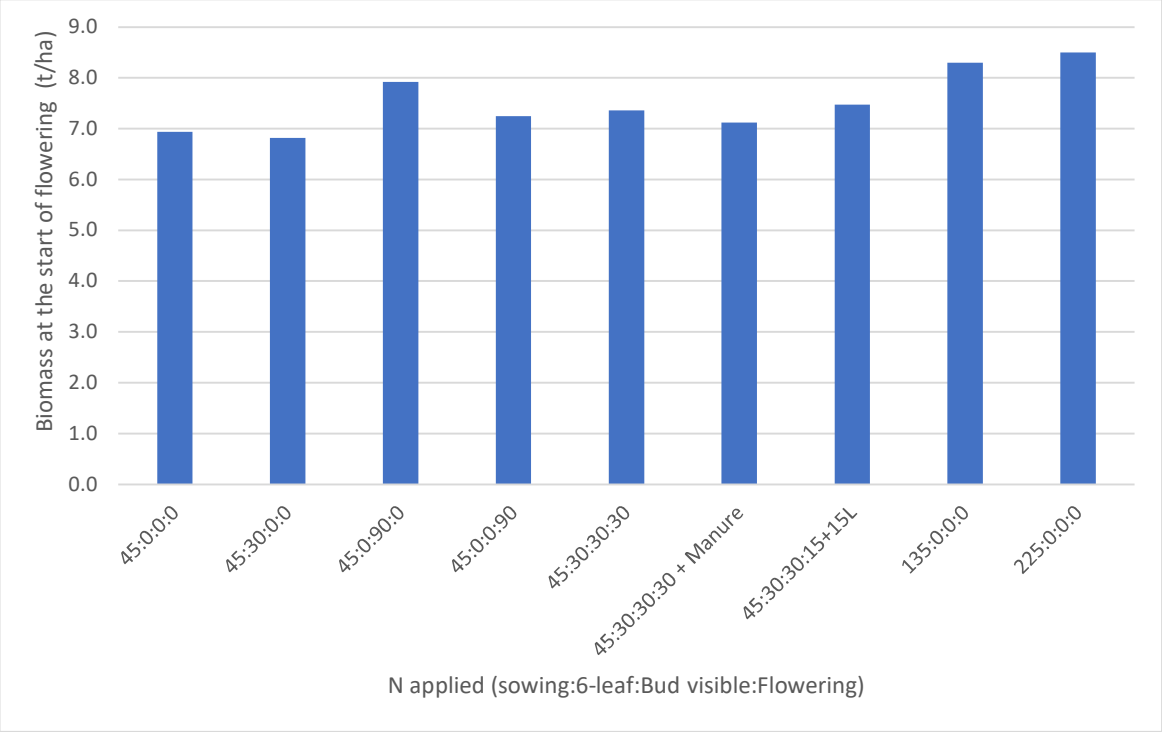

Figure 2. N applied (sowing:6-leaf:Bud visible:Flowering).

Drivers of yield potential in crops

John Kirkegaard, CSIRO Agriculture and Food, Canberra

The Hyper-Yielding Crops Project has a specific focus on the factors that determine the potential crop yield in high yielding environments, and this is not just rainfall. Some of the highest yielding areas of the world (in northern England and NZ with 16 t/ha wheat, 6 t/ha canola) share similar annual rainfall to parts of Australia. So - what are the key factors?

(1) Phenology – fitting the crop to the growing season
- Achieve the optimum flowering time to minimise stress in the "critical period"
- Critical period = when grain number is set = yield potential
  For wheat, 3 weeks before anthesis
  For canola and legumes, 1-3 weeks after start of flowering
- Sowing and harvest to maximise season length

(2) Capture resources to grow enough biomass to hit yield potential
- Light and temperature (=growth)
- Water
- Nitrogen

(3) Protect the potential – manage constraints (weed, diseases, lodging)
- Agronomy, economics, risk

At Wallendbeen, the optimum flowering periods that minimise stress in the critical period in the long-term are:
For wheat: ~mid-October
For canola: ~end August

This timing reduces the combined risk of heat, frost, drought on crops in the critical period.

Selecting varieties and sowing dates that achieve these flowering periods will maximise the yield potential on average, although in specific seasons the optimum will move around.

Managing to reduce water and N limitation in the critical period also maximises grain number and yield potential.

<u>Water supply and yield potential.</u>
- The most efficient wheat crops are able to grow 22 kg/ha grain for every mm of water used above a minimum evaporation of 60mm.
- The most efficient canola crops are able to grow 14 kg/ha grain for every mm of water used above a minimum evaporation of 60mm.

For Wallendbeen the average annual rainfall is 620mm; April-November is 432mm December to March (fallow) rainfall is 188mm (30% can be stored = 56mm).

- On average, potential yield for wheat can be estimated as [432 + 56 - 60] x 22 = **9.4 t/ha.**
- On average, potential yield for canola can be estimated as [432 + 56 - 60] x 14 = **6.0 t/ha.**

Nitrogen supply and yield potential

- For every tonne/ha of wheat yield the crop needs to see 40 kg N/ha.
- For every tonne/ha of canola yield the crop needs to see 80 kg N/ha.

So a 10 t/ha wheat crop or a 5 t/ha canola crop needs **400 kg/ha N** supplied.

What's been achieved experimentally at Wallendbeen previously?

In 2001 to 2003 canola experiments on this farm demonstrate the predicted potentials using the above rules of thumb are possible (Kirkegaard et al., 2006).

Year	History	Fallow (mm)	GSR (mm)	Soil N (kg/ha)	N fert (kg/ha)	Actual Yield (t/ha)	Water limited yield (t/ha)	N limited yield (t/ha)
2001	P-P-P-P	180	370	382	20	**5.5**	**5.1**	**6.3**
2002	C-W-C-W	167	271	77	102	2.8	3.6	2.9
2003	C-W-C-W	184	409	192	104	2.8	5.7	4.3

*Assume mineralised N was 100 kg/ha after pasture (2001) and 50 kg/ha after crops.

In 2001 (following pasture) the measured yield (5.5 t/ha) exceeded the predicted water limited potential based on rainfall (possibly due to deeper water access on these deep soils) but approached the N-limited potential due to plentiful N following pasture.

In 2002 the crop was well below the water-limited potential, but matched the N-limited potential, as N was low after a series of 4 crops and only 102 kg N were added. Thus the crop only yielded up to the N applied.

In 2003 there was MORE water available than in 2001, but there was only half the yield. The crop was apparently not water limited or N limited, so other factors (frost, disease, others?) must have played a role.

Stripe rust management in wheat

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

Stripe rust caused by the pathogen *P. striiformis var. tritici* has been more problematic as 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).

The situation with stripe rust is reminiscent of the 2003 – 2005 seasons in southern NSW when the wheat cultivar H45 was widely grown and foliar fungicides became more widely used in the region. The following key points and data tables illustrate that much of what we learnt about stripe rust control in the early part of new millennium is still relevant today. The following key points are a summary of some of what was learnt out of a GRDC project run between 2012 – 2017 when FAR Australia collaborated with the University of Sydney at Cobbitty in NSW.

Using foliar fungicides as part of an Integrated Disease Management (IDM) strategy to control stripe rust

KEY POINTS

- Use fungicides as the final part of an Integrated Disease Management (IDM) strategy after incorporating genetic resistance and cultural control.
- The key timings to consider foliar fungicide application are in the stem elongation period (GS30-39), since these timings will maximise green leaf retention in the top four leaves of the canopy.
- Fungicides applied at early stem elongation (GS30-32) provide good protection of leaves in the lower canopy, particularly flag-2 and flag-3, whilst fungicides applied at flag leaf emergence (GS39) provide good control of disease in the top of the canopy, particularly the flag and flag-1 leaves.
- The specific need for fungicide application will depend on growth stage at the onset of disease, cultivar resistance, whether ‘at sowing’ measures (e.g. flutriafol) have been used and predicted climatic conditions for the coming weeks.
- In moderately susceptible cultivars fungicides applied at GS30-32 or at sowing do not prevent reinfection of leaves in the upper canopy later in the season if

conditions for disease development remain conducive. This potentially means a further fungicide application may be warranted at flag leaf emergence (GS39).

- Adopting cultivars with greater levels of genetic resistance (i.e. rated MR-MS) rarely results in the application of more than one fungicide being economical and allows greater flexibility in fungicide timing during the stem elongation period (GS30-39). It is not economical to apply fungicides in varieties rated MR or better.
- Foliar fungicides only protect the leaves that have emerged at the time of application and are less effective where leaves are already visibly infected. That is, fungicides have better protectant than curative activity.
- A prophylactic fungicide application at full head emergence (GS59) will provide partial control (50-75%) of stripe rust head infections, but in most cases are applied too late to protect against infection of the important top four leaves.
- A greater reduction in the extent of head infection can be achieved by sowing varieties with higher levels of genetic resistance and/or controlling infection in the canopy prior to head emergence and flowering.
- The overall yield response to fungicide application is smaller in varieties with higher levels of genetic resistance which limits differences in the efficacy of different products and generally makes application uneconomical.
- There was no evidence that newer fungicide mixtures containing a triazole (epoxiconazole) in combination with a strobilurin or Succinate Dehydrogenase Inhibitors (SDHI's) active ingredient provided a significant improvement in disease control over epoxiconazole or tebuconazole alone.
- Fungicide applications have not produced economic returns in wheat crops with a yield potential of 4-6 t/ha when the severity of stripe rust infection on the flag leaf in untreated plots was only 10% or less at the start of grain filling. That is, the level of disease controlled was not enough to warrant protection through application of a fungicide.

To assist with the interpretation of these key points it is important to remember at which approximate development stage the key leaves in the cereal crop canopy emerge.

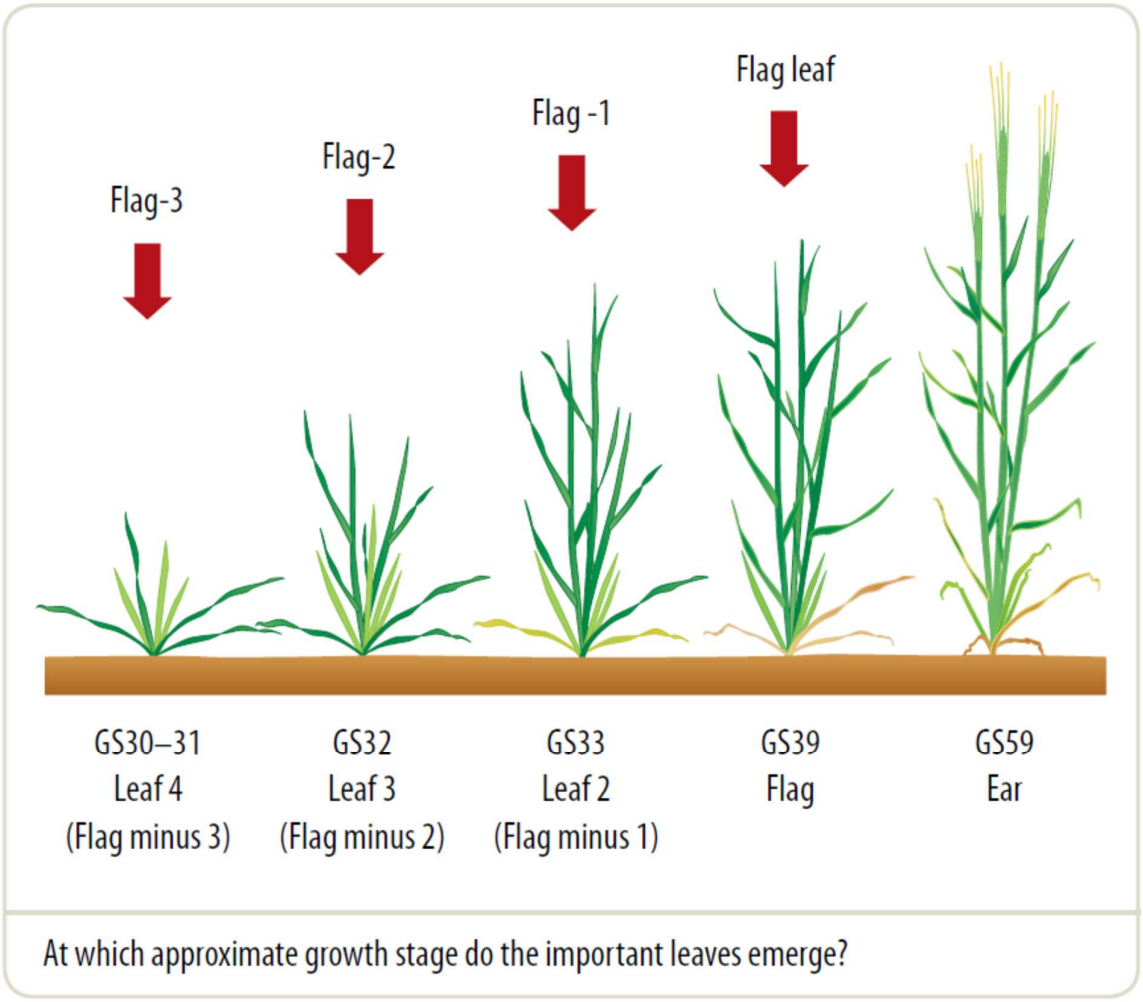

Figure 1. Diagram of growth stage and the corresponding leaf emergence.

2020 Fungicide performance (Provisional mid-season results – caution!)

At sowing measures for stripe rust control

In irrigated FAR Australia trials funded by the GRDC this season at Finley, results would indicate that flutriafol is still performing strongly as an at sowing measure on the fertiliser giving 80-90% control of stripe rust. This active ingredient was shown to give good control up to flag leaf in 2003-2005 and in 2020. Provisional results on the durum DBA Vittaroi are indicating better control than that observed with Jockey or Systiva seed treatments.

Foliar Fungicide performance

In southern Victoria, using the variety DS Bennett, foliar fungicides have been tested at GS31 and GS39 using two spray approaches. In these trials epoxiconazole used alone has performed strongly against stripe rust and as indicated in previous work conducted by FAR Australia working with Sydney University there has been no advantage to newer fungicide mixtures containing a triazole in combination with a strobilurin or Succinate Dehydrogenase Inhibitors (SDHI's) (Table 1). We await the late season assessments and

yield results to see if the fungicide mixtures will confer other green leaf retention benefits. It's important to emphasise that these are interim results.

Table 1. Stripe rust control with foliar fungicides assessed 23 September 2020 at booting GS39-45 cv. DS Bennett following application at GS31 and 39 – Gnarwarre, Victoria.

			% Leaf area infected (Active pustules & associated necrosis)							
Product	**Rate**	**Active ingredients**	**Flag - 1**				**Flag-2**			
	mL/ha	**(g ai/ha)**	**Active**		**Necrosis**		**Active**		**Necrosis**	
Untreated			0.7	a	7.6	a	4.9	abc	17.4	a
Radial	600	Epoxiconazole 45g + azoxystrobin 45g	0.0	bc	1.6	de	1.6	e	6.7	h
Soprano 500	125	Epoxiconazole 62.5g	0.1	bc	2.3	cde	2.3	de	6.2	h
Aviator Xpro	300	Prothioconazole 45g + bixafen 22.5g	0.1	bc	1.8	de	6.3	a	10.6	cde
Aviator Xpro	500	Prothioconazole 75g + bixafen 37.5g	0.0	c	1.3	e	5.2	ab	6.9	gh
Tazer Xpert + Banjo	500	Epoxiconazole 15.6g + azoxystrobin 40g	0.1	bc	2.6	cde	3.4	b-e	8.8	e-h

Figures followed by different letters are determined to be statistically different at a confidence level of 95%.
A – adjuvant (Banjo)

2020 Hyper Yielding Crops Site, Wallendbeen, NSW

NSW

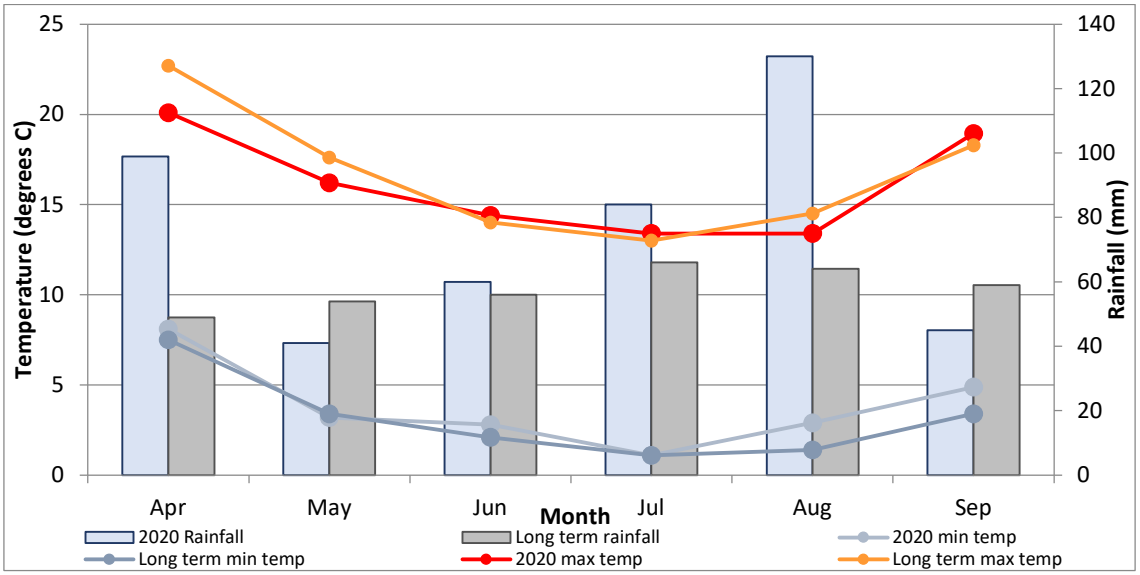

Figure 1. 2020 growing season rainfall and long-term rainfall (1955-2020) (recorded on farm), 2020 min and max temperatures and long-term min and max temperatures (1995-2020) (recorded at Cootamundra Airport) for the growing season so far (April-September). *Rainfall April to September= 459mm.*

Cootamundra Airport temperature data has been used as it is the most complete data set available, however it is at an altitude of 335m and the site sits at about 540m.

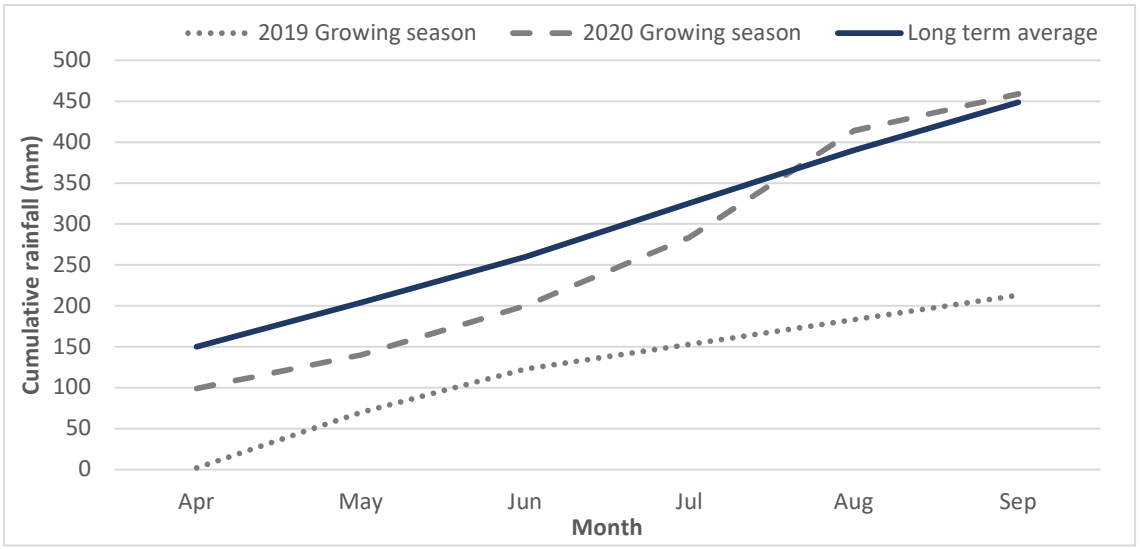

Figure 2. Cumulative growing season rainfall for 2019, 2020 and the long-term average for the growing season so far (April- September).

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