# GRAINS RESEARCH UPDATE

## 2026

# Campbell Town

Wednesday 24 June

9.00am to 1.00pm

The Grange Estate,
4 Commonwealth Lane

**#GRDCUpdates**

**CAMPBELL TOWN**
**GRDC Grains Research Update**
**convened by ORM Pty Ltd.**

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# GRDC Grains Research Update CAMPBELL TOWN

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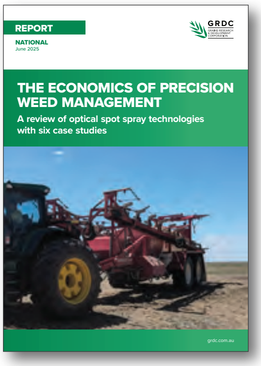
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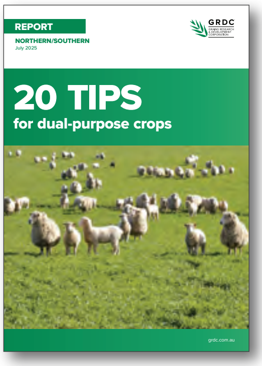
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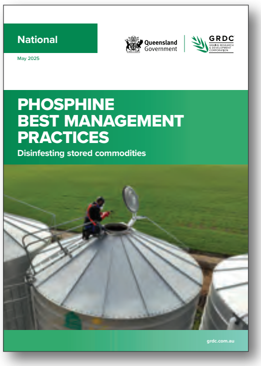
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# GRAINS RESEARCH UPDATE 2026

**The Grange Estate, Wednesday 24 June**

## PROGRAM

| | | |
|---|---|---|
| **9.00am** | Announcements and GRDC welcome | *GRDC representative* |
| **9.15am** | Improving fungicide spray decisions in wheat | *Tom Price,*<br>*FAR* |
| **9.55am** | Faba bean agronomy for better crops | *Grace Evans,*<br>*SFS* |
| **10.35am** | Morning Tea | |
| **11.05am** | From data to decisions: getting automation farm-ready at paddock scale | *Tim Neale,*<br>*DataFarming* |
| **11.45pm** | Beneficial insects to aid pest control | *Lilia Jenkins,*<br>*Cesar Australia* |
| **12.25pm** | The current drivers of global grain and input markets | *Andrew Whitelaw,*<br>*Episode3* |
| **1.10pm** | Lunch | |

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# SOUTHERN PANEL

## 2025-27 GRDC SOUTHERN REGIONAL PANEL

### ANDREW RUSSELL

PANEL CHAIR

**Rutherglen, Victoria**

Andrew is the director and a shareholder of Lilliput AG, and managing director of Baker Seed Co, a family owned farming and seed-cleaning business. He has served on GRDC's medium rainfall zone Regional Cropping Solutions Network and has held leadership roles with Riverine Plains Inc, Victorian Farmers Federation and the Rutherglen Group of fire brigades.

### PRU COOK

DEPUTY CHAIR

**Dimboola, Victoria**

Raised on a mixed farm in Victoria's Wimmera region, Pru has spent her professional career working in extension for the grains industry. Starting her career at the DPI, she has worked at GRDC and the Birchip Cropping Group, managing a number of extension projects. In recent years she has managed her own business specialising in extension, project development and project management.

### TIM MCCLELLAND

**Birchip, Victoria**

Tim farms with his wife, father and aunt on a 6500-hectare mixed property in the southern Mallee. After completing his Bachelor of Agriculture and Commerce at the University of Melbourne in 2006, he took on work at Advisor Edge, Birchip Cropping Group (BCG) and RMCG. In 2011, he moved back to Birchip to become formally involved in the family farm and continue his role with BCG.

### RUTH SOMMERVILLE

**Burra, South Australia**

Ruth is an agroecologist who runs a consulting business. She has a Bachelor of Science in Ecology and Master of Applied Science in Wildlife Management from the University of Sydney, and has worked in sustainable agriculture research, development and extension and property management since 2002. Ruth has been the Upper North Farming Systems Group Operations Committee Member in recent years.

### ANDREW WARE

**Port Lincoln, South Australia**

Andrew is a research agronomist who started his career with the South Australian Research and Development Institute (SARDI) and then spent time at CSIRO in Adelaide. This was followed by 10 years away from research, managing the family farm on the Lower Eyre Peninsula, before returning to SARDI. In 2019, he started his own research company, EPAG Research, delivering applied research across the Eyre Peninsula.

### DR KATHY OPHEL-KELLER

**Adelaide, South Australia**

Kathy is a strategic science leader with a strong track record in developing and leading national research programs with industry co-investment, including GRDC. Her own research background is in plant biosecurity and molecular detection of plant pathogens and she has a strong interest in capacity building and succession planning. Kathy is a former acting executive director of SARDI and a research director at Crop Sciences, covering applied research on plant biosecurity, crop improvement, climate risk management, water use efficiency and crop agronomy.

### WAYNE BURTON

**Halls Gap, Victoria**

Dr Wayne Burton has worked as an agricultural scientist and oilseeds breeder with over three decades of leadership across public and private sector research and development. Holding a PhD from the University of Melbourne and a Bachelor of Agricultural Sciences (Honours) from the University of Adelaide, he has played a pivotal role in the advancement of canola and mustard breeding and development in Australia.

### MAX YOUNG

**Ardrossan, South Australia**

Max Young farms at Ardrossan on the Yorke Peninsula. He has more than 40 years' experience growing predominately wheat barley and lentils. Max holds a Roseworthy Diploma in Agriculture and is a graduate of the Australian Institute of Company Directors (GAICD). He has served in leadership roles in both the South Australian No Tillage Association SANTFA and South Australian Grains Industry Trust (SAGIT) and is keenly interested in improving sustainable production through research. Max understands the importance of local grower groups as a conduit between researchers and growers.

### ADAM HANCOCK

**Naracoorte, South Australia**

Adam Hancock is a High Rainfall Zone agronomist with Elders, based in south-east South Australia. He has 15 years of experience advising grain growers to improve productivity and profitability through evidence-based agronomy and precision agriculture. He provides agronomic advice across a wide range of farming systems and environments, supporting clients with both in-season decision-making and long-term planning.

### GRETA DUFF

**Inverleigh, Victoria**

Greta Duff graduated from the University of Melbourne with a Bachelor of Agriculture, spending part of her studies at Dookie College. She began her career in the dairy industry before joining Southern Farming Systems (SFS) in 2020. Since then, Greta has led and contributed to a wide range of projects, particularly with GRDC, and is passionate about supporting the next generation of growers. Through her involvement with the Young Agricultural Professionals Network, she actively works to promote and retain young people in the agricultural industry.

### RON OSMOND

**General Manager of Strategy & Business Development**

Prior to joining GRDC in 2013, after completing a PhD in Agricultural Science, Ron worked in scientific and management roles in Intellectual Property Development and Commercialisation in the private sector. Ron's interest and expertise is in the translation of Research and Development into adoptable outcomes for Australian grain growers.

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# Can we make better disease management decisions in wheat with the aid of decision support tools

**Tom Price[1], Nick Poole[1], Max Bloomfield[1], Aaron Vague[1], Darcy Warren[1], Ben Morris[1], Rebecca Murray[1], Rajdeep Sandhu[1], Ashleigh Seach[1], Melissa Cook[2], Rohan Brill[3] and Sam Trengove[4].**

[1]Field Applied Research (FAR) Australia; [2]Agriculture Victoria; [3]Brill Ag; [4]Trengove Consulting.

**GRDC project code:** FAR2503-001RTX

## Keywords

- decision support tools, fungicide resistance, integrated disease management (IDM) strategies, wheat.

## Take home messages

- In a national survey of over 200 growers and advisers, 30% made their primary decisions on fungicide application based on the development stage of the wheat crop.
- Increasing issues with fungicide resistance in pathogen populations remind us that reducing fungicide applications and preventing preprogrammed prophylactic spraying is a key measure in slowing down fungicide resistance development.
- A new GRDC-funded investment is examining if decisions on fungicide applications could be improved using a range of decision support tools in conjunction with crop growth development stage.
- From simple rules of thumb based on rainfall and disease levels, through to newer tools such as the spore traps and apps (e.g. StripeRustWM app), the project is investigating if these tools can be used to improve fungicide approaches in wheat
- With results from the first year still being both harvested and analysed across four states, this paper reports on early results from the medium rainfall zone in Victoria.
- In a lower disease pressure season, early results of basing decisions not only on crop development stage but other supporting indicators have shown promise, with reduced fungicide applications increasing profitability.

## Overuse of fungicides and fungicide resistance

There has been a huge increase in the use of fungicides over the last twenty years, with few active ingredients available for use in broadacre cropping. However, unlike herbicide availability, there are limited available fungicide modes of action (MoA), with the industry being primarily dependent on only three MoA. The increase in the use of fungicides has resulted in increased issues with fungicide resistance, since the more we use fungicides to control disease, the greater the selection pressure on the pathogen population to change to more resistant biotypes. In broadacre crops, the Australian Fungicide Resistance Extension Network (AFREN) has made us very aware of those resistance issues, particularly pathogens that have either overcome our fungicide armoury or are in the process of overcoming them. AFREN has also reminded us over the last 5 years that **fungicides should be the last line of defence, not the first**. Key measures that should be pursued in an Integrated Disease Management (IDM) program, before fungicides are considered, are set out in the AFREN five.

1. Avoid susceptible crop varieties
2. Rotate crops – use time and distance to reduce disease carry-over
3. Use non-chemical control methods to reduce disease pressure
4. Spray only if necessary and apply strategically
5. Rotate and mix fungicides/MoA groups.

## Can we improve our current approach to fungicide application in wheat

If there is an overreliance on fungicides and fungicide resistance is increasing, is there anything we can do about it? Can we sensibly reduce fungicide input without increasing our disease risks and overall profitability? Can we modify our management to make better decisions that still maximise profitability but do not result in widespread prophylactic spray programmes based on preprogrammed disease management strategies? For example:

- Do we take sufficient account of either the genetic resistance of the variety, the physiological stage of the crop or the weather conditions dictating disease pressure?
- Are there new technologies or simple rules of thumb that would allow us to make more informed decisions?

The answer to these questions in wheat is being addressed by a new three-year GRDC investment ‘Integration of cost effective and sustainable management strategies for wheat foliar diseases in the southern region and southern NSW’ (FAR2503-001RTX) led by FAR Australia. This investment has the objective of assessing whether simple and novel approaches to decision-making based on physiology, infection thresholds and decision support tools (e.g. the disease apps, spore traps) can be used to make better, more profitable and sustainable decisions in wheat. The project covers nine research sites in the M-HRZ of four states: South Australia, Victoria, New South Wales and Tasmania.

How are growers in these regions currently making decisions on spraying fungicides? As part of the project field days this spring, we asked growers and advisers simple questions about their approach to spraying wheat. One question was ‘In 2025, how have you/will you make the decision to spray a fungicide?’ Responses from across the four states revealed that the development stage of the crop was put forward as the primary ranked factor for determining when to spray wheat, with 30% suggesting it the most important consideration. This is not to say that other factors were not considered, but that development stage of the crop was ranked first of the four factors (Figure 1).

The survey illustrates that growers and advisers recognise that the development stage of wheat and the production of the key leaves to drive grain fill need to be protected. In cereals, that is protecting the so-called **money leaves (top three – four leaves of the canopy, flag, flag-1, flag-2)**. So, the physiology of the crop is being considered by industry and is of primary consideration in making spray decisions. **However, is there an argument that we are now so fixated on spraying at key development stages and keeping the farm logistics simple, that we are ignoring the weather conditions, or the presence of disease in the crop itself, or evidence of pathogen activity?**

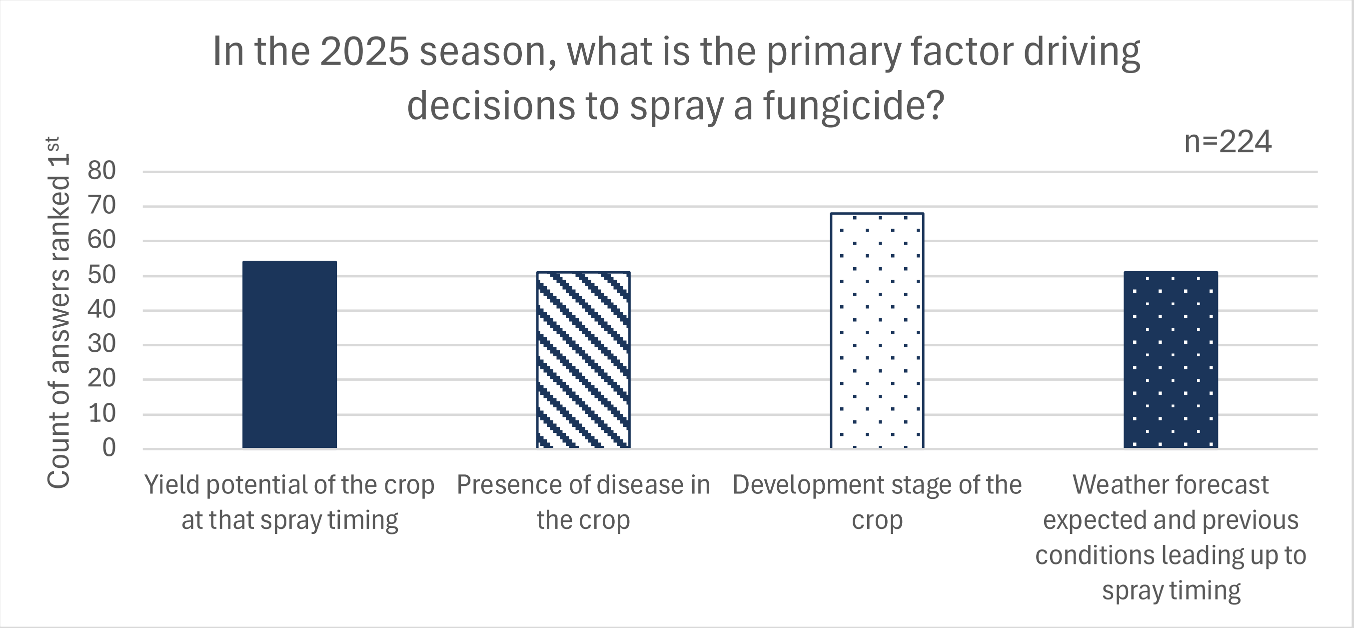

Figure 1. Growers and advisers mentimeter baseline survey 2025 (FAR2503-001RTX). In the 2025 season, how have you made/will you make the decision to spray a fungicide (ranking the four factors as primary factor). The graph illustrates how the four factors were ranked with regards to the factor ranked first.

Season 2025 did not shape up as a high disease pressure spring and was an ideal season to challenge our typical approach to fungicide application by growth stage. What are the simple indicators we could or should have been utilising to qualify spraying at the key development stages before we prophylactically spray fungicide across the whole wheat acreage?

## Simple rules of thumb

### *Resistant germplasm*

The simplest measure to reduce the number of fungicides applied is to grow a more resistant variety (to the diseases most prevalent in your region) than you are currently growing. When this is the case, do we adjust the number of fungicides applied? Do we reduce the rates of fungicide to match the lower risk? Or do we spray the acreage with the same fungicide irrespective of disease resistance rating because the logistics are simpler? Logistics are often put forward as a key reason that everything gets the same approach, that is, the same fungicide application. Certainly, it is easier logistics to omit a spray than to consider a lower application rate or cheaper fungicide, but if we purchase greater genetic resistance, can we profitably reduce the number of fungicide applications? It's imperative that we make use of genetic resistance to not only combat fungicide resistance (that is, to use less fungicides) but also to maximise our returns. The argument to apply the same fungicide to a more resistant variety as a susceptible variety, is that the genetic resistance in a resistant variety can break down to disease and thus, should be sprayed as an insurance measure. Whilst this can occur over time (that is, genetic resistance breaks down), with regional monitoring and references to independent information (NVT or the Germplasm Evaluation Network (GEN)), it's very often possible to get an early warning of such breakdowns. The use of the same fungicide input in resistant varieties as used in susceptible varieties is a classic overuse of fungicide and is often where fungicides provide the lowest economical return.

### *Use of disease thresholds and the presence of disease*

An international review of the different approaches to disease management in wheat was carried out. This review revealed that most overseas approaches (European, North American and New Zealand) were based on the growth development stage of the crop, but disease thresholds were also important to assess at the key development stages (Hansen 2022). It should be noted that establishing thresholds can be quite time consuming and, because of that, we don't always consider how much infection is present at specific development stages. In some cases, history has taught us that leaving stripe rust infection in susceptible crops will 'bite us' (a result that still shows through in 2025), even when the season is less conducive for other diseases, such as Septoria tritici blotch (STB). In

France, they have a threshold for STB related to a stem elongation growth stage: from GS32, >20% of the third leaf visible with symptoms (the last leaf emerged being counted if visible). In Australia, STB is frequently sprayed on sight at the tillering stage, with a disease incidence much lower than 50%. In contrast, the French might have 100% incidence in the lower canopy, but they are only concerned about the disease when the money (upper) leaves (flag, flag-1 and flag-2) are threatened.

### *Role of rainfall*

We know that rainfall is a key driver of disease pressure, particularly in wet weather diseases, such as Septoria tritici blotch (STB). High humidity and warm weather also favour the development of most foliar diseases, so more rainfall as spring temperatures increase means more disease. So, ask yourself, when does the key development period between the start of stem elongation (GS30–32) and early flowering (GS61) typically occur on your farm? In general, this period in wheat is typically 8–10 weeks, so monitoring exactly how much rain and how many rainfall events you have in this period is crucial to making more informed decisions. We also know that it will be a key driver of yield potential in those crops as well as disease pressure.

## More complex decision support tools

### *Spore traps*

Spore traps monitor fungal spore populations in the atmosphere. Using the BioScout spore trap network, spore levels were monitored and applications were triggered when peaks in pathogen spores were detected at critical growth stages. At sites that did not have a spore trap close by, local triggers/rules of thumb were implemented (Hagley site implemented the strategy to only spray when disease present and to save SDHI chemistry for the flag leaf).

### *Decision support app for stripe rust – StripeRustWM app*

This free app has been available for a few seasons now and uses a forecasting model to assist growers with fungicide application decisions, and the likely economic returns from those decisions in controlling stripe rust.

In 2026, a new decision support app will be released for STB, SeptoriaTriticiWM. The project will continue to test both apps in the coming season.

## First year results 2025

For most regions across southern Australia, the 2025 season was dry leading up to and during the stem elongation phase of wheat crops. This led to a relatively low disease pressure year, with 7 out of 9 sites providing yield response to fungicide applications. This paper looks at two contrasting sites; Yarrawonga (NE Victoria) and Hagley (Tasmania).

At Yarrawonga, the above protocol was used to test different disease management strategies in two varieties, Tomahawk CL Plus$^{A}$ (rated susceptible (S) to stripe rust, leaf rust, STB and very susceptible (VS) to wheat powdery mildew (WPM)) and the more disease resistant line RGT-Ponsford$^{A}$ (rated moderately susceptible (MS) to stripe rust, moderately resistant (MR) to leaf rust, moderately susceptible/susceptible (MSS) to STB and WPM). At Hagley, the same protocol was tested in Accroc$^{A}$ (rated moderately resistant/moderately susceptible (MRMS) to stripe rust, moderately susceptible (MS) to STB and susceptible (S) to leaf rust) and Longford$^{A}$ (rated resistant/moderately resistant (RMR) to stripe rust and leaf rust, and moderately resistant/susceptible (MRS) to STB).

Tables 1 and 3 show the yield and net margin results of six fungicide strategies applied to each variety at both research sites. The six treatments ranged from full control, based on three foliar fungicides (targeted at all diseases, Tables 2, 4 and 5), to strategies based on environmental triggers for STB, decision support app for stripe rust, through to spore spikes recorded in spore traps for STB and cereal rusts.

Neither the susceptible variety (Tomahawk CL Plus$^{\phi}$) or less susceptible variety (RGT-Ponsford$^{\phi}$) gave a significant yield response to fungicide (P=0.961), although the trend was for all fungicide treatments to be slightly higher yielding than the untreated (RGT-Ponsford$^{\phi}$ maximum response to fungicide 0.19t/ha and Tomahawk CL Plus$^{\phi}$ 0.33t/ha). If net margin gain ($/ha) was considered, using additional grain income generated by applying the fungicide minus fungicide and application costs, fungicide strategies applying a single fungicide were the most cost effective, particularly when the single fungicide was targeted for control of stripe rust. In terms of profitability, all three treatments were more profitable than the full four-unit fungicide control in both varieties (Treatment 2).

**Table 1:** Stripe rust and STB infection (%) at milky ripe (GS77), yield (t/ha) and net margins ($/ha) of different fungicide strategies in two different varieties at Yarrawonga, VIC – FAR CTC 2025.

| **Treatment** | **RGT-Ponsford$^{\phi}$** | | | | **Tomahawk CL Plus$^{\phi}$** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Yr flag leaf (%)** | **STB flag-1 (%)** | **Yield (t/ha)** | **Change in net margin ($/ha)** | **Yr flag leaf (%)** | **STB flag-1 (%)** | **Yield (t/ha)** | **Change in net margin ($/ha)** |
| 1. Untreated control | 0.9 b | 0.0 - | 5.41 | 0.0 | 2.9 a | 1.0 - | 5.79 | 0.0 |
| 2. Full control | 0.0 b | 0.0 - | 5.46 | -82.5 | 0 b | 0.2- | 5.98 | -33.5 |
| 3. 2 Spray control | 0.3 b | 0.0 - | 5.60 | 0.5 | 0 b | 0.0 - | 6.02 | 14.5 |
| 4. Spore trap | 0.2 b | 0.0 - | 5.59 | 18.0 | 0.2 b | 0.1 - | 6.06 | 49.5 |
| 5. DS apps (yr) | 0.0 b | 0.0 - | 5.55 | 22.0 | 0.1 b | 1.1 - | 6.12 | 88.5 |
| 6. Environmental triggers | 0.1 b | 0.0 - | 5.42 | -17.5 | 0 b | 0.3 - | 5.94 | 31.5 |
| **Mean** | | | **5.50 a** | | | | **5.98 b** | |
| Variety (yield) | Pval | 0.023 | Lsd (p=0.05) | | 0.35 | | | |
| Fungicide (yield) | Pval | 0.218 | Lsd (p=0.05) | | n.s | | | |
| Variety x Fungicide (yield) | Pval | 0.961 | Lsd(p=0.05) | | n.s | | | |

Disease severity scores followed by different letters are significantly different from one another.
Net margin: Value of additional grain at $350/t for AH grade minus cost of fungicide and application ($15/ha per pass). Minus net margin figures lost money compared to the untreated crop where no fungicide was applied.

**Table 2:** Treatment notes for Table 1.

| **Fungicide program** | **Target GS:31/32**<br>**Actual GS:32**<br>**Date:26 Aug** | | **Target GS:39**<br>**Actual GS:45**<br>**Date:18 Sep** | | **Target GS:59**<br>**Actual GS:61**<br>**Date:7 Oct** | |
|---|---|---|---|---|---|---|
| | **RGT-Ponsford$^{\phi}$** | **Tomahawk CL Plus$^{\phi}$** | **RGT-Ponsford$^{\phi}$** | **Tomahawk CL Plus$^{\phi}$** | **RGT-Ponsford$^{A}$** | **Tomahawk CL Plus$^{\phi}$** |
| Full control* | Opus® 500mL/ha | | Revystar® 750mL/ha | | Prosaro® 150mL/ha | |
| 2 spray control | Prosaro 300mL/ha | | Revystar 750mL/ha | | nil | |
| Spore trap ‘spike’ | Radial® 840mL/ha | | nil | | nil | |
| DS apps | nil | | Opus 500mL/ha | | nil | |
| Environmental triggers | nil | | Proviso® 250mL/ha | | nil | |

*Includes in-furrow treatment flutriafol 200mL/ha

In contrast to Yarrawonga, there were large yield responses (+6 t/ha) at the Hagley site from fungicide application in the susceptible variety Accroc$^{\phi}$ (table 3), while the resistant variety Longford$^{\phi}$ provided no yield response. This is a perfect example of how the use of truly resistant genetics can reduce fungicide use even in high pressure situations.

The longer growing season in Tasmania resulted in a clear advantage to the 3 foliar spray programs incorporating a head spray/flag leaf top up. The 3 foliar spray program was the most cost-effective strategy in Accroc$^{\phi}$ (local rule of thumb) providing a net margin increase of over $1800/ha. The response to fungicide was not significant in Longford$^{\phi}$ (P<0.001) but the local rule of thumb and the DS app approach resulted in no fungicides being applied and were as a result more cost effective than fungicide treated approaches.

**Table 3:** Stripe rust and STB infection (%) at midflowering (GS65), yield (t/ha) and net margins ($/ha) of different fungicide strategies in two different varieties at Hagley, TAS – FAR CTC 2025.

| **Treatment** | **Longford**ᶲ | | | | **Accroc**ᶲ | | | |
|---|---|---|---|---|---|---|---|---|
| | **Yr flag leaf (%)** | **STB flag-1 (%)** | **Yield (t/ha)** | **Change in net margin ($/ha)** | **Yr flag leaf (%)** | **STB flag-1 (%)** | **Yield (t/ha)** | **Change in net margin ($/ha)** |
| 1. Untreated control | 0.0 c | 0.0 d | 15.48 ab | 0.0 | 37.3 a | 11.1 a | 9.21 d | 0.0 |
| 2. Full control | 0.0 c | 0.0 d | 15.22 ab | -207.3 | 6.1 b | 4.9 b | 12.44 c | 839.8 |
| 3. 2 spray control | 0.0 c | 0.0 d | 15.66 ab | -29.8 | 2.4 bc | 2.6 c | 14.97 ab | 1644.3 |
| 4. Local rule of thumb | 0.0 c | 0.1 d | 16.09 a | 183.0 | 0.9 c | 4.2 bc | 15.74 ab | 1845.3 |
| 5. DS apps (yr) | 0.0 c | 0.0 d | 15.18 ab | -90.0 | 0.9 c | 2.4 c | 14.82 ab | 1584.8 |
| 6. Environmental triggers | 0.0 c | 0.0 d | 16.10 a | 113.5 | 0.7 c | 2.7 c | 14.29 b | 1404.3 |
| **Mean** | | | **15.62 a** | | | | **13.58 b** | |
| Variety (yield) | Pval | 0.036 | | | Lsd (p=0.05) | | | 1.80 |
| Fungicide (yield) | Pval | <0.001 | | | Lsd (p=0.05) | | | 1.18 |
| Variety x Fungicide (yield) | Pval | <0.001 | | | Lsd (p=0.05) | | | 1.67 |

Disease severity scores followed by different letters are significantly different from one another.
Net margin: Value of additional grain at $350/t for AH grade minus cost of fungicide and application ($15/ha per pass). Minus net margin figures lost money compared to the untreated crop where no fungicide was applied.

**Table 4:** Treatment notes for Table 3.

| **Fungicide program** | **Target GS:31/32**<br>**Actual GS:31-32**<br>**Date: 22 Sep** | | **Target GS:39**<br>**Actual GS:39**<br>**Date: 20 Oct** | | **Target GS: 59**<br>**Actual GS:59-61**<br>**Date: 6 Nov** | |
|---|---|---|---|---|---|---|
| | Longfordᶲ | Accrocᶲ | Longfordᶲ | Accrocᶲ | Longfordᶲ | Accrocᶲ |
| Full control | Opus 500mL/ha | | Revystar 750mL/ha | | Prosaro 150mL/ha | |
| 2 spray control | Prosaro 300mL/ha | | Revystar 750mL/ha | | nil | |
| Local rule of thumb | nil | Opus 500mL/ha | nil | Revystar 750mL/ha | nil | Prosaro 300mL/ha |
| DS apps | nil | Radial 840mL/ha | nil | Revystar 500mL/ha | nil | |
| Environmental triggers | Radial 840mL/ha | | Revystar 750mL/ha | Revystar 500mL/ha | Prosaro 300mL/ha | |

*Includes in-furrow treatment flutriafol 200mL/ha

**Table 5:** Treatment formulations and active ingredients rates.

| **Product** | **Actives** | **Rate applied/ha** |
|---|---|---|
| Flutriafol | 500g/L flutriafol | 200mL (100gai) |
| Opus 125 | 125g/L epoxiconazole | 500mL (62.5gai) |
| Revystar | 100g/L mefentrifluconazole + 50g/L fluxapyroxad | 750mL (75 + 37.5gai) |
| | | 500mL (50 + 25gai) |
| Radial | 75g/L azoxystrobin + 75g/L epoxiconazole | 840mL (62.5 + 62.5gai) |
| Proviso | 250g/L prothioconazole | 250mL (62.5gai) |
| Prosaro 420 SC Foliar | 210g/L prothioconazole + 210g/L tebuconazole | 300mL (63 + 63gai) |

## Key Message

The key message is that the most cost-effective disease management strategies were those that took account of development stage and looked at other supporting data to make a more informed decision. The result was less fungicide applied, resulting in less selection pressure on the pathogen population, reduced fungicide resistance risk and a more profitable outcome.

## Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the authors would like to thank them for their continued support. FAR Australia gratefully acknowledges the support of all research and extension partners in the Wheat Disease Management project which include Agriculture Victoria, Brill Ag and Trengove Consulting.

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BioScout public spore trap network (https://www.bioscout.com.au/nationalnetwork)

StripeRustWM Strip Rust Wheat Management App, Department of Primary Industries and Regional Development, Western Australia. https://www.dpird.wa.gov.au/online-tools/striperustwm/

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# NGN faba bean variety and agronomy trials in Tasmania

***Grace Evans.***

*Southern Farming Systems.*

**GRDC project code:** SFS2503-001RTX

### Keywords

- agronomy, faba beans, Tasmania, variety performance

### Take home messages

- Faba bean production in Tasmania is limited due to a range of factors.
- These trials aimed to assess varietal performance, densities, and disease management strategies.

## Background

The NGN faba bean variety and agronomy trials in Tasmania aim to address the current limitations in faba bean production within the region. Despite the high cost of importing new varieties and the limited adoption of faba beans due to lower returns compared to other field crops, there is a renewed interest in this legume rotation crop. This resurgence is driven by the development of local market opportunities.

Currently, Tasmanian growers have limited experience with new faba bean genetics and their performance under local conditions. This includes understanding the appropriate agronomic management practices unique to the region, such as varietal performance, optimal sowing times, and disease management strategies.

Trial work in the High Rainfall Zone (HRZ) of Victoria has shown that faba bean yields can reach up to 9t/ha. This has spurred interest among local growers to explore genetic advancements through the trial of new varieties in Tasmania. Additionally, the trials aim to define the best agronomic practices for the region's specific growing conditions.

## Method

The first year of the project saw four trials completed at the SFS Tasmania Hagley trial site. These trials consisted of a fungicide by variety trial, a faba bean density trial, a tick bean (faba minor) density trial, and a spring sown variety trial.

### *Fungicide by variety trial*

The trial was established to evaluate the interaction between faba bean variety and fungicide program under field conditions. Three varieties were included: PBA Amberley$^{\phi}$, PBA Bendoc$^{\phi}$ and PBA Samira$^{\phi}$. These were selected to represent a range of disease resistance levels to Chocolate Spot (based on National Variety Trial (NVT) disease ratings) and maturity types. PBA Bendoc$^{\phi}$ is considered the most susceptible (S), PBA Samira$^{\phi}$ moderately susceptible (MS), and PBA Amberley$^{\phi}$ the highest rating of moderately resistant, moderately susceptible (MRMS) and offers a more robust disease package of the three.

Three fungicide strategies were implemented to reflect different levels of disease management input. A nil fungicide program was included as an untreated control to provide a baseline for disease development and yield response. A budget or tactical fungicide program consisted of two applications, with Amistar® Xtra applied at the 5-node growth stage on 1 September 2025, followed by Miravis® Star applied at late flowering on 29 September 2025. A full fungicide program was also included, which followed the same early and mid-season applications as the budget treatment. Veritas® was also applied at late podding on 29 November 2025 to extend disease protection through to the end of the season.

The trial was sown on 20 May 2025 at a target plant density of 25 plants/m$^2$. Establishment counts were conducted early in the season to assess plant population across treatments. Phenology assessments were undertaken throughout the growing period to monitor varietal development, allowing comparison of maturity differences and alignment with disease risk periods and fungicide application timings.

Disease assessments were planned as part of the trial to monitor incidence and severity across treatments. However, the extremely low disease pressure experienced during the 2025 growing season meant that formal disease scoring was not required.

Soil testing was carried out at three key stages of the trial. Samples were collected prior to sowing to establish baseline conditions, again in October during peak crop growth and nodulation, and post-harvest in April 2026 to assess changes in soil status following the crop. At harvest, plots were assessed for grain yield, protein concentration and hundred grain weight. Gross margin analysis will also be conducted to evaluate the economic performance of each treatment combination. At the time of this report's submission, harvest data and economic analyses have not yet been processed and results will not be available until August 2026.

### *Faba bean density trial*

The trial was established to assess the effect of sowing density on phenology, crop development, yield and profitability of the faba bean variety PBA Amberley$^{A}$ under Tasmanian farming conditions. Three target plant densities were selected: 10, 20 and 30 plants/m$^2$, representing low, medium and high plant populations. These densities corresponded to approximate sowing rates of 70, 145 and 215kg/ha, respectively.

The trial was sown on 20 May 2025 and harvested on 24 February 2026. Establishment counts were conducted early in the season to confirm that target plant populations were achieved across treatments. Phenology assessments were undertaken throughout the growing season to monitor crop development and determine the timing of key growth stages, including 50% flowering and 50% podding.

Further crop assessments were conducted in late November (27 November 2025) to better understand yield components and harvest implications across plant densities. These measurements included the number of branches and pods produced per square metre, which were used to estimate yield potential. The height to the first pod on the stem was also recorded, as this is an important consideration for harvest efficiency. This measurement is particularly relevant for both direct heading and windrowing operations, where sufficient pod height is required to minimise grain loss while avoiding the risk of machinery damage from cutting too low and potentially collecting soil or debris.

At harvest, plots were assessed for grain yield, protein content and hundred grain weight (HGW). Profitability calculations will also be undertaken to compare the economic performance of each sowing density. At the time of this report's submission, harvest and economic data have not yet been analysed and results will not be available until August 2026.

### *Tick bean density trial*

This trial was designed to assess the impact of sowing density on crop development, yield potential and profitability under Tasmanian conditions. In each case, trials were sown on 20 May 2025 and harvested on 24 February 2026. Establishment counts were conducted to confirm target plant populations and phenology assessments were undertaken throughout the season to determine 50% flowering and podding dates. Both trials also included detailed late November assessments (27 November 2025), measuring branch number, pod number per square metre and height to the first pod, providing insight into yield components and harvestability considerations such as cutting height and risk of grain loss or machinery damage. Final harvest measurements for both trials included grain yield, protein content, grain weight and planned profitability analysis, although results were not available at the time of reporting.

The key differences between the two trials were the variety used and the target plant densities. The first trial focused on the variety PBA Amberley$^{\phi}$ with lower target densities of 10, 20 and 30 plants/m$^2$ (70, 145 and 215kg/ha), while the second trial used the tick bean variety 3FB240 and targeted higher densities of 30, 40 and 50 plants/m$^2$ (130, 175 and 220kg/ha). These differences were designed to reflect contrasting plant architecture and growth habits between conventional faba bean and tick bean types, and to evaluate how optimal plant population influences crop performance and harvest outcomes across varieties.

### *Spring sown variety trial*

The final trial in the program examined the performance of spring-sown faba beans under Tasmanian conditions. Building on the previous trials by maintaining similar core measurements, this trial expanded the focus to varietal performance under a spring sowing window. This trial was established in response to the strong potential of faba beans as a break crop in Tasmania. This was also alongside the recognised gap in local data for spring sowing systems, where shortened growing seasons and different environmental conditions can substantially influence crop development, flowering synchrony and overall productivity.

The trial included a range of commercially available varieties alongside developing and newly released breeding lines to capture both current and emerging genetic options. Varieties included PBA Bendoc$^{\phi}$, PBA Amberley$^{\phi}$ and PBA Samira$^{\phi}$, as well as four trial lines: AF15283 (now released as Barmah), AF17014, 16NF871 B-4 and 16NF891 D-8. The inclusion of these trial lines aimed to demonstrate the potential of new material and assess how these lines perform under Tasmanian spring-sown conditions relative to established varieties. All varieties were sown at a uniform target density of 25 plants/m$^2$ to ensure differences observed were attributable to genetic performance rather than plant population.

Consistent with the broader trial program, establishment counts were undertaken to confirm plant populations, and phenology assessments were conducted throughout the season to monitor crop development and key growth stages. At harvest, plots were assessed for grain yield and quality, with financial analysis planned to evaluate the economic viability of each variety. As with the other trials in the program, harvest and economic data have not been analysed at the time of report submission and results will not be available until August 2026.

## Results and discussion

Results are not available at the time of paper submission. For more up-to-date details, please visit the Southern Farming Systems website to view the 2025 Trial Results Book.

## Acknowledgements

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation, and the support of the GRDC, the author would like to thank them for their continued support. Thank you to Jason Brand (GEM Agronomy), James Manson, and Jon Midwood (TechCrop) for assisting in the design and development of these trials. Thank you to SFS staff for their management of the trials.

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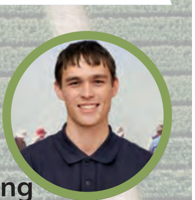

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# Taking the first steps to automated agronomy – don’t be alarmed

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**GRDC project codes:** DFL2312-001RTX, DFL2304-001RTX, DFL2304-002RTX

## Keywords

- agronomy, automation, drone-in-a-box, satellites.

## Take home messages

- Crop agronomy is a key part of the pathway to autonomy in grain production systems.
- Weeds, diseases, pests, nutrition disorders, and other anomalies can be detected using sensors, artificial intelligence, and satellite imagery.
- This information can be fed back to machinery and, ultimately, robots to treat affected areas.
- Agronomy is already highly digital, but poorly automated. Data are collected extensively, yet interpretation, prioritisation, and action remain heavily manual.
- Automation should focus on scaling agronomist capability rather than replacing agronomists.

## Background

GRDC has embarked on several new ambitious projects to explore, research, test, and navigate the pathway to autonomy in grain production systems. A key part of this pathway is crop agronomy. Our projects are examining how we can detect weeds, diseases, pests, nutrition disorders, and other anomalies using sensors, artificial intelligence, and satellite imagery – and feed this information back to machinery (robots in the future) to treat affected areas.

We are currently at the halfway stage of these projects, and they are focused on:

- green on brown weed detection (fallow) from satellite, and section-control herbicide application
- green on green weed detection (for example, ryegrass in cereals) from satellite, and section-control herbicide application
- early-stage disease detection (foliar diseases in cereals, Rhizoctonia) from satellite and targeted control with fungicides/cultural practices
- early detection of anomalies in crop growth using satellite imagery and providing alerts to growers and agronomists
- use of ‘drone-in-a-box’ technology for targeted crop scouting
- fusion of several datasets to help make decisions (yield, as-applied, imagery, EM, topography, protein)
- use of natural language models/AI to produce pesticide/nutritional recommendations
- the barriers to adoption of autonomous agronomy, and how an agronomist role might change over time.
- The projects demonstrated that agronomy is already highly digital, but poorly automated. Data are collected extensively, yet interpretation, prioritisation, and action remain heavily manual. The project confirmed that automation should focus on scaling agronomist capability rather than replacing agronomists.

## What is working now (high confidence)

The following facets are working well currently:

- AI-assisted interpretation of agronomic data
    - automated soil test interpretation is a proven near-term use case
    - AI can rapidly summarise results, identify constraints, and suggest research-backed remediation options
    - benefits include time savings, consistency, scalability, and support for less-experienced agronomists
    - accuracy is acceptable when data are structured and reference ranges are explicit
- paddock zoning and spatial prioritisation
    - electromagnetic (EM) sensing and stacked NDVI reliably define management zones
    - automation of zone creation and delivery is already achievable
    - these zones are suitable inputs for AI systems and variable-rate decisions
- remote sensing for detection and triage
    - satellite imagery change detection (temporal analysis) is effective for establishment checks, growth tracking, foliar disease, and crop dry-down/harvest assessments
    - high-resolution imagery can identify larger fallow weeds, and spatial anomalies such as Rhizoctonia
    - hyperspectral imagery can identify nutritional disorders, disease, and green-on-green weeds, such as ryegrass in wheat (noting that work to date is still limited)
    - the real value is directing attention (where to look), not replacing ground truthing.

## What is partially working (medium confidence)

The following facets are partially working at present:

- anomaly detection
    - Identifying ‘what is not normal’ across a paddock is technically feasible
    - this forms the backbone of future autonomous workflows for weeds, pests, diseases and nutrition
    - causal attribution (nutrition vs disease vs water vs pests) remains immature and R&D heavy
- AI conversational interfaces
    - chat-style interfaces reduce friction and improve usability of software platforms
    - transition from ‘assistant’ to ‘decision-support with triggers’ is plausible but requires guardrails (guidance from industry experts)
    - clear validation steps remain essential.

## What is not ready (low confidence)

The following facets are require further development:

- robotics and physical automation
    - robotic soil sampling and in-crop intervention are low TRL (technology readiness level) and poorly suited to Australian broadacre systems
    - cost, logistics, and limited benefit relative to manual methods make them non-viable in the near term
- fully autonomous drones
    - drone-in-a-box technology is technically sound but commercially constrained
    - CASA regulation, range limits, and operator requirements are major blockers.

## Critical constraints identified

The following critical constraints have been determined:

- data inconsistency is the primary bottleneck
- soil lab reports arrive in PDFs, Excel files, and APIs with inconsistent schemas
- many reports lack reference ranges, crippling automated interpretation
- AI accuracy degrades sharply with unstructured inputs and lack of supervision
- weather data density is far below what autonomy requires
- security risks around using AI in business was highlighted
- regulation lags technology, creating uncertainty.

## Strategic insights

The following strategic insights have been ascertained:

- software-first automation delivers the fastest ROI (return on investment)
- humans must remain in the loop for validation, accountability, and trust
- automation should prioritise interpretation, prioritisation, and timing
- robotics should be treated as a longer-term enabler, not a foundation.

## Priority industry gaps

The following industry gaps have been identified:

- standardised, AI-ready agronomic data formats
- region and crop-specific soil thresholds and recommendations
- CASA reform specific to agricultural drone operations
- dense, low-cost weather sensor networks
- sovereign high-resolution satellite capability.

## Conclusion

Agronomic automation is not a technology problem — it is a coordination, standardisation, and integration problem. The opportunity is real, near-term, and software-led. Software-first automation delivers the fastest return on investment because it scales interpretation and decision-making without requiring new hardware or regulatory change. Humans must remain in the loop to validate outputs, retain accountability, and maintain trust with growers and markets, particularly where decisions carry financial or agronomic risk. AI can be used to determine what matters, where to act, and when intervention is required. Robotics should be viewed as a longer-term enabler that may eventually execute decisions, but not as the foundation of current automation strategies.

## Acknowledgements

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# Supporting beneficial insects to strengthen pest control

***Lilia Jenkins[1], Evatt Chirgwin[1], Lisa Kirkland[1], Ary Hoffmann[2], Melissa Carew[2], Olivia Bange[3] and Paul Umina[1 2].***

*[1]Cesar Australia; [2]The University of Melbourne; [3]The Crop Capsules Company.*

**GRDC project codes:** UOM2404-006RTX, CES2307-001RTX

## Keywords

- beneficial insects, chemical toxicity, pest control, selective insecticides.

## Take home messages

- Protect beneficial insects if you want them to work for you**.** Broad-spectrum insecticides reduce the biological control provided by natural enemies.
- Use the updated Beneficials Chemical Toxicity Table, now including honeybees, to guide spray choices that protect natural enemies and pollinators.
- Look beyond insecticides when managing pests. Field evidence shows that augmentation of parasitoid wasps can reduce aphid numbers and slow population growth across the season, while insecticides mainly delivered short-term suppression.

## Background

Insecticides remain a cornerstone of pest management, providing a fast and cost-effective means of reducing pest pressure and protecting crops. However, the limitations of traditional chemical-based management have become increasingly apparent. Repeated exposure to the same modes of action has driven resistance evolution in several key pests in grains crops, including green peach aphids (*Myzus persicae*), bluegreen aphids (*Acyrthosiphon kondoi*), and redlegged earth mites (*Halotydeus destructor*). Many insecticides also have off-target impacts on beneficial insects, mites and pollinators, eroding ecological processes that would otherwise benefit crop productivity.

The long-term financial implications of this pattern extend beyond the immediate cost of a spray pass, contributing to a system that requires higher intervention and faces greater volatility (Murray et al. 2013). This creates a tension at the heart of modern pest management. Insecticides are a valuable tool, yet every spray carries the possibility of undermining the very biological systems that help to ensure long-term stability and profitability.

Integrated pest management (IPM) offers a pathway through this tension by using multiple management tools, such as beneficial insects, cultural methods, and crop resistance, alongside careful insecticide application in combination (Umina et al. 2019). However, successful adoption of IPM depends on growers having access to suitable management advice and tools to make informed decisions.

In Australian broadacre settings, growers already rely heavily on the beneficial insects in their fields. Naturally occurring pest enemies, such as parasitoid wasps, hoverflies, ladybird beetles, and lacewings, suppress pests below economically damaging thresholds, The use of selective chemicals that have a reduced impact on these organisms is a key part of IPM, as it allows growers to target pest species while reducing harm to beneficial insects, mites and other invertebrates.

However, even when beneficial insects are preserved, they need time to grow in numbers – via reproduction and migration – to levels that can meaningfully suppress growing pest populations, which can leave early season control gaps. Augmentation, the release of commercially reared parasitoids or predators into crops, can potentially help to close the time gap between pest pressure and natural enemy response (Eilenberg et al. 2001). While augmentation has already been successful in some agricultural settings, especially in high-value and protected cropping systems (for example, berries and cotton), its economic feasibility in Australian grains production remains uncertain (Nielsen et al. 2025).

Despite their potential, selective chemical use and augmentation are constrained by knowledge gaps, and the full value of beneficial insects is often unrealised. Growers need clear and accessible evidence about the efficacy and cost-effectiveness of beneficial insects to empower them to make informed IPM choices. Currently, gaps in empirical data on insecticide impacts on beneficial insects, including natural enemies and pollinators, limit efforts to implement such practices effectively alongside chemical use.

This lack of decision-support infrastructure poses a substantial barrier to the broader adoption of IPM. Addressing these knowledge gaps therefore represents important investments for the grains industry. Two recent research streams are attempting to address these questions.

The first is the ongoing refinement of the Beneficials Chemical Toxicity Table, a decision-making tool that consolidates information on the impacts of commonly used insecticides on several beneficial insect groups that add most value to grain systems. Following feedback from growers and advisers, the new version includes toxicity data for honeybees, allowing growers to more fully assess the consequences of chemical choices on pollination services, as well as on natural enemies, such as parasitoids. This work has been supported by the Australian Grains and Horticulture Pest Innovation Program (UOM2404-006RTX).

The second research stream (CES2307-001RTX) focuses on controlling one of the most economically important pests in grains – aphids – by augmenting populations of parasitoid wasps, which are widespread and effective natural enemies of aphids. The project is evaluating the value of parasitoid wasps in canola by examining how augmentation compares with conventional chemical control for aphids and the broader effects of each management method on local beneficial insect communities.

Together, these studies highlight both the risks of indiscriminate insecticide use and the opportunities that arise when chemical inputs and biological control are managed strategically.

## Methodology

### *Study 1: Beneficials Chemical Toxicity Table*

Key beneficial insects and insecticides relevant to the Australian grains industry were identified through expert consultation. Existing toxicity data were then compiled via a systematic literature review, with laboratory tests conducted to fill gaps using standard International Organisation for Biological Control (IOBC) protocols (see Knapp et al. 2023 for details). In short, toxicity classifications for natural enemies followed IOBC guidelines, which use per cent acute mortality after 48–72 hours exposure to each insecticide chemical.

Toxicity data for honeybees were derived from studies conducted under OECD laboratory protocols, which reflect the worse-case $LD_{50}$ values (the dose causing 50% mortality of the test population) at 24, 48, and 72 hours.

Data were analysed, standardised, and combined with existing Australian and international research to create the Beneficials Chemical Toxicity Table. In the table, a rating of low (L) represents <30% mortality, medium (M) 30–79%, high (H) 80–99% and very high (VH) >99% mortality. These ratings follow international guidelines published by the IOBC for beneficial insects (Hassan et al. 1994). Where toxicity varied within a species or chemicals within a group, ratings appear as split cells.

For honeybee toxicity, classifications were based on UK guidelines from the Pesticide Properties DataBase (PPDB), whereby low toxicity = $LD_{50}$ >100µg a.i./bee, moderate toxicity = $LD_{50}$ = 1–100µg a.i./bee, and high toxicity = $LD_{50}$ <1µg a.i./bee.

### *Study 2: Parasitoids in canola*

Field trials are running in 2024–2026 that are assessing aphid control by natural and augmented parasitoids using three plot types:

- augmented: commercial *Diaeretiella rapae* releases to boost natural populations
- natural: no releases, only existing parasitoids
- conventional: standard management, including insecticides.

In 2025 trials, each plot consisted of eight 0.5-ha subplots, with augmented and natural plots paired with conventional plots within a paddock, at a minimum of 250m apart to minimise parasitoid movement. Eighteen augmented sites, 11 natural parasitoid sites, and two unpaired conventional sites were surveyed across four regions: Northern NSW (6), Southern NSW (11), Northern Vic (7), and Southwest Vic (7).

Surveys occurred in winter and again in spring. *D. rapae* was released during the winter survey in augmented plots at 1000 parasitoids/ha using biodegradable capsules, staggered by latitude, with northern sites released earlier due to warmer conditions and earlier sowing dates. Follow-up surveys were conducted 9–12 weeks later at the pod-fill stage, timed to enable *D. rapae* to breed over ~3 generations before aphid outbreaks typically occur in spring.

Three plants per subplot (32 per plot) were examined in each survey for aphid and mummy densities, along with 10 additional biological parameters. Yield estimates were collected from each plot at the end of each season. Models were used to disentangle the effects of treatments on aphids, parasitoids, and yield, while accounting for other factors.

We assessed how parasitoid-based management adds value to the broader community of beneficial species by comparing eight insecticide-sprayed plots (carbamates or pyrethroids) with eight unsprayed sites relying on parasitoids for aphid control. In spring 2024, five sweep and vacuum samples were collected in a 3m$^2$ area 20m apart at each plot. DNA metabarcoding was then used to identify the species collected. This represents an emerging, rapid method for assessing biodiversity.

## Results

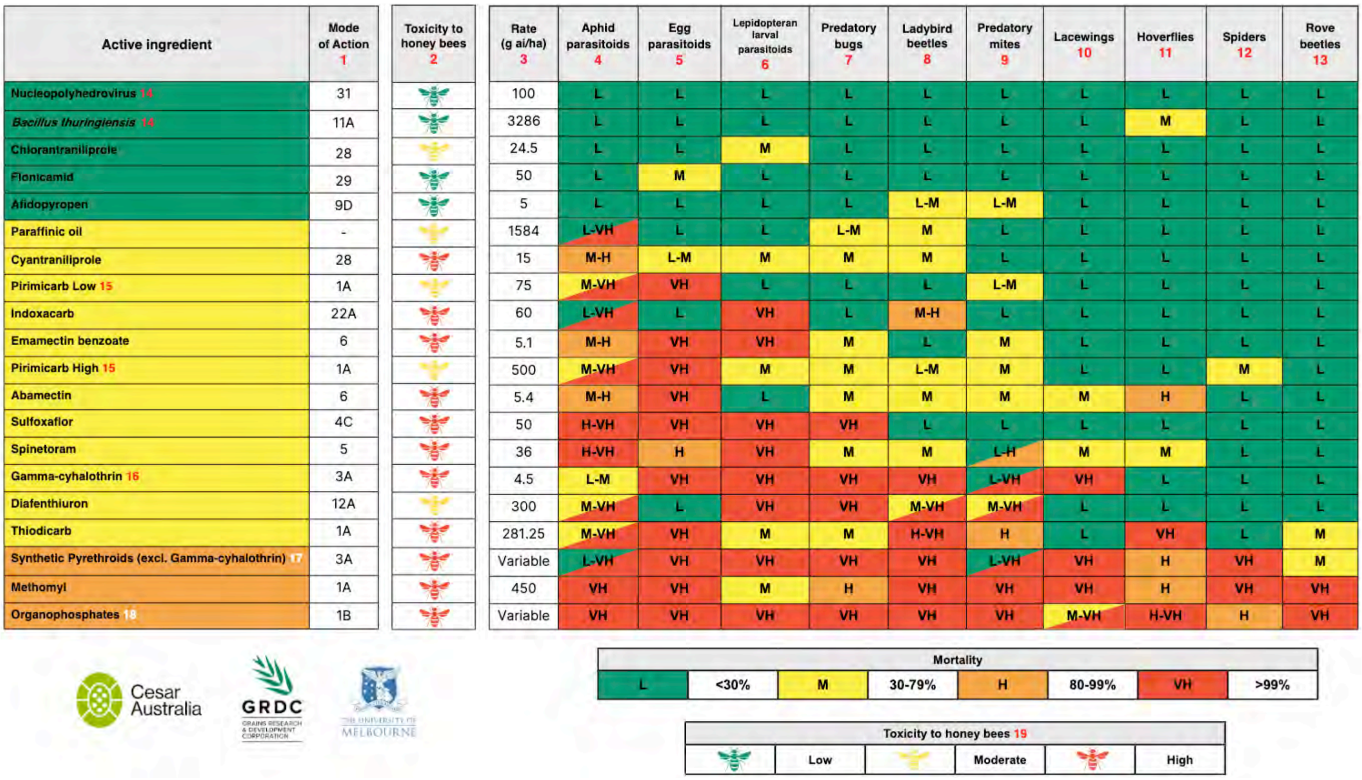
### *Study 1: Beneficials Chemical Toxicity Table*

The updated Beneficials Chemical Toxicity Table (Table 1) shows consistent differences between broad-spectrum and selective insecticides. Many broad-spectrum chemistries caused very high (>99%) mortality across a wide range of beneficial insects, including lacewings, ladybirds, hoverflies, and parasitoids. In contrast, most active ingredients promoted as selective, such as flonicamid and afidopyropen, caused low mortality in the beneficial species tested. These products are therefore more compatible with IPM, where conservation of natural enemies is a priority. However, not all selective products performed as expected: pirimicarb caused very high mortality in several species, including parasitoids, even below registered field rates, limiting its suitability in IPM programs and highlighting the importance of not working off assumptions when making spray decisions.

Parasitoids were generally sensitive to most chemicals, except for the most selective chemicals. In contrast, generalist predators like lacewings, hoverflies, and spiders, were more tolerant, suggesting that use of a selective insecticide will allow parts of the beneficial community to persist after spraying.

Honeybee toxicity results broadly mirrored those of natural enemies, with greater risk from broad-spectrum products and lower risk from selective options such as flonicamid and afidopyropen. However, direct comparisons are limited, as honeybee ratings are based on different testing protocols (IOBC vs OECD) and data-types (mortality to field rates vs LD$_{50}$ values, the chemical dose killing 50% of a sample). Honeybee ratings should be interpreted as indicators of acute chemical risk.

**Table 1:** Excerpt from The Beneficials Chemical Toxicity Table.



| Active ingredient | Mode of Action 1 | Toxicity to honey bees 2 | Rate (g ai/ha) 3 | Aphid parasitoids 4 | Egg parasitoids 5 | Lepidopteran larval parasitoids 6 | Predatory bugs 7 | Ladybird beetles 8 | Predatory mites 9 | Lacewings 10 | Hoverflies 11 | Spiders 12 | Rove beetles 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nucleopolyhedrovirus [14] | 31 | 🟩 | 100 | L | L | L | L | L | L | L | L | L | L |
| *Bacillus thuringiensis* [14] | 11A | 🟩 | 3286 | L | L | L | L | L | L | L | M | L | L |
| Chlorantraniliprole | 28 | 🟨 | 24.5 | L | L | M | L | L | L | L | L | L | L |
| Flonicamid | 29 | 🟩 | 50 | L | M | L | L | L | L | L | L | L | L |
| Afidopyropen | 9D | 🟩 | 5 | L | L | L | L | L-M | L-M | L | L | L | L |
| Paraffinic oil | - | 🟨 | 1584 | L-VH | L | L | L-M | M | L | L | L | L | L |
| Cyantraniliprole | 28 | 🟥 | 15 | M-H | L-M | M | M | M | L | L | L | L | L |
| Pirimicarb Low [15] | 1A | 🟨 | 75 | M-VH | VH | L | L | L | L-M | L | L | L | L |
| Indoxacarb | 22A | 🟥 | 60 | L-VH | L | VH | L | M-H | L | L | L | L | L |
| Emamectin benzoate | 6 | 🟥 | 5.1 | M-H | VH | VH | M | L | M | L | L | L | L |
| Pirimicarb High [15] | 1A | 🟨 | 500 | M-VH | VH | M | M | L-M | M | L | L | M | L |
| Abamectin | 6 | 🟥 | 5.4 | M-H | VH | L | M | M | M | M | H | L | L |
| Sulfoxaflor | 4C | 🟥 | 50 | H-VH | VH | VH | VH | L | L | L | L | L | L |
| Spinetoram | 5 | 🟥 | 36 | H-VH | H | VH | M | M | L-H | M | M | L | L |
| Gamma-cyhalothrin [16] | 3A | 🟥 | 4.5 | L-M | VH | VH | VH | VH | L-VH | VH | L | L | L |
| Diafenthiuron | 12A | 🟨 | 300 | M-VH | L | VH | VH | M-VH | M-VH | L | L | L | L |
| Thiodicarb | 1A | 🟥 | 281.25 | M-VH | VH | M | M | H-VH | H | L | VH | L | M |
| Synthetic Pyrethroids (excl. Gamma-cyhalothrin) [17] | 3A | 🟥 | Variable | L-VH | VH | VH | VH | VH | L-VH | VH | H | VH | M |
| Methomyl | 1A | 🟥 | 450 | VH | VH | M | H | VH | VH | VH | H | VH | VH |
| Organophosphates [18] | 1B | 🟥 | Variable | VH | VH | VH | VH | VH | VH | M-VH | H-VH | H | VH |

| Mortality | | | | | | | |
|---|---|---|---|---|---|---|---|
| L | <30% | M | 30-79% | H | 80-99% | VH | >99% |

| Toxicity to honey bees [19] | | | | | |
|---|---|---|---|---|---|
| 🟩 | Low | 🟨 | Moderate | 🟥 | High |

### *Study 2: Parasitoids in canola*

The 2025 field survey results revealed three promising trends suggesting that parasitoid augmentation could improve aphid biocontrol outcomes, consistent with results from 2024 trials.

First, aphid density was significantly lower in augmented plots than in natural plots ($\chi^2$=40.09, d.f.=1, p<0.01, Figure 1) across all regions except southwestern Victoria. In southern NSW, where aphid pressure was highest, augmentation reduced aphid numbers by around 50%, with similar trends observed in northern NSW and northern Victoria.

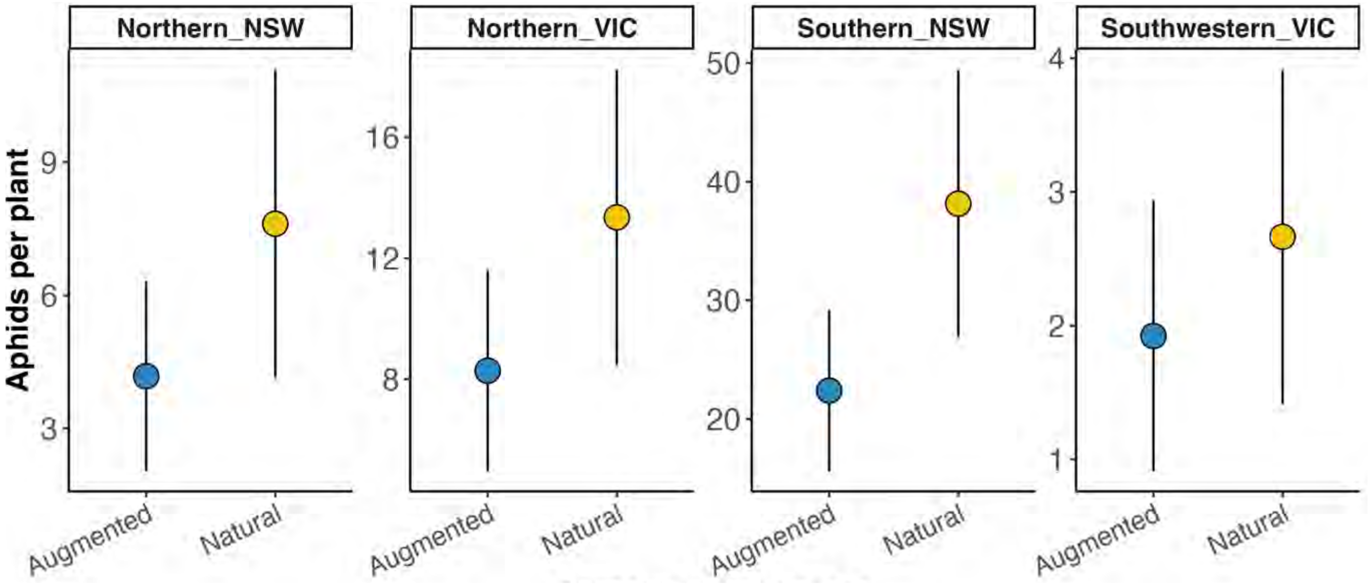


Figure 1. Average (±95% Confidence Intervals) number of aphids per canola plant at the augmented and natural (non-augmented) plots for each region in spring field surveys.

Second, aphid population growth from winter to spring was significantly less in augmented plots ($\chi^2$=6.20, d.f.=2, p=0.04, Figure 2, left panel), compared to the insecticide-treated or natural parasitoid plots. Together, these results suggest that insecticides may provide short-term suppression, without consistent season-long risk reduction, whereas augmentation can reduce pest population growth.

Third, conventional insecticides impaired the efficacy of parasitoids. In both natural and augmented plots, parasitoids clearly responded to aphid outbreaks, as aphid densities were strongly correlated with mummified aphid numbers ($\chi^2$=214.29, d.f.=1, p<0.01, Figure 2 right panel). However, the correlation was much weaker in insecticide-treated plots ($\chi^2$=26.22, d.f.=2, p<0.01, Figure 2 right panel), suggesting foliar sprays reduced parasitoid activity.

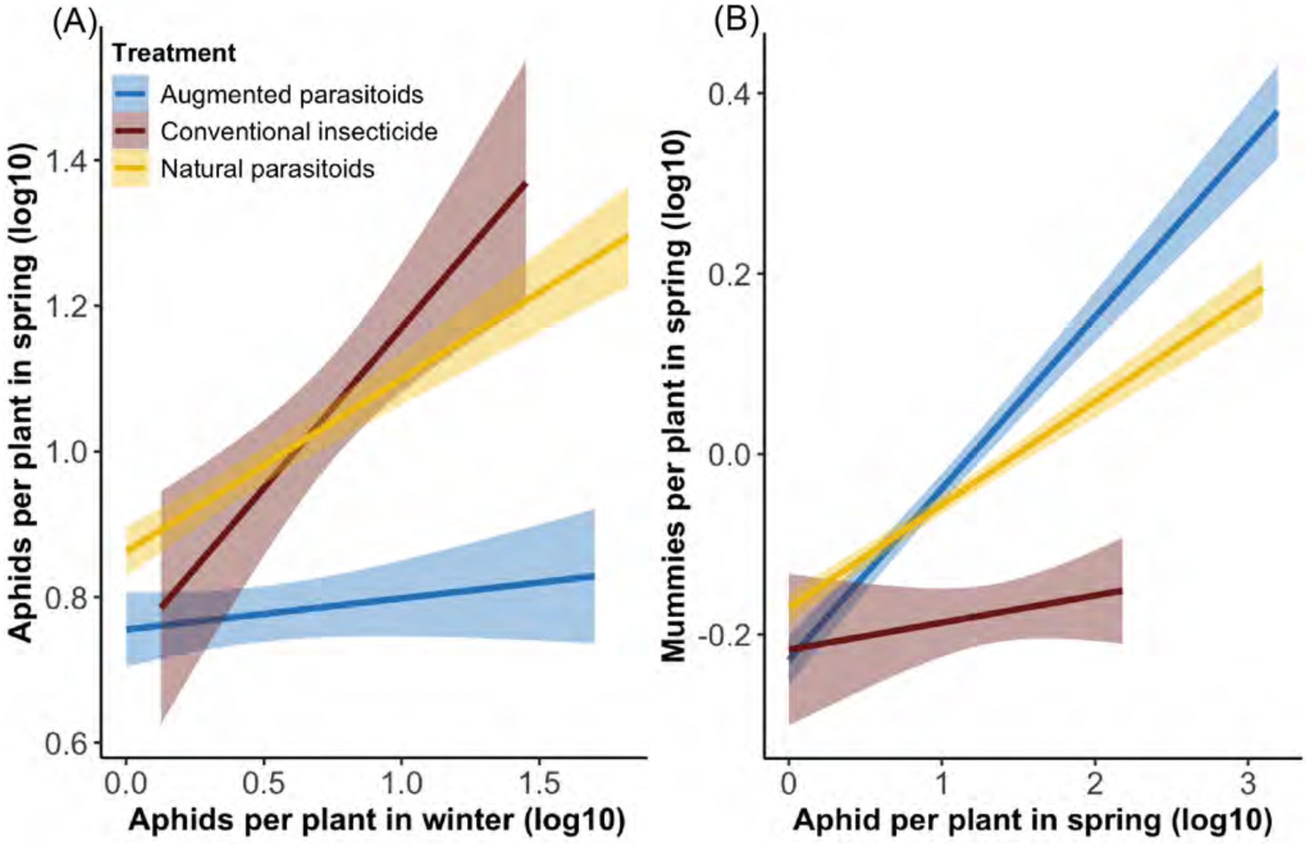


Figure 2. Aphid counts during the winter and spring surveys according to the linear best fit from the multiple regression model (left panel). Linear relationship between mummified aphids and aphid counts during the spring surveys (right panel). Note that numbers are shown on a log scale (with ±95% Confidence Interval error region).

From our 2024 trials, growers recorded little difference in yield between plots that received a foliar insecticide spray in spring and those that were augmented with parasitoid wasps (Figure 3). However, the limited number of replicates (three sites) of foliar sprays applied in 2024 suggests that this result should be interpreted with caution. Additionally, other factors within the paddock, such as nutrient levels and soil moisture, likely contributed to variability in the results.

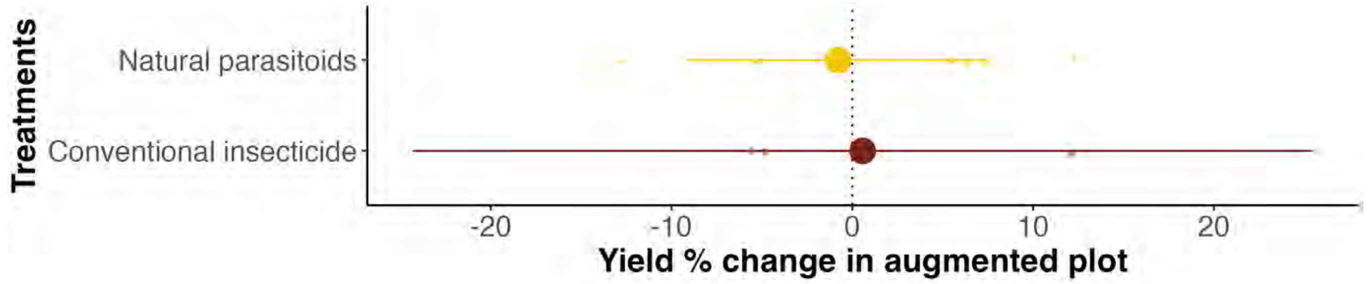


Figure 3. The average (±95% Confidence Intervals) yield differences between an augmented plot and a paired conventional or natural parasitoid plot (within the same paddock). Small dots indicate individual sites, large dots show overall averages.

The DNA metabarcoding results from sweep and vacuum samples align with the Beneficials Chemical Toxicity Table. Beneficial communities were more negatively affected than pest communities by foliar sprays, as evidenced by unsprayed plots hosting a greater diversity of beneficial insects than those with conventional spraying, whereas pest diversity was consistent across sprayed and unsprayed plots (Figure 4). Twenty-two beneficial species were detected across all sites, including parasitoids, hoverflies, spiders, ladybirds, lacewings, and bees, highlighting the natural ecological services that can be retained through selective spraying.

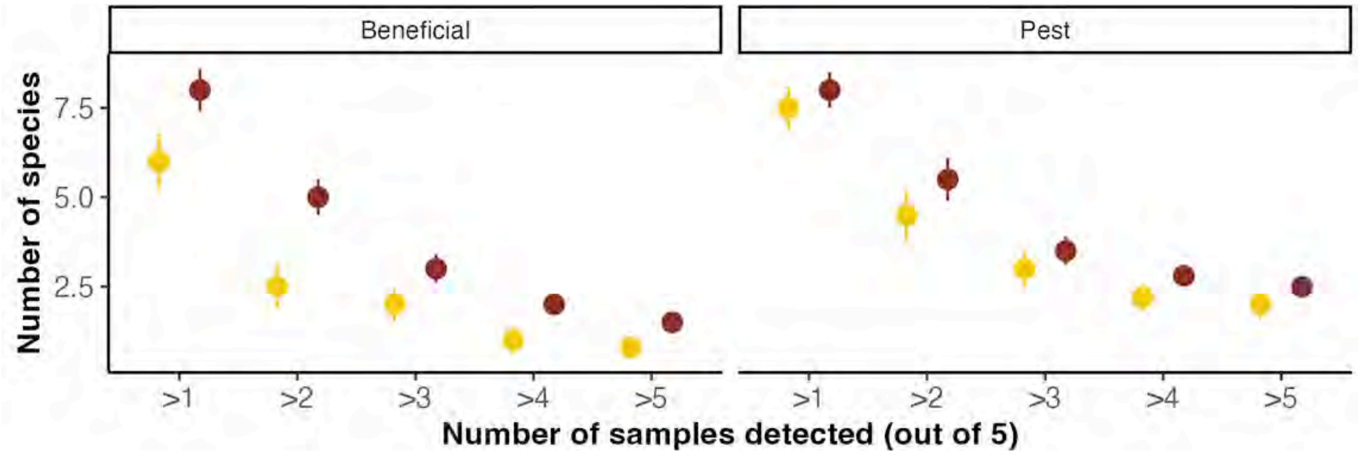


Figure 4. Mean (±S.E.) numbers of beneficial and pest invertebrates found in the five plot samples across the conventionally sprayed (red) and unsprayed experimental (yellow) plots.

## Conclusion

The two studies tell a complementary story of how insecticide use interacts with beneficial insect populations and what this means for pest management decisions in Australian grains systems.

Study 1 guides spray decisions that minimise harm to natural enemies and pollinators. Broad-spectrum insecticides seem cost-effective initially, but long-term costs like loss of biological control, reduced pollination, and higher outbreak risk may outweigh the initial savings. Selective insecticides provide the foundation for integrating chemical and biological control rather than trading them off. Study 2 provides field data that suggest broad-spectrum insecticides, while effective at rapidly reducing pest numbers, can disrupt the pest-control services provided by natural enemy populations. Study 2 also suggests that augmentation may enhance these pest-control services.

The studies therefore represent two sides of the same coin. Selective chemical choices create the conditions under which biological control can flourish, and augmentation strengthens biological control where natural populations fall short. The broader implication is that beneficial insects are a form of on-farm natural capital. As with any valuable asset, maintaining and strengthening that capital contributes directly to long-term productivity. While further economic and logistical assessment will be explored in the next year of Study 2, the clear takeaway is this: protecting beneficial insects is a sound crop protection strategy.

## Acknowledgements

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Beneficials chemical toxicity table (https://cesaraustralia.com/resources/beneficials-toxicity-table/)

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Notes

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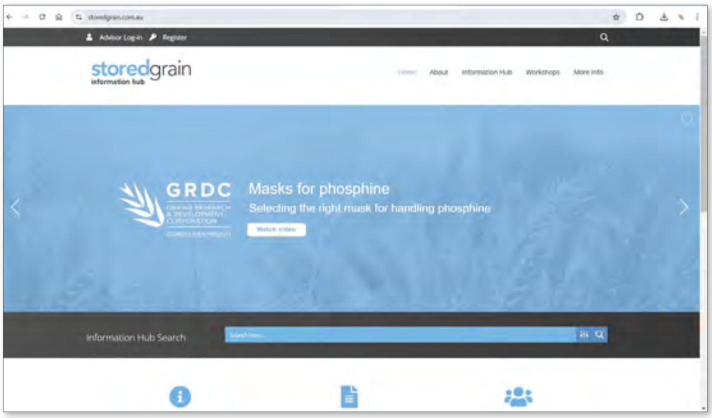
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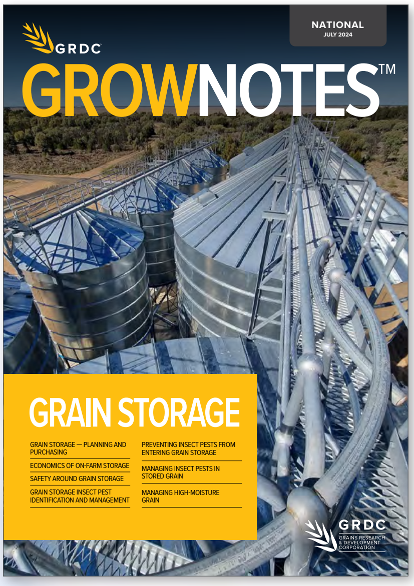
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# GRDC Grains Research Update CAMPBELL TOWN

## Acknowledgements

We would like to thank those who have contributed to the successful staging of the Campbell Town GRDC Grains Research Update:

- The local GRDC Grains Research Update planning committee that includes growers, advisers and GRDC representatives.

- Partnering organisation: Southern Farming Systems

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**Tom Price, FAR**

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**Grace Evans, SFS**

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**4. From data to decisions: getting automation farm-ready at paddock scale**
**Tim Neale, DataFarming**

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**Lilia Jenkins, Cesar Australia**

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