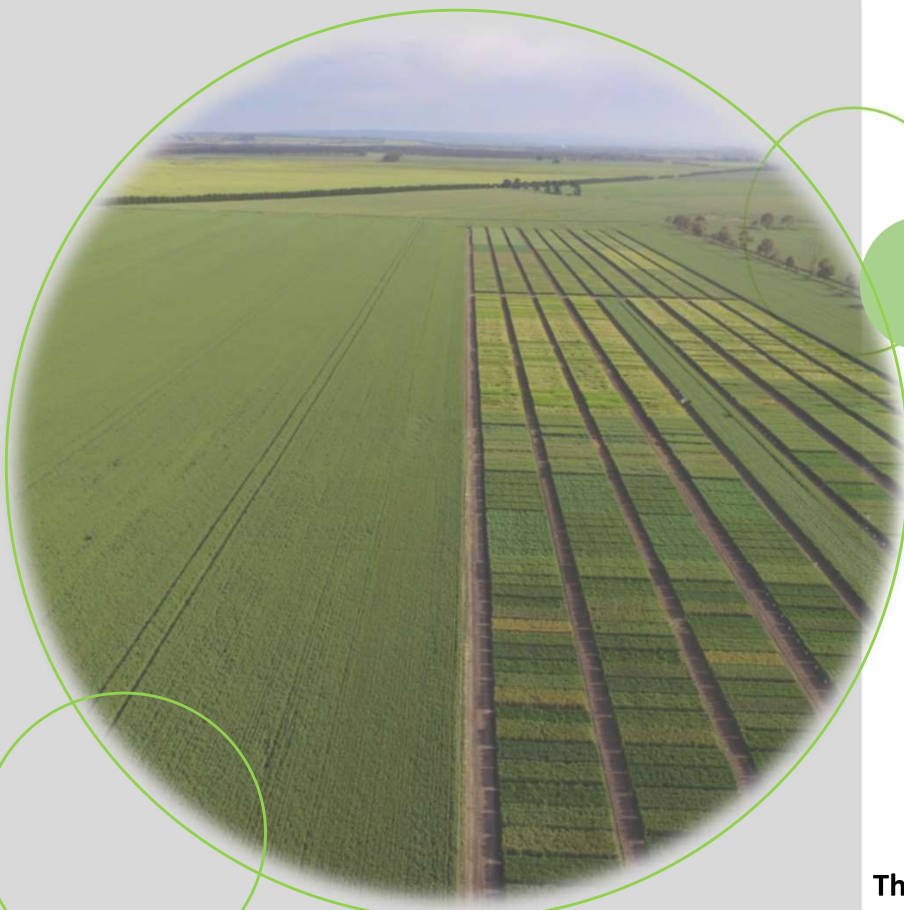
NSW CROP TECHNOLOGY CENTRE

# FIELD DAY

# INCREASING PRODUCTIVITY IN THE HRZ OF NSW

Wednesday 12th October 2022



Thanks to the following event sponsor:

Seed Force — AN RAGT COMPANY

Thanks to the following lunch sponsor:

Nutrien Ag Solutions

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

**NSW CTC trial site courtesy of: Charlie Baldry**

SOWING THE SEED FOR A BRIGHTER FUTURE

## VISITOR INFORMATION

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

## HEALTH & SAFETY

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

## FARM BIOSECURITY

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

## FIRST AID

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

## LITTER

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

## VEHICLES

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

## SMOKING

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

Thank you for your cooperation, enjoy your day.

**COVID-19**

Help us keep COVID-19 away.

If you are visiting FAR Australia offices or trial sites, please observe the following good hygiene practices to reduce the risk of infection with COVID-19:

- Sanitise your hands when entering the office or trials site and at regular intervals.
- Wash your hands regularly for 20 to 30 seconds. If soap and water is not available, use an alcohol-based hand sanitiser. Hand sanitiser does not replace washing your hands after using the bathroom.
- Avoid touching your eyes, nose and mouth.
- Cover your mouth and nose when coughing and sneezing with a tissue or cough into your elbow.
- Dispose used tissues into a bin immediately and wash your hands afterwards.
- Practice social distancing:
  - Keep a distance of 1.5 metres between you and other people.
  - Avoid crowds and large public gatherings.
  - Avoid shaking hands or any other physical contact.

Thank you for your cooperation.

# INCREASING PRODUCTIVITY IN THE NSW HRZ

## FEATURING THE GRDC'S HYPER YIELDING CROPS

On behalf of our investor, the **Grains Research & Development Corporation** along with the HYC project team, I am delighted to welcome you to our 2022 NSW Crop Technology Centre Field Day featuring Hyper Yielding Crops (HYC).

Hyper Yielding Crops is a national project led by Field Applied Research (FAR) Australia. Over the past three years, the HYC project has aimed to push the economically attainable yield boundaries of wheat, barley and canola. As well as the five research centres across the HRZ's of Australia, the project has been successful in engaging with growers to scale up the results and create a community network with the aim of lifting productivity. If you are interested in getting involved in 2023, then please get in touch (see contact details in this booklet).

To make the programme as diverse as possible, I would like to thank all our speakers who have helped to put today's programme together; in particular our keynote speaker Dr Steven Simpfendorfer who has made the trip from the NSW Department of Primary Industries to join us today. Dr Simpfendorfer is based at the Tamworth Agricultural Institute where he leads research and extension programs on the integrated management of winter cereal diseases in northern NSW.

Finally I would like to thank the GRDC for investing in this research programme. Also a big thanks to Charlie Baldry our host farmer for his tremendous practical support given to the team and to today's Keynote speaker sponsor SeedForce and our lunch sponsor Nutrien Ag Solutions.

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

***Nick Poole***
*Managing Director*
*FAR Australia*

**Hyper Yielding Crops**

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 achieved through sowing the right cultivars, at the right time and with effective implementation of appropriately tailored management strategies. The popularity of this project highlighted the need to advance a similar initiative nationally which would strive to push crop yield boundaries in high yield potential grain growing environments.

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

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

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

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

**For more details on the project contact:**

Rachel Hamilton – HYC Communications and Events, FAR Australia
Email: rachel.hamilton@faraustralia.com.au

Nick Poole – HYC Project Lead and HYC wheat research lead, FAR Australia
Email: nick.poole@faraustralia.com.au

Dr Kenton Porker – HYC barley research lead
Email: Kenton.porker@faraustralia.com.au

Rohan Brill – HYC canola research lead
Email: rohan@brillag.com.au

Jon Midwood - HYC extension coordinator, TechCrop
Email: techcrop@bigpond.com

Scan the QR code for 2021 HYC project results

# Wallendbeen Crop Technology Centre 2022 Climate Update

**Growing Season Rainfall to date**

The current 2022 rainfall at Wallendbeen is much higher than long term trends; up until the start of October the March – October rainfall was 533mm compared to long term median of 382mm for the same time period. This is still less than the 2016 season.

**Long-term growing season rainfall and yield potential**

The long-term median rainfall for Wallendbeen from April – October is 411mm of rain. Using a French and Schulz equation, assuming 60mm is lost to evaporation, ignoring fallow rainfall, and a water use efficiency of 25kg/ha/mm in cereals a yield potential of > 8.7 t/ha should be possible in more than 50% of years.

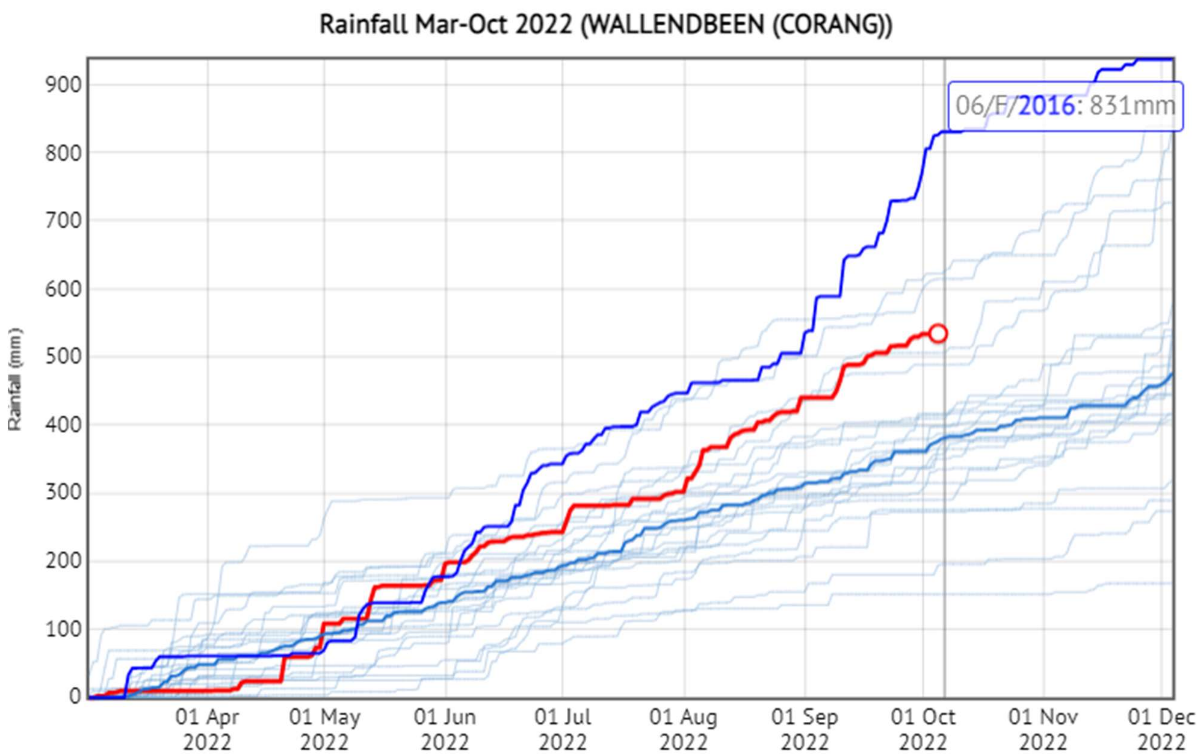



Figure 1. Long term rainfall (mm) trends for Frankland in the period from Apr – Dec. The dark line represents the **long-term median,** and red line the 2022 season tracking relative to other seasons light blue deciles. 2016 is highlighted. (DATA Source: Australian CLIMATE online 2022).

**Solar Radiation and Temperature (figures 1 and 2)**

In parts of the high rainfall zone solar radiation and temperature during the critical period (15 Sep – 10 Oct) are the limiting factors to yield more often than water supply. This was a defining feature of 2021, with temperature consistent or slightly warmer than long term trends, however solar radiation lower than average leading to reduced photosynthesis and grain number potential. As of Oct 1 in 2022 this looks to be case again in 2022 see paper discussing this.

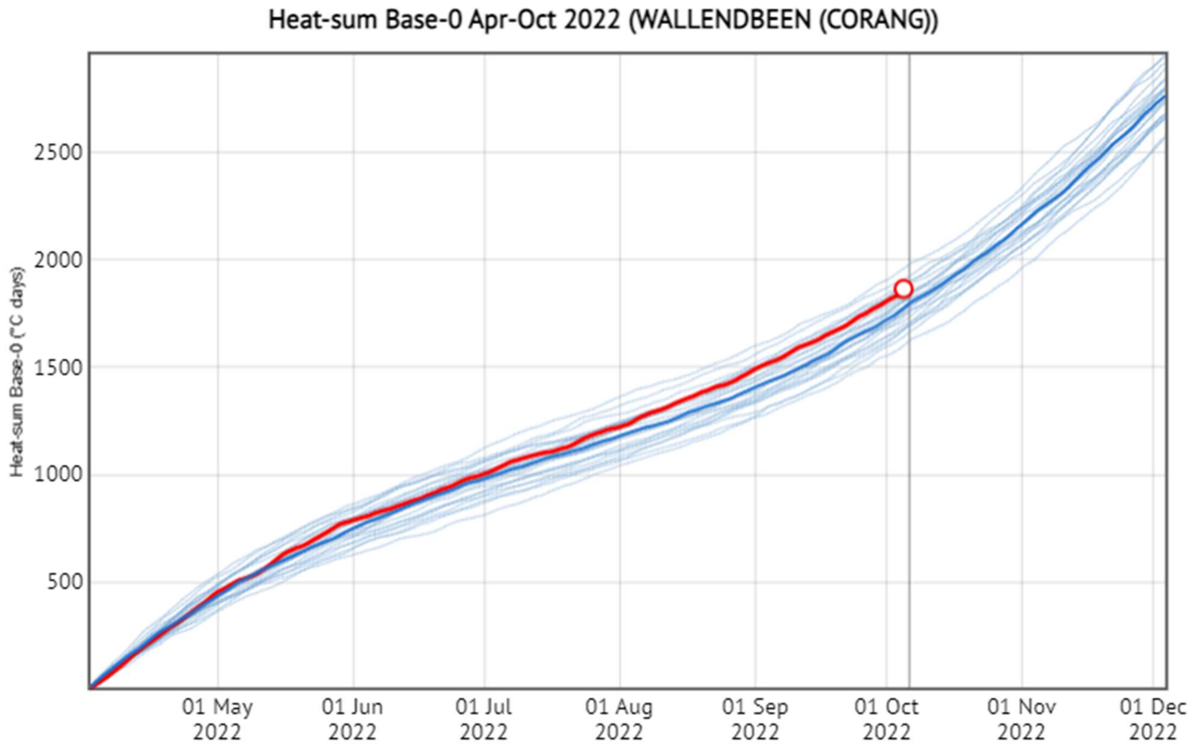



Figure 2. Long term **accumulated temperature** trends for Wallendbeen in the period from Apr – Nov. The dark line represents the **long-term median,** and red line the 2022 season tracking relative to other seasons light blue deciles. (DATA Source: Australian CLIMATE online 2022).

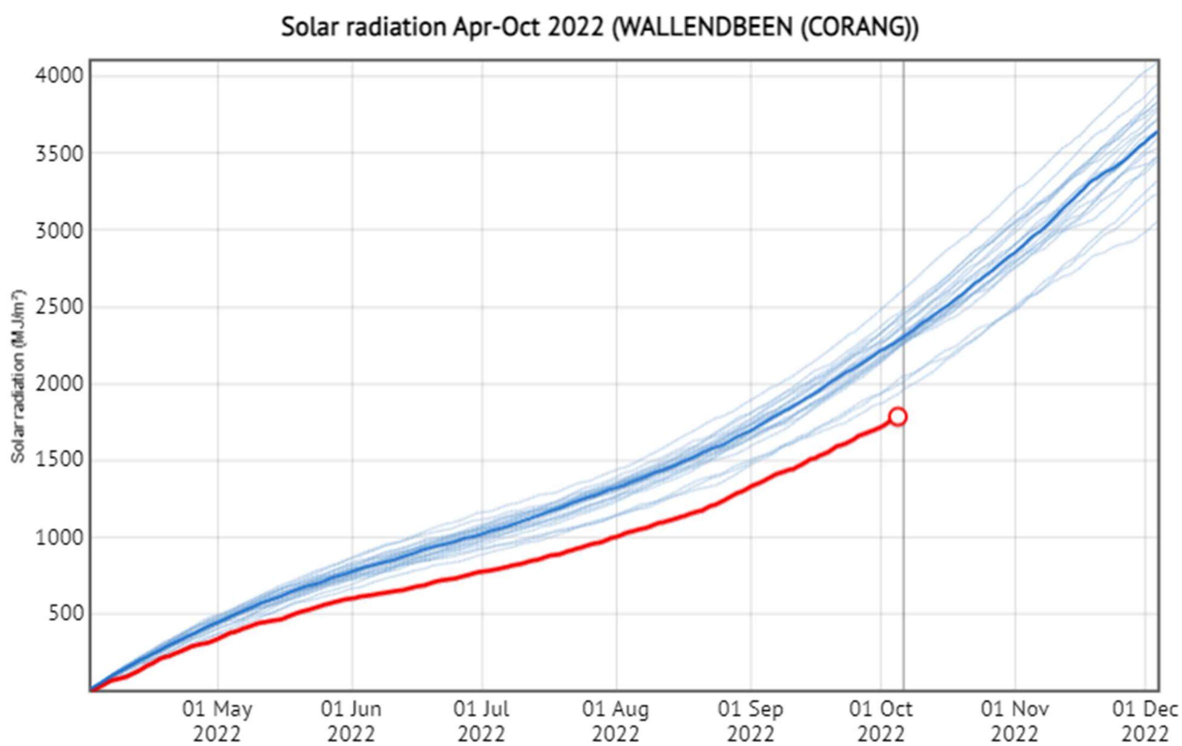



Figure 3. Long term **accumulated Solar Radiation** trends for Wallendbeen in the period from Apr – Nov. The dark line represents the **long-term median,** and red line the 2022 season tracking relative to other seasons light blue deciles. 2021 is marked for comparison (DATA Source: Australian CLIMATE online 2022).

# Hyper Yielding Canola – more than just urea and fungicide

*Rohan Brill, Brill Ag*

**Key Points**

- 2020 and 2021 Hyperyielding Canola trials have shown that yield potential can be raised through increased attention to nutrient manage ment and variety choice.
- At Hyperyielding Canola sites in four states in 2021, canola yield was improved where animal manure (chicken or pig) was applied.
- 2022 trials will provide a better understanding of the reasons for the manure response and if the response can be replicated with the application of inorganic nutrition alone.
- 45Y95 CL was the standout variety at Wallendbeen in 2021, it grew a high amount of biomass with a high conversion of that biomass to grain yield.
- The use of fungicide has limited yield loss from disease at Wallendbeen in both 2020 and 2021, with the best value application being the 20-30% bloom timing.

**Importance of nutrition for Hyper Yielding Canola**

The aim of the canola component of the Hyper Yielding Crops project is to determine management practices that achieve 5 t/ha canola grain yield in high yield potential environments. Nitrogen management has been prioritised as one management strategy that is important for canola yield. At Wallendbeen in 2021 there was no response to applied N (as urea) with rates applied up to 300 kg/ha. This was largely due to the very high fertility of the paddock following a pasture phase, with 340 kg/ha N stored in the top 90 cm soil plus 2% Organic Carbon. Over and above N application (at the 225 kg/ha N rate) there was a response to the application of chicken litter at 3 t/ha (dry basis). This supplied 110 kg/ha N, 30 kg/ha P and 105 kg/ha K and increased yield by 0.5 t/ha. Animal manure may not be readily available and/or the cost may be prohibitive, so 2022 trials are looking further into the reasons for the response to manure. The trials will determine if a similar response can be achieved by matching the nutrition supplied in manure with inorganic inputs. Is it a matter of simply increasing the NPK inputs to match or is there a benefit from manure beyond just the nutrient content? Does the manure increase nutrient supply when it is most required, i.e., through the crop critical period?

The positive response from manure application was mirrored at all four HYC Canola sites in 2021, including:

- Gnarwarre, Victoria (pig manure)
- Millicent, SA (pig manure)
- Kojonup, WA (chicken manure)

There was a range in yield response from 0.5 t/ha at Wallendbeen to 0.8 t/ha at Gnarwarre and Kojonup.

**Variety Choice 2021**

Once nutrition is optimised, a variety needs to be chosen that will capitalise on the investment in soil fertility. In a Genotype * Environment * Management (GEM) Trial at Wallendbeen in 2021 the standout for grain yield was 45Y95 CL, being at least 0.8 t/ha higher yielding than all other varieties (Table 1).

***Table 1.*** *Yield of spring canola varieties at four national HYC canola sites in 2021.*

| | **Gnawarre Vic** | **Kojonup WA** | **Millicent SA** | **Wallendbeen NSW** |
|---|---|---|---|---|
| *ATR Wahoo* | 3.5 | 1.8 | 3.3 | 3.6 |
| *HyTTec Trifecta* | 3.9 | 2.7 | 4.4 | 5.2 |
| *45Y95 CL* | * | * | 6.4 | 6.4 |
| *45Y93 CL* | * | * | 5.7 | 5.6 |
| *45Y28 RR* | 4.5 | 2.9 | 5.1 | 4.9 |
| *Condor XT* | 3.9 | 3.4 | 5.1 | 5.2 |
| l.s.d. ($p$<0.05) | 0.21 | 0.13 | 0.34 | 0.36 |

Detailed assessment of 45Y95 CL at the Wallendbeen site showed that it had high biomass at maturity but also a high harvest index, with 36% of final biomass being grain (Figure 1). 45Y95 CL had a high number of seeds per pod (21) with a high number of pods/m² (8422) (Table 2), the only variety that was above average for both components. Experiments and measurements will be completed again in 2022 as subtle differences in final biomass and harvest index can magnify into large differences in crop profitability.

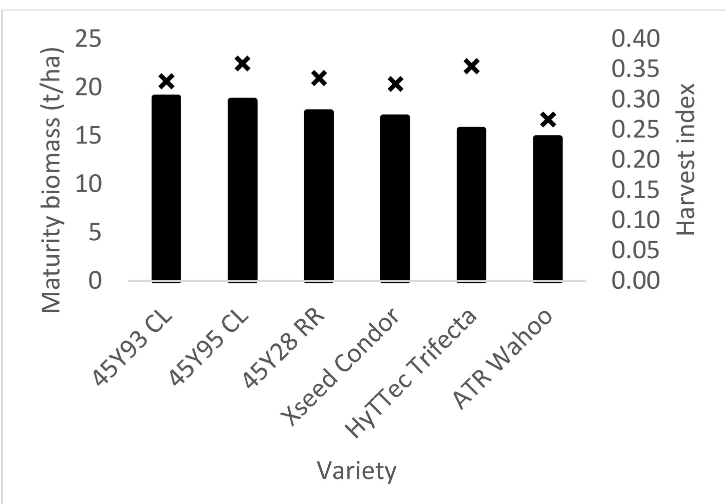



***Figure 1:*** *Maturity biomass (bars) and harvest index (X) of six canola cultivars in Wallendbeen GEM trial 2021.*

***Table 2.*** *Seeds/pod and pods/m² of six spring canola varieties in Wallendbeen HYC GEM trial 2021.*

| | Seeds/pod | Pods/m² |
|---|---|---|
| ATR Wahoo | 21 | 5240 |
| HyTTec Trifecta | 17 | 8003 |
| 45Y95 CL | 21 | 8422 |
| 45Y93 CL | 18 | 8692 |
| 45Y28 RR | 18 | 7628 |
| Condor TF | 15 | 8263 |
| *Mean* | *18* | *7708* |

There was also a winter version of the Hyper Yielding Canola GEM site, where the highest yielding variety was Hyola Feast CL at 3.8 t/ha. The high fertility at the site led to very tall winter canola plots and whiched lodged badly by harvest time. Further grazing treatments have been included in 2022 to evaluate the response of new winter canola varieties to grazing and the value that may bring for forage and grain yield.

**YieldMax Trial 2022**

The YieldMax Trial was sown in 2022 which gives an opportunity to evaluate the best varieties with a strong nutrition package. The nutrition treatments include:

- High Input – 40 kg/ha P, 225 kg/ha N, 3 t/ha (dry basis) Chicken Manure
- Low Input – 15 kg/ha P, 150 kg/ha N.

Biomass samples were taken at flowering to determine the differences between varieties and treatments. The difference between varieties was generally greater than the difference between nutrition treatments (Figure 2). TT varieties had the least biomass and Xseed Condor (Truflex) had the most biomass. Biomass samples will be taken again at crop maturity as growth between the start of flowering and maturity has a much stronger correlation with grain yield than growth pre-flowering. Will the high input treatment increase growth during the crop critical period and which varieties will use this high nutrition the most efficiently?

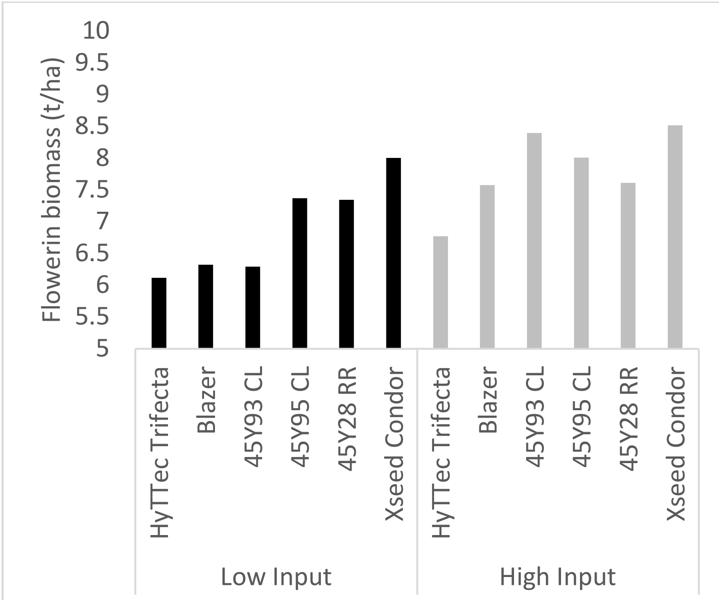



***Figure 2:*** *Effect of nutrient management on flowering biomass of six canola varieties at Wallendbeen 2022.*

## HYC Canola Disease Management

With large biomass canola crops in high yield potential environments, it might be expected that growers would need to increase fungicide inputs to protect crops from disease. However, across the project in 2021 the yield response to fungicide (difference between Intensive and Nil fungicide program) ranged from nil in four (of seven) trials to 0.9 t/ha in a trial at Wallendbeen in 45Y28 RR canola (Figure 3). Intensive fungicide program included Saltro Duo on seed, Prosaro at 4-leaf stage, Aviator Xpro at 20% bloom stage and a follow up Prosaro at 50% bloom stage. The single best value fungicide application in 2021 was the use of an SDHI product (e.g. Aviator Xpro, Miravis Star) at 20-30% bloom stage.

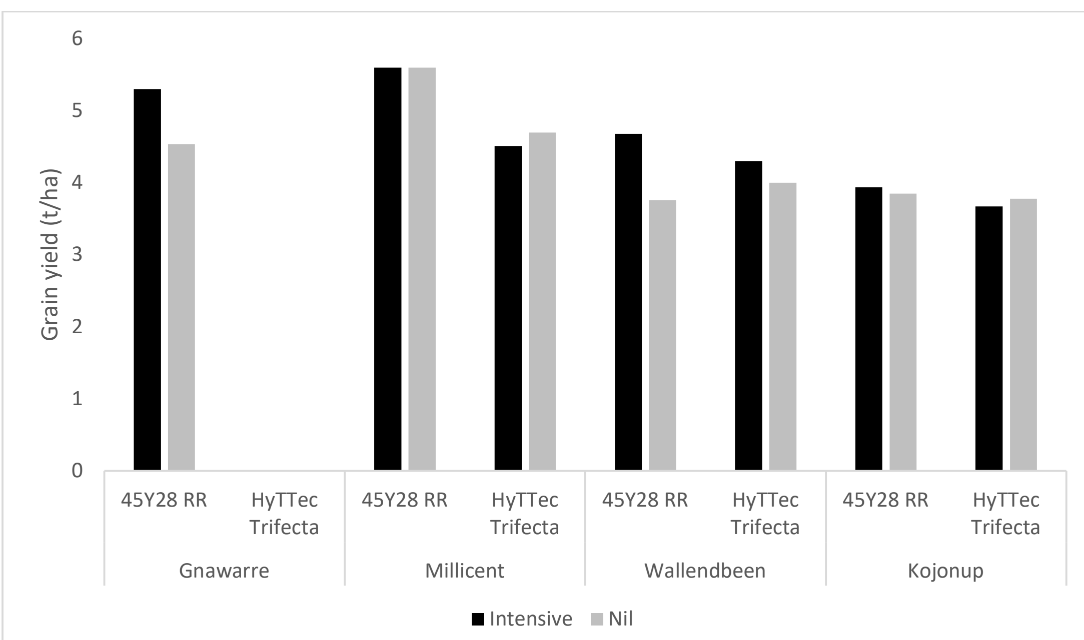



***Figure 4****: Effect of fungicide program (Intensive versus Nil) on grain yield of 45Y28 RR at Gnarwarre, Millicent and Wallendbeen and on HyTTec Trifecta at Millicent and Wallendbeen in 2021.*

**Hyper Yielding canola results**

Full results from 2021 are available at https://faraustralia.com.au/wp-content/uploads/2022/04/HYC-2021-Results-FINAL.pdf.

Results from 2022 will also be made available through the FAR Australia website and various other channels such as through social media and GRDC Updates.

The primary role of Field Applied Research (FAR) Australia is to apply science innovations to profitable outcomes for Australian grain growers. Located across three hubs nationally, FAR Australia staff have the skills and expertise to provide 'concept to delivery' applied science innovations through excellence in applied field research, and interpretation of this research for adoption on farm.

## Contact us

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**SOWING THE SEED FOR A BRIGHTER FUTURE**

# Back to basics on wheat stripe rust management and what might be lucking in a drier season

*Dr Steven Simpfendorfer, Senior Plant Pathologist, NSW Dept Primary Industries*

Steven will reinforce some of the basics around infection and temperature interactions with wheat stripe rust which impact on management decisions. In this interactive session differences in varietal reactions between seasons will be explored and why 2022 has been the highest-pressure year ever recorded across eastern Australia. What has worked and what has created issues with management in 2022. What are some of the common misconceptions around stripe rust and what are we really trying to achieve with a late ‘head wash’? What do we need to consider doing different in 2023 to improve management? Can we really keep growing very susceptible varieties? What are the continued risks for industry?

With three consecutive wet seasons the focus has all been around leaf disease management. Steven will discuss lurking issues within farming systems, especially Fusarium crown rot and take-all, which have not gone away. Build-up of inoculum is largely going unnoticed and is poised to express as a considerable issue if dry and warm grain fill conditions return in subsequent seasons. How can growers identify risks and what can they do to minimise losses?

Growers and their advisers are also welcome to bring samples from cereal crops they are still concerned about for diagnosis and discussion of appropriate management options.


As our brand evolves, we're excited to align our business more closely with RAGT.

RGT Cesario, RGT Nizza CL, RGT Waugh, RGT Baseline TT and RGT Clavier CL, RGT Planet and many more to come. Get the most out of our great local products, with plenty more to look forward to as RAGT brings more top-class products to market. Talk to your local Seed Force representative to find out more.

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# HYC Disease management germplasm interaction (2020)

*The following is based on results from the southern NSW Hyper Yielding Crops research programme which is a national GRDC investment taking place across the higher yielding regions of southern Australia. The research is taking place at Wallendbeen at 540m altitude which naturally creates a generally cooler longer season environment for growing high yielding crops. At this altitude disease infection can be delayed until later in the season compared to lower altitudes in the Riverine Plains region. Please note these are first year results.*

**Key messages 2020:**

- In seasons that favour higher yield potential, one of the most important components in growing high yielding cereal crops is disease management.
- The feed winter wheats RGT Accroc and Anapurna significantly out yielded all other cultivars at all three levels of disease management and achieved over 10t/ha with fungicide input.
- There was a significant interaction between cultivar and fungicide management with the stripe rust susceptible cultivars LRPB Trojan and DS Bennett giving yield responses of 5.27 and 3.07 t/ha to a single flag leaf fungicide compared to less than a 1t/ha with the majority of cultivars.
- Septoria tritici blotch (STB) was the principal disease in untreated crops of Scepter and Beckom, whilst stripe rust was the main disease in LRPB Trojan, DS Bennett, Coolah, RGT Accroc and Catapult. Other cultivars were subject to low levels of both stripe rust and STB disease pressure.
- Only LRPB Trojan, Catapult, Coolah and DS Bennett gave significant yield increases to the application of four units of fungicide (seed treatment and three foliar fungicides) over a single flag spray.
- Where genetic resistance in a wheat cultivar is not sufficient to delay fungicide decisions until flag leaf emergence (GS37-39), look to target the following three key timings for fungicide intervention; first node GS31, flag leaf emergence GS39 with an optional third application at head emergence GS59.
- Avoid repeated use of the same fungicide active ingredients, and in the case of the newer Group 11 QoI (strobilurins) and Group 7 SDHIs, where possible restrict strategies to just one application per season in order to slow down and help prevent the selection of resistant strains.

# HYC Disease management germplasm interaction (2021)

*The following is based on results from the southern NSW Hyper Yielding Crops research programme which is a national GRDC investment taking place across the higher yielding regions of southern Australia. The research is taking place at Wallendbeen at 540m altitude which naturally creates a generally cooler longer season environment for growing high yielding crops. At this altitude disease infection can be delayed until later in the season compared to lower altitudes in the Riverine Plains region. This is the second year that results have been reported from this research site.*

**Key messages 2021:**

- In seasons that favour higher yield potential, one of the most important components in growing high yielding cereal crops is disease management.
- The results for the second year have shown that genetic resistance can be exploited to delay fungicide intervention resulting in strategies that use less fungicide in seasons of high yield potential.
- The feed winter wheats RGT Accroc, Anapurna and RGT Cesario significantly out yielded all other cultivars at all three levels of disease management and achieved over 10t/ha with fungicide input.
- There was a significant interaction between cultivar and fungicide management with the stripe rust susceptible cultivars Trojan and Catapult giving yield responses of 1.09 and 3.58 t/ha to a single flag leaf fungicide compared to less than a 1t/ha with the majority of cultivars.
- Septoria tritici blotch (STB) was the principal disease in untreated crops of Scepter and Beckom, whilst stripe rust was the main disease in Trojan, RGT Accroc and Catapult. Other cultivars were subject to low levels of both stripe rust and STB disease pressure.
- Only Trojan, Catapult, gave significant yield increases to the application of more than one fungicide unit while Only Trojan gave significant increase to four units of fungicide (seed treatment and three foliar fungicides).
- The significant interaction observed in grain yields was also apparent in the grain quality (test weights and screenings) and the resulting wheat grade.
- Highest return on investment was seen in the spring wheat cultivars Trojan, Beckom and Catapult due to the increase in grain yield and quality.
- Where genetic resistance in a wheat cultivar is not sufficient to delay fungicide decisions until flag leaf emergence (GS37-39), look to target the following three key timings for fungicide intervention: first node GS31, flag leaf emergence GS39 with an optional third application at head emergence GS59.
- Avoid repeated use of the same fungicide active ingredients, and in the case of the newer Group 11 QoI (strobilurins) and Group 7 SDHIs, where possible restrict strategies to just one application per season in order to slow down and help prevent the selection of resistant strains.

# It's been wet and cool, but this doesn't mean that Wallendbeen 2022 is on target for 10 tonne yields – how does this compare to other seasons?

***Kenton Porker,*** *Nick Poole, Tom Price, Ben Morris, Rebecca Murray (FAR Australia)*
*John Kirkegaard (CSIRO)*

2022 has been extremely wet and the water supply for a 12.5t/ha cereal crop has already been achieved based on water use efficiency metrics. However, this doesn't mean that >12t/ha yields are attainable due to other climatic constraints such as solar radiation and temperature in the critical period.

**Solar Radiation and Temperature drives yield when water and N is non-limiting.**
All crops have a 'critical period" in which the number of grains is set and increasing grain number is the key to higher yields. In cereals, the critical period is occurring in the 3 weeks before flowering. The importance of the critical period for crop management must be given greater attention in high rainfall environments.

Minimising stress and maximising growth in this critical period are the key to high yields. To minimise stress, flowering should be timed to minimise the risk of frost, heat and drought and ensure water and nutrients are in good supply. Other factors that limit photosynthesis such as disease and lodging also need to be managed. Other papers will discuss this.

To maximise growth, the crop requires cool temperatures – which increase the duration of the critical period - and sunny days which increase photosynthesis for growth. A common way to measure the PTQ is the photo-thermal quotient (PTQ) which is simply (total radiation/average temperature) in the critical period. A high PTQ means more photosynthesis for more days and more grain and more yield. Crop yield is proportional to the duration of the critical period, and the critical period shortens with a lower photothermal quotient.

This is why higher yields can be achieved in Tasmania, and other places like NZ of high PTQ with crop flowering in long summer days, with cool temperatures more similar to those experienced in September at Wallendbeen. Based on long term data and experience the 10$^{th}$ October is considered the most optimal time to be flowering at Wallendbeen to achieve this goal.

# TIMETABLE

**NSW CROP TECHNOLOGY CENTRE FIELD DAY (WALLENDBEEN): WEDNESDAY 12 OCTOBER 2022**

**Featuring the GRDC's Hyper Yielding Crops**

Thanks to our keynote speaker sponsor: Seed Force

| In-field presentations | Station No. | 10:15am-12:00noon | 12:30 | 1:15 | 1:30 | 2:00 | 2:30 | 3:00 | 3:30 | 4:00 |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Rohan Brill, Brill Ag and HYC Canola Research Lead will be joined by Nick Poole (FAR Australia) and Dr John Kirkegaard (CSIRO) to discuss:*** *Hyper yielding canola in NSW what have we learnt so far?* | Canola research site | ALL | Lunch kindly sponsored by Nutrien Ag Solutions | Opening address by Roy Hamilton, GRDC Northern Panel Member and Nick Poole FAR Australia's Managing Director for an introduction to the cereal research programme. | | | | | | Closing address followed by refreshments kindly sponsored by Nutrien Ag Solutions |
| ***Dr Steven Simpfendorfer, NSW DPI*** *Back to basics on wheat stripe rust management and what might be lacking in a drier season.* | 1 | | | | 1 | | | 2 | | |
| ***Tom Price and Ben Morris, FAR Australia*** *Have we got sufficient genetic resistance to reduce our fungicide input?* | 2 | | | | | 1 | | | 2 | |
| ***Dr Kenton Porker, FAR Australia*** *How often can we achive 10t at Wallendbeen?* | 3 | | | | 2 | | 1 | | | |
| ***Jon Midwood, Techcrop*** *Hyper Yielding Crops: Capturing yield potential through innovation and benchmarking.* | 4 | | | | | 2 | | 1 | | |
| ***Nick Poole, FAR Australia*** *Open discussion around tailoring our farming system to achieve hyper yielding crops?* | 5 | | | | | | 2 | | 1 | |
| **In-field presentations** | Station No. | 10:15am-12:00noon | 12:30 | 1:15 | 1:30 | 2:00 | 2:30 | 3:00 | 3:30 | 4:00 |

For the afternoon's presentations, would be obliged if you could remain within your designated group number.

Thank you for your cooperation.

| Group |
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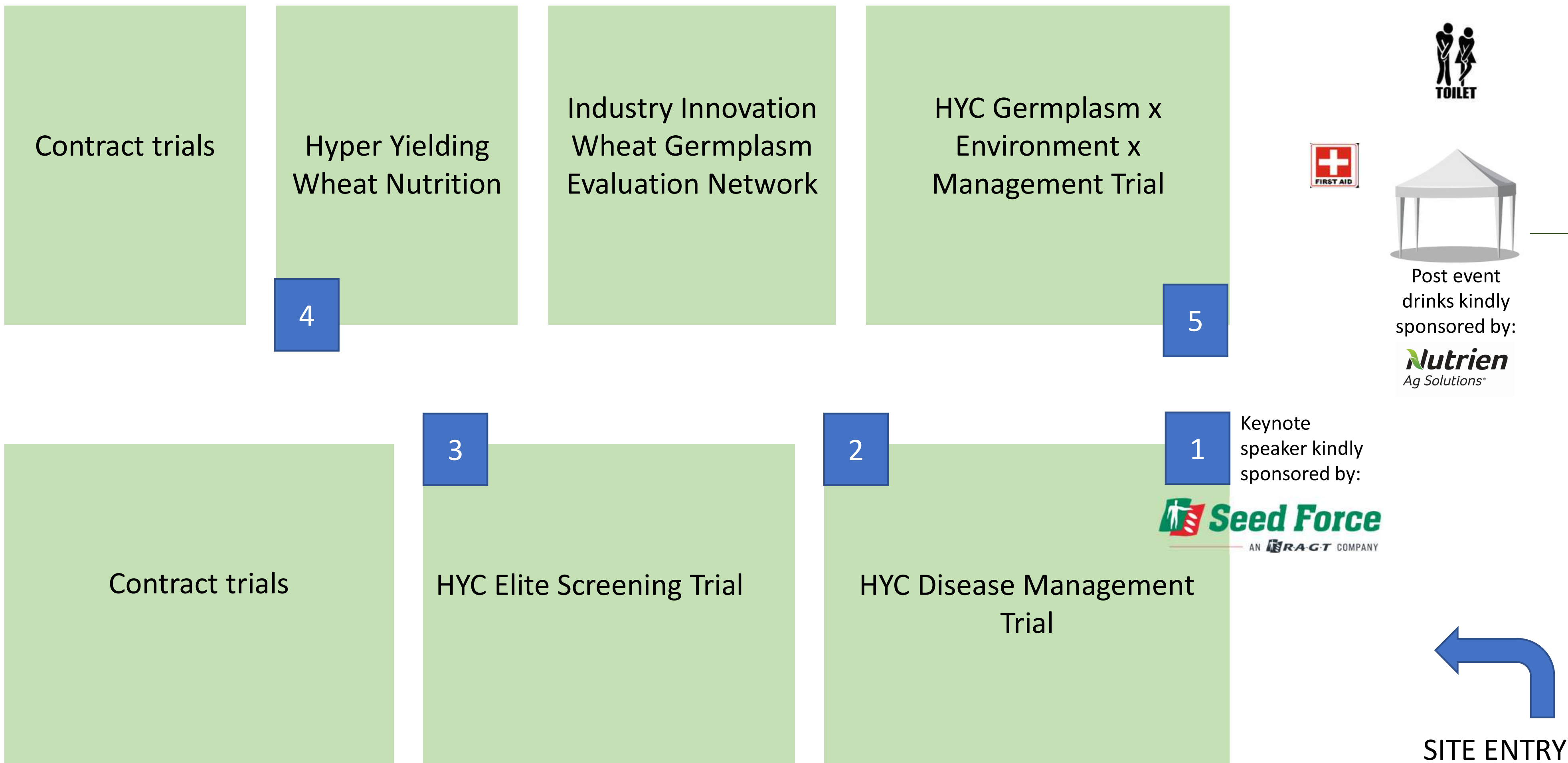
NSW CROP TECHNOLOGY CENTRE

# 2022 SITE MAP: Featuring the GRDC's Hyper Yielding Crops



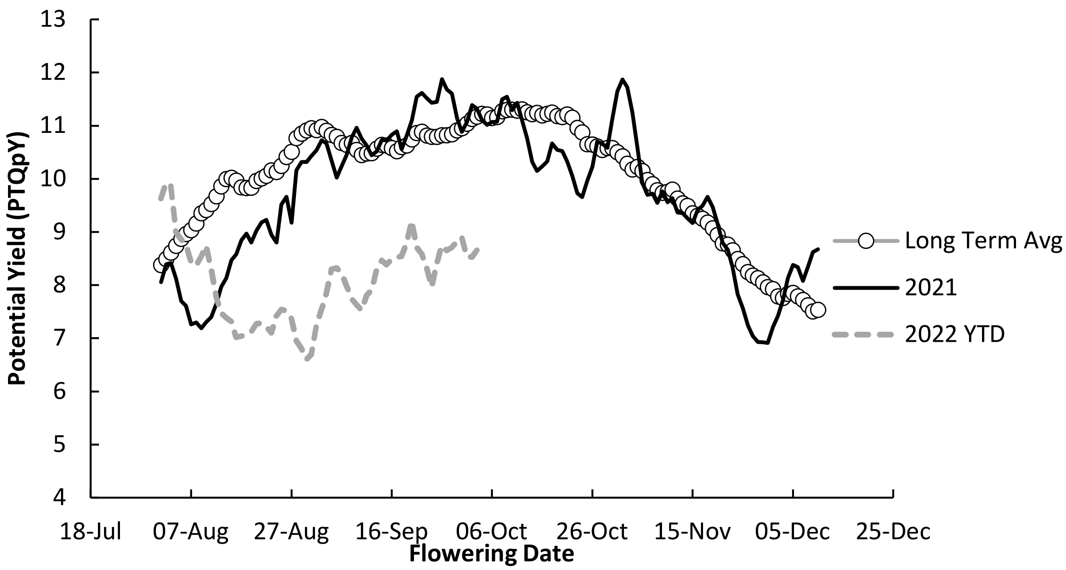



*Figure 1. Long Term (last 20 years) yield potential and relationship with flowering date at Wallendbeen based on the photothermal quotient compared to 2021, and 2022 YTD.  Note this is the upper ceiling of yield potential and does not factor in frost and heat risk and assumes water is non limiting.*

The PTQ puts an upper limit on the potential yield in any environment and can vary from season to season. This is highlighted above with solar radiation being lower than the long-term average and 2021 despite the extra rainfall. This means the only likely way to achieve 10t/ha in 2022 will be if later flowering crops experience conditions of higher PTQ in the next few weeks and remain stress free. Similar trends were observed in 2021 yield results with a mild and wet finish, with later flowering cultivars like Big Red for example achieving higher yields due to a higher PTQ (figure 2).

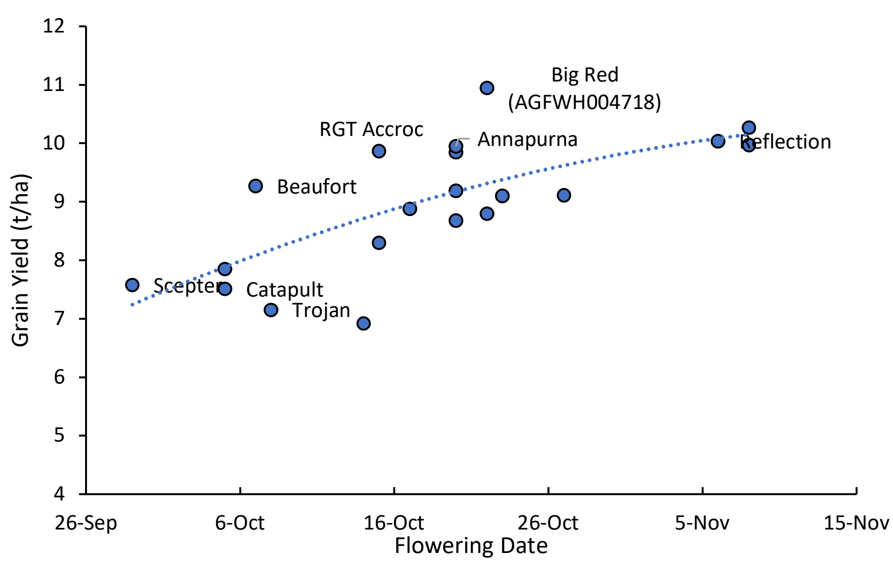



*Figure 2. Grain yield and flowering time relationship from Wallendbeen HYC 2021.*

## Long Term Yield Potentials

Based on simple water use efficiency metrics, and the photothermal quotient calculations outlined, these data demonstrate that yields greater than **10t/ha are possible in almost 50% of years since 2010.** When flowering on the 10th October for wheat, the following table highlights that grain yields have likely been **water limited in 6 out of the last 13 years**, whereas yields have been **light limited 7 out of the last 12** years in our quest to achieve 10 tonnes per hectare. The question HYC research then aims to address is how to set crops up for 10 tonne per hectare and protect yield potential.

*Table 1. Grain Yield potentials based on water use efficiency, and photothermal quotient equations for Wallendbeen over the last 10 years (using SILO Bom Data) shaded cells indicates the factor with the lowest yield potential limiting yield.*

| Year | Water Limited Yield Potential (t/ha) | Photothermal Quotient Yield Potential (t/ha)# |
|---|---|---|
| 2010 | >12.5* | 12.4 |
| 2011 | 12.5 | 10.0 |
| 2012 | 9.94 | 12.2 |
| 2013 | 6.29 | 11.3 |
| 2014 | 9.29 | 12.3 |
| 2015 | 11.3 | 11.5 |
| 2016 | >12.5* | 8.9 |
| 2017 | 8.3 | 10.6 |
| 2018 | 6.8 | 12.3 |
| 2019 | 5.4 | 10.3 |
| 2020 | >12.5* | 8.5 |
| 2021 | >12.5* | 11.3 |
| *2022 YTD** | *>12.5** | *8.6** |

*assumes runoff after 500mm of water supply

#based on a flowering date of 10th October (except for 2022 was based on the 3rd October for printing)

## Choosing a cultivar and sowing date to achieve 10 tonne potential?

New genetics offer improved yield and may convert light and water into yield more efficiently than older genetics in the high rainfall zones; in particular cultivars that are coming out of Europe where breeding for high yield potential is a greater focus. Breeding programs in Australia are understandably more focused on breeding for improved water use efficiency for the wheat belt. However, as this data highlights, yield may be limited by solar radiation and temperature in 50% of years, and top end yield potential rather than water. For a cultivar to achieve 10t/ha, it needs to have the genetic yield potential to do so, but it must also have the correct flowering behaviour to align its critical period with the environment. Some of the slower developing winter feed wheats have realised this potential in the southern states and when sown in the high rainfall environments, such as Tasmania. However, our data suggests that cultivars such as Big Red, Accroc and Anapurna are equally as well adapted to Wallendbeen, particularly when sown in April in seasons like 2020, 2021 and 2022 when yields are not water limited. This is because their critical period is aligned with the most optimal conditions to achieve 10t/ha and they flowered in the week from the 7th October to the 14th in 2020. Based on long term data, this date is the period in which highest yields could be achieved based on the photothermal quotient (light and temperature in the critical period) (figure 1). While it must be noted high yields can be achieved by flowering earlier and later than this, the frost and heat risk are considerably higher and will reduce yields.

Grain yields from 2020 at Wallendbeen reflect these differences in flowering time when disease is controlled (table 2). However, when the crop canopy was not managed the crop failed to achieve its potential, as outlined in the FAR Australia disease results.

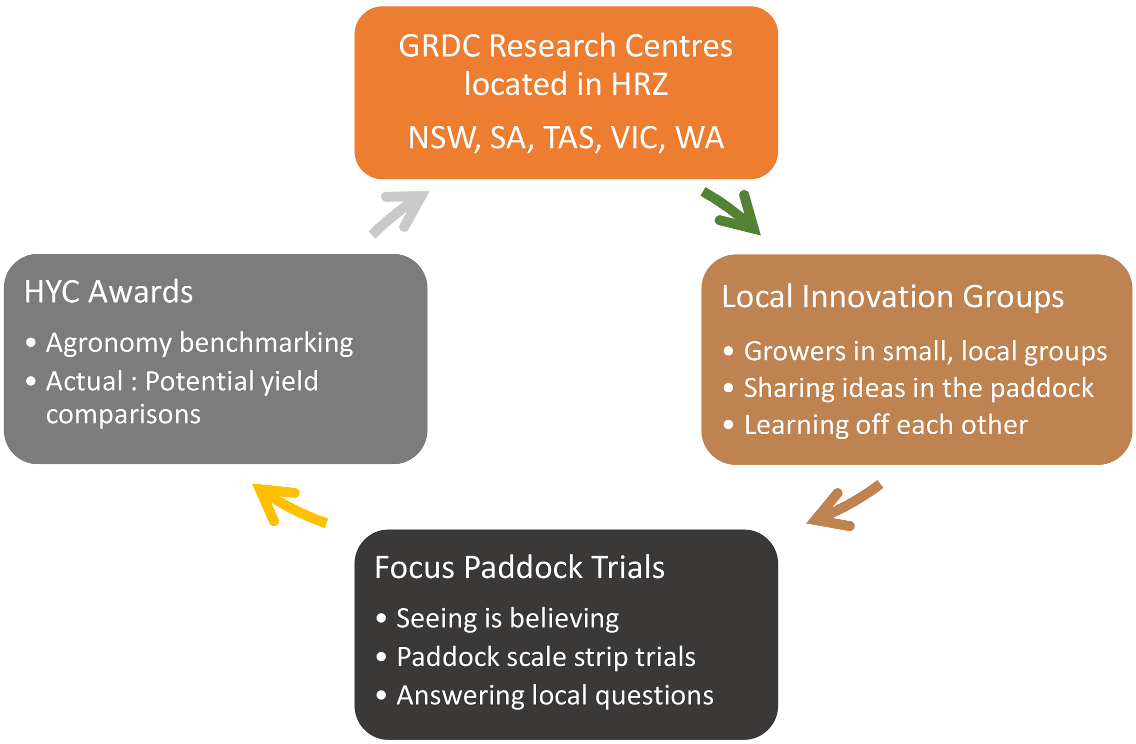
*Table 2. Flowering responses and yield data (when disease is controlled) at Wallendbeen in 2020 Hyper Yielding Crops site.*

| Variety | Flowering Week | 2020 Yield |
|---|---|---|
| Trojan (spring) | 23-Sep | 8.3 |
| Scepter (spring) | 23-Sep | 8.3 |
| Beckom (spring) | 23-Sep | 8.5 |
| Catapult (spring) | 23-Sep | 8.3 |
| Gregory (spring) | 23-Sep | 7.2 |
| Nighthawk (facultative) | 8-Oct | 8.6 |
| ***RGT Accroc (winter)*** | ***8-Oct*** | ***10.3*** |
| Kittyhawk (winter) | 8-Oct | 8.0 |
| ***Anapurna (winter)*** | ***14-Oct*** | ***10.4*** |
| DS Bennett (Winter) | 14-Oct | 9.7 |
| Variety (LSD) | | 0.031 |

## GRDC Hyper Yielding Crops NSW

*Jon Midwood, TechCrop*

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




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

***Innovation groups***

In 2020 RP set up two innovation groups in southern NSW region and one in NE VIC . All groups had a spring crop walk during August, where the groups met out in a paddock and discussed not only the crops they looked at on the day, but also the specific questions the groups had and whether they could answer the question with a simple paddock strip trial. The layout, assessments and treatments of these strip trials were facilitated by the RP project officer and as a result three different trials were setup.

The following are details from one of these Focus paddock trials.

***Focus paddock trials:***

1. ***Culcairn Focus paddock trial***

Research question: If you're growing a stripe rust susceptible variety like Trojan, what sequence of fungicides and timings gives the highest yield and the best margin over fungicide costs?

Paddock details

| | |
|---|---|
| **Crop** | Cereal: Wheat |
| **Variety** | Trojan |
| **Area** | 68.00ha |
| **Sow Rate** | 80.00 kg/ha |
| **Sow Date** | 15-05-20 |
| **Harvest Date** | 02-12-20 |
| **Harvest Yield** | 7.31T/ha |
| **Stubble Management 1** | Retained Canola |
| **Fallow Management 1** | None |
| **Seeder type** | Disc (Single) |
| **Row spacing** | 250mm |

Fungicide Treatments

| **Treatment** | **GS30** | **GS32** | **GS39** |
|---|---|---|---|
| Control | Cogito 0.125 l/ha | - | |
| Treatment 1 | Cogito 0.125 l/ha | - | Radial 0.84 l/ha |
| Treatment 2 | Cogito 0.125 l/ha | Prosaro 0.15 l/ha | Opus 0.5 l/ha |
| Treatment 3 | Cogito 0.125 l/ha | Prosaro 0.15 l/ha | Radial 0.84 l/ha |

## Results

| Measurement | Control | | Treatment 1 | | Treatment 2 | | Treatment 3 | |
|---|---|---|---|---|---|---|---|---|
| Yield (t/ha) | 4.11 | d | 7.42 | b | 7.67 | a | 7.09 | c |
| Protein (%) | 12.70 | | 11.90 | | 11.80 | | 12.00 | |
| Screenings (%) | 4.13 | | 1.92 | | 2.47 | | 2.21 | |
| Test weight (kg/hL) | 63.80 | | 75.20 | | 75.00 | | 73.40 | |

*Means followed by the same letter do no significantly differ (P=0.05)*

## Conclusion

If Stripe rust was left uncontrolled, the yield losses were up to 4.0t/ha. The additional gross margin from the application of fungicide was $800/ha. The highest yielding treatment statistically was Treatment 2 at 7.67t/ha which included a triazole at GS32 followed by GS39

### *HYC Awards*

Award paddocks were nominated from the Innovation groups initially, with the aim being to collect and record specific wheat paddock information and to provide an agronomic benchmarking report which compares that paddock to all the others entered, both regionally and nationally. Nominated paddocks had their validated yields compared to a biophysical 'potential yield' for that paddock, which allows for the variability of soil types, rainfall, temperature and radiation across all regions. All agronomic information such as sowing dates, variety, crop development timings, soil data – pH, soil organic carbon, N, P, K etc., and in-season applications were collected by the project officer from RP. Paddock yields, harvest maturity samples, harvest index calculations and grain samples were also collected for analysis. Reports were sent out to all participating growers allowing them to benchmark their agronomy from over 50 factors and compare it to other growers in their region.

The winner for the highest yield in NSW in 2021 was Damien Schneider from Culcairn with a 8.87t/ha crop of Rockstar wheat, sown after canola on 15th May.

Damien was also the winner of the award for the highest yield as a percentage of the potential yield with his crop of Rockstar. The potential yield was calculated to be 8.73t/ha and Damien's crop exceeded this at 101% potential yield.

The following are an example of some of the agronomic benchmarks produced in the HYC Awards report for N.VIC/ S NSW in 2021:

| Agronomic Factor | Top 25% Award paddocks | Remaining 75% |
|---|---|---|
| Yield (t/ha) | 8.0 | 6.3 |
| N applied (kg N/ha) | 173 | 119 |
| Kg of N / tonne yield | 22kg N/t | 19kg N/T |
| Fungicides ($/ha) | $31 | $21 |
| Fungicides ($/t) | $4.1/t | $3.3/t |
| Dry Matter (t/ha) | 22 | 19 |
| Harvest index | 48% | 41% |
| Head count (m2) | 517 | 436 |
| 1000 grain weight | 45.3 | 42 |

Key take home messages from N.VIC/ S NSW Award data 2021:

- The top 25% reached GS61 at closer to the optimum timing to give best chance of achieving the potential yield. This was done from a targeted sowing date and appropriate variety phenology
- In 2021 top 25% yielding group got to an average GS61 timing 11 days later than the remaining 75% from the same average sowing date.
- 2 of the 3 highest yielding crops in 2021 were grown using true winter wheats (Accroc and Anapurna). The longer, softer finish to the season in 2021 would have helped these varieties reach their potential!
- Wheat following legumes were approx. 0.75t/ha higher yielding than following a wheat or canola in 2021.

Please contact Kate Coffey at Riverine Plains (0427 141221) for information about being part of this exciting project or to enter a wheat crop as an HYC award paddock in 2022.

# Fungicide resistance update - national situation and issues for the northern grains region.

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**GRDC project code:** CUR00023, AFREN project (Australian Fungicide Resistance Extension Network) CUR1905-001SAX

**Keywords:** Wheat powdery mildew (WPM), net blotch, Septoria tritici blotch (STB), Integrated Disease Management (IDM), fungicide resistance, DeMethylation Inhibitors (DMI)

## Take home messages

- Monitoring and analysis of pathogen populations by CCDM in 2021 revealed new resistance mutations affecting fungicide performance for the first time in Australia and in other cases existing mutations being more widespread and affecting more states.
- In a field trial in NE Victoria which combined field efficacy with laboratory analysis, testing has revealed significant differences in DMI (Group 3, triazole) performance for control of WPM.
- The results illustrated that the weaker compounds (triadimefon, epoxiconazole, tebuconazole, cyproconazole and propiconazole) provided less than 50% control of WPM
- Fungicide resistance and reduced sensitivity can be slowed down by using IDM approaches that reduce the number of fungicide applications required.
- To 'slow the train', growers and advisers need to adopt fungicide resistance management strategies that avoid repeated applications of the same modes of action and active ingredients.
- IDM strategies can include crop rotation, stubble management, green bridge control, sowing less disease susceptible cultivars, nutrition and canopy management (e.g. grazing) to minimise disease pressure.

## Background

Fungicide resistance is a major concern for Australian growers as it potentially reduces the efficacy of fungicides and the economic benefit they can generate. To minimise the yield gap on cropping farms, particularly in higher yielding seasons that favour disease development it is essential to maintain impact of these agrichemicals through fungicide resistance management strategies.

The first step in recognising the significance of this problem is to understand which pathogens are developing issues and to which fungicide actives.

## What is the current status of fungicide resistance and reduced sensitivity in Australia?

Over the last decade the Fungicide Resistance Group (FRG) at the Centre for Crop and Disease Management, (CCDM at Curtin University) has been working with industry and other researchers to establish a fast and cost-effective monitoring system for fungicide resistance of common fungal pathogens of broad acre grain crops. Current cases of fungicide resistance and reduced sensitivity in Australian broadacre grain crops are outlined in Table 1.

**Table 1.** Fungicide resistance and reduced sensitivity cases identified in Australian broad acre grains crops.

| Disease | Pathogen | Fungicide Group | Compounds affected | Region (status) | Industry implications |
|---|---|---|---|---|---|
| Barley powdery mildew | *Blumeria graminis* f.sp. *hordei* | 3 (DMI) | Tebuconazole<br>Propiconazole<br>Flutriafol | WA (R), Qld, NSW, Vic, Tas, (L) | Field resistance and reduced sensitivity to some actives |
| Wheat powdery mildew | *Blumeria graminis* f.sp. *tritici* | 3 (DMI) | Propiconazole<br>Tebuconazole | NSW, Vic (R),<br>Tas, SA (L) | Field resistance to some actives in NSW and Vic. The gateway mutation is the first step towards resistance. This mutation does not seem to reduce efficacy in the field but combined with other mutations can affect DMI efficacy |
| | | 11 (QoI) | Azoxystrobin<br>Pyraclostrobin | Vic, Tas, SA & NSW (R) | Field resistance to all Group 11 fungicides |
| Barley net-form of net blotch | *Pyrenophora teres* f.sp. *teres* | 3 (DMI) | Tebuconazole<br>Epoxiconazole<br>Propiconazole<br>Prothioconazole | WA (R),<br>VIC, SA (RS) | Field resistance and reduced sensitivity to some actives |
| | | 7 (SDHI) | Fluxapyroxad<br>Bixafen<br>Benzovindiflupyr | SA,<br>(R & RS),<br>VIC (L) | Reduced sensitivity or resistance depending on the frequency of resistant population |
| Barley spot-form of net blotch | *Pyrenophora teres* f.sp. *maculata* | 3 (DMI) | Tebuconazole<br>Epoxiconazole<br>Propiconazole<br>Prothioconazole | WA (R, RS)<br>VIC (L) | Field resistance to some actives |

| | | | | | |
|---|---|---|---|---|---|
| | | 7 (SDHI) | Fluxapyroxad<br>Bixafen<br>Benzovindiflupyr | WA<br>(R, RS) | Field resistance and reduced sensitivity |
| Wheat septoria tritici blotch | *Zymoseptoria tritici* | 3 (DMI) | Tebuconazole<br>Flutriafol<br>Propiconazole<br>Cyproconazole<br>Triadimenol<br>Epoxiconazole | NSW, Vic, SA, Tas (RS) | Reduced sensitivity |
| | | 11 (QoI) | Azoxystrobin<br>Pyraclostrobin | SA, (Millicent region) (R) | Frequency of A143 mutation in Millicent region unknown. 32 STB samples collected from 29 locations across Victoria, South Australia and NSW in 2021 did not detect the mutation associated with resistance to QoI fungicides |
| Canola Blackleg disease | *Leptosphaeria maculans* | 3 (DMI) | Tebuconazole<br>Flutriafol<br>Prothiconazole<br>Fluquinoconazole | VIC, NSW, SA, WA (RS) | Reduced sensitivity |

**Table 1 definitions**

***Reduced sensitivity (RS)**: Fungi are considered as having reduced sensitivity to a fungicide when a fungicide application does not work optimally but does not completely fail. In most cases, this would be related to small reductions in product performance which may not be noticeable at the field level. In some cases, growers may find that they need to use increased rates of the fungicide to obtain the previous level of control. Reduced sensitivity needs to be confirmed through specialised laboratory testing. Note that mutations that cause field failure (full resistance) present at lower frequencies in a pathogen population would give similar field symptoms to mutations that cause small reductions in field performance but do not cause field failure.*

***Resistant (R)**: Resistance occurs when the fungicide fails to provide an acceptable level of control of the target pathogen in the field at full label rates. Resistance needs to be confirmed with laboratory testing and be clearly linked with an unacceptable loss of disease control when using the fungicide in the field at full label rates.*

***Laboratory detection (L):** Measurable differences in sensitivity of the pathogen to the fungicide when tested in the laboratory. Detection of resistance in the lab can often be made before the fungicide's performance is impacted in the field.*

## Fungicide reduced sensitivity and resistance in NSW/SA/Victoria in 2021

The following section carries results from three states. Although resistance results from Vic and SA may seem less relevant to the northern GRDC region, they give us an early warning of potential issues in southern NSW where farming systems are more similar to SA and Victoria.

### Wheat Powdery Mildew in the northern grains region

Wheat powdery mildew (WPM) was particularly problematic in NSW in 2020 but was less damaging in 2021.

Steven Simpfendorfer (NSW DPI) co-ordinated 22 samples of WPM for testing with CCDM over the last two seasons and the results revealed widespread fungicide reduced sensitivity in the DMIs and resistance in the QoIs (Table 2). The F136 mutation in WPM is a gateway mutation that doesn't confer field resistance but in combinations with other mutations (which are still being characterised) in the same gene does confer reduced sensitivity in the field.

**Table 2.** Location of 22 wheat powdery mildew samples collected across NSW in 2020 and 3 in 2021 along with frequency of DMI (triazole) gateway and QoI (strobilurin) mutations.

| Location | Year | Region | Variety | DMI F136 | QoI A143 |
|---|---|---|---|---|---|
| Katamatite | 2020 | NE Vic | Scepter | 100% | 90% |
| Katamatite | 2020 | NE Vic | Scepter | 100% | 90% |
| Cobram | 2020 | NE Vic | Scepter | 100% | 46% |
| Cobram | 2020 | NE Vic | Scepter | 100% | 28% |
| Balldale | 2020 | SE NSW | Scepter | 100% | 98% |
| Walbundrie | 2020 | SE NSW | Scepter | 100% | 5% |
| Rennie | 2020 | SE NSW | Suntop | 85% | 27% |
| Rennie | 2020 | SE NSW | Scepter | 85% | 20% |
| Jerilderie | 2020 | SE NSW | Scepter | 100% | 37% |
| Corowa | 2021 | SE NSW | Scepter | 100% | 94% |
| Deniliquin | 2020 | SW NSW | Scepter | 99% | 35% |
| Deniliquin | 2020 | SW NSW | Scepter | 99% | 20% |
| Deniliquin | 2020 | SW NSW | Scepter | 83% | 20% |
| Hillston | 2020 | SW NSW | Vittaroi | 96% | 21% |
| Hillston | 2020 | SW NSW | Vixen | 94% | 3% |
| Hillston | 2020 | SW NSW | Vixen | 85% | 6% |
| Yenda | 2020 | SW NSW | Cobra | 100% | 44% |
| Yenda | 2020 | SW NSW | Vixen | 100% | 12% |
| Finley | 2021 | SW NSW | Scepter | 100% | 38% |
| Edgeroi | 2020 | NE NSW | Lillaroi | 82% | 29% |
| Wee Waa | 2020 | NW NSW | Bindaroi | 62% | 51% |
| Wee Waa | 2021 | NW NSW | Aurora | 100% | 20% |

FAR working in collaboration with CCDM and NSW DPI ran an irrigated trial at Katamatite in NE Victoria in 2021 to determine the field performance of different modes of action and DMI active ingredients for control of WPM. The results illustrated some interesting differences in field performance which whilst not all statistically significant illustrated that the weaker compounds of triadimefon, epoxiconazole (Opus), tebuconazole (Folicur), cyproconazole and propiconazole (Bumper) were giving less than 50% control (Figure 1). Isolates from this trial were taken in October (post application) and the samples sent to CCDM for fungicide resistance testing. Analysis for the presence of the A143 mutation that affects WPM control globally when using group 11 QoIs (strobilurins) was present in all treatments (Figure 2) but as might be expected was highest in the experimental treatment that received straight strobilurin alone (azoxystobin - Mirador®). Therefore, although the WPM control within this experimental treatment was not the poorest (still less than 50% control) it indicates that the population that remains post application will be less effectively controlled. Clearly, we don't apply this fungicide alone in Australia but in mixtures with DMIs, however it demonstrates the selection pressure that can occur in a season when we use fungicide actives that are at higher risk of resistance development in the pathogen. Significant differences to the untreated in the level of the QoI mutation in plots treated with DMIs and the Group 5 fungicide Prosper® (spiroxamine) will be investigated further.

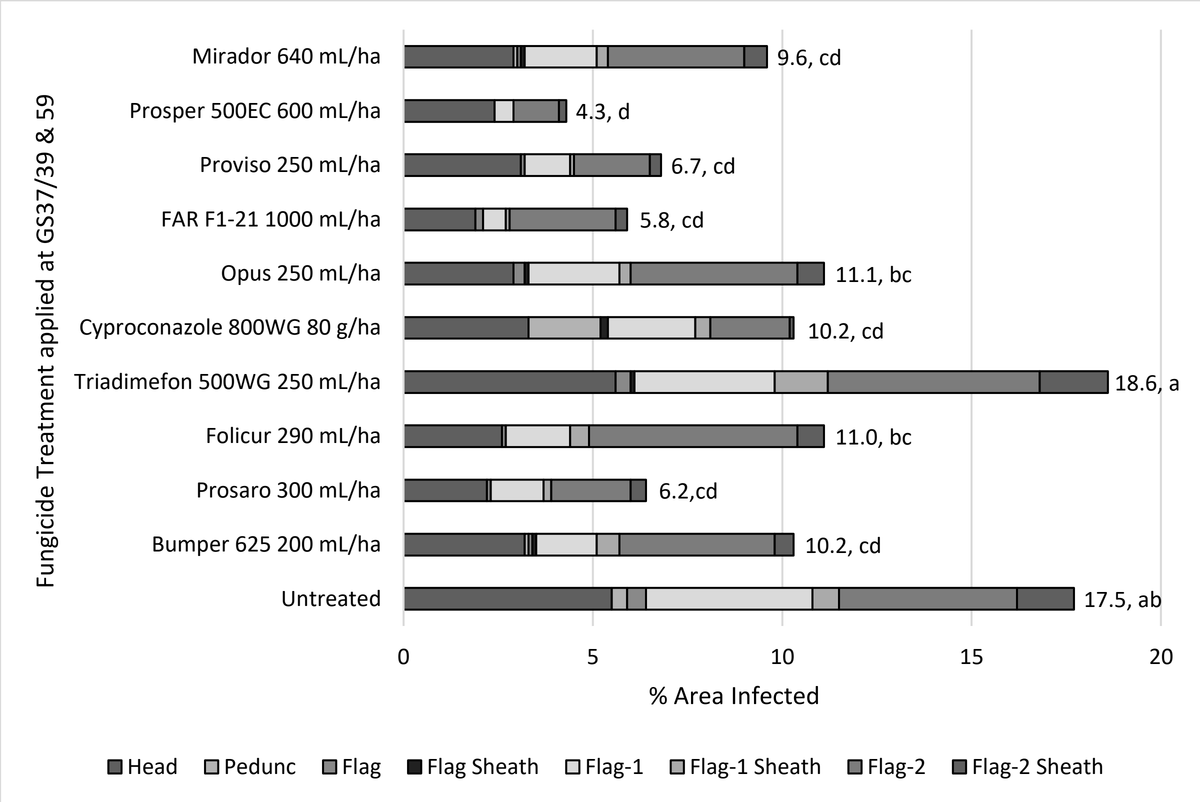


**Figure 1.** Influence of two spray fungicide application (GS37/39 and GS59) on wheat powdery mildew (WPM) infection on different components of upper canopy – cv Scepter, Katamatite, Vic 2021.
*Notes: Data labels and statistical significance based on total WPM infection of all plant components listed*
**Notes:** *Please be aware that cyproconazole, FAR F1-21, Prosper and Mirador have been included in this experimentation as experimental treatments that currently cannot be used commercially in this form. These treatments were included to test the full range of available individual fungicide actives some of which are only approved in mixtures*

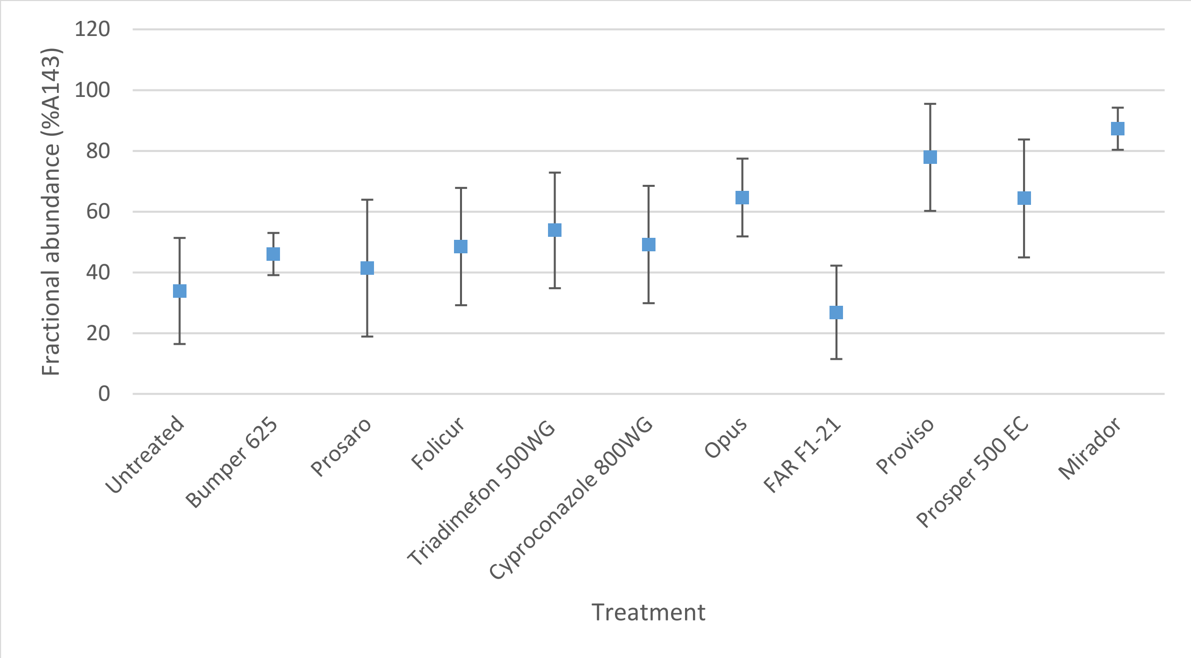


**Figure 2.** Fractional abundance of the A143 mutation in the different fungicide treatments applied for WPM control – cv Scepter, Katamatite, Vic 2021. (CCDM analysis)

*Note: When the mutation at G143A occurs the G amino acid in the wild type is replaced with an A amino acid*

**SDHI resistance and reduced sensitivity in net form of net blotch (NFNB) in barley**

The *SdhC*-H134R mutation in the SDHI (Group 7) target site, was detected in six samples from Victoria and one sample from South Australia in 2021. This mutation was first observed in Australia in NFNB from the Yorke Peninsula of South Australia in 2019 and is associated with the highest resistance factors affecting the key SDHI compounds such as fluxapyroxad, bixafen and benzovindiflupyr.

Four other samples from Victoria and one sample from South Australia in 2021 were associated with low resistance factors for SDHI compounds and classed as the mutations conferring reduced sensitivity. These mutations have been detected previously. In the case of the SdhD-D145G mutation it was first observed in Australia in NFNB from the Yorke Peninsula of South Australia in 2019 and in the case of SdhC-N75S in spot form of net blotch (SFNB) in the Cunderdin region in WA in 2020.

**DMI reduced sensitivity in NFNB**

The F489L-2 mutation in the DMI (Group 3) target, *Cyp51A*, was detected in six samples from Victoria and one sample from South Australia in 2021. This mutation was previously observed in Australia in NFNB from the Yorke Peninsula of South Australia in 2019 and is associated with reduced sensitivity to DMI compounds.

Genetic changes in the region that controls the DMI target were detected in one sample from South Australia in 2021. This different type of mutation has been previously observed in Australia in SFNB from Western Australia since 2016 and is associated with reduced sensitivity to DMI compounds.

**QoI resistance in septoria tritici blotch (STB)**

Fungal cultures isolated from two STB samples collected in South Australia in 2020, were found to carry fungicide resistance mutation A143, which is associated with full resistance to QoI (Group 11) fungicides. *In vitro* analysis of two STB resistant isolates obtained from these samples showed a 200-

fold increase in azoxystrobin resistance compared to sensitive reference isolates. Subsequent molecular analysis of 32 STB samples collected from 29 locations across Victoria, South Australia and NSW in 2021 did not detect the mutation associated with resistance to QoI fungicides.

**So what does this mean for growers and advisers**
Fungicide resistance management strategies which should be used within broader IDM include:

- With wheat and barley crops where two to three fungicide applications occur within a season, avoid repeat applications of the same product/active ingredient and where possible also avoid the same mode of action in the same crop. This is particularly important when using Group 11 QoI (strobilurins) and Group 7 SDHIs, which preferably would only be used once in a growing season.
- Avoid using the seed treatment fluxapyroxad (Systiva®) year after year in barley without rotating with foliar fungicides of a different mode of action during the season.
- Avoid applying the same DMI (triazole) Group 3 fungicide twice in a row, irrespective of whether the DMI is applied alone or as a mixture with another mode of action.
- Avoid the use of tebuconazole alone and flutriafol for STB pathogen control in regions where reduced sensitivity is problematic, as these Group 3 DMIs are more affected by reduced sensitivity strains than other DMIs.
- Group 3 DMIs such as epoxiconazole (Opus®) or triazole mixtures \such as prothioconazole and tebuconazole (Prosaro®) when used alone are best reserved for less important spray timings, or in situations where disease pressure is low in higher yielding scenarios.
- With SDHI seed treatments such as fluxapyroxad (Systiva®) or QoI fungicides used in-furrow such azoxystrobin (Uniform®), consider using a subsequent foliar fungicide with a different mode of action, and therefore avoiding, if possible, a second application of SDHI or QoI fungicide active.

Clearly, the best way to avoid fungicide resistance is not to use fungicides! However, in high disease pressure regions, this would be an unprofitable decision. When a cultivar's genetic resistance breaks down or is incomplete, it is imperative that growers and advisers have access to a diverse range of effective fungicides (in terms of mode of action) for controlling leaf disease. Hence, we need to protect their longevity. In order to protect them, one of the most effective measures is to minimise the number of fungicide applications applied during the season. Therefore, consider all aspects of an Integrated Disease Management (IDM) strategy when putting your cropping plans together at the start of the season, since this will help reduce our overall fungicide dependency.

**Principle components of IDM**
***Rotations*** – where possible avoid high risk rotations for disease, for example, barley on barley or wheat on wheat.
***Seed hygiene*** – minimise the use of seed from paddocks where there were high levels of disease that could be seedborne (e.g. Ramularia, net form net blotch).
***Use less disease susceptible cultivars***, particularly when sowing early. Where this is not possible delay the sowing of the most susceptible cultivars to reduce disease pressure where the phenology of the cultivar is adapted to the later development window.
***Cultural control*** such as stubble management, where disease risks are high and the penalties for stubble removal are not as high.
***Grazing*** early sown cereal crops up to GS30 to reduce disease pressure.

**AFREN (Australian Fungicide Resistance Extension Network)**

The Australian Fungicide Resistance Extension Network (AFREN) was established to develop and deliver fungicide resistance resources for grains growers and advisers across the country. It brings together regional plant pathologists, fungicide resistance experts and communications and extension specialists.

AFREN wants to equip growers with the knowledge and understanding that they need to reduce the emergence and manage the impacts of fungicide resistance in Australian grains crops.

As members of AFREN, the authors of this paper are keen to hear if you believe you are encountering reduced sensitivity or resistance in your broad acre crops.

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FAR Australia would like to acknowledge the assistance of Andrew McPherson and James Reilly in sourcing and managing the field trial conducted near Katamatite in 2021. The research undertaken as part of this project is made possible by the significant contributions of growers and their advisers through their support of the GRDC.

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FAR AUSTRALIA

NSW CROP TECHNOLOGY CENTRE

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

# Hyper Yielding Crops: NSW

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# Nutrien Ag Solutions Cootamundra

Nutrien Ag Solutions is committed to delivering a diverse range of products and services at the best possible value to our customers. We work hard to know your business and endeavour to help you grow it.

**Our Products & Services:**

- Merchandise
- Livestock
- Farm Services
- Finance
- Insurance
- Real Estate
- Wool
- Agronomy

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