Mallee Farmer

ISSUE #21

AUTUMN EDITION 2022

Featuring

A new tool for the battle against Mallee Seeps.

Past, Present and Future Climate eBook for the Victorian Mallee.

Protecting and restoring Buloke Woodlands in the southern Mallee.

Australian Government
National Landcare Program
mallee catchment management authority

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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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Dr Chris McDonough. Photo: Mallee CMA.

Acknowledgement of Country

The Mallee Farmer acknowledges and respects Traditional Owners, Aboriginal communities 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 latest and recently revamped edition of the Mallee Farmer – your insight into the recent dryland farming research, trends and programs in the Mallee.

In this edition we have some interesting articles on a range of important topics including research and development underway to support farmer decision making on cropping and livestock farming, timely management of weeds, farm safety, wind erosion and land management surveys and a new edition to the Mallee Farmer the RALF Regional Roundup.

This time of year, is an important one for the farming community with planning underway for the new season. The Mallee Farmer has kept that in mind and highlighted useful resources and important work being done to support our farming community to help make informed decisions on-farm.

Significant work is being undertaken across the Mallee region by our supporters and contributors including Agriculture Victoria, Landcare, Mallee Catchment Management Authority (CMA), Mallee Sustainable Farming, GRDC, Birchip Cropping Group and Rural Financial Counselling Service to name a few.

Among the highlights of this edition:

- ***Mallee Sustainable Farming outlines how the targeted research trials have paid off with the development of a new on-line tool to assist in the control of Mallee seeps;***
- ***More decision-making support for dryland cropping and livestock farming enterprises in the Mallee are now available in the form of a climate eBook;***
- ***We hear from Hopetoun farmer Alan Malcolm who spoke at a recent commemorative service that would have been Molnar's 100th birthday, describing the agricultural scientist "as a woman ahead of her time";***
- ***Mallee farmers will now benefit from an update to the Bureau of Meteorology's (BoM) Climate Outlook Service which has resulted in the addition of new 'chance of extreme' outlooks;***
- ***Mallee Catchment Management Authority has received funding for five years (June 2018 – June 2023) to undertake activities to protect and enhance Buloke Woodland remnants in the southern Mallee;***
- ***The Gear Up for Ag Health and Safety Program is working with secondary school students to build their understanding of common agricultural risks and the importance of safe practices on farms.***

With the introduction of the new regular RALF Regional Roundup by Glen Sutherland and Cameron Flowers readers will have a finger on the pulse about all things farming related in the Mallee. In this edition, Glen and Cameron update us on the role they are playing in engaging, supporting and informing our farmers and community.

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

A topic farmers are always grappling with is weeds, both prevention and eradication and this edition offers a huge array of practical information and research being undertaken on the topic.

Finally, I'd like to offer my gratitude to everyone who has 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 Program ensures the Mallee Farmer continues to be a valuable resource.

Allison McTaggart
Chair
Mallee Catchment Management Authority.

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Farming systems consultant Dr Chris McDonough at one of the Mallee Seeps trial sites. Photo: Mallee Sustainable Farming.

A new tool for the battle against Mallee Seeps.

By Chris McDonough, Insight Extension for Agriculture.

Farmers now have access to a new on-line guide for fixing Mallee Seeps.

Mallee Seeps are a growing issue for farmers across the region as once productive land is reduced to saline scalds. However, the MSF Mallee Seeps Project has shown many positive results in turning these problems around through undertaking extensive on-farm demonstrations and trials across the Mallee. These experiences, along with those of participating farmers has now been captured in the new on-line **Fixing Mallee Seeps application** that has recently been developed.

This interactive program shows:

- ***how to identify mallee seeps from other saline land degradation,***
- ***how mallee seeps form in our modern mallee farming system,***
- ***the key factors farmers need to assess, and***
- ***clear practical strategies that farmers should take for their particular situation.***

There are multiple links within the decision tree to brief videos from various sites that show the practical on-farm applications, management techniques and successful results of rehabilitation in recent years.

The key to successfully managing Mallee Seeps lie in understanding both the salinity level of the perched water tables as well as the stage of seep development. While early identification and strategic action is vital in reducing impacts, even well-established seep scalds have been brought back into production.

There are two main objectives for Mallee Seep management:

1. ***Establish and maintain living cover over the affected areas.***

2. ***Employ targeted high water use strategies to lower/dry out the perched water table.***

Lucerne planted on the upward slopes can be an effective way to intercept water flowing from under sand dunes. Photo, Insight Extension for Agriculture.

While achieving these outcomes can be difficult depending on circumstances, this new online guide shows practical solutions and examples where seep impacts have been halted, reversed, covered, and in some cases even brought back to cropping.

Farmers and advisors are encouraged to visit this program at https://msfp.org.au/mallee-seeps-decision-tree/ or through the MSF website.

The Mallee Seeps project is supported by Mallee Sustainable Farming through funding from the Australian Government's National Landcare Program and the Grains Research and Development Corporation.

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Deep ripping boosts pulse yields on deep sands in the Victorian Mallee.

By Michael Moodie, Frontier Farming Systems
and Jason Brand, Agriculture Victoria.

Main / key points

- Deep ripping at Tempy in 2021 led to large grain yield increases in chickpea (236%), Faba Bean (16%), Field Pea (13%) and Lentil (79%) grown on a deep sandy soil.
- Variety selection had minimal impact on the productivity of each pulse crop and there was no additional benefit of growing a particular variety following a deep ripping treatment.
- Pulse crop responses to deep ripping at Tempy in 2021 are consistent with findings from other trials conducted in previous seasons. Across several sites deep ripping has increased chickpeas gross margins by approximately $667/ha and improved faba bean, field pea, lentil and vetch gross by more than $300/ha.

Brief background

A new project funded by the Grains Research and Development Corporation (GRDC) commenced in 2021 to investigate opportunities to address local constraints to close the yield gap of pulse crops throughout Victoria. Project partners Frontier Farming Systems, Mallee Sustainable Farming and Agriculture Victoria collaborate to deliver trials within the Mallee region. In 2021, a site was established near Tempy to continue to investigate the potential for deep ripping to increase the production of pulse crops grown on deep sandy soils within the Central Mallee region. Research over the previous two seasons (2019-20) had shown deep ripping led to substantial yield increases for most pulse crops grown on deep sands where pulse productivity is normally constrained. The new 2021 trials looked to build on these existing findings by quantifying yield responses of chickpea, lentil, faba bean and field pea over a greater range of seasons.

Results/findings

Deep ripping resulted in significant yield increase for each crop (Figure 1). For all pulse crops, the average grain yield was approximately 0.5 tonnes p/ha without ripping, however following deep ripping, the average grain yield was close to 1.5 tonnes p/ha for chickpea, field pea and faba bean and 1 tonne p/ha for lentils.
The percentage yield increase for each crop is shown below:

- Chickpea: 236%
- Faba Bean: 161%
- Field Pea: 131%
- Lentil: 79%

For each pulse crop, four different varieties were grown, however variety selection only affected grain yield in field peas. In this crop, PBA Butler and OZP1901 produced higher grain yield than the variety PBA Oura.

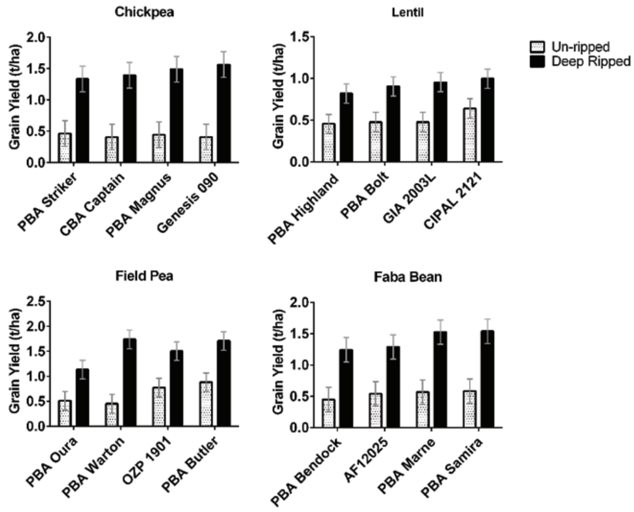

Figure 1. The grain yield of chickpea, lentil, field pea and faba bean varieties grown with and without deep ripping on a sandy soil near Tempy (Victorian Mallee) in 2021.
Error bars are the least significant difference (of the variety x deep ripping interaction).

Implications of the findings

The findings from this trial are consistent with similar trials conducted on deep sands in the Victorian and South Australian Mallee during 2019-20. Across all trials (including Tempy 2022), chickpea and faba bean were the most responsive pulse crops to deep ripping with an average yield increase of 210%. Lentil yields were improved by 166%, and field peas and vetch by approximately 100%. Gross margin analysis showed that the observed yield response was highly profitable (Table 1. Page 6).

In contrast to the other grain legumes, deep ripping provided only a small yield benefit in lupin (Table 1). Lupins also have a much higher establishment risk than other pulse crops due to their requirement for shallow seed placement. Therefore, lupins should not be sown into deep ripped paddocks in the first season post-amelioration as deep seed placement, soil throw or slumping of furrow walls can lead to as poor establishment.

Considerations prior to deep ripping pulse crops

While these trials have shown large productivity and profitability benefits, growers considering deep ripping must evaluate operational risks. For example, deep ripping before a pulse phase should be targeted to paddocks with high levels of residual stubble to ensure adequate ground cover is maintained and minimise erosion risk. Care also needs to be taken with pre-emergent herbicides to minimise risk of crop damage. Trafficability of heavy machinery is also an issue that needs to be managed post-ripping. Rolling with heavy


Faba bean response to deep ripping on the right compared to non-ripped on the left side. Photo Frontier Farming

steel drum rollers is recommended to reconsolidate the surface and provide better flotation for the seeder and self-propelled sprayers.

Crop	Average yield benefit (t/ha)	Average grain price ($/t)	Gross margin benefit ($/ha)
Chickpea	1.1	$643	$668
Field Pea	1.0	$427	$387
Faba Bean	0.9	$449	$364
Vetch	0.7	$533	$333
Lentil	0.5	$703	$312
Narrow Leaf Lupin	0.1	$486	$7

Table 1: Average gross margins demonstrate the yield benefit to pulses of deep ripping on deep sands across six Mallee trial sites from 2019 to 2021. Calculations are based on the average January grain price from 2020 to 2022 for each pulse crop and the annualised cost of ripping of $40 per hectare.

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Warracknabeal Secondary College chemical exposure demonstration. Photo Agriculture Victoria

Gearing Up the Next Generation of Farmers.

By Agriculture Victoria Media.

Do you know a Victorian secondary school that would be interested in free agricultural health and safety training for students?

The Gear Up for Ag Health and Safety Program works with secondary school students to build their understanding of common agricultural risks and the importance of safe practices on farms.

Funded by Agriculture Victoria's Smarter, Safer Farms program and delivered by the National Centre for Farmer Health, Gear Up for Ag delivers education on topics including safe quadbike and motorbike usage, respiratory protection, agrichemical exposure, eye and ear safety, zoonotic diseases (from cattle and sheep), heat related stress and skin protection and the importance of keeping healthy, both physically and mentally.

Since its inception in 2018, Gear Up for Ag has reached nearly 400 students across 14 Victorian secondary schools and agricultural colleges.

Casterton Secondary College teacher Ms Bel Kelleway said it can be difficult to teach students about the importance of health and safety within the normal school curriculum.

"The program is a fun way for students to discuss serious health and farm safety issues that impact them," she said.

Gear Up for Ag Program Facilitator, Ms Morna Semmens said workshops are delivered by trained facilitators and students are actively encouraged to participate in interactive learning opportunities and co-operative activities.

"At the conclusion of the workshop a free personal protective equipment kit is given to students to take home and implement their learnings.

"Providing education on health, wellbeing and safety issues to farmers at a young age is vitally important given 76% of participating students plan to continue to work in agriculture.

"During the Gear Up Program we discuss strategies that can be applied to minimise risk and we demonstrate proper and correct usage of personal protection equipment when risk can't be eliminated," Ms Semmens said.

Expressions of interest are now open for 2022 workshops and secondary schools are encouraged to register their interest early to avoid missing out.

Visit the National Centre for Farmer Health or contact Cecilia Fitzgerald on (03) 5551 8533 to get involved. Supported by Smarter, Safer Farms, a $20 million Victorian Government commitment to improve safety and skills outcomes for Victorian farmers.

AGRICULTURE VICTORIA

Photo: Andrew Weeks, Cesar Australia

New study reveals resistance to sulfoxaflor in field populations of green peach aphid and two novel mechanisms conferring this resistance.

By Jacquie Murphy, Business & Communications Officer, EnviroDNA

The green peach aphid is an economically important crop pest that is worth keeping a close eye on.

As one of the most insecticide-resistant insect species worldwide, we've been doing just that for quite some time. Recently in a collaborative study published in Insect Biochemistry and Molecular Biology, we have findings that, once again, demonstrate the adaptative potential of this species.

This research, supported through funding provided by the Grains Research and Development Corporation (GRDC) and Corteva Agriscience, has revealed significant levels of insecticide resistance to sulfoxaflor in the green peach aphid in Australia.

And notably, resistance persists after many months of culturing in the laboratory in the absence of insecticide exposure, demonstrating the heritable basis of this resistance.

These are important findings given sulfoxaflor is one the last remaining active ingredients in the grains industry that remains effective against the green peach aphid. With evolved resistance to many registered insecticides, the list of available chemical control options is quickly diminishing.

How'd we get here?

The green peach aphid, Myzus persicae, is a global pest with an extremely broad host range of more than 400 different plants species. In Australia, they infest a variety of horticultural and broadacre crops including canola, lupins, field peas, capsicums, pepper, eggplant, cruciferous vegetables, and tomatoes.

In this study our researchers from Cesar Australia, together with The University of Exeter, The University of Melbourne and CSIRO, examined the sensitivity of green peach aphid populations from Western Australia to sulfoxaflor.

Photo: Andrew Weeks, Cesar Australia

An important backstory here is that in 2018 the insecticide Transform® - containing the active ingredient sulfoxaflor - experienced control failures in canola fields following applications in the Esperance region of Western Australia.

However, it remained unclear the cause of these failures, whether due to poor application practices, the use of sulfoxaflor at rates below those recommended for green peach aphid, or because of resistance to the chemical.

New resistance findings

There were several questions this new research study set to answer. Firstly, to determine whether there were significant levels of resistance to sulfoxaflor present in field populations of aphids. And if so, whether this resistance was conferred by known mechanisms of resistance to neonicotinoids, that act on the same target-site as sulfoxaflor, or was due to novel mechanisms of resistance.

We found low, but significant, levels of resistance to sulfoxaflor across multiple independent bioassay experiments. And somewhat surprisingly, we identified two novel mechanisms – the overexpression of a P450 gene and a UDP-glucuronosyltransferase gene - conferring resistance to this compound.

This study demonstrates the importance of continued resistance monitoring of green peach aphid populations in Australia and elsewhere, and further highlights the need to implement long-term resistance management strategies in the field.

More information

Access the full paper online at www.sciencedirect.com Find more information about the topic at "Resistance Management Strategy for the Green Peach Aphid in Australia Grains" via the GRDC website.

Acknowledgments

Technical input into this study was provided by James Maino, Siobhan de Little, Evatt Chirgwin, Andrew Weeks, Lisa Kirkland and Samantha Ward (Cesar Australia) and Victoria Mallott, Emma Bass and Jo Mackisack (University of Exeter).

We thank Ben Congdon, Emma Clarke and Alice Butler for assistance with aphid collections. This study was supported through funding provided by the Grains Research and Development Corporation and Corteva Agriscience.

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION | Cesar Australia

Photo: RFCS

Confidential, independent, local and free farm business support.

By Rural Financial Counselling Service, Victoria West staff.

The Rural Financial Counselling Service (RFCS) has been a free resource for Australian primary producers for over 35 years, providing free and independent farm business support during times of financial stress or uncertainty, including operating through adverse climatic or market events.

In 2022, the National Recovery and Resilience Agency (NRRA) is responsible for overseeing the RFCS program and its newer regional small business counterpart, the Regional Small Business Support Program.

Suffered a farm business set back? Our service is here to assist.
RFCS Victoria West is the local provider for Victoria's regional west, including the Mallee CMA area, with rural financial counsellors (RFCs) and small business financial counsellors based in the regional areas they service.

Recognising that wellbeing can be crucial factor in being able to improve a challenging financial situation, RFCS Victoria West has also established wellbeing counselling for farmers and rural or regional small business owners, available to anyone working with a rural or small business financial counsellor.

Executive Officer David Stafford says it's important to the service that RFCs understand local conditions and local communities.

"If you've got a farming operation and you're thinking you could use a hand with getting on top of your books or sorting something out with your creditors, you'd be glad to know that a rural financial counsellor can come out to the farm to minimise disruption to your farming day."

If the farm isn't a good place to talk business concerns, we can arrange a more suitable meeting place. We have a whole range of ways we can help a primary producer or small business, including referrals to legal specialists, or support with FHA applications or farm debt mediations."

RFCs follow the financial counselling process of enabling the client to gain a clear understanding of their financial position and options through a thorough assessment of all factors. The RFC assists the primary producer to explore the risks, benefits and consequences of all available options while remaining impartial, and can make referrals to financial, legal or even marketing specialists. RFCs also provide support through advocacy and negotiation, which may mean speaking with creditors, banks or insurance companies, or a supporting role at a farm debt mediation or succession planning session."

Mallee farmers can arrange an initial chat with one of the local team by calling 1300 735 578. Your local RFC or regional wellbeing counsellor will be in touch within 24 hours. Appointments can take place on farm, minimising disruption to your day, or an alternative location can be arranged.

RFCS Victoria West can be contacted on 1300 735 578 or via our website at www.RFCSVictoriaWest.com.au.

RFCS Victoria West

Serradella trial plot at Ouyen 2021. Photo: Frontier Farming

Could French Serradella provide an alternative fodder option on "Lupin" soils in the Mallee.

By Roy Latta and Michael Moodie, Frontier Farming Systems

This article summarises the findings from two demonstration sites established in 2021 near Ouyen and Patchewollock to evaluate the potential for Serradella to provide a pasture option on neutral to acidic deep Mallee sands.

Main / key points

- Serradella have been shown to perform well on deep Mallee sands with a pHCa < 7.5 and where lupins have been grown previously.
- Serradella pods can be readily harvested using existing on farm machinery to provide a cheap seed source for establishing pastures.
- Summer sowing offers a novel opportunity to establish Serradella using hard seeded pod harvested on farm in previous seasons.

Potential benefits of Serradella in the Mallee include:

- Adapted to deep infertile, coarse textured soils.
- Deep rooting and produces an extended green feed period compared to most annual legumes.
- Potential for seed collection and cleaning with on-farm equipment
- Tolerance to pH (4.0< pHCa <7.5).
- Good tolerance to redlegged earth mite and aphids.
- Very palatable to stock and high nutritive value.
- No major anti-nutritional properties.

There is also potential for Serradella to be established using novel methods aimed at reducing the cost of pasture establishment and improving productivity from greater water use efficiency. The methods are:

- Twin sowing where hard seed/pod is sown with the crop before the pasture phase. Little/none pasture is expected to establish in the crop phase.

Hard seed "softens" over the summer period and germinates to produce a viable pasture in the following autumn.

- Summer sowing in where hard seed/pod is sown in the summer prior to the pasture phase where the hard seed "softens" and germinate to produce a viable pasture in autumn.

French Serradella. Photo: Frontier Farming

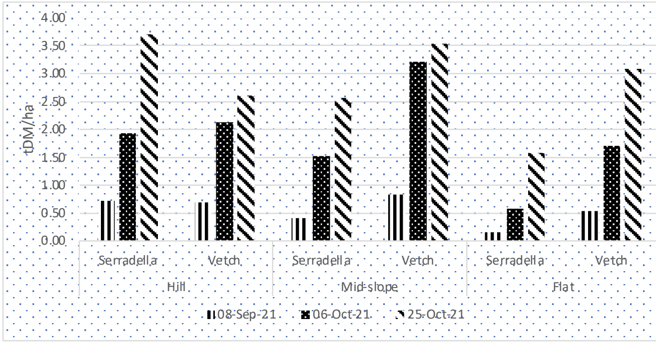

Figure 1. Total serradella and vetch biomass (tDM/ha) in the 3 soil zones, at 3 sampling times at Ouyen.

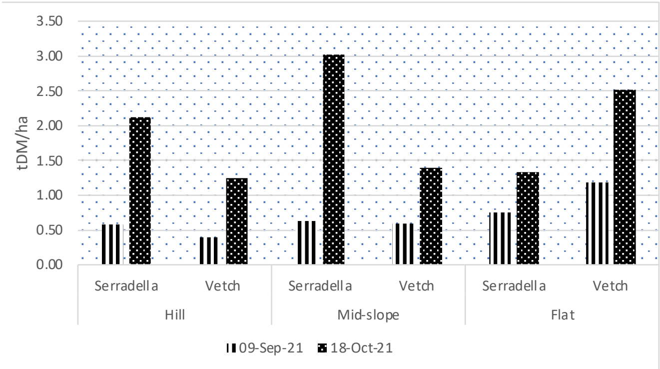

Figure 2. Total serradella and vetch biomass (tDM/ha) in the 3 soil zones, at 2 sampling times at Patchewollock.

Results and findings

Two demonstration sites of approximately one hectare each were dry sown on the 1st of March at Ouyen and 2nd of March at Patchewollock. The sites were selected because they were sown to lupin in 2019 and cereal in 2020. Treatment strips were 100 metres long and ran from the near peak of an east west sand dune to the neighbouring flat. The site was intersected into three zones described as hill, mid-slope and flat. A block of Volga vetch was sown alongside to provide a comparative assessment of current local practice. The 0-10 cm soil pH (CaCl2) was less than 7 only on the hill location at Ouyen, increasing to more than 8 on the flat. At the Patchewollock location soil pH (CaCl2) was less than 7 down to 50 centremetres on the hill and less than 7 down 30 centremetres on the flat.

There was no measurable rain from seeding in March until late May. Then both sites received approximately 100 millimetres of rain for the period from the end of May through to the end of September. A further 60 millimetres in October to November resulted in a total growing season rainfall (GSR) of near 160 millimetres at both sites.

Serradella produced an extra 1 to 1.5 tonne biomass than vetch on the hill zones at both locations and on the mid-slope site at Patchewollock. Vetch produced an extra 1 to 1.5 tonne of biomass to serradella on the flat sites at both locations and on the mid-slope site at Ouyen.

Serradella seed pods. Photo: Frontier Farming

Machine harvested yields were similar for Serradella pods and vetch seed at Ouyen with higher yields achieved on the hill than the flat for each species. Slightly lower Serradella pod yield was achieved at Patchewollock while vetch at this site was not harvestable. The harvested seedpod numbers of the serradella versus the seed numbers of the vetch at the trial average seedpod/seed yields of 0.3 t/ha were approximately 6000 serradella seedpods/m2 versus 600 vetch seeds/m2.

Serradella Nodulation. Photo: Frontier Farming

Table 1. Machine harvested seedpod and seed yields (t/ha) of serradella and vetch in December 2021 at Ouyen and Patchewollock.

Site	Location	Serradella	Vetch
Ouyen	Hill	0.48	0.35
	Mid-slope	0.33	0.36
	Flat	0.15	0.24
Patchewollock	Hill	0.36	*
	Mid-slope	0.19	*
	Flat	0.08	*

Implications of the findings

The demonstration sites show that serradella could provide a dual purpose (hay, grain, grazing) alternative to vetch on neutral to acidic deep sandy Mallee soils. These soil types are where lupins are commonly grown. Serradella can also provide operational benefits over vetch such as summer sowing and lower seeding rates.

To successfully establish a French serradella phase pasture, we recommend:

- Sowing in February early March. The time of seeding is necessary to continue the rate of seed softening of the shallow sown seedpods.
- Sowing on-farm produced seedpod at 5 kg/ha to 20 kg/ha. The seeding rate is based on the small seedpod size (10 kg/ha = ~250 seedpods/m2). A soft seeded cultivar such as Eliza requires sowing at 5 kg/ha while 20 kg/ha is required for a hard seeded cultivar such as Margurita pod.
- Serradella and lupin share the same rhizobia species for inoculation (Group G/S rhizobia). A history of lupin in the paddock reduces the the risk of inadequate nodulation and the need for inoculation, particularly where summer sowing of pod is used to establish the pasture.
- Chemical weed control options include post seeding pre-emergent Spinnaker (not Simazine) and/or post-emergent Broadstrike and grass selective herbicides plus a spring insecticide for Heliothis control.

Further information and contact details

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Trial Information

Location: Town or District:
Ouyen, central Mallee — Patchewollock, central Mallee

Rainfall:

Ouyen	Patchewollock
Av. Annual: 300	Av. Annual: 337
Av. GSR: 210	Av. GSR: 223
2021 Total: 160	2021 Total: 160
2021 GSR: 140	2021 GSR: 130

Yield:
Potential:
50 kgDM pasture/mm plant available water=4 tDM/ha
Actual:
Serradella 3.5 tDM/ha on 80mm

Paddock history:
2020: Barley both sites
2021: Lupin both sites

Soil type:
Both sites are light textured calcarosols

Soil test:
Ouyen 0-10 cm; pH 6.7 CaCl2 10–70 cm; pH 7.9–8.7 CaCl2
Patchewollock 0-10 cm; pH 6.2 CaCl2 10–70 cm; pH 6.3– 7 CaCl2

Plot size:
Both sites are approximately 1 hectare, sub blocks 0.25 hectares

Yield limiting factors:
Rainfall

Livestock:
Enterprise type: Multipurpose hay, grain graze

Monitoring wind erosion and land management in the Victorian Mallee – 2019 to 2021

By Darryl Pearl and Martin Hamilton, Land Management Extension Officers, Agriculture Victoria.

Key messages:

- Observations from the 2021 roadside surveys and satellite imaging
- Land management practices and satellite imagery are used to assess the levels of ground cover likely to offer soil protection particularly at harvest and throughout summer and autumn
- Comparisons with two previous years
- Landsystem Total Vegetative Cover (TVC) targets were met more frequently during 2021, despite having less rainfall, compared with 2020.

Roadside observations

With 2021 rainfall being variable across the Mallee, this increased the potential for wind erosion. This was not observed to be the case, as there was an overall increase in cereals planted, providing better ground cover quality compared to that of legumes. While overall this is a positive for the Mallee, it was identified at the finer scale there were some very high to highly susceptible landsystems that had an increase in legumes sown. For these landsystems, this may increase the area exposed to erosion.

The 2021 autumn roadside survey observed that 73.7% of paddocks at that time had good ground cover from standing undisturbed stubble. Only 1% of paddocks were observed to have been either cultivated or burnt.

During the 2021 spring roadside survey there was an overall increase of cropped paddocks compared to 2019 and 2020. Of the cropped paddocks 62.1% would be harvested and 8.3% were hay crops. Brown or green manures made up 1 % of surveyed paddocks (Figure 1).

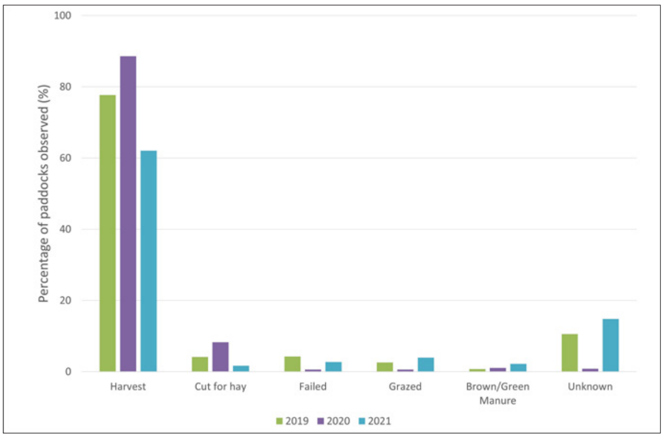
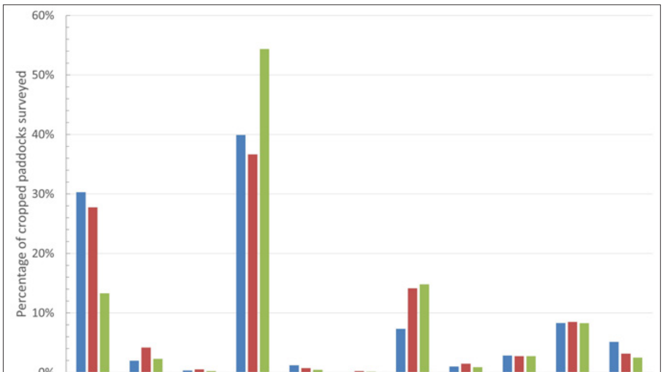


Figure 1: Dryland agriculture secondary management types Spring 2021.

There was a notable decrease in barley sown (Figure 2), accompanied by an increase in paddocks sown to wheat. Decreases in oats, chickpeas, faba beans, lupins, vetch and canola accompanied a marginal increase in lentils.



	Barley	Oats	Ryecorn	Wheat	Chickpeas	Faba Beans	Lentils	Lupins	Peas	Vetch	Canola
2019	30.3%	2.0%	0.3%	39.9%	1.2%	0.0%	7.3%	1.0%	2.8%	8.3%	5.1%
2020	27.7%	4.2%	0.5%	36.6%	0.7%	0.2%	14.1%	1.5%	2.7%	8.5%	3.1%
2021	13.3%	2.3%	0.2%	54.4%	0.4%	0.1%	14.8%	0.9%	2.7%	8.3%	2.5%

Figure 2: Percentage of crop types per paddocks for 2019, 2020 and 2021.

MODIS Fractional Cover Imaging

MODIS Fractional Cover maps are produced to calculate the area and quality of cover 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 Catchment Management Authority, with 66.6%, 70% and 72.2% of dryland agricultural areas sown to cereals in 2019, 2020 and 2021 respectively (Figures 3, and 4 and 5). The second most common crop type is legumes, with 11.3%, 17.1% and 10.1% of dryland agricultural areas sown to legumes in 2019, 2020 and 2021 respectively. Oilseeds account for a small proportion of dryland agricultural crops in the Mallee. Less area was sown to oilseeds in 2020 compared to 2019 and in 2021 there was no real change from 2020. These regional-scale patterns are observed at the paddock scale during the 2019, 2020 and 2021 roadside surveys (Figure 3).

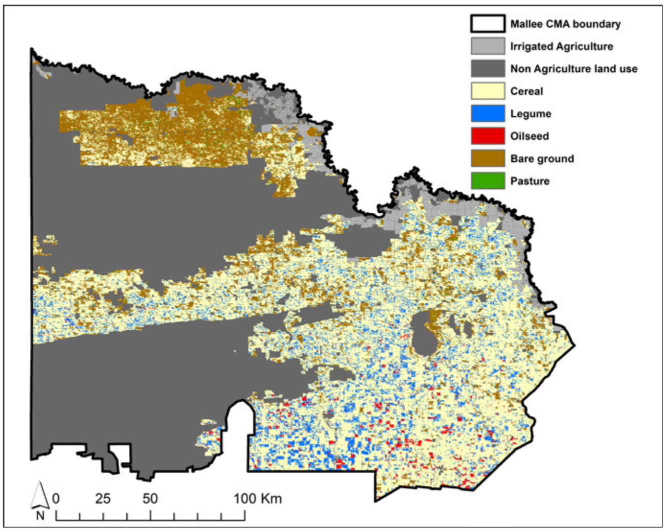


Figure 3: Dryland agriculture land cover (derived from satellite imagery) for 2019.

Areas of bare ground were largely observed in the northern Mallee during 2019. During 2019, about 20% 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 4% (Figure 4) of dryland agricultural areas during 2020.

In 2021 there was a 2.2% increase in bare area (Figure 5) particularly in the Millewa and the area between Swan Hill and Sea Lake. This was a result of the variable rainfall over the Mallee in 2021.

The prevailing weather conditions and vegetative growth, which produces biomass capable of covering the ground, are intrinsically connected. Higher rainfall in 2020 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. The decline in barley in 2021 is however thought to be partially attributed to uncertain global markets, rather than more favourable weather conditions and was replaced by wheat.

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 a good seasonal break in 2020 and good summer rain in 2021, which prompted an increase in lentils being sown (with little change in other legumes), taking advantage of higher soil moisture.
Annual and growing season rainfall across the Mallee was higher in 2020 than 2021, yet regionally, satellite imaging each month shows land system Total Vegatation Cover (TVC) targets were met more frequently during 2021 compared with 2020.

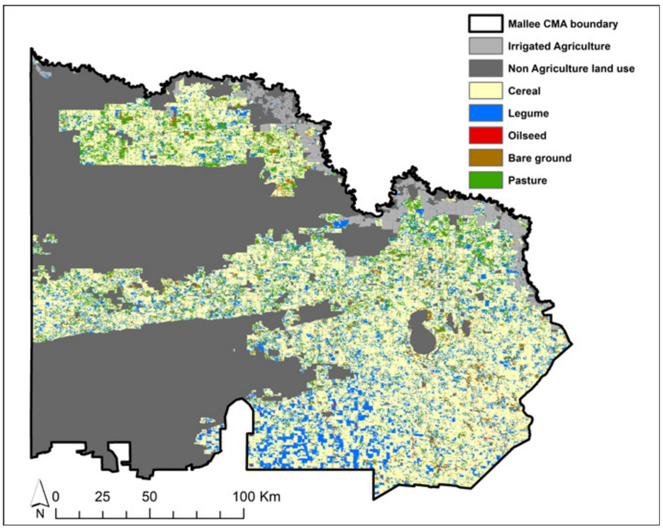


Figure 4: Dryland agriculture land cover (derived from satellite imagery) for 2020.

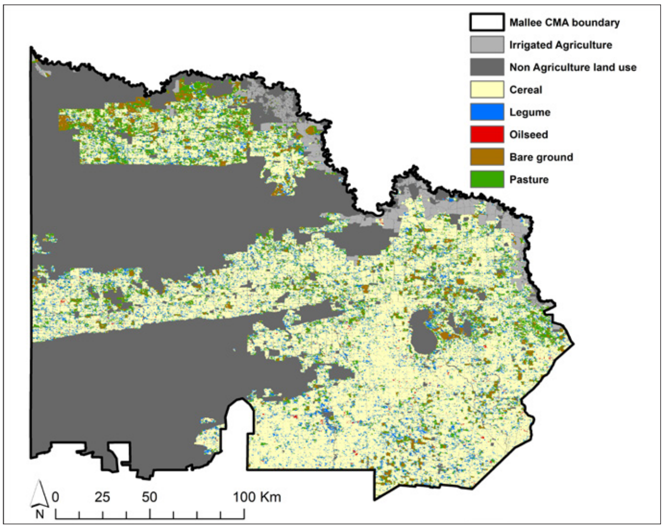


Figure 5: Dryland agriculture land cover (derived from satellite imagery) for 2021.

In Summary

Annual and growing season rainfall across the Mallee was higher in 2020 than 2021. Yet in general individual landsystem TVC targets were met more frequently during 2021 compared with 2020. This means at a more localised scale all landsystems met their relevant landsystem specific target for at least nine months in 2021. This is an improvement on 2020 and 2019.

The target threshold level is generally accepted to be more than 50% ground cover. Land management practices and satellite imagery are used to assess the levels of ground cover likely to offer soil protection particularly at harvest and throughout summer and autumn.

We know favourable weather increases vegetative growth. However, good management by farmers is key to retaining it, regardless of the weather. Crop selection, stubble height, and controlled grazing, all contribute to reducing the risk of wind erosion in the Mallee.

Acknowledgements

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AGRICULTURE VICTORIA


Glen Sutherland.
Northern Mallee RALF.


Cameron Flower.
Southern Mallee RALF.

Regional Agriculture Landcare Facilitators (RALF) Regional Roundup.

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

In this edition of the magazine, we're introducing a new regular column to the Mallee Farmer, the 'RALF Regional Roundup.' Read on for some background about the RALF program and what the column aims to do.
The Regional Agriculture Landcare Facilitator (RALF) program is a national network of agriculture- focused, regionally based facilitators which has been established through the support of the Australian Government's National Landcare Program's Regional Land Partnerships (RLP) Initiative.

In 2018, the Mallee Catchment Management Authority (CMA) established two RALF positions in the region. Cameron Flowers is based in Birchip and works in the southern Mallee. Glen Sutherland is based in Mildura and works in the northern Mallee.

The RALFs engage with farmers, community groups and agricultural industries and inform them about the outcomes of current agricultural research, emerging trends and technologies, changing land management practices and new government policies and initiatives to help improve the sustainability, productivity and profitability of farm businesses and farming communities.

The RALFs work closely with agriculture-related government agencies (state and federal) and farmer-based research and development organizations, including Mallee Sustainable Farming and Birchip Cropping Group.

RALFs maintain regular communications with the Australian Government about emerging issues within the region, such as reporting on the impacts of seasonal conditions on sustainable agriculture, farm business and communities.

The RALF Regional Roundup will provide news and information about upcoming regional events relating to sustainable agriculture and other activities that may be of interest to farmers and farming communities. The column will also identify new resources for farming communities, such as online articles and tools that can support sustainable agriculture.

What's coming up in June?

GRDC Farm Business Update – 15th June, Swan Hill and 16th June, Horsham.

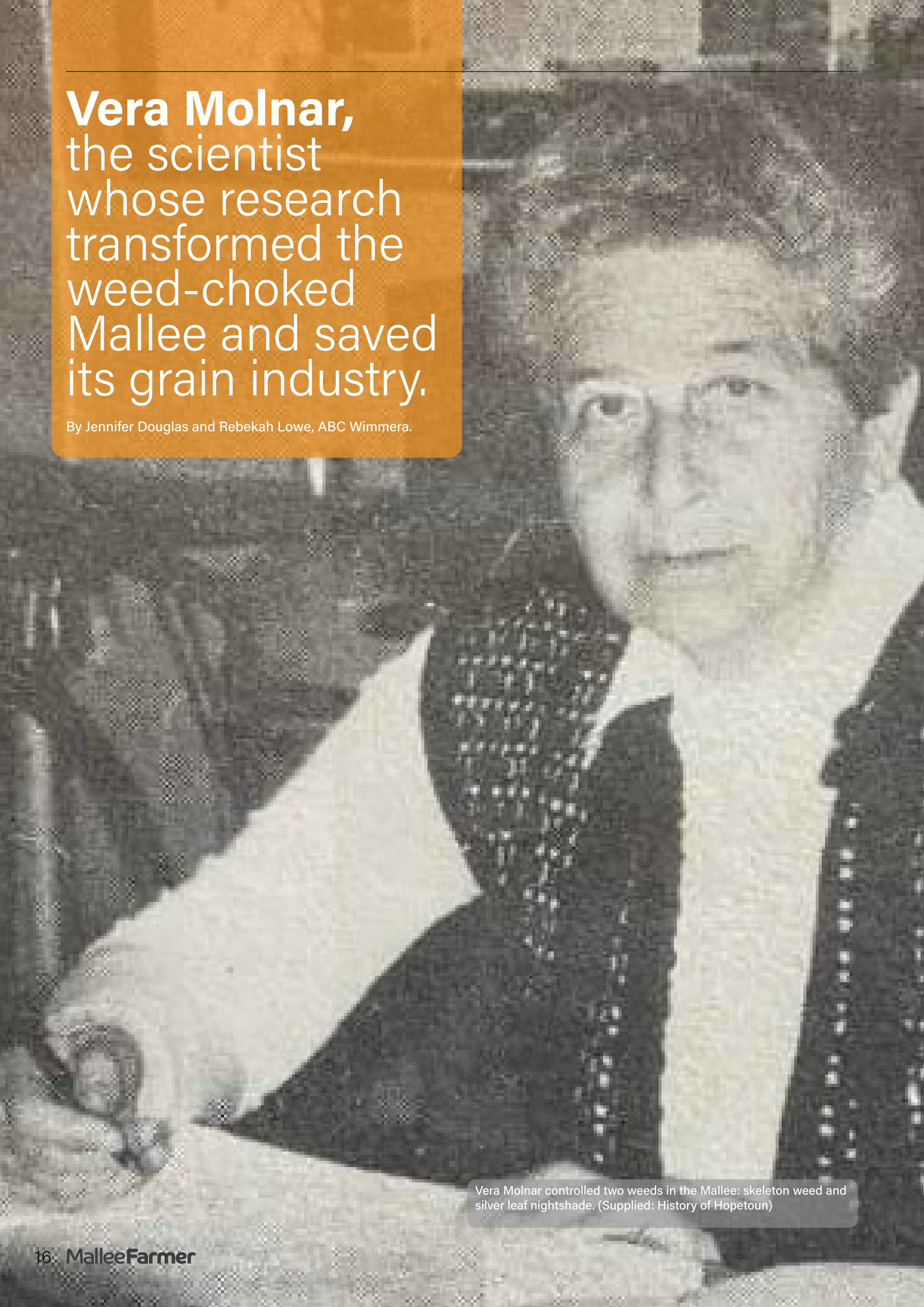
The GRDC Farm Business Update events drive innovation and adoption of improved farm business management practices across the grains industry.
More information is available at the
GRDC website (https://grdc.com.au/) .
Click on the events tab to register for an event.

Handy new resources.

New Climate Extremes forecasts are now available thanks to the Forewarned is Forearmed project.
Mallee farmers will now benefit from an update to the Bureau of Meteorology's Climate Outlook Service which has resulted in the addition of new 'chance of extreme' outlooks to the multi-weekly and seasonal forecast website (http://www.bom.gov.au/climate/outlooks/#/overview/summary).

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.



Vera Molnar, the scientist whose research transformed the weed-choked Mallee and saved its grain industry.

By Jennifer Douglas and Rebekah Lowe, ABC Wimmera.

Vera Molnar controlled two weeds in the Mallee: skeleton weed and silver leaf nightshade. (Supplied: History of Hopetoun)

The work of research scientist Vera Molnar has been celebrated as having saved the Mallee grain farming industry from noxious weeds that were spreading across the region in the 1960s and 1970s.

Molnar's research at Hopetoun in Victoria led to the eradication of two noxious weeds — skeleton weed and silver leaf nightshade — that had proved resistant to all attempts to halt their spread.

Skeleton weed infested lupin crop, making harvest nigh impossible. Photo Mallee CMA

Hopetoun farmer Alan Malcolm spoke at a recent commemorative service that would have been Molnar's 100th birthday, describing the agricultural scientist "as a woman ahead of her time".

"A refugee, she came to Australia, escaping the Hungarian Revolution via East Berlin, a dangerous journey for anyone," Mr Malcolm said.

Researchers gather data about skeleton weed, a serious threat to pastures and wheat crops. (Supplied: CSIRO) Molnar began working for the Keith Turnbull Research Institute in Frankston on the vermin and noxious weeds destruction board, and played a vital role in tackling agricultural weeds.

"In the 1960s the Mallee grain industry was under serious threat from the noxious skeleton weed and silver leaf nightshade," Mr Malcolm said.

Silver leaf nightshade, flowering stage. Photo, Mallee CMA

Farmers were fighting a losing battle, with both weeds choking viable farmland between Hopetoun and Ouyen.

"These weeds were a serious threat to the future of cereal cropping in the Mallee," Mr Malcolm said.

Skeleton weed drastically reduces cereal yields by competing for water and nutrients.
(Supplied: CSIRO Entomology)

The Mallee's farmers were desperate for help and when the research job was announced, Molnar applied three times before being appointed.

"Back in the early 1960s, the Department of Agriculture was reluctant to send a single woman to the Mallee apparently," Mr Malcolm said.

Arriving in Hopetoun in 1964, she immediately got to work on her research, setting up trial plots all over the region.

1930's horse and cart with scientists gathering weed samples. Photo CSIRO

Molnar spent nine years researching the best methods for controlling the weed that had spread across the Mallee and Western Victoria.

Her research identified four varieties of skeleton weed that were spreading uncontrolled across the region. After chemical control tests failed to effectively control the weed, she researched a biological control, using a rust fungus that successfully destroyed the plant and in combination with a little insect that sucked the weed dry, hopes for the weed's eradication were in sight.

She discovered that a combination of both the rust fungus and the sap-sucking mite was successful in killing three of the four varieties of skeleton weed.

"Between those two agents, farmers wiped it out, it was probably the equivalent of using myxomatosis to control the rabbits, the effects were an incredible achievement," Mr Malcolm said.

More than 20 years later, these methods transformed the Mallee landscape from being choked by weeds to a major cereal cropping region.

Molnar retired in 1982, her scientific agricultural research having saved the Mallee grain growing industry.

"She was one in a million," Mr Malcolm said.

Weeds worth spotting:
Mesquite, camel thorn and water hyacinth found in the Mallee.

By Emily Hill, Leading Biosecurity Officer, Community Surveillance, Agriculture Victoria.

It's not always straight forward when dealing with weeds in the Mallee.

> But when it comes to State Prohibited Weeds (SPWs) – Victoria's highest category of declared noxious weeds – there's only one thing to do – report them to Agriculture Victoria.

Weeds classified as SPWs either do not occur in Victoria or are present in such small numbers that they can be reasonably expected to be eradicated.

If left untreated they can become widespread and impact agricultural production through loss of desirable pasture species, injury to livestock and fouling of water sources and cause environmental and social damage.

Agriculture Victoria Community Surveillance Leading Biosecurity Officer Emily Hill said Agriculture Victoria staff can remove and treat SPW infestations at no cost to landholders.

"In the Mallee, sites of mesquite, camel thorn and water hyacinth have been identified to be growing in a variety of Mallee environments including public spaces and backyard ponds," Ms Hill said.

"Thanks to reports from the public, we have been able to quickly respond to these infestations and appropriately treat them to ensure our primary production, environment and native flora and fauna are protected," she said.

"It's very important to report any sightings or occurrences of SPWs you see so we can work to treat these infestations and stop the spread.

"Landholders and the farming community can help Agriculture Victoria keep Victoria free from State prohibited weeds."

State Prohibited Weed sightings can be reported to Agriculture Victoria on 136 186 or email weed.spotters@agriculture.vic.gov.au

Camel thorn in flower. Photo: Agriculture Victoria

Camel thorn

Camel thorn is found in the northern parts of Victoria, usually associated with irrigated pastures and neglected areas. It is a rigid, much-branched, spiny shrub commonly 25cm to 60cm tall but can grow up to 1.5m tall.

Aerial growth dies in autumn and new shoots emerge from roots in spring. Camel thorn has been known to break through sealed bitumen roads, while sharp-tipped spines can be a danger to stock.

A major source of spread is from the movement of root fragments due to cultivation.

Mesquite spreads mainly by seed, through grazing or livestock movement, contaminated machinery, or flood waters. Photo: Agriculture Victoria

Water hyacinth. Photo: Agriculture Victoria

Mesquite

Mesquite spreads mainly by seed, through grazing or livestock movement, contaminated machinery, or flood waters. Photo Agriculture Victoria

Mesquite is native to northern South America, Central America and southern parts of the United States.

It was introduced into Australia for primary production purposes and now threatens the industry by invading grazing land, supressing grass cover and diversity and inhibiting livestock access to waterholes. It is spread mainly by seed, through grazing or livestock movement, contaminated machinery or flood waters.

Water hyacinth

Water hyacinth is one of the world's worst aquatic weeds. It infests rivers, dams, lakes and irrigation channels on every continent except Antarctica. It devastates aquatic environments and costs billions of dollars every year in control costs and economic losses.

Water hyacinth is native to the Amazon basin in South America and was brought to Australia in the 1890s as an ornamental plant.

More information about these particular weeds can be found on the Agriculture Victoria website;

- Camel thorn | State prohibited weeds | Weeds | Biosecurity | Agriculture Victoria
- Water hyacinth | State prohibited weeds | Weeds | Biosecurity | Agriculture Victoria
- Mesquite | State prohibited weeds | Weeds | Biosecurity | Agriculture Victoria
- State prohibited weeds | Weeds | Biosecurity | Agriculture Victoria

AGRICULTURE VICTORIA

Managing N Fertiliser to Profitably Close Yield Gaps.

Dr James Hunt (University of Melbourne), James Murray (Birchip Cropping Group), Kate Maddern (Birchip Cropping Group)

Take home messages

- Making N fertiliser decisions based on Yield Prophet® Lite or an environmentally appropriate N Bank target maximises profit, stops soil organic N decline and prevents accumulation of excessive mineral N.
- N decisions based on 50% Yield Prophet® or 125kg/ha N bank strategy apply more N (60 – 80kg/ha) and are over $100/ha per year more profitable than the district average N rate (21 – 30kg/ha N).
- The most profitable strategies all have neutral to positive N balances (more N applied in fertiliser than removed in grain) indicating soil organic N is not being mined.
- High urea prices in 2022 will reduce profit and optimal N rates. Growers can offset this by planting a higher area of legumes (grain, hay, pasture, brown manure) and using organic wastes (manure, compost, biosolids) where available and cost effective.

Project 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) which reduces farm profitability and global food security. Alleviating N deficiency would increase national wheat yields by 40% (Hochman and Horan 2018), and substantially improve farm profit.

On farms with no legume pastures, most of the crop N supply must come from 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 use of it increases cost of production and value-at-risk for growers. Growers fear that over-fertilisation will result in 'haying off', which reduces both yield and quality. There is also the concern that overapplied fertiliser that is not used by crops is lost to the environment by leaching, volatilisation and denitrification. Consequently, efforts continue to be 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 that can be explained by N deficiency. Chronic N deficiency has also caused soil organic matter to decline (Angus and Grace 2017) and has driven a rise in the proportion of low protein grain produced in Australia, which has eroded our standing as a producer of quality wheat in export markets.

'N banks' are a strategy for managing N in crop production areas with low environmental losses (leaching, denitrification). Most of the Wimmera-Mallee has soils which are free-draining and hold a reasonable amount of water, and therefore, environmental losses of N are low. N banks are therefore an effective strategy for managing N in most of the region.

Exceptions are areas prone to waterlogging or have very sandy soils. The advantages of N banks are that they are simple to calculate, ensure crops are rarely N deficient, and if set at an appropriate level for the environment, soil organic N is not mined. They also shift the cost of N fertiliser into years following a year of high production, rather than in the year of possible high production.

N banks require growers to set a locally relevant target for crop N supply (soil mineral N plus fertiliser N) that is enough to maximise yield in the majority of seasons. Soil mineral N is then measured early in the growing season, and if less than the target N bank, is topped up to the target value with fertiliser N.

A nutrition management tool such as Yield Prophet® uses a forecast of the future to provide a N app strategy rate for growers, using APSIM, and a probability factor to determine the application rate.

The N bank management strategy that is currently being developed does not even attempt to match crop N supply to seasonal demand, it simply makes sure that the crop has enough N supply (soil mineral N measured early in the season + fertiliser) to achieve water limited potential yield in most seasons. We do this by selecting an N bank yield target appropriate for the environment and apply N accordingly. A target of 125kg/ha N is proving most profitable in the southern Mallee (average wheat yield ~3.0 t/ha), but it is likely to be more like ~200 kg/ha N (average wheat yield >5 t/ha) at higher rainfall locations in southeastern NSW (Smith et al., 2019). We then use soil mineral N measurements from soil cores to work out how much mineral N the crop has available and top up the balance with fertiliser.

For example:
IF the soil mineral N measured in soil cores (0-1 m) = 75kg/ha N AND the N bank target for you 125kg/ha of N THEN the fertiliser required to meet N bank target = 125 – 75 = 50kg/ha N (or 100kg/ha urea).

Assessment of the N bank is achieved by soil testing for nitrate and ammonium. The 'N bank' management system relies on growers knowing how much mineral N (nitrate and ammonium) they have available to a crop early in the growing season. Consequently, for any rational decision to be made on N management, it is critical that paddocks are soil tested to measure mineral N.

This can be done any time from March through to June, but if done following sowing it is essential that samples are taken from the inter-row to avoid sampling any fertiliser N applied at sowing. Soil cores should be taken to at least 0.6m (ideally >1.0m) and segmented into different depths (e.g. 0-0.1m, 0.1-0.3m, 0.3-0.6m). At least six cores need to be taken per paddock or production zone within a paddock, and bulked samples carefully mixed. Samples should be kept cool and ideally air dried before being sent to an accredited laboratory for analysis. A good soil sampling contractor will do all of these things for you!

The yield gap due to N deficiency is always bigger in high production years. Growers either need to make a realistic assessment of current economic yield and associated crop nitrogen demand or choose an N bank target (see calculations in following section). They then need to calculate how much mineral N was available to crops early in the season from soil samples (refer preceding section), and therefore how much fertiliser N needs to be applied to achieve economic yield or the N bank target.

The bulk of this fertiliser should be applied in July-early August when cereal crops are at Z30-31 and canola hasn't started elongating. Applying at this time minimises volatilisation losses (cold often wet soil with rain fronts coming through) and maximises chances of crop uptake. If you are applying N during July you do not need to do it right in front of a substantial rain, just do it by the calendar. Crops can be topped up later in the season (e.g. Z37), but risk of volatilisation losses are higher and substantial rain is needed to make sure the N becomes available to crops. If top-dressing later than mid-August you should do it in front of a substantial (>15mm) forecast rain.

Growers in the Wimmera and Mallee shouldn't fear over-application (supplying more N than the crop needs this year) on paddocks that aren't sandy or don't reliably get waterlogged. Leaching and denitrification losses are very low and N that is not used by the crop this year will be available for next year's crop.

Crop simulations and the BCG-La Trobe long-term N field experiment at Curyo is showing that occasional over-application is more profitable in the long-term than under-application. This agrees with findings from a similar long-term experiment in semi-arid China. The only other reason not to overapply is if your cash flow is tight and you can't afford not to get a return on investment in fertiliser N this year.

It can be beneficial to soil sample high and low yielding zones of paddocks independently to get a better picture of what is happening across the paddock. Some growers are making variable rate N applications based on protein maps from previous crops and are reporting a high level of success at achieving higher yield and protein in high performing areas of paddocks and avoiding chronic over-fertilisation in low yielding areas. Whilst protein maps are an effective way of informing how N is best allocated across a paddock, they can't help with estimating the base rate, with soil testing and the management systems described above necessary to achieve this.

N management performance should be reviewed over the longer term (>3 years), and there are two effective ways to do this and make sure growers are achieving your production goals. The first is by reviewing wheat grain protein. If growers are producing wheat with less than 10.5% protein (ASW), then yields are highly likely to be N limited, and profits will almost certainly be increased by increasing N application rates. If protein is between 10.5% and 11.5% (APW), yields are likely to be N limited and profits improved by increasing N application. If protein is between 11.5% and 13% (H2) yield is likely maximised and there will be no benefit from further N application. If protein is over 13% (APH) it is extremely unlikely that yields are N limited, and growers may be over applying N at the expense of some yield and perhaps profit, depending on whether they are attracting price premiums for high protein grain.

The N Bank project has only one current research site, located in the Southern Mallee at Curyo, and although modelling has been undertaken through CSIRO to determine the theoretical N bank targets for other grain growing regions, applied in-paddock research is required to validate and demonstrate the potential of this strategy.

Project 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
Crop year rainfall:	(Nov – Oct): 2018: 200mm 2019: 368mm 2020: 358mm 2021: 241mm
GSR:	(Apr – Oct): 2018: 138mm 2019: 149mm 2020: 221mm 2021: 197mm
Soil type:	Sandy loam top-soil with clay content and calcium carbonate increasing with depth
Paddock history:	2017: Lentil

Trial details

Crop type/s:	2018: wheat cv. Scepter 2019: canola cv. Hyola 350 TT 2020: wheat cv. Scepter 2021: barley cv. Spartacus CL
Treatments:	Refer to Table 1
Seeding equipment:	Knife points, press wheels, 30cm row spacing
Sowing date:	2018: 14 May 2019: 29 April 2020: 16 May 2021: 14 May
Replicates:	Four
Harvest date:	2018: 15 November 2019: 15 November 2020: 21 November 2021: 25 November

Trial inputs

N fertiliser:	Refer to Table 2 for nitrogen fertiliser applications in 2020 and 2020 BCG Season Research Results (pages 122 to 128) for results from 2018, 2019 and 2020. All nitrogen fertiliser has been top dressed as a single application of urea during winter.
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

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. There were four different systems being 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 (NB))
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 to which only starter fertiliser was applied (7kg N/ha per year).

Within the Yield Prophet® and N bank systems there were different treatments targeting different yield potentials (Table 1). In the Yield Prophet® treatment prior to 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 banks).

N fertiliser rates in these treatments were calculated as the N bank value minus soil mineral N (kg/ha) measured prior to sowing.

All gross margins were calculated using values from the 2021 SAGIT Gross Margin Guide, assuming medium rainfall and five-year average prices (SAGIT 2021).

Table 1. 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 + fertilser = 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)

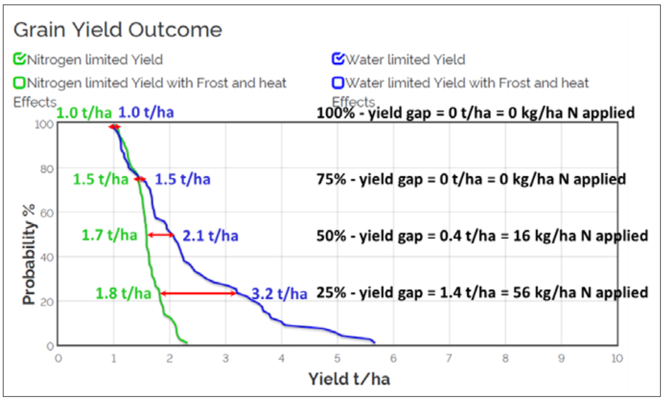


Figure 1. An example from 2018 of how Yield Prophet® is used to determine water limited potential yield given probabilities of different season outcomes and how this is used to calculate a yield gap and N fertiliser rate required to close the yield gap.

Results and interpretation

2018 – 2020 results

Please see 2020 BCG Season Research Results (pages 122 – 129) for results from the 2018 – 2020 growing seasons.

2021 Results

There were large differences between treatments in soil mineral N measured before sowing in 2021 (Table 2). There was a strong positive relationship between three-year N balance (fertiliser applied minus N removed in grain in 2018 – 2020) and soil mineral N measured before sowing in 2021 (Figure 2). On average 76% of fertiliser N applied 2018 – 2020 that exceeded grain removal was available as mineral N before sowing in 2021. This is consistent with 2019 and 2020 season results. Yield Prophet® 50% and 25% treatments had the highest mineral N, reflecting the very high fertiliser N applications made in 2020. These treatments would have been most susceptible to N losses over summer. All N bank treatments had comparatively low mineral N.

Despite the relatively dry growing season (only 129mm of rain to 28 September), grain yield, protein and gross margin responded positively to N supply (Table 2). The highest yielding treatment was the 150kg/ha N Bank treatment which applied the most fertiliser N in 2021. The most profitable treatment was the Yield Prophet® 25% treatment which had applied high rates of N in 2020 (128kg N/ha), a lot of which was carried over as mineral N in 2021, so only 8kg N/ha fertiliser N was applied.

Table 2. Soil mineral N measured prior to sowing, top-dressed N, crop N supply, grain yield, protein and gross margin for different treatments in the experiment in 2021.

System	Treatment	Soil mineral N (kg/ha)	Top dressed N (kg/ha)	N supply (kg/ha)	Yeild (t/ha)	Protein %	Gross margin ($/ha)
Nil	Nil	26	0	33	1.1	10.0	-$113
Replacement	-	48	50	105	2.3	10.7	$77
National average	-	41	45	93	2.2	10.4	$62
Nitrogen banks (kg/ha N)	100 125 150	34 57 67	59 61 76	100 125 150	2.3 2.4 2.6	10.8 11.6 12.2	$64 $83 $105
Yield Prophet® probability	100% 75% 50% 25%	38 46 131 108	0 0 0 8	45 53 138 123	1.1 1.7 2.1 2.4	10.3 10.7 11.0 12.2	-$113 $17 $104 $158
Sig. diff. LSD (P=0.05)		<0.001 24	- 	<0.001 20	<0.001 0.2	<0.001 0.7	

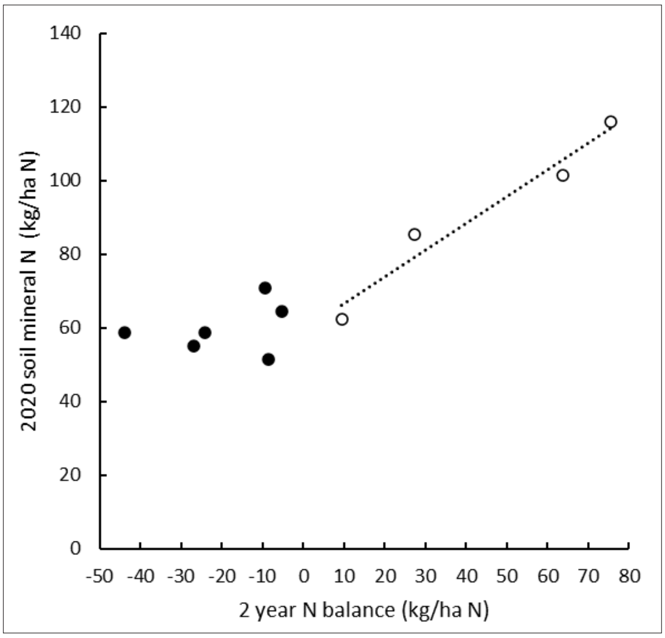


Figure 2. The relationship between three-year N balance (2018-2020) and soil mineral N measured before sowing in 2021. The linear regression is fitted by least-squares regression to the positive N balance values only and is of the form y = 0.48x + 60.60, R^2 = 0.69.

Four-year averages

Comparison of the different systems over the four years of the experiment shows the Yield Prophet 50% and N Bank 125kg/ha N treatments were most profitable, with several other treatments not far behind. All these treatments on average applied more fertiliser N than the district average of 21 – 30kgN/ha (Norton 2016) or the national average of 45kg/ha (Figure 3). Assuming the district average N application is 30kgN/ha, the fitted quadratic function suggests the Yield Prophet® 50% and Nitrogen Bank 125kg/ha treatments have on average returned ~$100/ha per year more profit than the district average.

The two most profitable treatments also had a neutral to slightly positive four-year N balance (Figure 4), 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 four year N balance of -89kg/ha N. Based on the soil C:N ratio at the site of 9.7, this suggests ~863kg/ha of soil organic carbon has been lost.

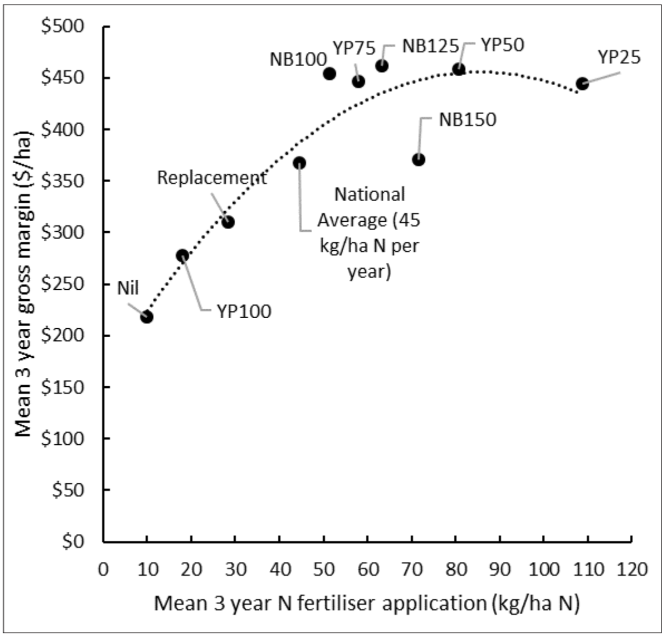


Figure 3. The relationship between mean four-year fertiliser application and mean four-year gross margin for the different treatments. The quadratic function fitted by least-squares regression is of the form $y = -0.05x2 + 7.16x + 37.51$, $R^2 = 0.90$.

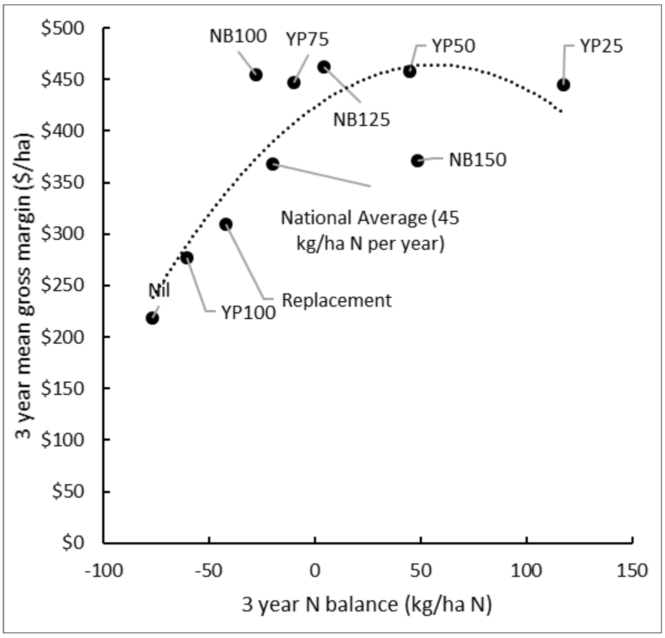


Figure 4. The relationship between four-year N balance and four-year mean gross margin for the different treatments. The quadratic function fitted by least-squares regression is of the form $y = -0.01x2 + 1.05x + 282.74$, $R^2 = 0.84$.

The grains industry is understandably concerned about what high urea prices will mean for farm profitability and N strategies in 2022. Figure 5 shows the four-year average N rate and gross margin for this experiment assuming either a urea price of $550/t (same as Figure 3) or $1100/t with all other costs and prices held constant. Profit will be reduced at high urea prices and the most profitable urea rate in this example reduces from 73kg N/ha to 61kg N/ha.

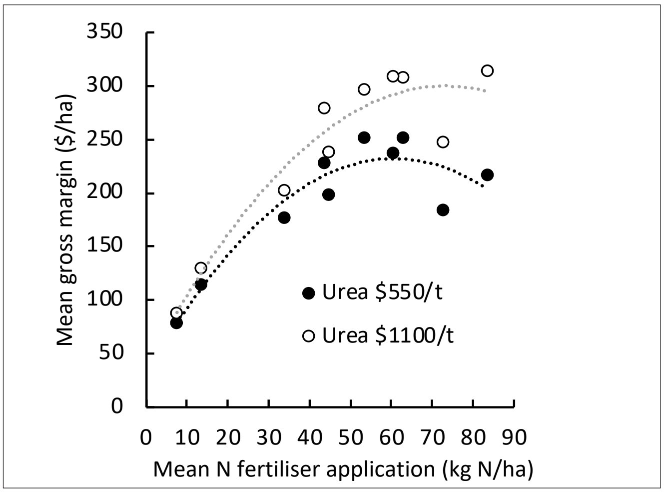


Figure 5. The relationship between mean four-year fertiliser application and mean four-year gross margin for the different treatments assuming a urea price of either $550/t or $1100/t. The quadratic functions fitted by least-squares regression are of the form $y = -0.05x2 + 7.16x + 37.51$, $R^2 = 0.90$ for $550/t and $y = -0.05x2 + 6.61x + 31.64$, $R^2 = 0.88$ for $1100/t.

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 (60 – 80kg N/ha N or 130 – 174kg/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). Growers in low rainfall regions with heavy textured soils can be confident the majority of applied N not used in year of application will remain in the soil for use in subsequent seasons and is not a lost cost.

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 are a legitimate concern, given the strong reliance of continuous cropping systems on synthetic N fertiliser for high yields and profits. Growers can offset this price rise by increasing the planted area of legumes (grain, hay, brown manure or pastures—whatever fits), particularly in paddocks that return a low soil N test and would require substantial fertiliser N inputs if planted to non-legume crops. Growers with good access to organic wastes (manures, composts, biosolids) can substitute these for N fertiliser.

Always test N content of organic wastes before application to ensure they are cost effective in comparison to synthetic fertilisers and that an agronomically appropriate rate of N (and other nutrients) is being applied.

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Acknowledgements

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Photo: Agriculture Victoria

Past, Present and Future Climate eBook for the Victorian Mallee.

By Heather Field, Agriculture Victoria Climate Change Service Development Officer, Agriculture Victoria

More decision-making support for dryland cropping and livestock farming enterprises in the Mallee is now available in the form of a climate eBook.

The 'Past, Present and Future Climate eBook for the Victorian Mallee' not only gathers together key tools and resources on historical rainfall and temperature data, but also provides future climate trends and projections.

The Mallee's climate is variable and getting warmer and drier. This variability will likely continue, with greater extremes. However, there are many practices that can be done to prepare and adapt. Reduced rainfall combined with increasing temperatures will challenge farm businesses as the winter growing season is compressed and the summer season extends.

The eBook shares some of these potential climate impacts and useful resources, including:

- Past and recent rainfall and temperature trends
- Historical growing season rainfall
- Climate driver influences on growing season rainfall
- Historical temperature extremes
- A guide to using seasonal forecasts
- Projected changes in rainfall, temperature, and season length
- Potential climate impacts and useful resources
- Products and information on climate and adaptation

Historical climate variability in the Mallee
Understanding long-term historic rainfall and temperature data and analysing these records to see how climate drivers have influenced past rainfall can aid in predicting what our climate will be like in the future.

Annual rainfall in the Mallee has decreased by around 20mm (7%) from 320mm over the past 30 years (1989-2018) when compared to the previous 30 years (1959-1988).

In Birchip, rainfall patterns have decreased in the autumn and spring months, when comparing the periods between 1989-2018 with 1959-1988. Over the past 30 years, winter growing season rainfall in the Mallee (April to October inclusive) for Birchip decreased 48mm (Figure 1).

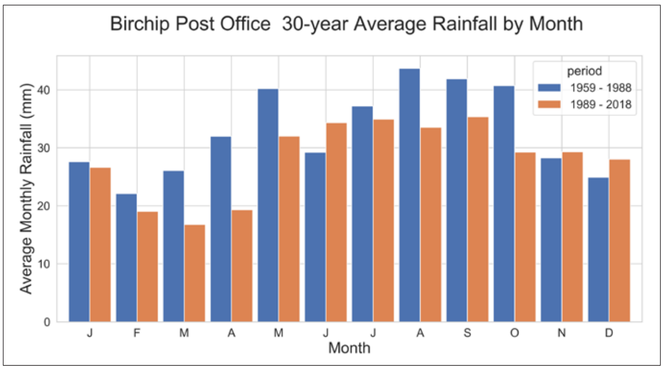

Figure 1: Birchip Post Office 30-year Average Rainfall by Month (Source: Bureau of Meteorology, 2019).

The Bureau of Meteorology Mallee Climate Guide 2019 provides more information about the rainfall and temperature over the last 30 years (1989 -2018).

Future climate projections for the Mallee
What are the climate projections saying and what does this mean for temperature and rainfall in the coming 30 years?

Rainfall in the Mallee is highly variable, and this variability is likely to dominate the rainfall patterns over the next decade.

Victoria's temperature increased by just over 1^{o}C between 1910 and 2018. This warming is expected to continue with temperatures in the Mallee region also increasing.

The increase in temperature will depend on the world's greenhouse gas emissions over the coming decades.

Under a high emissions scenario (rising emissions), maximum temperatures in the Mallee are expected to show a median increase of 1.31^{o}C by the 2030's (2020-2039), compared to 1986-2005. By mid-century, the increase is likely to be greater, with a median of 2.21^{o}C (Figure 2).

Modelling has shown that by the 2050's, the climate of Mildura could be more like the current climate of Menindee in NSW, and Swan Hill more like Balranald in NSW.

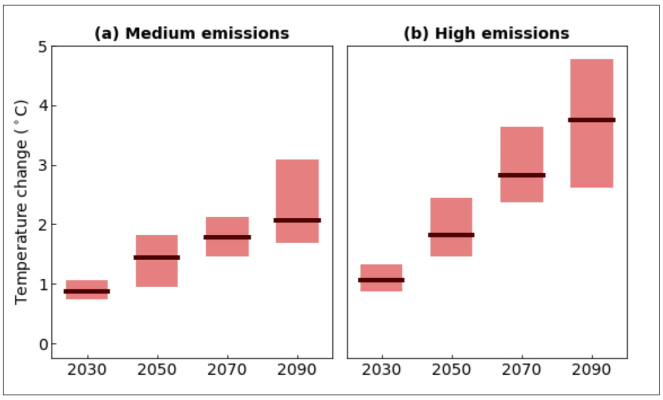

Figure 2: Projected changes in annual mean temperature in the Mallee for medium emissions - RCP 4.5 (a) and high emissions - RCP 8.5 (b).

Mallee Climate Projections 2019 provide more information to help understand the scope and scale of changes to the climate that we can expect in the Mallee region.

Find out more
The eBook is one of many climate change adaptation tools being developed for primary production to build resilience to the changing climate and is available online agriculture.vic.gov.au/mallee-climate-eBook.

Feedback about how this new product might be improved and what other information could be included is welcomed by emailing heather.field@agriculture.vic.gov.au.

The eBook sources climate data and analysis relevant to the Mallee region from Agriculture Victoria, Bureau of Meteorology, Department of Environment, Land Water and Planning (DELWP) and the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Protecting Victoria's agriculture sector and improving its resilience to external threats such as climate change, pests, disease, natural disasters and resource scarcity is a key pledge under the 2030 Agriculture strategy and the Victorian Primary Industries Adaptation Plan.

AGRICULTURE VICTORIA

Protecting and restoring Buloke Woodlands in the southern Mallee.

By Jennifer McCamley,
Mallee Catchment Management Authority.

Planting tubestock at Birchip Racecourse Recreation Reserve in June 2021. Photo: Mallee CMA

Introduction
Buloke Woodlands were once widespread in the broad riverine plains of the Murray-Darling Depression and Riverina Bioregion. Extensively cleared for grazing and cropping, these woodlands now exist as scattered remnants on public and private land, subject to a number of ongoing threats to their survival. It is estimated that between 60% to 75% of vegetation associated with Buloke Woodlands in the Mallee has been depleted. Buloke Woodlands are listed as endangered under the federal *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* and as threatened under the *Victorian Flora and Fauna Amendment Act 2019.*

Under the Australian Government's National Landcare Program, the Mallee Catchment Management Authority (CMA) has received funding for five years (June 2018 – June 2023) to undertake activities to protect and enhance Buloke Woodland remnants in the southern Mallee. The Mallee CMA is working with a range of partners to deliver revegetation works to improve the floral diversity and structure of woodland remnants, targeted rabbit and weed control programs on both public and private land, and a demonstration site to trial Buloke woodland restoration techniques.

Targeting the Buloke Woodlands of the southern Mallee
In the Victorian Mallee, the strongholds for Buloke Woodlands occur in the Mallee National Parks (Murray-Sunset, Wyperfeld and Hattah- Kulkyne National Parks) and further south on private land and in public and road reserves around the Birchip, Culgoa, Hopetoun and Sea Lake areas.

Under the Regional Land Partnerships Program, on-ground works and project activities to protect and restore Buloke Woodlands are being delivered in two target areas in the southern Mallee: the Avoca Basin and Yarriambiack (North Wimmera Creeklines) (see Figure 1). The target areas contain important stands of Buloke Woodland in bushland and road reserves, and on private land. The two target areas cover 404,262 hectares (ha) of predominantly dryland farming and contain 19,300 ha of Buloke Woodland. This is 22% of all Buloke Woodland remnants in the Mallee. Eighty eight percent of woodlands in the target areas occur on private land.

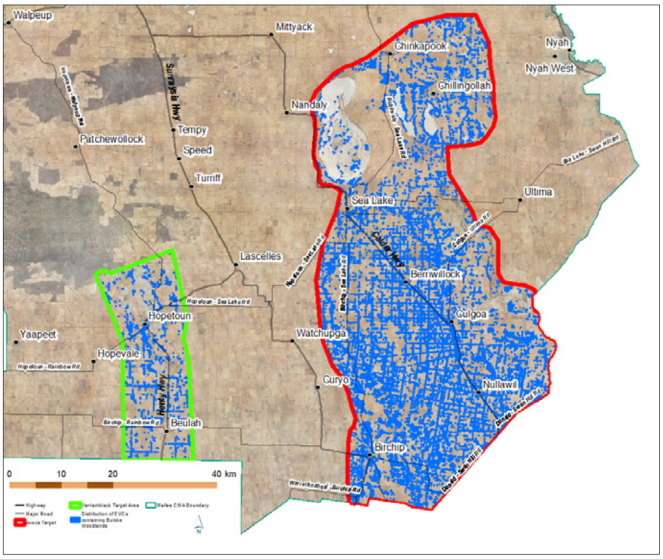

Figure 1. The two target areas showing the distribution of Ecological Vegetation Classes containing Buloke Woodlands

What are the key threats

An intact Buloke Woodland typically has an 'open woodland structure', with a canopy of Buloke *(Allocasuarina luehmannii)* and less commonly Slender Cypress-pine *(Callitris gracilis)* over a mid-storey of sparse small trees and tall shrubs. The ground layer consists of small shrubs, herbs and Wallaby and Spear grasses. Today, Buloke Woodlands occur as scattered remnants of varying quality, with some poor-quality remnants now comprised of veteran Buloke trees, with no understorey species present.

The most pressing threat to Buloke Woodlands is the chronic failure of Buloke to regenerate, and senescent trees are not being replaced with new recruits.

Understorey species are also failing to regenerate. While several factors are likely to be involved in this, browsing by rabbits is known to be a major impediment to natural regeneration. Buloke seedlings are highly palatable to rabbits and research has shown Buloke seedlings remain susceptible to browsing damage for at least seven years (Bennett et al. 2020). Rabbit browsing on understorey species also reduces the plant species diversity and structural complexity of Buloke Woodland communities, greatly reducing their habitat value for a range of fauna species.

Buloke woodland remnants are also being degraded by the invasion of environmental woody weeds, such as African Boxthorn and Cactus species. These species compete for space and resources, particularly soil moisture.

Revegetating degraded remnants of Buloke Woodland

The Mallee CMA is working with Barengi Gadjin Land Council Aboriginal Corporation (BGLC), local government, community groups and private land managers to restore remnants of Buloke Woodland on roadsides, bushland reserves and private land in the two target areas. BGLC are delivering the revegetation works, with their Dalki Garringa Native Nursery collecting the seed and growing the tubestock for each year's plantings.

Species-poor Buloke woodland remnants have been planted with tubestock and direct-seeded with key canopy, mid-storey and understorey species to restore both species richness and vegetation structure. Species planted and seeded include Buloke, Slender Cypress Pine, Sugarwood and a range of Eucalypt, Acacia and small shrub species. By June 2021, 180ha of supplementary planting had been undertaken across the two target areas, with 35,800 tubestock planted and 69 kilograms of seed sown.

Rabbit control programs have been undertaken by the relevant land managers and community groups to protect the new plantings from grazing, and to support natural regeneration processes within the broader remnants. Adequate soil moisture levels are vitally important for tubestock establishment, particularly in the hot summer months, and follow-up waterings of the plantings are undertaken when rainfall levels are low.

Reducing the impact of rabbits and environmental weeds on Buloke woodland roadside remnants

The Mallee CMA is working with local government authorities and local Landcare groups to control rabbit populations and environmental weed infestations in roadside remnants of Buloke Woodland. The rabbit control works aim to reduce rabbit abundance to <1 rabbit per spotlight hectare. Research has shown rabbit density above this level, and the associated browsing pressure, seriously decreases the ability of native species to regenerate. These roadside rabbit populations also act as source populations which can disperse into adjoining public and private land. Weed management targets WoNS (Weeds of National Significance) which are problematic in our region: African Boxthorn, Bridal Creeper, Prickly Pear, Wheel Cactus, Hudson Pear, Athel Pine, Boneseed and Buffel Grass. Control works aim to reduce weed cover to 0%.

Each targeted roadside area receives an initial rabbit and weed control treatment, with this being followed up in the subsequent year to maximise the efficacy of the works. Between June 2018 and June 2021, 11,585 ha were managed for rabbits and 2,850ha for WoNS through initial and follow-up control. Over this period, 4,558 rabbit warrens have been destroyed, with average rabbit abundance reduced to <0.5 rabbits per hectare. A total of 2,504 weed infestations have been removed, with Boxthorn, Prickly Pear, Wheel Cactus and Bridal Creeper found to be the main weeds infesting roadsides. Average weed cover has been reduced from 2.78% to 0.78%.

Buloke Woodlands are not regenerating. Photo Mallee CMA

Working with landholders to protect remnants on private land

With such a high proportion of Buloke Woodlands occurring on private land in the southern Mallee, private land managers have an important role to play. The Buloke Stewardship Program aims to engage with these land managers and provides financial incentives to help them carry out on-ground works which will protect and improve the condition of Buloke Woodland remnants on their properties. Under the program, landholders enter into a three-year management agreement with the Mallee CMA and commit to excluding stock from their Stewardship sites and reducing rabbit abundance and WoNS cover to specified target levels. They also agree to other actions which will improve the habitat value of their remnants, such as retaining all fallen timber, leaf litter and standing trees. Eighty-four hectares of remnant Buloke Woodland on private properties are currently under Stewardships.

Trialling restoration techniques for Buloke Woodland: the Buloke Woodland Regeneration Trial

In partnership with the Mallee CMA, Arthur Rylah Institute (ARI) has designed a four year project which is investigating the best management options for restoring degraded Buloke Woodland remnants on farm properties. The focus of the project is a 13-hectare demonstration site established near Birchip in 2019. The site is on clay soils and is trialling a set of targeted restoration techniques for Buloke and understorey species. The demonstration site provides a 'local' site where knowledge about restoration techniques can be exchanged between ARI, MCMA, landholders and the community through field days and information sheets. (For further information on the trial design, please see Mallee Farmer #19, Winter 2021.)

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Further Information

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Australian Government | National Landcare Program | mallee catchment management authority | Barengi Gadjin Land Council | Dalki Garringa Native Nursery

New Climate Extremes forecasts now available thanks to Forewarned is Forearmed project.

By Jemma Pearl, Grains Seasonal Risk Project Officer, Agriculture Victoria

Mallee farmers will now benefit from an update to the Bureau of Meteorology's (BoM) Climate Outlook Service which has resulted in the addition of new 'chance of extreme' outlooks to the multi-weekly and seasonal forecast website. These are an output from the Forewarned is Forearmed Project – a partnership of government, research organisations, and industry sectors, in-part funded through the Australian Government's, Rural R&D for Profit Program.

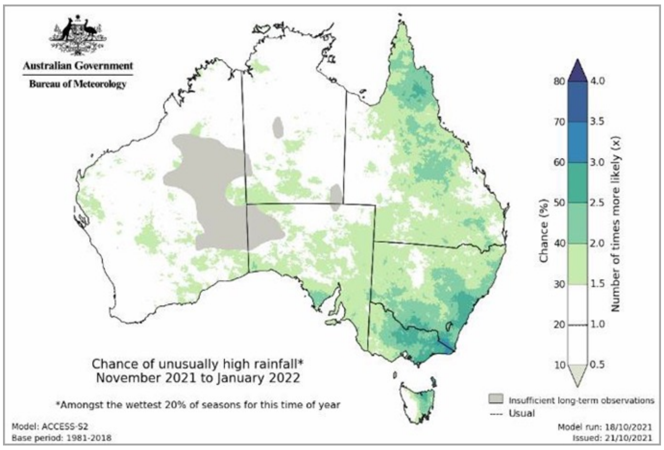
The new forecasts respond to the growing need for information around extreme climate events; helping to build climate resilience and support informed decision-making. The outlooks draw on the Bureau's upgraded climate model (ACCESS-S2) which is at the cutting edge of global seasonal forecasts. The tools comprise maps and location-specific bar charts showing the chance of climate extremes in the forecast outlook. Specifically, these indicate the chance of unusually warm/cool and dry/wet conditions for the weeks, months and seasons ahead. The climate extremes used in these outlooks refer to the chances of being in the top or bottom 20% of historical observations including:

- The 'chance of extreme' maps and pop-up bar charts are available across Australia and are accessed via the left-hand menu on the climate outlooks interface, under the rainfall, maximum and minimum temperature sub-headings.
- The bar charts are available for your local region by clicking on the map or using the search icon to type in a location.
- Accuracy, past climatology and explanatory information is also available on the website, including new pop-up information when you select a location or click on the maps.

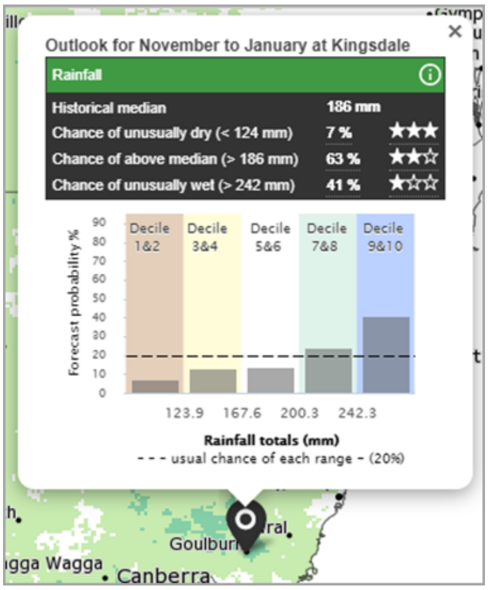
For the past three years, Agriculture Victoria has contributed to the national project by gathering insights on hot, cold, wet and dry extreme forecasts from the new BoM ACCESS-S model and searching for improved ways to communicate these forecasts to farmers.

Stay tuned as webinars will be held by Agriculture Victoria to showcase these new tools.
For more seasonal climate information, check out:

- The Bureau's updated seasonal outlooks
- Forewarned is forearmed: Outlooks and new features on the Bureau of Meteorology's website. www.bom.gov.au/climate/outlooks/#/rainfall/summary
- The Break Newsletters
- My Rain Gauge is Busted podcast series



Example of the new forecast outlook map showing the chance of unusually high (in the top 20% of historical observations) rainfall for November 2021 – January.



Example of the new local forecast rainfall pop-up bar chart showing the forecast rainfall distribution probabilities including rainfall thresholds and accuracy assessments (stars).

The Forewarned is Forearmed project is supported by funding from the Australian Government Department of Agriculture, Water and the Environment as part of its Rural Research and Development for Profit program.

AGRICULTURE VICTORIA

Are you a 2022 farm safety hero?

By Agriculture Victoria Media Team.

Agriculture Victoria is partnering with Kidsafe Victoria to deliver another year of the Farm Safety Creative Competition.

The competition encourages all farm safety heroes to get creative and design educational materials that promote injury prevention on the farm.
The theme for this year's competition 'Farm Safety Heroes,' focuses on how we can all play a part in making the farm a safe experience for everyone whether we live, work on, or visit a farm.

Agriculture Victoria's Acting Executive Director of Agriculture Policy, Dr Julie Simons, said although farms are wonderful places for children to learn and grow up, they can also be very dangerous.

"This initiative encourages children and adults to take an active role in farm safety in an interactive and fun way." said Dr Simons.

This year's farm safety heroes can submit their choice of creative entry, including a video, illustrated story, comic strip, poster, collage or a radio advertisement.

The winners will feature in a state-wide farm safety education campaign designed to increase farm safety awareness among Victorian parents and carers.
Farms are unique environments which are often both a workplace and a home, and children often intersect with the workplace environment, either by helping with jobs or using the property for recreation.

Common injury risks for children on farms include vehicles such as quad bikes, motorbikes and tractors, and incidents involving animals, water, machinery and poisons.

According to the Victorian Injury Surveillance Unit, children under the age of 15 in Victoria's outer regional areas are four times more likely to die due to injury than children in major cities.

In 2020-21, 441 Victorian children under the age of 15 presented to an Emergency Department as a result of an injury on farm.

The Farm Safety Creative Competition is open to all pre-school and primary school aged children in Victoria.
The Farm Safety in Schools Campaign and Creative Competition is funded by Smarter, Safer Farms, a $20 million initiative to improve safety outcomes for Victorian farmers, their families, farm workers and visitors.

For more information about the competition and other learning resources, visit Kidsafe Victoria.
www.kidsafevic.com.au
Entries are open until 4 November 2022.

MalleeFarmer

Australian Government | National Landcare Program

mallee catchment management authority

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