Mallee Farmer

ISSUE #23 AUTUMN EDITION 2023

Featuring

Latest Crop Research Results.

New tool to help farmers measure emissions reductions.

Advice in implementing a farm biosecurity plan.

A six-part Ground Cover supplement

Forage Shrub update.

National Wheat Varity Trial results for the Mallee.

And much more

Australian Government | National Landcare Program

mallee catchment management authority

Contents

NLP Acknowledgement
This publication is supported by the Mallee Catchment Management Authority (CMA), through funding from the Australian Government's National Landcare Program.

Australian Government | National Landcare Program

mallee catchment management authority

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Front cover photo:
Birchip Cropping Groups Grains Researcher, Clair Pickles.
Photo: BCG

Acknowledgement of Country

The Mallee Farmer acknowledges and respects Traditional Owners, Aboriginities and organisations.

We recognise the diversity of their cultures and the deep connections they have with Victoria's lands and waterways.

Chair's Report.

Welcome to the first edition of the Mallee Farmer for 2023 – your insight into the latest dryland farming research, training, trends and programs in the Mallee.

In this edition we have some interesting articles on a range of important topics including information on wind erosion for spring, carbon and emissions performance in the agricultural industries, research into the risk of cereal rust for the 2023 season, and our RALF regional roundup.

Now that harvest is over many farmers are looking ahead at the season to come, it is important for the farming community to continue to plan ahead. Included in our latest edition of The Mallee Farmer are useful resources and stories about work being done to support our farming community to help make informed decisions on-farm.

The commitment from supporting agencies and organisations including Agriculture Victoria (AgVic), Landcare, Mallee Catchment Management Authority (CMA), Mallee Sustainable Farming, GRDC, Birchip Cropping Group (BCG) and Rural Financial Counselling Service to name a few is vital in supporting the regions farmers to continue to deliver high grade products across the world.

Among the highlights of this edition:

- ***Mallee Sustainable Farming six-part series on ground cover including seed priming and virtual fencing;***
- ***Learn about what wheat varieties farmers should grow in 2023, research by Birchip Cropping Group;***
- ***We hear from Ag Vic on the extreme risk of cereal rust for 2023 and how to best manage this;***
- ***Mallee farmers obligations for implementing a farm biosecurity plan is outlined by Ag Vic, along with training, record keeping and actions to undertake;***
- ***Mallee CMA is continuing its work to support the Ramsar listed Hattah-Kulkyne National Park with work being undertaken to support habitat and manage pests.***

With the inclusion of the regular RALF Regional Roundup by Glen Sutherland and Cameron Flowers readers are provided with great insights to trends, growth areas, upcoming events and research topics. In this edition, Glen and Cameron provide an update on the news and information about upcoming regional events and resources relating to sustainable agriculture that may be of interest to farmers and farming communities.

As Chair of Mallee CMA I am always interested to see the research, training and work being undertaken across the many groups and stakeholders to benefit our farming community.

A timely topic for farmers which is only requiring more attention to continue to improve productivity and yields is on-farm emissions. In this edition Ag Vic provide some great tools to help farmers start their on-farm emissions reduction journey.

A huge thanks goes out to all those who have contributed to this edition of the Mallee Farmer. I know you will find it very informative and a helpful resource for the coming season and beyond! The support provided by the community and the Australian Government's National Landcare Programme ensures the Mallee Farmer continues to be a valuable resource.

Allison McTaggart
Chair
Mallee Catchment Management Authority.

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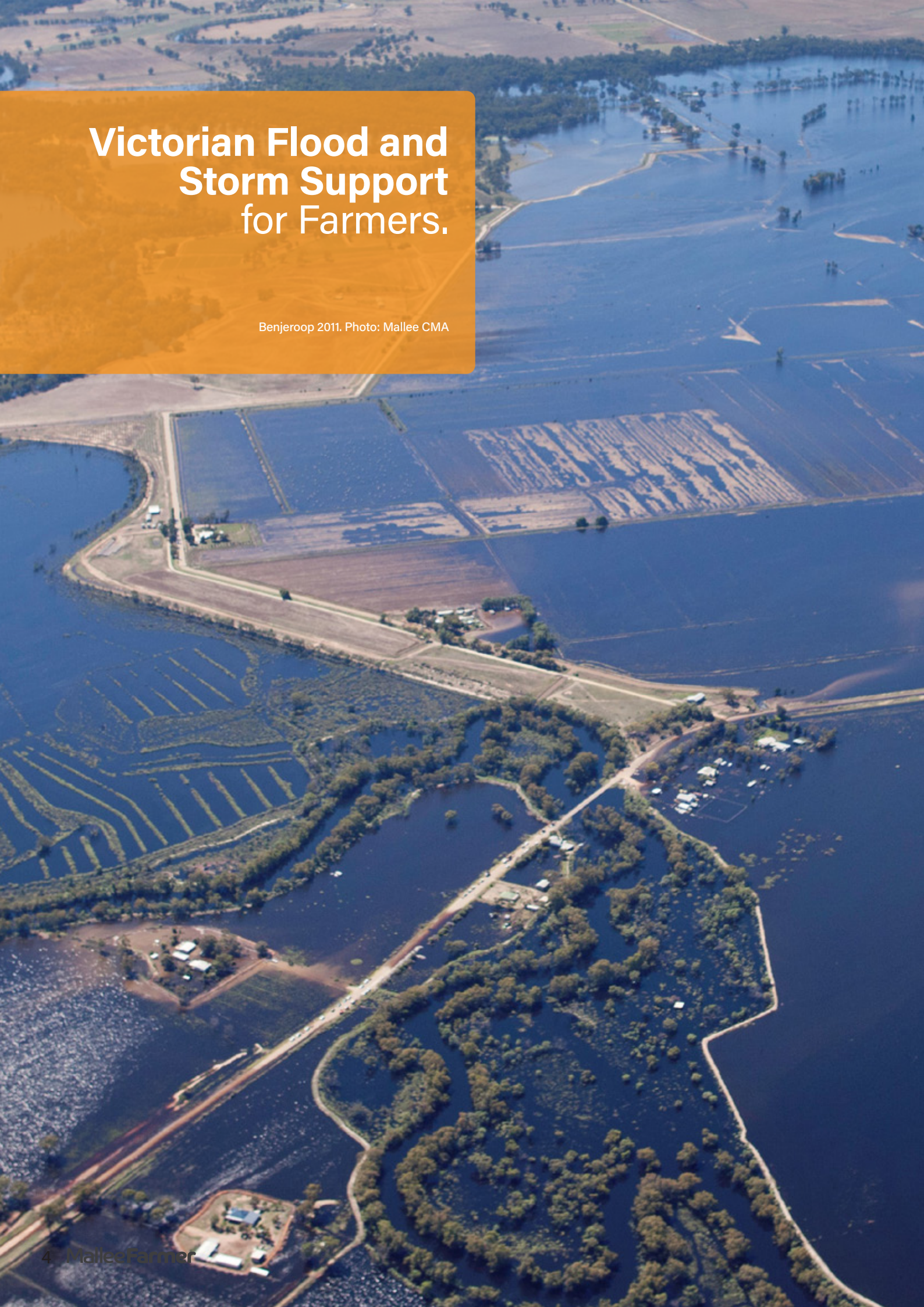
Victorian Flood and Storm Support for Farmers.



Benjeroop 2011. Photo: Mallee CMA

A range of support measures are available for flood and storm-affected farmers. Information about these measures can be found at agriculture.vic.gov.au/floods (https://agriculture.vic.gov.au/farm-management/emergency-management/floods). For any urgent animal welfare needs, please contact P: 136 186.

Technical Information and decision-making support
Agriculture Victoria is working with Victorian farmers and industry to prepare for, respond to and recover from natural disasters (including floods and storms) through delivery of technical information and decision-making support services to help farm business recovery including:

- **Grazing, cropping and pasture management**
- **Irrigation and horticulture system rehabilitation**
- **Soil erosion management**
- **Land management**
- **Animal health and nutrition**
- **Farm mapping and planning**
- **Water quality**
- **Weed management**

Farmers are encouraged to contact the Agriculture Recovery team on Phone: 0427 694 185 (Mon-Fri between 8.30am and 5pm) or Email recovery@agriculture.vic.gov.au

Farmers and service providers are encouraged to subscribe to the Flood Recovery digital newsletter (https://agriculture.vic.gov.au/support-and-resources/newsletters/ag-recovery-newsletter) to access latest events and information.

National Centre for Farmer Health: flood response support
The National Centre for Farmer Health is committed to supporting primary producers whose properties, livestock or crops were damaged or lost in the floods and storms through the delivery of initiatives to boost farmer mental health and wellbeing, including:

- **A supportive online community through the #BuildingFarmSpirit social media campaign,**
- **Free access to online psychology support delivered by farmer health trained psychologists,**
- **Support for community events providing social connection and mental health promotion opportunities for farmers, farming families and farming communities,**
- **Distribution of mental health resources and support information.**

More information is available on the National Centre for Farmer Health website. (https://farmerhealth.org.au/building-farm-spirit)

Rural Financial Counselling Service
The Rural Financial Counselling Service offers free and independent financial information, options, decision-making support and referral services to farmers and small, related rural businesses who are in, or at risk of, financial hardship.

A Rural Financial Counsellor can help farmers prepare for discussions with their banks to make informed decisions for the future benefit of their business. They can also assist farmers to apply for financial assistance. To connect with your local service call 1300 771 741 or visit the National Emergency Management Agency (https://nema.gov.au/get-support/rural-financial-counselling-service/rural-financial-counselling-service-information/locations#/map)

Victorian Primary Producer Flood Recovery package
Flood and storm-affected farmers and growers are eligible to apply for financial support via the current flood recovery grants.

Applications close at 4 pm on Sunday 30 April 2023. Available grants include:

1. **Primary Producer Recovery Grants:**
   Up to $75,000 grants to cover the cost of recovery and get businesses up and running again.
   Note: This replaces the $10,000 Primary Producer Flood Clean–Up, Relief Grants announced on 19 October. Producers that have received a Primary Producer Flood Clean–Up Relief Grant of $10,000 can now apply for up to a further $65,000 under the Primary Producer Recovery Grant, bringing the total to $75,000.
2. **Rural Landholder Grants:**
   Up to $25,000 grants to cover the costs of disaster impacts for small-scale producers.
3. **Primary Producer Concessional Loans:**
   Up to $250,000 to restore or replace damaged equipment and infrastructure, or to cover short-term business expenses.
4. **Primary Producer Transport Subsidies:**
   Up to $15,000 to support the transport of emergency fodder or stock drinking water, and the movement of livestock.

Eligibility criteria and closing date for applications
For specific eligibility criteria that apply for all support programs, please refer to the guidelines for full details. Program guidelines, application forms and a list of local government areas eligible for assistance are available at ruralfinance.com.au.
(https://www.ruralfinance.com.au/industry-programs/victorian-primary-producer-flood-recovery-package)

Primary producers are advised that applications for grants close at 4pm on Sunday 30 April.

For further information contact Rural Finance on 1800 260 425. For assistance with understanding and applying for financial support contact the Rural Financial Counselling Service on 1300 771 741.

AGRICULTURE VICTORIA

What Wheat Varieties should be Grown in 2023.

Photo: BCG

Claire Pickles - Birchip Cropping Group
Photo: BCG

By Claire Pickles (Birchip Cropping Group).

BCG researchers have been busy compiling the wheat GRDC National Variety Trial (NVT) results for the Mallee, Wimmera and North Central to help inform decision making.

Many growers are considering introducing alternative varieties for the 2023 season, given the high disease exposure risk from some commonly grown varieties, such as stripe rust in Scepter wheat.

2022 NVT results

- Sunmaster, Sunblade CL Plus and Beckom were the highest yielding varieties in 2022 in the Mallee and were 10 per cent above the region mean.
- In the North Central region, Sunblade CL Plus, Sunmaster and RGT Zanzibar were the highest yielding in 2022.
- Long-term yield data suggests Vixen, Rockstar, Scepter, Catapult and Beckom have yielded higher than the region mean over the past six years in the Mallee.
- Calibre, Rockstar, Ballista, Brumby, Scepter and Vixen were the highest yielding varieties long term (2017 2021) as a percentage of region mean in the Wimmera.
- Calibre, Sunmaster, Brumby and Reilly are new varieties worthy of consideration in the future.

Varieties are constantly changing as breeding brings new varieties to the market. Choosing which varieties to grow is an area many growers find difficult each year. On occasions the variety is not the problem, when time of sowing and overall management have major impacts on final grain yield.

Multiple factors at play

Choosing a wheat variety is an ongoing process, with many growers chasing the most rust resistant variety. However, the presence of a green bridge over summer, rotation, in-season management and the season itself, often play a bigger role in disease levels.
Consider how often we see a decile 10 season.
Selecting multiple maturity length varieties is also crucial for spreading risk and management on farm.

2022 results explained

In 2022 fungicide management and disease profile played a big part in grain yield. BCG saw varieties that have done consistently well during the past few years perform poorly. All trials in the NVT were managed for disease. Growers faced the same challenges in 2022, in such a high-pressure disease situation.

Scepter has been a commonly grown variety, however each year there are new varieties released with greater yield potential. It is worthwhile assessing all aspects of a new variety before changing after just one season.

Anecdotal evidence from 2022 showed that for many growers where disease was managed in Scepter, grain yield was not affected and, in some cases, – with four fungicide applications – it topped grain yields. In such a high disease year there may also have been diseases other than stripe rust affecting grain yield. Consider the cost associated with achieving four fungicide applications as well as the time, labour commitment and frequency of these seasonal conditions.

Conclusion

In a season with a decile 10 GSR, high spring rainfall and an elongated grain filling period, disease was a big factor in wheat yields in 2022. While these conditions will not be experienced every year, it is important to understand variety choices and management when the forecast of a high rainfall year is upon us.

If selecting an alternative to Scepter, consider including a second variety in your rotation where you can spread your risk as well as lessen the management (spraying) pressure. Consider Sunmaster, Beckom or Reilly which are MRMS for stripe rust as a second variety on farm, not as a whole program replacement, but to mitigate risk by having part of the program with a slightly better rating, allowing for a wider spraying window.

In the North Central it is a similar situation to the Mallee in terms of selecting an additional variety. Choose a variety that has been a consistent performer for a few years and has the characteristics that suit your rotation or can be managed in a timely manner.

Table 1. Variety and quality charactersitics for commonly grown varieties and some new releases (number in brackets denotes how many years in NVT).

Variety	Maturity	Stripe Rust	Stem Rust	YLS	CCN	Septoria	Quality
Scepter (6)	M	MSS	MRMS	MRMS	MRMS	S	AH
Sunmaster (2)	M	MRMS	MS	MSS	MSS	S	APH*
Vixen (6)	Q	S	MRMS	MRMS	MSS	S	AH
Beckom (6)	M	MRMS	MRMS	MSS	R	SVS	AH
Reilly (4)	M	MRMS	MR	S	MRMS	S	AH
Calibre (3)	Q-M	MS	MR	MRMS	MRMSp	S	AH
Clearfield:		5.2	Vetch (Hay)	2.2	Wheat (Grain)	1.2	
Sunblade CL Plus (4)	M	MRMS	MS	MSS	MSS	S	AH
Razor CL Plus (6)	Q-M	MS	MR	MSS	MR	SVS	ASW

p = provisional rating. R = Resistant RMR = Resistant to moderately resistant, MR = Moderately resistant, MRMS = Moderately resistant to moderately susceptible, MS = Moderately susceptible, MSS = Moderately susceptible to susceptible, S = Susceptible, SVS = Susceptible to very susceptible. Maturity, Q = quick, M = mid.
(*APH – Australian Prime Hard, minimum protein 13%)

Given the expression of so many diseases, it will be important to ensure clean seed is sourced for the 2023 sowing program

Going into the 2023 season it is important to have seed tested if there's any chance it may carry over disease, such as white grain disorder or fusarium. High soil moisture levels will also be present in many regions and there will be a green bridge to consider.

Stripe rust impacted wheat.
Photo: AgVic

Cereal Rust Management for 2023.

By the Horsham Field Crops Pathology group, Agriculture Victoria

The rust risk going into the 2023 season will be extreme. The opportunity for a large amount of rust inoculum from 2022 to survive summer/autumn on volunteer cereals (the 'green bridge') and infect new crops will be immense due to widespread summer cereal volunteers across eastern Australia. Rust outbreaks are more severe following seasons with widespread volunteers, as rust can only survive from one season to the next on living plant material. Rust does not survive on seed, stubble, or soil.

History tells us that rust risk is high in seasons following summers with a green bridge. The green bridge does not necessarily have to occur within the region but may be in neighbouring states such as NSW.

It is therefore essential that growers take the following steps to reduce their risk:

- **remove the green bridge (volunteer cereals) by mid-March**
- **use a current cereal disease guide to check resistance ratings of their varieties and, where possible, avoid susceptible varieties**
- **develop a fungicide management plan, with an emphasis on up-front options, such as flutriafol on fertiliser, to provide early rust suppression**
- **download the StripeRustWM App; free for iPads and tablets for support with wheat stripe rust management.**

When rust risk is high, the benefits from widespread use of up-front fungicide treatments (such as flutriafol on fertiliser) should not be underestimated in providing regional control. Such a practice on all at-risk cereal varieties on an industry wide scale can greatly reduce the rust risk across a district.

2022 in review

To put the risk for the 2023 season into perspective it is important to understand what happened during 2022, when disease pressure on cereal crops was extreme.

As expected during 2022, rust appeared in Victorian wheat crops earlier than usual. This was due to the substantial opportunity for rust to survive summer on volunteer cereals (the 'green bridge') in northern Australia. This early rust on-set, along with the favourable conditions for disease development, resulted in a damaging outbreak of stripe rust across Victoria.

Industry reports during the season confirmed that strategies of avoiding susceptible cultivars, using up-front fungicides, and timely foliar fungicide applications all contributed towards reduced stripe rust pressure in paddocks. Where control was inadequate, large yield losses due to stripe rust in wheat occurred. There were limited reports of wheat leaf rust and no reports of wheat stem rust in Victoria. There were also multiple reports of barley leaf rust later in the season. This high disease pressure has greatly increased the risk for the 2023 season, due to the high amount of inoculum carryover, across eastern Australia.

AGRICULTURE VICTORIA

Murrayville Forage Shrub Workshop and Field Walk.

By Dr Nick Partridge, Mallee Sustainable Farming

Image: Dr Jason Emms discussing the finer points of Saltbush grazing management at the Murrayville forage demonstration site. Photo: Mallee CMA

Farmers in the Murrayville district recently gathered at the Murrayville Sports Club to hear forage shrubs expert Dr Jason Emms speak about how best to utilise shrubs on mixed farms in the Mallee. Jason was able to draw on his many years' experience working in shrubs research and had a number of key messages for the group:

- Companion pasture (medic, clover, grass) is essential for driving the productivity of a forage shrub planting.
- It is best to crash graze (high stocking density for a short period), not set stock, so fencing off forage shrubs is essential. Temporary fencing can also be an effective tool in grazing management. Heavy grazing at least once a year is needed to prevent tall shrubs such as Old Man Saltbush getting too tall.
- Regrowth is sacrosanct – grazing regrowth too soon after a heavy graze kills shrubs.
- Consider planting a mix of species, with forage shrub species choice determined by salinity, waterlogging and texture.
- Sheep can require a 'training period' on shrubs, either as lambs 'on mum' or grazing in short, sharp, repeated bursts.
- Blocks or alley designs can be used, but always plant 2-3 rows together to prevent a wind tunnel forming where a plant is missing.
- Use a baiting program to stay on top of rabbits or they can breed up in a shrub patch. This is especially true if underutilised and allowed to become too thick.

The group then went on to visit several field sites, with the first a demonstration site established over 8 years ago showing several species including Old Man Saltbush, Silver Saltbush, Ruby Saltbush and Eremophila (Tar Bush).

The second site visited was a stand of Old Man Saltbush established by direct seeding in 2020. In this case, the farmer, Leon Yard, wanted a quick and economical approach to saltbush establishment in a paddock with shallow soil, stone and limited crop potential. The site was lightly cultivated, ripped and sown with a Kimseed direct seeder owned by the Murrayville Landcare Group. Leon was pleasantly surprised at the way seedlings established over the first spring and summer, with more plants emerging after each significant rain. The Old Man Saltbush is now ready to graze.

Murrayville farmers hearing from Blue Wyatt about how his Old Man Saltbush planting has served a dual purpose, both remediating salt scald plus providing a useful source of sheep feed. Photo: Mallee CMA

Finally, the group visited an Old Man Saltbush stand established by direct seeding about 15 years ago. According to the owner, Trevor (Blue) Wyatt, the site, which is at the base of a sandhill, used to run water and was a visible salt scald. However, after 15 years of saltbush, the site has stopped running water and annual grasses now grow between the shrubs. There has been significant recruitment of further saltbush plants since initial seeding also. While some plants have grown too big to be readily grazed by sheep, Blue is experimenting with ways of reducing plant height and plans to make a hedge trimmer to help with the job in future.

The workshop and field walk were delivered as part of a broader Mallee shrubs project currently taking place across the Victorian Mallee. For more information about shrub establishment or management, please join our forage shrubs 'community of practice' – register your interest via the Program Manager, Dr Nick Paltridge, email nick@msfp.org.au.

This project is supported by the Mallee Catchment Management Authority through funding from the Australian Government's Future Drought Fund.

Workshop presenter Dr Jason Emms and Blue Wyatt discussing native plants suitable for forage shrub plantations. Photo: Mallee CMA

Monitoring wind erosion and land management in the Victorian Mallee - 2022.

By Martin Hamilton, Land Management Extension Officer, Agriculture Victoria,
and Kathryn Sheffield, Research Scientist, Agriculture Victoria

Key messages:

- Monitoring land management practices and satellite imagery are used to assess the levels of ground cover likely to offer soil protection during summer and autumn throughout the Mallee as part of the *Monitoring wind erosion and land management in the Victorian Mallee* project.
- Observations from 2022 are presented, in conjunction with relevent observations from three previous years, to highlight key differences and important points.
- Farmers were quick to take advantage of the prevailing conditions as the area considered to be protected from wind erosion with a Total Vegetation Cover (TVC) greater than 50 per cent in 2022 was higher than the three previous years ranging from 71.2 per cent in February to 99.7 per cent in August.
- A key feature of 2022 was significantly higher than average rainfall during the growing season resulted in increased levels of ground cover.

Roadside observations

Above average rainfall in January and March in the northern Mallee facilitated high levels of soil moisture for sowing in March. Below average rainfall for June and July in all regions, combined with days of sunlight, provided a measure of respite from previous rainfall and promoted growth and raising growers' expectations for a good season. However, all regions received well above average rainfall for the remainder of the growing season.
The excessive moisture promoted crop diseases and caused lodging in some barley crops as well as increased the likelihood of widespread flooding in the south-eastern Mallee. Localised damage from severe storms during November also resulted in a delayed harvest and crop losses. Despite this, the Mallee managed to achieve good yields, even record breaking in some areas. Grain quality was an issue in some regions, especially in lentils and barley with low test weights and downgrading in some instances.

The 2022 autumn roadside survey observed that 79 per cent of paddocks at that time had good groundcover from standing undisturbed stubble while 17 per cent of paddocks at that time were covered with either a pasture or weeds. Signs of erosion were observed in 9.5 per cent of paddocks surveyed compared to 10.2 per cent in 2021 with increases of six per cent and one per cent occurring in the high and very high susceptibility zones, as a result of summer rainfall amounts, and subsequent land management practices to control weeds in preparation for sowing.

The 2022 spring roadside survey recorded a 6.7 per cent increase of paddocks in a cropping rotation with 76 more paddocks compared to 2021. Of the cropped paddocks 78.1 per cent would be harvested and 2.8 per cent were hay crops. Brown or green manures made up 2.8 per cent of surveyed paddocks (Figure 1). It is important to note the spring transect data was collected between 27 September and 3 October 2022, prior to the significant October rainfall events and storms, which influenced the actual cover management outcomes of the 2022 season. There was a notable increase in barley sown between 2021 and 2022 (Figure 2), accompanied by a decrease in paddocks sown to wheat. There was also an increase in paddocks sown to lentils and vetch between 2021 and 2022. Further analysis of the data reveals 20 per cent of paddocks sown to legumes were re-sown to legumes in 2022. This indicates farmers were quick to take advantage of available soil moisture to increase the nitrogen levels in soils. Even though legumes, when harvested, leave the ground with very litte biomass for protection, other land management practices strive to retain it such as crop selection, stubble height, and controlled grazing, thereby reducing the risk of wind erosion in the Mallee.

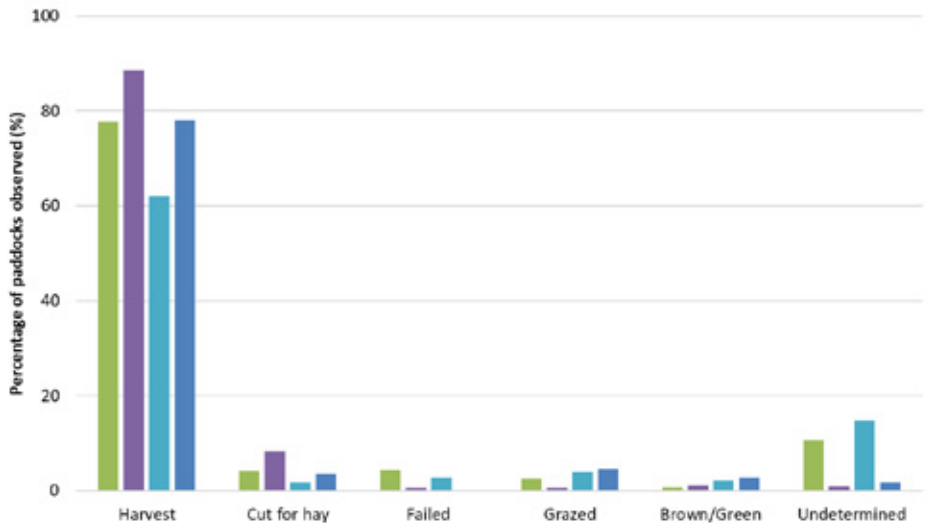
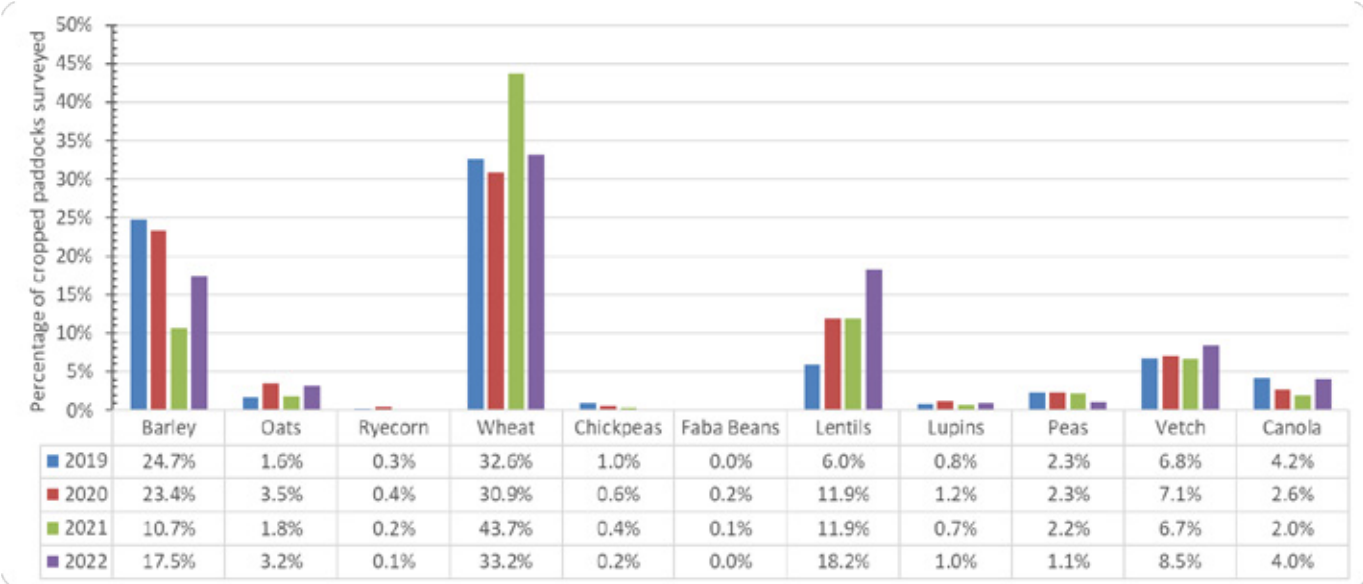


Figure 1: Dryland agriculture secondary management types Spring 2019 - 2022.



	Barley	Oats	Ryecorn	Wheat	Chickpeas	Faba Beans	Lentils	Lupins	Peas	Vetch	Canola
2019	24.7%	1.6%	0.3%	32.6%	1.0%	0.0%	6.0%	0.8%	2.3%	6.8%	4.2%
2020	23.4%	3.5%	0.4%	30.9%	0.6%	0.2%	11.9%	1.2%	2.3%	7.1%	2.6%
2021	10.7%	1.8%	0.2%	43.7%	0.4%	0.1%	11.9%	0.7%	2.2%	6.7%	2.0%
2022	17.5%	3.2%	0.1%	33.2%	0.2%	0.0%	18.2%	1.0%	1.1%	8.5%	4.0%

Figure 2: Percentage of crop types for surveyed paddocks Spring 2019 - 2022.

MODIS Fractional Cover Imaging

MODIS Fractional Cover maps are produced to calculate the area and quality of cover (whether vegetation is living, dead or senescing) and can identify cereals, legumes and canola crop types, as well as pasture and bare ground in dryland agricultural areas. Cereals are the dominant crop type grown across the Mallee CMA, with 66.6 per cent, 70 per cent, 72.2 per cent, and 70.8 per cent of dryland agricultural areas sown to cereals in 2019, 2020, 2021 and 2022 respectively (Figures 3 - 6). The second most common crop type is legumes, with 11.3 per cent, 17.1 per cent, 10.1 per cent, and 21.9 per cent of dryland agricultural areas sown to legumes in 2019, 2020, 2021 and 2022 respectively. Oilseeds account for a small proportion of dryland agricultural crops in the Mallee. These regional-scale patterns are also reflected at the paddock scale from observations taken during spring roadside surveys (Figure 2).

Areas of bare ground were largely observed in the northern Mallee during 2019. During 2019, about 20 per cent of dryland agricultural areas were bare ground (Figure 3), which could be attributed to the low rainfall recordings in areas of the northern Mallee. In comparison, bare ground accounted for less than four per cent (Figure 4) of dryland agricultural areas during 2020. In 2021 there was a 2.2 per cent increase in bare area to 6.2 per cent of dryland agricultural areas (Figure 5) particularly in the Millewa and the area between Swan Hill and Sea Lake. During 2022, the area of bare ground decreased to 1.6 per cent of dryland agricultural areas (Figure 6).

The prevailing weather conditions and vegetative growth, which produces biomass capable of covering the ground, are intrinsically connected. Higher rainfall in 2020 and 2022 reflects this. Similarly, to some degree, crop selection is also based on climatic conditions and affects ground cover. This can be seen in 2019 when barley proved to be a suitable choice, given the dry conditions. The remaining stubble provided good soil protection into 2020.

Legumes, on the other hand are an important part of a crop rotation, providing nitrogen to the soil, feed for livestock and diversity in the business. However, if not managed well there is a risk of reduced ground cover as crops are cut lower to the ground. Farmers responded quickly to good seasonal breaks in 2020 and 2022, which prompted an increase in lentils being sown (with little change in other legumes), taking advantage of higher soil moisture.

A key feature of 2022 was significantly higher than average rainfall during spring, particularly during October, with a significant Victorian flood event during October recording record rainfall in many areas. Rainfall deciles for the winter crop growing season between April and October 2022 were very much above average or the highest on record. Across the Mallee, the area considered to be protected from wind erosion (TVC greater than 50 per cent) ranged from 71.2 per cent in February to 99.7 per cent in December. Land system targets were met more frequently than during 2021, with 11 of 13 land systems meeting their respective targets for all 12 months during 2022. Much of the Mallee had above long-term average from October to December, likely because of significant spring rainfall.

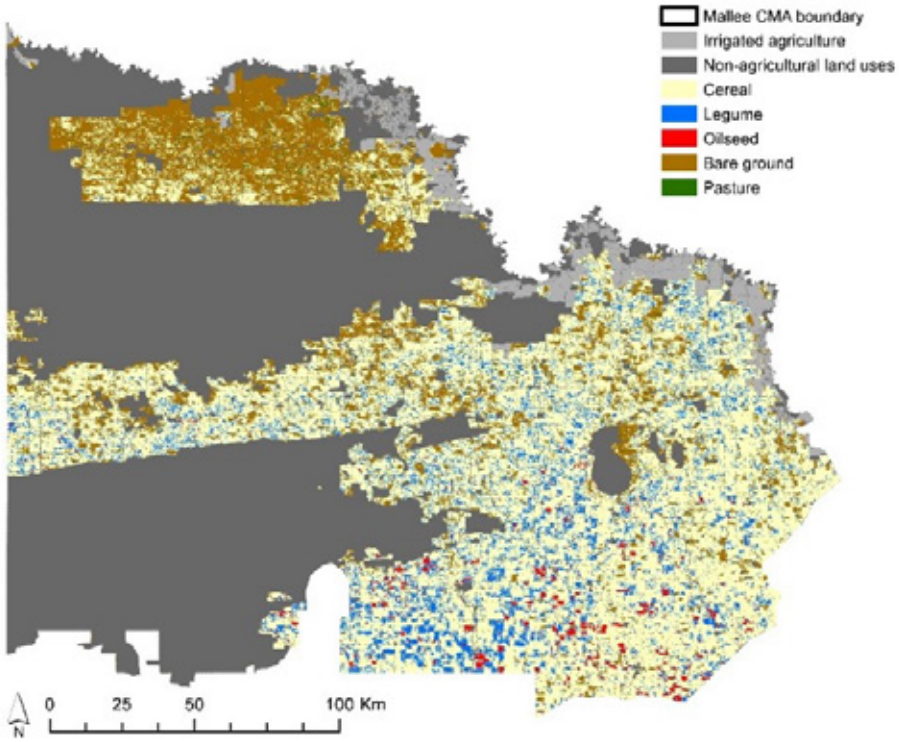


Figure 3: Dryland agriculture land cover (derived from satellite imagery) for 2019.

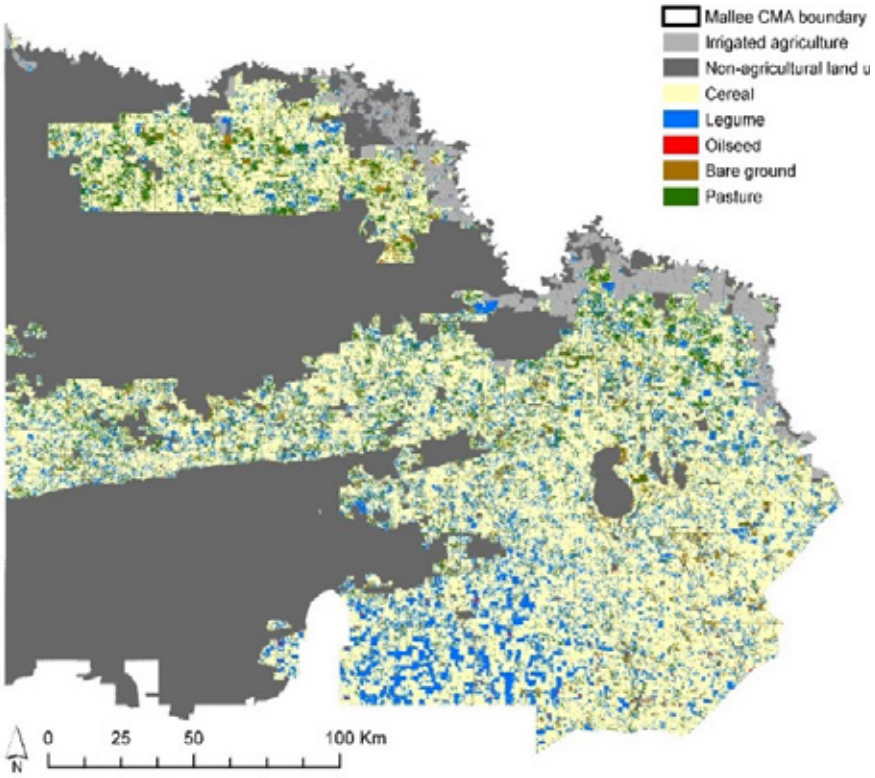


Figure 4: Dryland agriculture land cover (derived from satellite imagery) for 2020.

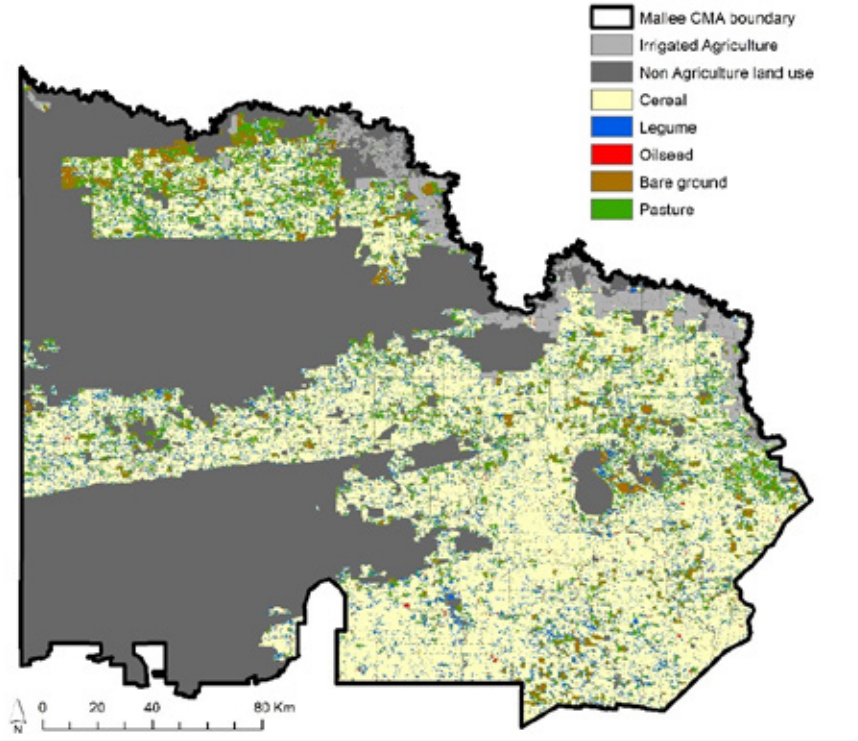


Figure 5: Dryland agriculture land cover (derived from satellite imagery) for 2021.

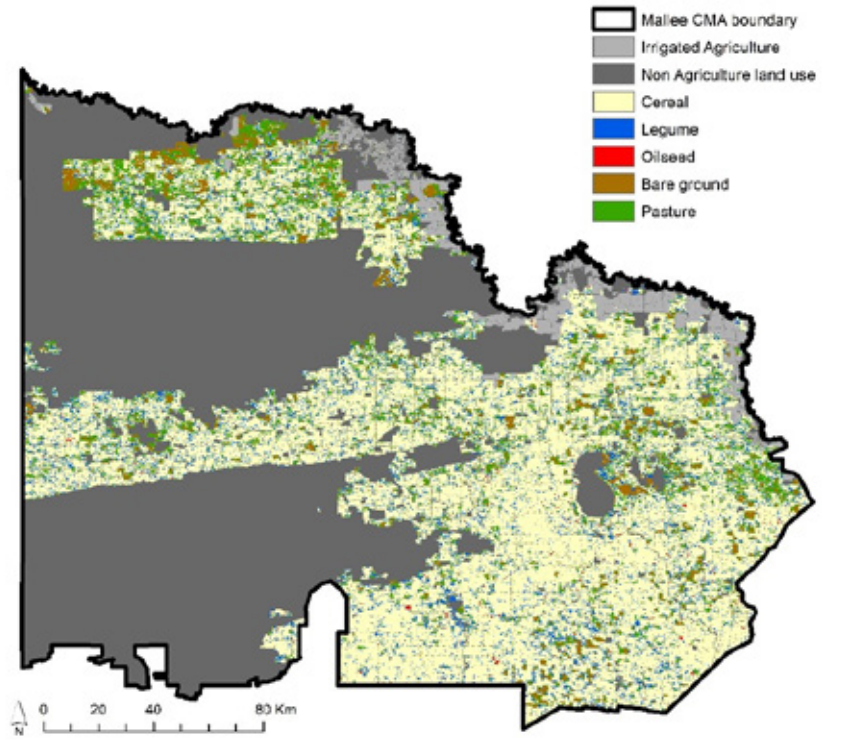


Figure 6: Dryland agriculture land cover (derived from satellite imagery) for 2022.

In Summary

Overall, results indicate that an increase in rainfall can produce an increase in ground cover and farmers are quick to take advantage of this. The spring survey reported an increase in paddocks under a cropping rotation rather than fallow, compared to previous years. The spring survey also reported a notable increase in legumes. Harvesting of legumes leaves significantly less biomass to adequately protect the ground, which increases the risk of wind erosion. However, higher levels of ground cover seem to have been retained in 2022 in comparison to previous years.

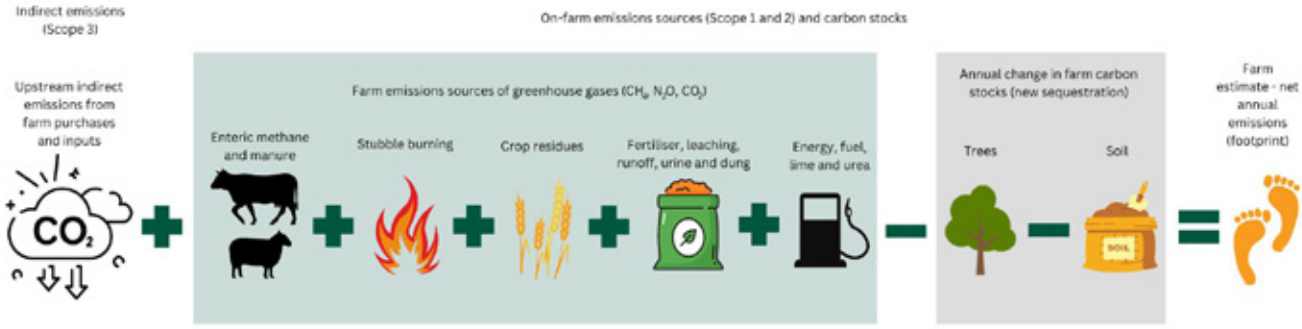
Good management practices by farmers such as suitable crop selection, retaining adequate ground cover including stubble height, and controlled grazing, and favourable seasonal conditions has contributed to reducing the risk of wind erosion in the Mallee.

Acknowledgements

Agriculture Victoria's Darryl Pearl, Sabah Sabaghy and Rebecca Mitchell. This work is supported by Mallee Catchment Management Authority, through funding from the Australian Government's National Landcare program

Tools to help farmers start their on-farm emissions reduction journey.

By Jemma Pearl, Project Officer Climate Change – Agriculture Victoria



Sources of greenhouse gas emissions and sequestration on Victorian mixed farms. Source: Agriculture Victoria

As more attention is being paid to the carbon and emission performance of agricultural industries and farms, Agriculture Victoria is providing the tools and resources to support farmers understand how to start their emissions journey.

All food and fibre systems produce some form of greenhouse gas emissions:

- **Methane** is mainly caused by animal digestion and respiration, manure stockpiles, and effluent ponds
- **Nitrous Oxide** is mainly from fertilisers, animal manures and denitrification, and
- **Carbon Dioxide** comes from fossil fuel-based electricity consumption, diesel and petrol use fertiliser and lime applications, animal manure stockpiles, and effluent ponds.

The production, manufacture and supply of inputs used on the farm can also contribute to a farm's overall emissions profile.

The Making cent$ of carbon and emissions on-farm (https://agriculture.vic.gov.au/climate-and-weather/understanding-carbon-and-emissions/making-cents-of-carbon-and-emissions-on-farm) booklet provides practical actions that farm businesses can take now to improve their emission performance. In many cases, actions to reduce emissions or increase carbon on farms have multiple benefits for farm businesses, such as increasing farm health and profitability.

The booklet focuses on six action areas where emissions performance can be addressed:

- **Energy:** increasing efficiency, renewable energy, and emissions reduction
- **Nitrogen use efficiency and fertilisers:** improving efficiency and saving money
- **Healthy soils:** to grow food and store carbon
- **Livestock:** improving performance and reducing energy loss
- **Trees:** for farm health and sequestration
- **Supply chain:** preparing for what others are doing.

These areas help farm businesses take control of their situation and consider options to improve the resource efficiency of their operations.

Many farmers have already made great resource efficiency improvements, helped by new technologies, practices, and skills and these improvements can also reduce overall emissions.

A number of other free, practical tools and resources have been developed and are available on the Agriculture Victoria (https://agriculture.vic.gov.au/climate-and-weather) website to help inform and educate the industry about weather and climate patterns, carbon emissions, and energy use on farms;

- The recently updated Soil Carbon Snapshot (https://agriculture.vic.gov.au/climate-and-weather understanding-carbon-and-emissions/soils-and carbon for-reduced-emissions) delivers the latest science around soil carbon and includes links to 70 research references and soil carbon reports relevant to Australian agriculture.
- Agriculture Victoria also delivers climate webinars on topics relevant to primary producers and others working in agriculture. Subscribe to be notified (https://confirmsubscription.com/h/r/21B78619269B25F2540EF23F30FEDED) when new webinars become available.
- For farmers considering selling carbon credits from their trees or soils, a revised set of Frequently Asked Questions (https://agriculture.vic.gov.au/climate-and weather/understanding-carbon-and-emissions selling-carbon-from-trees-and-soils) has been developed to help inform business decision-making.

Agriculture Victoria has also commenced the On-Farm Emissions Action Plan Pilot Over three years the team will work with up to 250 farm businesses across the state to measure their on-farm emissions profile and identify potential actions to manage and reduce emissions while maintaining productivity.

The On-Farm Emissions Action Plan Pilot is being delivered as part of the Agriculture Sector Emissions Reduction Pledge to provide practical information, tools and services to support farmers to understand and reduce emissions.

Stay up to date with the Pilot by visiting and bookmarking the On-farm Emissions Action Plan Pilot (https://agriculture.vic.gov.au/climate-and-weather/policy-programs-action/on-farm-action-plan-pilot-program) webpage or express your interest in the program by emailing actionplanpilot@agriculture.vic.gov.au

AGRICULTURE VICTORIA

The Ground Cover Project.

Researchers checking seeding depth at Lowaldie.
Image: Therese McBeath, CSIRO.

Australian Government
Department of Agriculture, Fisheries and Forestry

Future Drought Fund

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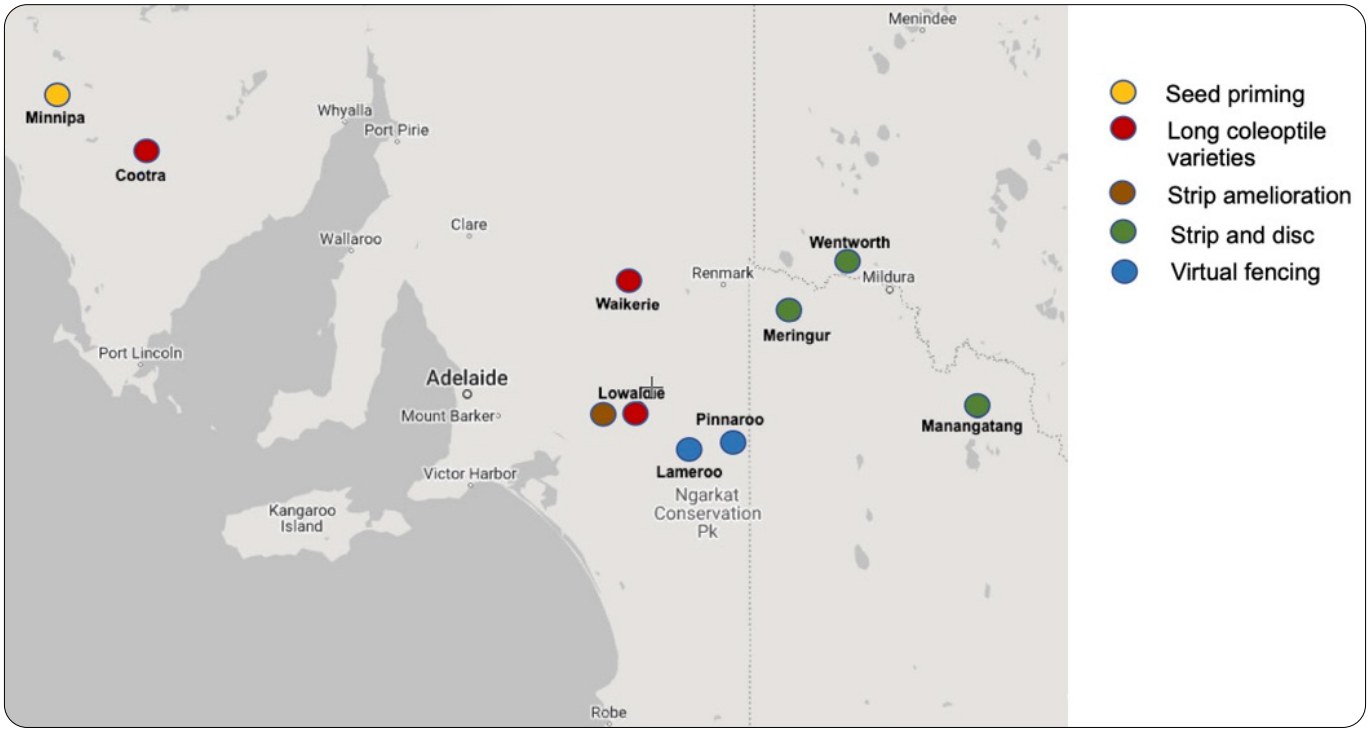

Project Overview - The issue of keeping ground cover.

We all know how beneficial groundcover is for improving rainfall infiltration, reducing runoff and lowering erosion risk. Retaining groundcover during drought means paddocks quickly regain production potential when the drought breaks and need less remediation than those that suffered erosion.

Of course - maintaining groundcover in low rainfall environments is always a challenge. In drier years there is simply less biomass to become protective stubble. More legumes in rotations have had many agronomic benefits such as building soil nitrogen and disease control, but means limited stubble after harvest.

It's tough, but there are more options on the horizon to help farmers keep groundcover in dry periods.

Since 2022, six projects have been underway that explore practices and technologies to maximise groundcover in the system year-round. Funded with just under $2.5 million from the Australian Government's Future Drought Fund Innovation's funding stream, the projects cover a range of strategies that improve crop establishment and reduce stubble disturbance and degradation at multiple points throughout the season:

- **Seeding – seed priming to help seeds germinate in low moisture conditions.**
- **Crop establishment - long coleoptile wheat to sow into subsoil moisture rather than having to wait for the autumn break.**
- **Harvest – strip and disc systems. Stripper front harvesting to maximise the proportion of standing crop residue with disc seeders to seed into the standing stubble.**
- **Grazing – virtual fencing to easily manage grazing pressure.**
- **Soil amelioration options – ameliorating in strips to keep protective stubble and minimise erosion risk. Amelioration also often leads to more biomass and therefore more stubble.**

These projects were chosen because the technology is either already in use in other regions (and needs assessing and adapting to suit low rainfall environments) or is close to market.

Seed priming is commercially available overseas and some horticulture crops in Australia but needs work to adapt for grain crops in Australia. Long coleoptile wheat is used commercially overseas but is in the test phase in Australia. Strip and disc systems are currently used in high rainfall areas in Australia. Virtual fencing trials are well underway and are expected to be commercially available soon. Soil amelioration is becoming standard practice where it's needed but working in narrow strips (strip amelioration) needs assessing.

Trial sites have been established in the SA Mallee, Vic Mallee, NSW Mallee and the Eyre Peninsula. See Figure 1.

This newsletter summarises what the trials found in 2022 and the plans for 2023.

Partners: AIREP, Mallee Sustainable Farming, UniSA, CSIRO, EPAG Research, SARDI, Frontier Farming Systems.

Figure 1. Seeding deeper into moisture (left hand plot) significantly improved crop biomass relative to shallow sowing (right hand plot) – 14 weeks after sowing.

Seed Priming.

Research Collaborators: South Australian Research and Development Institute (SARDI), South Australian No Till Farmers Association (SANTFA), Uni SA and Ag Innovation & Research Eyre Peninsula (AIR EP)

Seed priming – soaking the seed before sowing – aims to initiate the early stages of germination. The process reduces the amount of moisture needed to complete germination, meaning that seeds:

- **can germinate faster and more uniformly once sown**
- **can germinate in lower soil moisture than normal and show greater vigour**
- **might establish better in non-wetting soil.**

On the sandy, non-wetting soils, seed priming could help establish more vigorous groundcover in drier seasons and provide an increased yield potential.

How it works
Soaking 'primes' the seed by kickstarting the germination process - the 'imbibition' phase, where the seed rapidly absorbs water and the 'activation' phase, where metabolic changes are triggered that prepare the seed to physically germinate. These two phases are reversible by drying without affecting seed germinative viability.

Beyond soaking in water (hydro-priming), seeds can be soaked in a range of solutions for additional benefits, such as a micro-nutrient solution (nutri-priming) for improved seedling agronomic performance, or an aerated osmotic solution (osmo-priming) for improved seed germination potential in a saline environment.

Seed priming is widely used with horticultural seeds. Yet despite proven benefits in rainfed grain cropping internationally, there has been little research on integrating seed priming into Australian broadacre cropping.

Trials at Minnipa, South Australia, are investigating the impact of seeding strategies (hydro-priming soaking time, use of soil wetting agent in the seed zone, sowing depth relative to the moisture front) on the ability to improve wheat crop establishment, early vigour and yield in non-wetting sands.

The trials
2022
A small plot trial was implemented in 2022 comparing the impact of soaking Calibre wheat seeds for 6 or 12 hours, when sown at three depths within a drying top layer:

- **2-3 cm (shallow) –seeding 30mm above the soil moisture front into a drying layer, with and without a wetting agent.**
- **4-5 cm (baseline) – seeding at the visible soil moisture front.**
- **7-8 cm (deep) – seeding 30mm below the soil moisture front into greater moisture.**

The small plot trial was established on a non-wetting sand near Minnipa. Seed priming did not affect crop establishment. During earlier laboratory tests, soaking seeds for three hours had a significant impact on initial emergence but there was no difference in final emergence. Soaking times longer than 12 hours may be needed in non-wetting sands.

The wetting agent slightly improved crop establishment while the deep-sown treatments had the greatest establishment rates, unaffected by seed priming treatments. Throughout the season, deep-sown seeds had the highest early and late dry matter, but following a favourable spring finish, there were no differences in wheat yield with the trial averaging 3.6 t/ha.

The research team also set up pot experiments to test the extent of seed weight change with the time of soaking, recording a 57 per cent weight increase after 25 hours. The significant weight change in primed seeds implies that seeder calibration must be adjusted proportionally to maintain the targeted plant population.

2023
This year, the pot experiments and small plot replicated trial will be repeated with adjusted treatments. The project is also aiming to develop a scalable, proof-of-concept mechanised solution for an on-farm seed priming process and air seeder cart modifications to facilitate the metering of 'wet' seeds. The equipment will be used to implement paddock-scale demonstration plots across a zone of changing soil types to help capture variable soil moisture profiles at seeding and quantify their impact.

Sowing Deeper with Long Coleoptile Wheat.

Research Collaborators: Commonwealth Scientific and Industrial Research Organisation (CSIRO), Eyre Peninsular Ag Research (EPAG), Ag Innovation and Research Eyre Peninsula (AIR EP).

What if you didn't have to wait for the autumn break for your crop to germinate?

Long coleoptile wheat varieties could give growers an opportunity to establish a crop when the weather isn't cooperating.

Wheat varieties with long coleoptiles can germinate from deeper in the soil than their conventional counterparts. By sowing deeper into residual summer moisture, crops can access water immediately. In dry years with limited autumn rain, this could mean the difference between having a crop or not.

Other benefits include:

- **sowing beneath a non-wetting soil layer (see 'Grower experience' at the end of this article)**
- **better crop emergence when seeding depth is harder to control, such as after mechanical soil amelioration**
- **seeding deeper to avoid pre-emergent herbicides**
- **ensuring timely establishment regardless of the seasonal break by accessing subsurface moisture, such that growers are confident wheat crops will hit their environment's optimal flowering period and maximise yield.**

The innovation

Short coleoptiles and the need to sow shallow came about with the Green Revolution. As wheat varieties were selected to be semi-dwarf and grow more yield rather than biomass, coleoptile length shortened.

With an alternative dwarfing gene 'Rht18' identified, wheat can grow a coleoptile up to 120-140mm long, while maintaining the reduced height necessary to support high yields. To safely sow wheat at greater depth, long coleoptile cultivars are required. Modern varieties usually need to be within five centimetres of the surface. Even those with longer coleoptile traits need to be sown relatively close to the surface.

Two separate sets of trials in South Australia are looking at strategies for using long coleoptile wheat.

Research

EPAG Research at Cootra, Andrew Ware

The overarching question for this project is how does coleoptile length affect crop establishment and yield when planting seed deeper?

In 2022, 12 cultivars with differing coleoptile length genetics were planted at three sowing depths (40, 80, 120mm).

Across all cultivars, the shallow-sown seed (40mm) yielded the best, seed sown at 80mm had a lower yield, and the deep-sown seed yielded the lowest. These results suggest that seeding deeper penalises yield, regardless of coleoptile length.

The next steps are to work out why there was a yield drag from sowing deeper. Researchers are still going through the data and there is no obvious cause yet. Crop establishment was generally lower when cultivars were sown deeper, but the correlation between yield and establishment was very weak. Other factors such as reduced tillering might be contributing to the lower yield.

Season may have also played a role. Rain was fairly consistent from January onwards. There was not an opportunity to test sowing deeper into subsoil moisture when there was dry surface soil – the conditions where long coleoptile varieties should show their value.

This year the project will also look at:

- **How much subsoil moisture is needed to establish wheat.**
- **How variable soil moisture is in the 50 -120 mm zone across the landscape.**
- **How often there are opportunities to seed deeper and establish crops in the optimal window.**

Figure 1. Deep-sown conventional wheat (left) vs long coleoptile wheat (right). Note the yellowing and stunted appearance of the conventional wheat. Image: Andrew Ware.

CSIRO research at Waikerie and Lowaldie, Bonnie Flohr

The CSIRO field experiments are testing a range of crop cultivars and management strategies (sowing depth, sowing rate, delving tynes and crop sequence) to work out how to maximise crop establishment under declining autumn seasonal break rainfall.

Vetch and five wheat cultivars (Mace, Mace18, Scepter, Yitpi, Yitpi18) with differing coleoptile length genetics were sown either shallow (40-50mm) or deep (110-120mm). Scepter was also sown at a conventional and higher seeding rate.

Figure 2. Researchers checking seeding depth at Lowaldie.
Image: Therese McBeath, CSIRO.

In 2022, at both sites, sowing depth had a greater impact than coleoptile length on plant establishment. Deeper sown treatments had better plant establishment in the first few weeks, regardless of coleoptile genetics.

The difference was more pronounced at Lowaldie, where there was a delayed season break and a non-wetting sand topsoil layer. Deeper-sown seeds established earlier, giving an extra two to three weeks of growth and therefore more groundcover than shallow-sown treatments. Associated with the earlier establishment, deeper-sown treatments also had a significant yield advantage over shallow-sown treatments.

At Waikerie, soil moisture was adequate down the profile which was reflected in the crop. Crop establishment was similar between shallow and deep-sown seeds. There was no significant difference in yield between regular and long coleoptile varieties when both were sown deeply suggesting no yield penalty with deep sowing. Note this site yielded poorly overall.

The experiments at both sites were on a loose, sandy soil. In the 2022 growing season, most deep-sown treatments established adequate plant numbers regardless of coleoptile genetics. Researchers suspect the outcome would vary in soils with a heavier texture and/or higher density as they would pack and strengthen differently around the seed. This requires further investigation.

This year the program is sowing the same treatments into the 2022 brown manure vetch plots (sown May 2022, terminated September 2022) and continuous cereal plots. The aim is to see if adding brown manure into the rotation improves establishment by accumulating more soil water at depth during the longer fallow period.

The soil at Lowaldie will be spaded and the research focus is 'can deep sowing long coleoptiles improve crop establishment by overcoming variable seeding depth on newly ameliorated soils?'

Experiments on the Mallee and the Eyre Peninsula both suggest that season plays a role in the efficacy of sowing deeper. While there is more to tease out, it appears the value of sowing deep is realised when the topsoil is dry. If there is already moisture in the top five centimetres, there is little need to sow deep.

Grower experience – deep sowing

For the last few years, Ed Hunt on the eastern Eyre Peninsula has been experimenting with deeper sowing on sandy soils. He has sown wheat and barley down to 75mm and vetch as deep as 100mm. Although sowing deeper than the varieties would recommend, the crops have been reasonably forgiving.

A key benefit for Ed is the ability to sow beneath the most non-wetting soil layer, which is about five centimetres deep on his soils. By also sowing on the row, when it does rain the moisture follows the old root channels and the dry non-wetting soil acts like a mulch. Sowing beneath the non-wetting layer could be another tool growers use while working out their amelioration strategy and budget.

Another benefit is weed control. When deep sowing vetch into moisture he's found the crop has a good opportunity to establish and outcompete the weeds which struggle to germinate in the dry topsoil.

In practice, making the most of longer coleoptile varieties and deeper sowing will mean digging a few holes before seeding to work out where soil moisture is and the seeding depth to aim for. In the driest years there might not be enough soil moisture, so it pays to check.

Figure 1. Proof of concept high-capacity inclusion ripper component layout.
Image: Agricultural Machinery Research and Design Centre (AMRDC) of UniSA.

Stubble Friendly Soil Amelioration - Working in Strips.

Research Collaborators: University of South Australia (UniSA), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Mallee Sustainable Farming (MSF)

Ameliorating soil constraints such as compaction and non-wetting can boost yield but comes at the expense of surface groundcover. Deep ripping can spare some amount of stubble but spading and inversion ploughing leave the soil bare.

Erosion risk is commonly managed with timing: ameliorating as close to cropping as possible to limit the period of exposure when soil is vulnerable and planting as soon as possible after amelioration or, where possible, ameliorating and planting in one pass where there is subsoil moisture available. However, even when planting simultaneously, such as with one pass spade and sow machines, it still takes time for the crop to grow enough to provide functional groundcover and minimise soil erosion risks.

Strip amelioration is a concept that allows growers to ameliorate paddocks in stages while maintaining functional groundcover.

Strip-amelioration and strip-sowing
Strip amelioration works a portion of the paddock by leaving alternating strips of ameliorated soil and undisturbed standing stubble. The machines are modified to work in narrow strips, which keeps the ameliorated soil better protected by close surrounding standing stubble.

With lower erosion risk, the amelioration window can be wider, giving growers more flexibility in fitting soil amelioration into the calendar.

The project is also evaluating simultaneous strip-sowing (sowing the ameliorated strips only), which aims to not disturb the standing stubble strips, leaving better protection than uprooted or knocked down stubble by blanket sowing. Researchers hope that strip-sowing can especially benefit pulses by providing trellising support and minimising the erosion risk after harvesting a strip-sown pulse crop.

Trial set-up and early results
A large plot trial (12m wide x 70m long plots, with 4 replications) at Lowaldie in South Australia is testing the idea of strip inclusion ripping (with blanket sowing) and strip spading (with strip-sowing) on a non-wetting sandy rise. The soil suffers from low fertility and organic matter and is prone to erosion.

The inclusion ripping treatment is working to 500 mm depth and uses high-capacity inclusion plates (600mm long) with inclusion discs that move the topsoil and crop residue down the full ripping depth. The 1.2 m (dual) rip line spacing leaves about half-metre wide undisturbed surface strips between the rip-lines (Figure 2).

A strip spader equipped to spade and sow in one pass is also being modified to spade 0.4m wide strips at a 0.8m spacing, and sow 2-3 rows over the spaded strips. Figure 3 is an example of strip spading outcome in a hay paddock.

Figure 2. Dual tine strip-inclusion ripper used at the Lowaldie demonstration site. Image: AMRDC of UniSA.

Figure 3. Visual effect of strip spading in a hay paddock. Image: Wasse b.v. Farmax

Figure 4. Barley establishment response over a 40 per cent strip inclusion ripped plot (centre) with adjacent control plots on a low fertility sand at Lowaldie South Australia (SA). Image: AMRDC of UniSA.

Table 1. Strip amelioration treatment sequence

Year	Crop	Control	Strip Rip 1	Strip Rip 2 (out of phase)	One Pass inclusion rip	Strip Spading
2022 Set Up Phase	Barley	-	1st Pass Strip area = 40%	-	-	-
		Blanket Sowing Year 1				
2023 Main Trial Year	Pulse	-	2nd Pass Strip area = 60%	1st Pass Strip area = 40%	Single Pass Strip area =100%	1st Pass Strip area = 50%
		Blanket Sowing Year 2				Strip Sowing

2022 was largely a set-up year. The site was sown to barley and one strip-rip treatment (40% of the paddock area) was undertaken to 500mm depth under minimal surface residue conditions (Figure 2). Crop germination and dry matter growth visually improved over the ripped strips (See Figure 4). At the 2022 harvest there was a 0.64 t/ha (28%) yield response from the strip-rip treatment. The control plot yielded 2.3 t/ha.

The 200-250mm high stubble will be left un-grazed until sowing in 2023 to demonstrate the full value of the strip amelioration concepts.

Table 1 gives a brief overview of the experimental treatment sequence, with funding currently secured for the 2023 cropping season. Results comparing the different phases of these systems side by side will be available at the end of this year. Of particular interest are the various treatment impacts on crop biomass (NDVI), grain yields but also stubble residue levels remaining post-harvest.

Machinery

Strip ripping is achieved with a standard ripper fitted with half the tines set on double spacing (e.g. every 1.2m instead of every 0.6m). A double-spaced layout is especially important for inclusion ripping as the additional components clutter the frame (Figure 1).

Helper discs were combined with high-capacity inclusion plates to achieve a more active inclusion process, while rear mounding discs and a bar roller leave a levelled and firmed up surface, ready for seeding. This strip inclusion ripping concept can easily be adapted to existing ripper machinery.

Potential implementation issues may include tracking stability during the second pass as the implement might drift towards the initial rip-lines. Operating on wider than double rip-line spacing and adding steering coulters to the frame may mitigate such issues. Recommended tine layouts on a strip-ripper are symmetrical, aiming to rip behind the tractor driving wheels on the first pass so the tractor can shift across on the second pass, while still driving on undisturbed ground.

The strip spading concept was recently developed by the UniSA research group and requires a spader specifically modified for the job, with tailored blades and internal shields. For these trials, a European manufacturer is supplying a modification kit for a research spader. If the trials prove successful, commercially available farm-scale strip spaders with sowing kits could become available and meet market demand. The strip-spading approach could achieve more thorough soil mixing and amendment incorporation outcome than inclusion ripping, though it is limited to 400mm depth.

Figure 1. Stripper front testing at Meringur.
Image: MSF

Stripper Front Harvesting and Disc Seeding.

Research Collaborators: Frontier Farming Systems, Mallee Sustainable Farming (MSF)

'Strip and disc' systems – a stripper front harvester and disc seeder - are already used successfully in higher rainfall regions. The system is favoured as a way to conserve stubble.

The stripper front harvester 'picks' the heads off the wheat, leaving tall standing stubble. Because it is not in contact with the soil the stubble lasts longer, providing better erosion control, shading and cooling the soil surface, and making conditions more favourable for the emerging crop. However, because of the long stubble, disc seeders rather than conventional tyned seeders are required to sow through the stubble.

Strip and disc in low rainfall regions

What we don't know is if strip and disc systems can work in low rainfall regions. Trials in western Victoria and western NSW are investigating the suitability of the system in low rainfall Mallee conditions. Aspects being studied include:

- **Lower yields:** will the stripper front harvester will work on lower yielding (2.5t/ha) crops?
- **Pulses:** is it possible to grow pulses with a disc seeder.
- **Herbicides:** many pre-emergent herbicides are not registered for use with disc seeders.
- **Root diseases:** root diseases such as Rhizoctonia tend to increase when using disc seeding in the cereal phase.

Figure 2. Disc seeding at Wentworth NSW. Image: MSF

The trials

2022
Two sites (Manangatang and Meringur) are evaluating harvest losses from the stripper front on wheat and barley sown at different rates, row spacings and times to create differences in crop density.

Decent rain meant 2022 was a great season for many farmers in the region, but made it hard to test out the stripper front on a low yielding crop. Due to the late harvest, data is still being analysed, but the stripper front appeared to be reasonably successful on the 3-4t/ha crops. Researchers are keen (but do understand that farmers are less keen) to test it on a low yielding (2.5t/ha) crop.

The trials at Manangatang are also looking at pre-emergent herbicide options in wheat and barley, and in-furrow fungicides to address the Rhizoctonia problem in a disc-seeding system. Root health and grain yield data is still being analysed, but there was some yield advantage from managing Rhizoctonia with in-furrow fungicides.

At Wentworth in NSW, three disc seeding systems (H-Hart Gent Double Disc Opener; Serafin Baldan Single Disc; Rootboot Razor Disc) were tested on field peas and chickpeas, sowing them into wheat stubble to see how well they establish and yield. Yield data is currently being analysed but crop growth appeared similar throughout the season across the treatments.

2023
This year researchers will sow pulse crops into the wheat and barley stripper front residue at Meringur and Wentworth, collecting data on crop establishment and yield. At Manangatang, they will disc seed a cereal crop and look more closely at herbicide options and fungicides to manage Rhizoctonia.

Figure 1. Groundcover measurements being conducted on virtually fenced grazed areas at the Pinnaroo virtual fencing cattle trial, October 2021 (Source: GRDC).

Virtual Fencing.

Research Collaborators: Commonwealth Scientific and Industrial Research Organisation (CSIRO), Grains Research and Development Corporation (GRDC), Australian Wool Innovation (AWI), Gallagher, Mallee Sustainable Farming (MSF).

Growers are looking forward to the opportunity to move fences without leaving the house. Virtual fencing has been in development for over a decade and more recently paddock trials on crop-livestock mixed farms have been underway in South Australia, New South Wales and Victoria.

Many farmers see the technology as a potential game changer for paddock grazing and groundcover management. Growers can easily move virtual fences around paddocks using the software on their computer or phone to:

- ensure no one area becomes too heavily grazed (or under grazed)
- keep cattle off vulnerable soil types and erodible or waterlogged areas
- better control grazing pressure to maintain optimal groundcover.

Other potential benefits include the ability to target grazing to areas with high weed levels, managing grazing patterns in frosted crops, and protecting establishing pastures. While virtual fencing devices for cattle are nearing commercial readiness, work to develop devices for sheep remains in the early stages.

Managing grazing patterns

Two trials at Pinnaroo, South Australia (SA), have tested virtual fencing to manage grazing patterns. In 2021, virtual fencing was used to graze out frost and weed prone areas while leaving the rest of the cropping paddock for harvest. Figure 1 shows an area grazed by cattle before the fence was shifted to a new area.

In 2022, the fences were shifted regularly so cattle would evenly graze a dual-purpose barley crop to minimise potential yield effects and avoid erosion prone areas (Figure 2).

Economically, virtual fencing could mean more feed value from a whole paddock as growers can better match grazing pressure across variable soil types, and allow more efficient grazing across otherwise large cropping paddocks, without the cost and labour of wire fencing.

How it works

In the case of the e-shepherd devices used in the Pinnaroo trials, each animal wears a solar-powered neckband with a GPS and counterweight to keep them the right way up. The devices communicate with a base station that is set up on the farm.

"As the animals approach a virtual fence line, the GPS in the collar registers the proximity and the collar makes a sound – an audio cue to stop and turn around," says Rick Lewellyn, project leader at CSIRO. During an initial training phase, the animals quickly learn that if they don't turn around and keep walking across the virtual fence line they will eventually receive a small electrical stimulus.

Figure 2. Impact of grazing on dual purpose barley crop maturity at Pinnaroo VF trial October 2022. (Source: Damian Mowat, CSIRO).

The virtual fencing technology used in the trials was originally developed in conjunction with CSIRO's animal behaviour and welfare team led by Dr Caroline Lee. It includes features to protect the animals. For example, they won't receive cues if they are running fast towards the fence (say they have been scared by dogs) or if the animals are on the wrong side of the fence but heading back in the right direction.

For now, the commercial devices are for cattle but early-stage work is underway on developing a version for sheep. The smaller size of sheep and wool growth means a new set of challenges need to be overcome. However, preliminary trials using research devices show that the ability of sheep to learn to respond to virtual fencing is promising, with learning rates similar to cattle. In a recent small-scale trial conducted by the project on a mixed farm at Lameroo, specially adapted research devices were used (see Figure 3 where the sheep wore them across their backs). Other preliminary work has explored the potential for ear tags as a longer-term possibility.

Next steps

Virtual fencing is expected to be commercially available soon, with Gallagher now providing indicative costing on their website and aiming for a 2023 release of their e-shepherd system. However, there is still the need for legislative change in some states to allow farmers to use the technology when it becomes available. Meanwhile, on-farm trials are providing valuable insights into the potential use and value for Australian mixed-farmers.

Latest info on commercial release plans and pricing: https://am.gallagher.com/-/media/Bynder/Animal-Management/Document/ALL-GGL-Brochures/eShepherd-FAQ-sheet-2022-Web---V2-original.pdf

Figure 3: Non-wool sheep virtual fencing trial at Lameroo, October 2022. The sheep are standing near the base station that receives the signals from the collars. (Source: Rick Lewellyn, CSIRO).

Recent MSF Mallee Seeps workshop at Manangatang. Photo Mallee CMA.

Regional Agriculture Landcare Facilitators (RALF) Regional Roundup.

By Glen Sutherland and Cameron Flowers, Regional Agriculture Landcare Facilitators, Mallee Catchment Management Authority.

The RALF Regional Roundup provides news and information about upcoming regional events and resources relating to sustainable agriculture that may be of interest to farmers and farming communities.

Late summer and early autumn saw a flurry of farmer engagement activities across the Mallee and the good news is there are still more to come. Details about up and coming farmer events are listed below.

What's coming up in 2023?

Mallee Sustainable Farming
MSF events over the next few months are currently in the planning stage and are expected to happen before June 2023. Keep an eye out for these by following MSF on their Facebook page (https://www.facebook.com/MSFMallee) or by visiting the MSF website (https://msfp.org.au/). Source MSF.

Birchip cropping Group – Managing Dry Season Sheep Nutrition
March 30th, 2023, Wycheproof.
Managing out of season nutrition and containment setup/management. An interactive workshop combining information sharing and demonstrations to maximise livestock production out of season. Topics to be covered include:

- 'Basic' nutrition (how the rumen works, the importance of feed testing (especially with spoiled fodder and grain this year), reading a feed test, animal requirements, understanding intake);
- Grazing standing crops (how to, tips and tricks, supplementing protein, cost benefit v's putting a header in v's grazing stubbles);
- Containment feeding – nutrition focus (ration formulation, tips and tricks to keep in mind)

- Infrastructure: Demonstration of operating containment systems – discuss yard layout and operations, changes made over time to make it work better, more labour efficient, how do you know it's working well (observations, weighing, economics etc). Discuss location, set up, size, water, feeders, slope, waste management, shade, using electronic identification (eID) and other technology etc.

Registration for the event is available at https://www.bcg.org.au/events/managing-out-of-season-nutrition/ Source BCG.

Birch Cropping Group - Main Field Day
September 13th, 2023
The BCG Main Field Day is on Wednesday the 13th of September. The event offers growers and advisors the latest in local agronomic research including disease management, new varieties, new herbicide technology, nutrition and farming systems. Gates open at 8am with onsite catering available from breakfast through to drinks at the conclusion of the day.

This event is free for BCG members and $50 for non-members. To become a member, visit www.bcg.org.au For more information on becoming a member or regarding the field day visit online at https://www.bcg.org.au/ . Or follow this link Source BCG.

GRDC National Farm Business Update
April 5th, 2023. (Online)
National Farm Business Update online; The farming challenge - decision making in the face of uncertainty. Presenter Barry Mudge will cover the dynamics of having to make decisions in the absence of complete information, something most farmers are no strangers to.

"Barry has a practical background with farming in a highly variable low rainfall environment and has been directly involved in both the practical and technical aspects of agriculture for over 40 years. He has managed the family farming property in the Upper North of South Australia (SA) for over 15 years and has had stints during his career with the Commonwealth Development Bank and Rural Solutions SA".

Registration for the event is available here https://www.eventbrite.com.au/e/the-farming-challenge-decision-making-in-the-face-of-uncertainty-tickets-575120840917

Or click the link here if you're reading this on-line.
Source GRDC

Handy resources
Agriculture Victoria's Rain and Grain project produces a monthly soils moisture monitoring newsletter. The project utilizes soil moisture monitoring (SMM) probes, that provide real time soil water data. They record soil water content at one source point from 30cm down to 1 metre as a reference point for the paddock in which the probes are located. Soil Moisture Monitoring sites have been established throughout Victoria, including sites in the Mallee at Werrimull, Ouyen, Speed, Birchip and Normanville (between Birchip and Kerang). The newsletters also include monthly rainfall data for Victoria.

You can subscribe to the newsletter here or visit https://agriculture.vic.gov.au/support-and-resources and follow the link to the Newsletters section where you subscribe for regular updates and reports to be delivered straight to your email in-box.

Acknowledgement
The northern and southern RALF'S are supported by the Mallee Catchment Management Authority, through funding from the Australian Government's National Landcare Program.

AgVic Talk on all things AgTech and Energy.

By Agriculture Victoria Media

Digital agriculture has the potential to provide farmers with information and the ability to solve problems and seize opportunities for growth. In season five of the AgVic Talk podcast we explore AgTech and Energy, what is it? How do you identify opportunities and plenty of tips and tricks from farmers and experts?

From solar-powered poultry farms to on-farm drone trials and the difficulties of connectivity in rural and remote areas, this season covers everything you need know to further understand the evolving world of AgTech and Energy.

The series will help farmers learn what AgTech is, what energy solutions are available and how farmers can use them to improve productivity and efficiency on-farm.

These 14 episodes are the latest in the AgVic Talk series, which began as a pilot in August 2020 to cover contemporary commentary on how members of the agricultural community recover, grow, modernise, protect, and promote Victorian agriculture.

You can subscribe and listen to AgVic Talk wherever you get your podcasts:

- **Subscribe to AgVic Talk on Spotify**
- **Subscribe to Apple Podcasts.**

More information available at https://agriculture.vic.gov.au/support-and-resources/podcasts/agvic-talk-podcast-series/agvic-talk-season-5

Implementing your farm Biosecurity Plan.

By Richard Smith, Agriculture Victoria Dairy Industry Development Officer.

An up-to-date farm biosecurity plan is an essential tool to protect the farm business from pests and disease, but a plan is only effective if the actions and practices it contains are implemented and followed.
Training, planning, recording, and updating regularly, should be among the actions described in the farm's biosecurity plan.

Training is often an overlooked component of farm biosecurity. Employees should be able to identify diseases, pests and weeds that are of concern, or know to notify the livestock manager if they are unsure.
Farm managers can create easy to follow biosecurity practices and provide access to training, so everyone understands their roles and responsibilities. It's a good idea to keep records to ensure everyone's training is current and up to date.

It is also important the farm biosecurity plan is flexible so it can also be used in times of emergencies, such as floods, fire, drought, or other extreme events. The plan should describe procedures to follow during such events, including:

- **Evacuating yourself and your livestock**
- **Supplying or sourcing emergency feed and water**
- **Cleaning and disinfecting infrastructure**
- **Increased monitoring schedules for disease or injuries**
- **Inspecting yards and paddocks for new weeds or pests**

Records are another critical element in biosecurity management. Make sure National Vendor Declarations accompany all stock movements and keep your National Livestock Identification System (NLIS) up to date.
It is important that you review or update your plan whenever management practices or risks to your property change.

Information on how to develop a farm biosecurity plan can be found on the Agriculture Victoria website, or phone 136 186. For information on workshops and webinars visit agriculture.vic.gov.au/events for details.
For information on Victoria's biosecurity please visit agriculture.vic.gov.au/biosecurity.

AGRICULTURE VICTORIA

Figure 1. BCG Curyo N trial site 2022.
Image: BCG

Managing N Fertiliser to Profitably Close Yield Gaps.

By James Hunt (University of Melbourne), Kate Finger and James Murray (Birchip Cropping Group)

Take Home Messages

- In 2022, Yield Prophet® Lite 50 per cent treatment applied more N (137kg N/ha) and was more profitable (gross margin $1205/ha) than the N Bank 125kgN/ha treatment (69kg N/ha, gross margin $951/ha) but mean profit for the two treatments over five years was similar ($575 vs $524kg N/ha).
- Over five years of the experiment, N decisions based on 50 per cent Yield Prophet® or 125kg/ha N bank strategy applied more N (63-74kg N/ha) and were $128-179/ha per year more profitable than the district average N rate (21 – 30kg N/ha).
- The most profitable strategies all had neutral to positive partial N balances (more N applied in fertiliser than removed in grain) indicating soil organic N was not being mined.
- High urea prices in 2022 were offset by higher grain prices, and the most profitable treatments and N application rates remained the same over the last five years.

Background
Australian wheat yields are only half what they could be for the rainfall received (Hochman et al. 2017). Nitrogen (N) deficiency is the single biggest factor contributing to this yield gap. This is also likely to be true for other non-legume crops (barley, canola and oats) and reduces farm profitability. Alleviating N deficiency would increase national wheat yields by 40 per cent (Hochman and Horan 2018).

On farms with no legume pastures, most of the crop N supply must come from N fertiliser. Grain legumes do not provide enough N to support yield of subsequent crops at the intensity at which they are currently grown. N fertiliser is a costly input and its use increases the cost of production and value-at-risk for growers. Growers fear over-fertilisation will result in 'haying off', which reduces both yield and quality. There is also concern that overapplied fertiliser not used by crops is lost to the environment through leaching, volatilisation and denitrification. Consequently, efforts are made to match N fertiliser inputs to seasonal yield potential. This is difficult in southern Australia due to the lack of accurate seasonal forecasts for rainfall. The difficulty in matching N supply to crop demand and a tendency for growers to be conservative in their N inputs is responsible for a large proportion of the yield gap explained by N deficiency.

In 2018, BCG and La Trobe University began a multi-year experiment to evaluate the potential for different N management systems to profitably close the yield gap and slow organic matter decline; 2022 was the fifth season of the experiment.

Aim
To evaluate different N management systems designed to profitably close the yield gap due to N deficiency and slow soil organic matter decline.

Paddock details.
Location: Curyo
Soil type: Sandy loam top-soil with clay content and calcium carbonate increasing with depth
Paddock history: 2017: Lentil
Trail details.
Treatments: Refer to Table 1
Seeding equipment: Knife points, press wheels, 30cm row spacing
Replicates: Four

Table 1. Crop Type, sowing and harvest dates and rainfall for the five years of the trial.

	2018	2019	2020	2021	2022
Crop year rainfall (Nov-Oct) mm	200	368	358	241	558
GSR (Apr-Oct) mm	138	149	221	197	396
Crop Type	Wheat	Canola	Wheat	Barley	Wheat
Variety	Scepter	Hyola 350TT	Scepter	Spartacus CL	Razor CL
Sowing Date	14 May	29 April	16 May	14 May	19 May
Harvest Date	15 November	15 November	21 November	25 November	7 December

Trail inputs.
N fertiliser:

Table 1. Nitrogen fertiliser (starter fertiliser + top-dressed urea) applied to different treatments in all years of the experiment.

		Total N fertiliser applied (kg N/ha)				
System	**Treatment**	**2018**	**2019**	**2020**	**2021**	**2022**
Nil	Nil	16	7	7	7	7
Replacement	-	16	27	42	57	49
National average	-	44	38	52	52	52
Nitrogen banks (kg/ha N)	100	69	49	36	66	20
	125	94	32	64	68	69
	150	119	64	32	83	95
Yield Prophet® probability	100%	16	31	7	7	45
	75%	16	95	63	7	75
	50%	32	119	91	7	137
	25%	72	119	135	15	143

Starter fertiliser: 2018: Urea @ 35kg/ha at sowing (host farmer management)
2019: Granulock Z @ 60kg/ha at sowing
2020: Granulock Z @ 60kg/ha at sowing
2021: Granulock Z @ 60kg/ha + triple superphosphate @ 35kg/ha at sowing
2022: Granulock Z @ 60kg/ha + triple superphosphate @ 35kg/ha at sowing

The experiment was kept free of weeds and disease as per current best practice management.

Method
A multi-year experiment using a randomised complete block design was established in 2018 to evaluate the performance of different N management systems. Four different systems were tested:

1. **Matching N fertiliser to seasonal yield potential (Yield Prophet® and Yield Prophet® Lite, YP)**
2. **Maintaining a base level of fertility using N fertiliser (N banks)**
3. **Replacing the amount of N removed in grain each year with fertiliser in the next season (replacement)**
4. **Applying national average N fertiliser rate (45kg/ha) each season (national average, NA)**

All systems were compared to a nil control which received only starter fertiliser (7kg N/ha per year). Within the Yield Prophet® and N bank systems there were different treatments targeting different yield potentials (Table 2). In the Yield Prophet® treatment before 2021, water limited potential yield was determined at different levels of probability; the amount of N required to achieve these yields was applied, assuming a requirement of 40kg/ha N per t/ha wheat yield and 80kg/ha N per t/ha canola yield (Figure 1). From 2021 onward, Yield Prophet® Lite was used in a similar way. For the N bank treatments there were different target levels of N fertility (N bank targets). N fertiliser rates in these treatments were calculated as the N bank target value minus soil mineral N (kg/ha) measured prior to sowing.

Table 2. Nitrogen management systems and treatments used in the experiments.

System	Treatment	Description
Nil	Nil	No nitrogen applied other than in starter fertiliser
Replacement (R)	-	Amount of N removed in grain applied as fertiliser N in the following season
National average (NA)	-	National average N fertiliser (45kg/ha N) applied each season
Nitrogen banks (kg/ha N)	100	Soil mineral N + fertiliser = 100kg/ha N
	125	Soil mineral N + fertiliser = 125kg/ha N
	150	Soil mineral N + fertiliser = 150kg/ha N
Yield Prophet® probabilities	100%	Yield with lowest yielding season finish on record (decile 1 in Yield Prophet® Lite)
	75%	Yield with lower yielding quartile season finish (decile 2 – 3 in Yield Prophet® Lite)
	50%	Yield with median season finish (decile 4 – 7 in Yield Prophet® Lite)
	25%	Yield with higher yielding quartile season finish (decile 8 – 9 in Yield Prophet® Lite)

All gross margins were calculated assuming a urea price of $1400/t and cash grain prices delivered Birchip early January 2023. All other variable costs are from the 2022 SAGIT Gross Margin Guide assuming medium rainfall (SAGIT 2022).

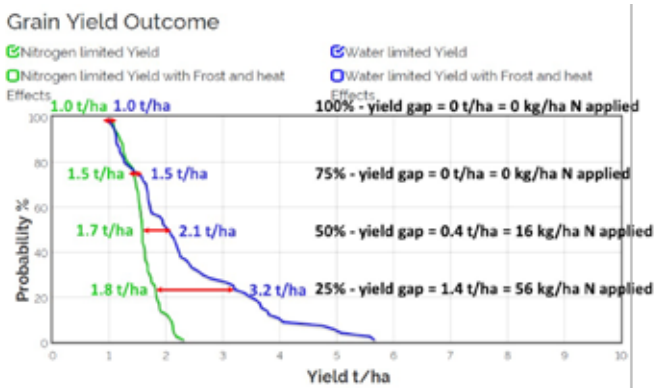

Figure 1. An example from 2018 of how Yield Prophet® is used to determine water limited potential yield, given probabilities of different season outcomes, and how this is used to calculate a yield gap and N fertiliser rate required to close the yield gap.

Results and interpretation

2018 – 2021 Results

Please see BCG Season Research Results from 2018-2021 growing seasons for previous results of the experiments.

2022 Results

Soil mineral N measured before sowing was similar across treatments, with only the 100kg/ha N Bank treatment and Yield Prophet® 25% treatment having significantly more mineral N than other treatments (Table 2). Of the treatments with a positive four-year N balance, 40 per cent of fertiliser N applied in excess of offtake in grain was available as mineral N before sowing in 2022, with the remainder either lost or immobilised (data not shown).

In the very favourable 2022 growing season, grain yield, protein and gross margin responded positively to N supply (Table 3). The highest yielding treatments were the Yield Prophet® 25 per cent and 50 per cent treatments which applied the most fertiliser N in 2022 (143 and 137kg N/ha respectively). These were also the most profitable treatments. The N Bank treatments that were more conservative in the favourable season applied less fertiliser, yielded less and were less profitable.

Table 3. Soil mineral N measured prior to sowing, top-dressed N, partial crop N supply (soil mineral N + fertiliser N), grain yield, protein and gross margin for different treatments in the experiment in 2022.

System	Treatment	Soil mineral N (kg/ha)	Top dressed N (kg/ha)	Partial N supply (kg/ha)	Yield (t/ha)	Protein (%)	Gross margin ($/ha)
Nil	Nil	66	0	66	2.5	8.0	$522
Replacement	-	72	42	114	4.0	8.3	$926
National average	-	62	45	107	4.2	8.6	$988
Nitrogen banks (kg/ha N)	100	99	13	112	3.8	8.4	$943
	125	71	62	133	4.3	8.6	$972
	150	68	88	156	4.8	9.3	$1,070
Yield Prophet® probability	100%	74	38	112	3.7	8.0	$832
	75%	81	68	149	4.9	9.2	$1,167
	50%	65	130	195	5.6	9.4	$1,226
	25%	112	136	248	5.6	10.5	$1,320
Sig. diff. LSD (P=0.05)		**<0.001 19**			**<0.001 0.5**	**<0.001 0.9**	

Five-year averages

Comparison of the different systems over the five years of the experiment using 2022 costs and prices shows the relationship between mean N application and gross margin flattening out (Figure 2). Yield Prophet® 25, 50 and 75 per cent and N Bank 100 and 125kg N/ha are all equally profitable and have applied between ~50 and 94kgN/ha per year on average. The Yield Prophet® 50 per cent and N Bank 125kg N/ha treatments sit in the middle of this band and have applied 74 and 63kgN/ha on average. Assuming the district average N application is 30kg N/ha (Norton 2016), the fitted quadratic function suggests the Yield Prophet® 50 per cent and Nitrogen Bank 125kg/ha treatments have on average returned $179/ha and $128/ha more profit per year (Figure 2).

The Yield Prophet® 50 per cent and N Bank 125kg/ha treatments also had a neutral to slightly positive five-year N balance (Figure 3), indicating soil organic N was not being mined and soil organic matter was likely being maintained. This contrasts to the Nil control which had a five-year N balance of minus 124kg/ha N. Based on the soil C:N ratio at the site of 9.7, this suggests ~1203kg/ha of soil organic carbon has been lost.

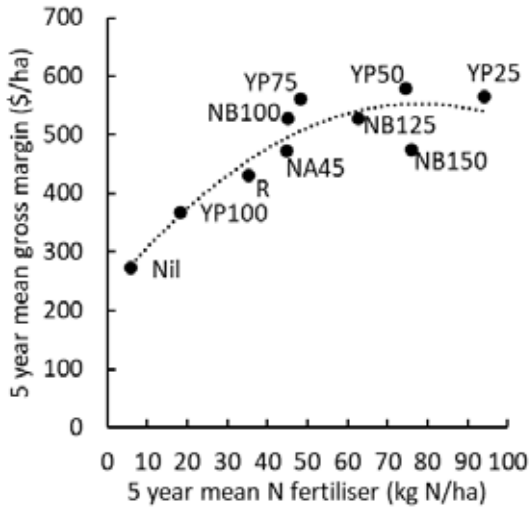

Figure 2. The relationship between mean five-year fertiliser application and mean five-year gross margin for the different treatments. The quadratic function fitted by least-squares regression is of the form y = -0.05x2 + 8.30 x + 229.61, R^2 = 0.85.

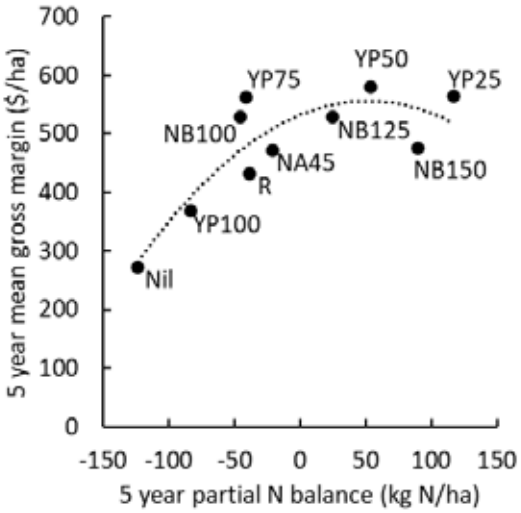

Figure 3. The relationship between five-year N balance and five-year mean gross margin for the different treatments. The quadratic function fitted by least-squares regression is of the form y = -0.01x2 + 0.93x + 531.60, R^2 = 0.74.

Commercial practice and on-farm profitability

Growers should soil test and use an environmentally appropriate fertiliser N management strategy such as Yield Prophet® Lite or N Banks to maximise profits. In this experiment, profit has been maximised at much higher rates of fertiliser N (~70kg N/ha N or 152kg/ha urea per year) than is usually applied in the district (21 – 30kg N/ha or 46 – 65kg/ha urea). Long-term profitability is likely to be increased by growers being less conservative with N fertiliser applications, particularly for those consistently achieving cereal grain proteins of less than 11.5% (ie. APW or ASW wheat).

In the very favourable season of 2022, Yield Prophet® treatments were more aggressive with N applications and were more profitable compared to N bank treatments. However, over the five years of the experiment, profitability of the best Yield Prophet® and N Bank treatments is very similar.

The most profitable treatments in this experiment have neutral to slightly positive N balances, indicating a 'win-win-win' where profits are maximised, soil organic N is not mined and excessive mineral N is not accumulated that is then susceptible to losses. Growers should check the long-term N balances of their paddocks to ensure soil organic N is not being mined. A spreadsheet to do this is available here: https://www.bcg.org.au/understanding-crop-potential-and-calculating-nitrogen-to-improve-crop-biomass-workshop-recording/

High urea prices in 2022 and beyond are a legitimate concern, given the strong reliance of continuous cropping systems on synthetic N fertiliser for high yields and profits. However, increases in grain prices have offset rises in the price of urea, and results of this experiment show the most profitable N rates have not changed during the five years of the experiment.

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Black Box sapling
Image: Mallee CMA

Restoring the Hattah Ramsar Lakes.

By Stephanie Robinson – Mallee Catchment Management Authority

The Hattah-Kulkyne National Park, located 40 km south of Mildura, contains 12 interconnected wetlands, collectively known as the Hattah Ramsar Lakes site. This site was listed in 1983 under the Ramsar Convention. The 1971 Ramsar Convention on Wetlands of International Importance is an international treaty for the conservation of wetlands and this listing recognises the unique assemblages of flora and fauna found at the Hattah-Kulkyne wetlands.

Threats posed by invasive species
Invasive plant and animal species represent major threats to the ecological character and integrity of the Hattah Ramsar Lakes site. Key threats include:

- High grazing pressure by rabbits and feral goats
- Waterbird predation by foxes
- Soil disruption by feral pigs
- Environmental weeds, and
- River Red Gum encroachment on the lakebeds

These key threats impact the ability of native flora and fauna to respond to favourable watering events, both environmental watering and natural flooding events such as the 2022 flood.

Management actions to address key threats
Under a four-year Regional Land Partnerships program (2019-23), Mallee CMA have been working with key stakeholders, Parks Victoria and the Arthur Rylah Institute (ARI) to restore the ecological integrity of the Hattah Ramsar Lakes site.

A suite of activities is being undertaken to address priority threats. On-ground works are being delivered within targeted landscape zones and project activities completed to June 2022 include:

Integrated pest animal management
- 4,367ha of River Red Gum floodplain and 800ha of Black Box floodplain controlled annually for feral goats and rabbits, with 539 goats and 1,125 warrens destroyed.
- Waterbird breeding habitat (littoral zone) bordering the Ramsar-listed lakes controlled annually for foxes, with 204 fox mortalities recorded.

Terrestrial weed control
- 800ha of Black Box floodplain and 1,000ha of Fringing Woody Vegetation controlled annually for infestations of high threat weeds, with 1,782 weed infestations eradicated. Prickly Pear, Noogoora Burr and African Boxthorn have been the most commonly treated high threat weeds.

The effectivity of these control works in reducing threat levels is being monitored. Pre-control works monitoring was undertaken in 2019 to act as a baseline against which to measure change in invasive species abundance and presence.

River Red Gum management
Thickets of River Red Gum have encroached on the lakebeds of the Ramsar site, threatening the vulnerable lake bed herbland vegetation community. These River

Regent Parrots
Image: Mallee CMA

Feral goats captured by camera monitoring
Image: Mallee CMA

Red Gum stands have thickened to an extreme density since 1996, with very little growth in the diameter of trees, and their high-density levels restricting the tree hollow development on which several bird species depend. To mitigate this threat, 20 hectares of an extremely dense thicket has been thinned.

Black Box regeneration trial

Black Box populations at the Hattah Ramsar Lakes site are in poor health and are not regenerating. The Mallee CMA has been working with ARI to better understand the recruitment niche of the Black Box *(Eucalyptus largiflorens)* life cycle at the Hattah Ramsar Lakes site. A key knowledge gap is understanding the factors that influence seed germination, seedling survival, juvenile growth rates and time to maturity of this important floodplain species.

To better understand these factors, a Black Box regeneration trial site was established in autumn (April) 2021 in an area of Black Box floodplain where very little regeneration was occurring. The trial investigated the effectiveness of different management options (natural regeneration, direct seeding, tube stock planting and browsing control) in supporting improved regeneration outcomes. Regular monitoring of the trial site has been undertaken by both ARI and citizen scientists.

Three years after the establishment of the regeneration experiment, only four of the initial 63 plants remained alive (two tube stock and two natural regeneration). Most seedling death was attributed to browsing, most likely by kangaroos. Browsing impacts on tube stock had been evident in the first three months, with unguarded plants heavily impacted. No germinants were recorded in the direct seeding treatment.

Key learnings and recommendations from this trial have highlighted the importance of:

- Maintaining and/ or enhancing native and exotic browsing control at Hattah Lakes,
- Implementing browsing control in restoration works, and
- Ensuring adequate soil moisture (water availability) in the first year of seedling establishment.

Ongoing works

This is the final year (2022-23) of the RLP program and Mallee CMA are continuing to partner with Parks Victoria to control goats, pigs, rabbits, foxes and environmental weeds at the Hattah Ramsar Lakes site. The 2022 flooding event at the Hattah Ramsar Lakes site delayed the planned commencement of these works; however, as the water continues to draw down, these important on-ground works to restore the ecological integrity of the Ramsar site have begun and will be completed by the end of June 2023.

For more information, visit www.malleecma.com.au, or contract the Mallee CMA on 03 5001 8600.

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MalleeFarmer

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