MALLEE FARMER

ISSUE 17 • Winter 2020

Featuring:

Ian Brown's Cowangie stock containment set up

Drought Support Update

Landcare News

Tuning in- New MSF Farm Talk Pod Casts

Cropping Research Trials Results

And Much More

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Cover Photo, Ian Brown, Agriculture Victoria

Chair's Report

Welcome to the latest edition of the Mallee Farmer – and what a bumper edition it is!

Thank you to all of our regional partners for contributing to this edition of the Mallee Farmer, despite the COVID-19 restrictions changing so much of our everyday lives. It has been inspiring to see how our regional partners in the agriculture sector have responded to the challenges of COVID-19 and managed to continue to deliver their important work. People across the Victorian Mallee and beyond really have risen to the challenges posed by COVID-19 to ensure work continued in the sustainable agriculture sector. This work is so important and valuable, not only to the economy but also to the fabric of our regional communities.

In this edition of the Mallee Farmer you will find:

- An overview of the new regional climate and weather guides that are now available to help farmers plan for future challenges;
- A look at the drought support funding available, including the extension to the popular Farm Machinery Improvement Grant program;
- The latest findings from local research and development (R and D) trials investigating deep ripping and soil amelioration approaches to increase the productivity of sandy soils; and
- An insight into what a new dryland farming-focused Community of Practice could offer local farmers.

But, with so much great work happening in sustainable agriculture, we couldn't leave this edition of the Mallee Farmer there!

We also catch up with Mallee Sustainable Farming about Farm Talk Podcast For Mallee Farmers and chat with Agriculture Victoria about research testing the benefit of reducing inter-row evaporative losses in-crop on wheat growth and yield.

NLP ACKNOWLEDGEMENT

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

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Following on from the popularity of the local case studies published in the last edition of the Mallee Farmer, this time we take a look at the design of Ian Brown's stock containment areas on his Cowangie property. It is a great example of how important this on-farm infrastructure can be when it comes to making the movement of sheep in and out a one-person job.

There's also a really interesting report on research into early intervention methods to stop dune seeps becoming a larger problem; a reminder to sheep producers about the potential for trace mineral deficiency diseases affecting lambs this year; and our Regional Agriculture Landcare Facilitator Glen Sutherland gives us the heads up that mice might be back and becoming an emerging problem.

There's a lot to learn in this edition of the Mallee Farmer! I hope you enjoy it and look forward to the next edition.

Sharyon Peart

Chairperson, Mallee CMA Board

Want to be mailed a copy of the Mallee Farmer?

Two editions of the Mallee Farmer are produced each year. The spring edition is available around July – August and the autumn edition is released around late March. If you would like to register to have a copy mailed direct to you. fill out the form below and return to the Mallee Catchment Management Authority.

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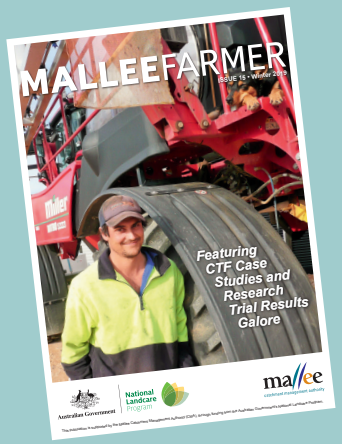

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Mallee Weather and Climate Guide - A new tool to help farmers manage climate-related risks

By Glen Sutherland

Northern Mallee Regional Agriculture Landcare Facilitator, Mallee Catchment Management Authority

Our weather, and the resultant impacts, including on the lack of rainfall and the widespread devastation of bush fires and drought, has put the topic of climate change firmly back on the agenda.

While both weather and climate refer to atmospheric conditions, there are important differences between the two. Weather is about the prevailing atmospheric conditions, at any given location, measured in the short-term, anywhere from minutes to months. Climate is about collecting and comparing long term weather data, over many years, to identify trends, or patterns, of the same atmospheric conditions, for a given location.

A new tool to assist Mallee farmers in assessing climate-related risks is now available with the release of the Regional Weather and Climate Guides. These guides were developed through a collaboration between the Bureau of Meteorology, the CSIRO and FarmLink Research.

The guides aim to improve the resilience of farming businesses by providing localised facts about the likelihood, severity and duration of key weather variables such as rainfall, frosts, seasonal breaks and the number and severity of hot days. The guides were developed as part of the Australian Government's Drought Assistance Package.

A snapshot of the Mallee's Weather and Climate Guide shows that over the past 30 years:

- Annual rainfall has decreased by around 7%;
- The decrease in rainfall is seen mostly in the autumn and spring months;
- Winter rainfall has been reliable compared to other seasons, with summer being the most unreliable;
- Dry years have occurred twice as often as wet years;
- Autumn break usually occurs around mid-May in the east through to mid-June in the west;
- Spring frosts have been more common and have been occurring later; and
- There have been more hot days, with more consecutive days above 38 °C.

Further Information

Access to weather and climate guides for other regions are available at: http://www.bom.gov.au/climate/climate-guides/

The Northern Mallee Regional Agriculture Landcare Facilitator is supported by the Mallee Catchment Management Authority, through funding from the Australian Government's National Landcare Program.

Please refer to the climate guide for the Victorian Mallee below for further information.

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A climate guide for agriculture in the Victorian Mallee

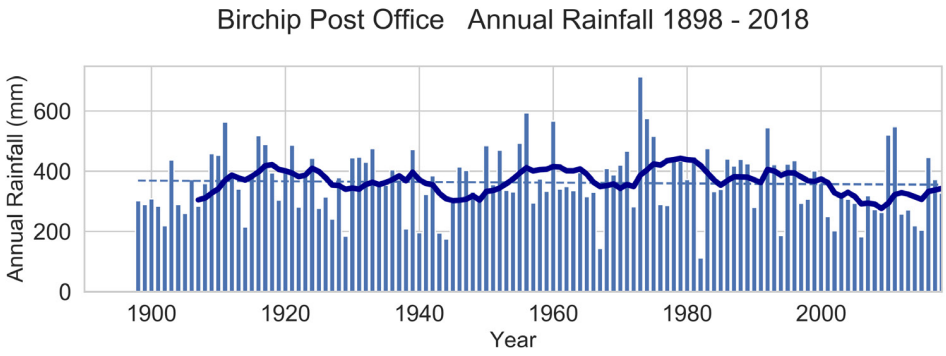
In the last 30 years in the Mallee

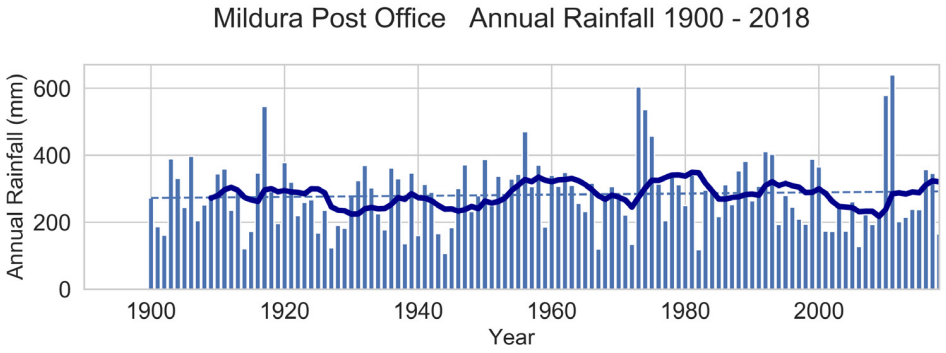
- Annual rainfall has decreased by around 7%
- The decrease in rainfall is seen mostly in the autumn and spring months
- Winter rainfall has been reliable compared to other seasons, with summer being the most unreliable
- Dry years have occurred twice as often as wet years
- Autumn break usually occurs around mid-May in the east through to mid-June in the west
- Spring frosts have been more common and have been occurring later
- There have been more hot days, with more consecutive days above 38 °C

Annual Rainfall

Annual rainfall totals in the Mallee are highly variable year on year

Annual rainfall in the Mallee has decreased by around 20 mm (7%) from about 320 mm to about 300 mm over the past 30 years (1989–2018) when compared to the previous 30 years (1959–1988). The charts show annual rainfall (blue bars), with a 10-year running average (solid blue line) for Birchip and Mildura. Although there has been a decrease in annual rainfall in the past 30 years, it is within the range of natural variability.
In the past 30 years (1989–2018), dry years (lowest 30%) have occurred 13 times, and wet years (highest) 30%) have occurred six times, while the remaining years were in the average range. Note the Millennium drought accounted for five of the dry years in the recent period. During the previous 30-year period (1959–1988), dry years occurred five times and wet years occurred 12 times.



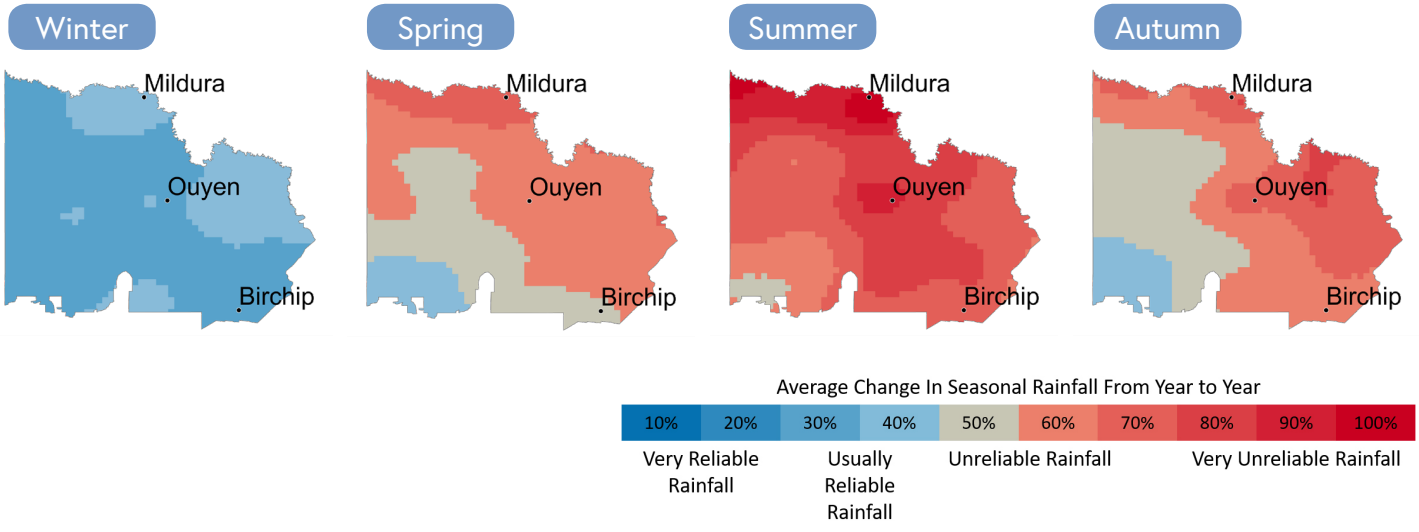


For more information on future projections, visit the Climate Change in Australia website
> www.climatechangeinaustralia.gov.au

Want to know more about the guides? Try Frequently Asked Questions at
> www.bom.gov.au/climate/climate-guides/

Mallee winter rainfall is reliable; summer rainfall is unreliable

Rainfall reliability maps for the past 30 years (1989-2018) show winter rainfall has been moderately reliable across the region (light blue areas), ranging from about 50 mm up to 110 mm in the wetter years. This is in contrast to spring and autumn rainfall, which has been less reliable (light red areas), especially in the north-east. Summer rainfall has been unreliable across the region (red areas), and although there have been some wet summers in the past 30 years, summer rainfall has not been reliable from year to year.

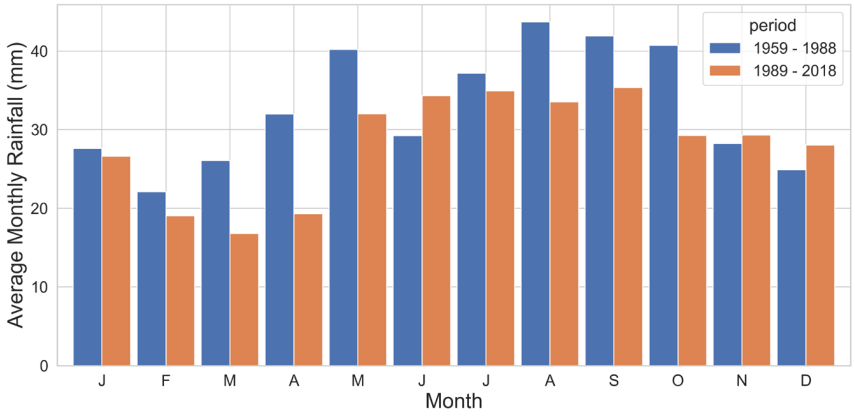


Rainfall Timing

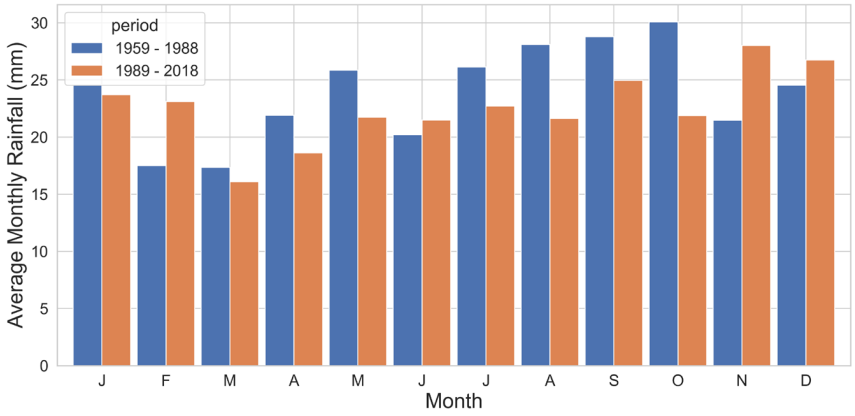
Rainfall has decreased in the autumn and spring months

Rainfall decreased in the autumn and spring months at Birchip and Mildura between 1989–2018 (orange bars) compared with 1959–1988 (blue bars).
Over the past 30 years, winter growing season rainfall (April to October inclusive) for Birchip was 214 mm; 48 mm lower than the 262 mm average for the previous 30-year period (1959–1988). For Mildura, growing season rainfall decreased 28 mm over the same period.

Birchip Post Office 30-year Average Rainfall by Month

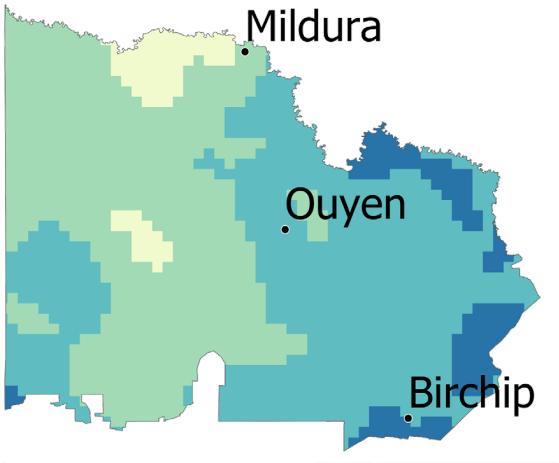


Mildura Post Office 30-year Average Rainfall by Month



For more information on the latest observations and science behind these changes, refer to the State of the Climate Report
> www.bom.gov.au/state-of-the-climate/

Timing of the autumn break in the Mallee region



In the Mallee, the autumn break can be defined as at least 15 mm of rainfall over three days. The map shows that over the past 30 years (1989–2018), the break typically occurred within the last two weeks of May in the eastern parts of the region (blue to green areas), and not until June in much of the west (light green to yellow areas).

Weeks after 1 April	6	7	8	9
Autumn Break Usually Occurred After...	19 May	26 May	2 June	9 June

A climate guide for agriculture **Mallee, Victoria**

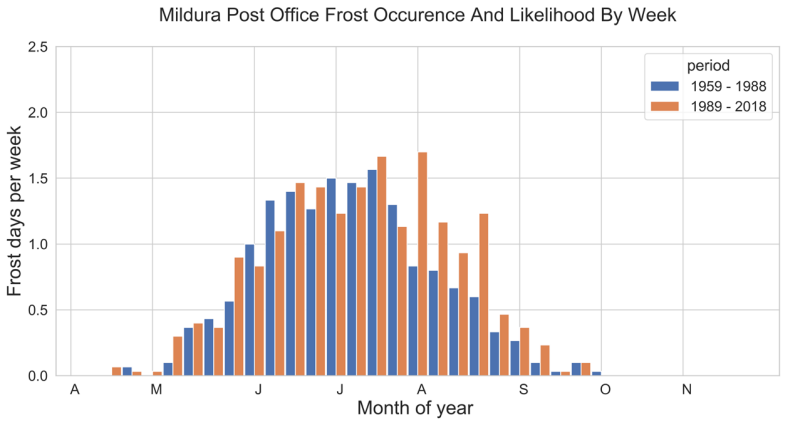
Frost

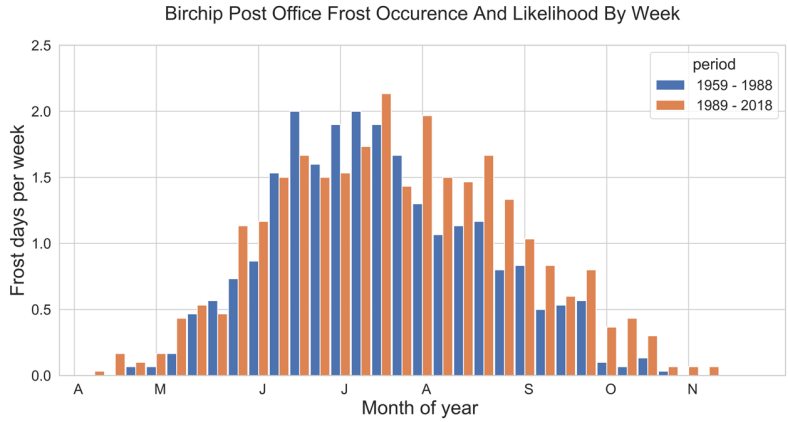
Later and more frequent frosts

The number of potential frosts has increased at Mildura and Birchip between 1989-2018 (orange bars) compared with 1959-1988 (blue bars). Frost frequency increased in late spring, with an average of eight more spring nights with the potential for frost between 1989-2018 compared to 1959-1988.

Mildura's frost risk has typically ended by the start of October, whereas Birchip has experienced frosts well into October and into November, about once every second year. The latest potential frost night recorded for the region was the 30th of November 1991.

More frosty nights have tended to occur through dry winter and spring periods, when soil moisture is low, and cloud cover infrequent. On average, the Mallee region has had four more spring frost nights following a dry winter.

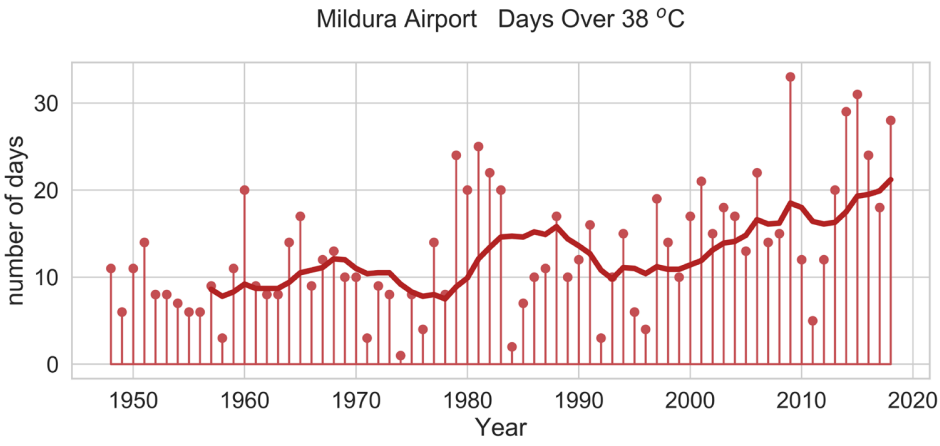




Temperature

The Mallee has experienced more hot days in the past 30 years

The chart shows the annual number of days above 38 °C (blue bars), with a 10-year running average (solid blue line) for Mildura. Mildura experienced an average of 16 days per year above 38 °C between 1989–2018, compared to an average of 10 days per year above 38 °C between 1959–1988. Since 1989, unprecedented temperatures of 46 °C have been recorded for Mildura six times. Instances of consecutive days above 38 °C have also been more frequent in the past 30 years. In 1959, 2007, 2009 and 2018, Mildura experienced four periods of 10 or more days in a row above 38 °C; noting three of these four instances have occurred since 2007. In both 2009 and 2018, the periods above the 38 °C threshold lasted 13 days.



Regional Weather and Climate Guides are produced as a partnership between Bureau of Meteorology, CSIRO and FarmLink

Latest Drought Support Information

By Sue McConnell
Agriculture Victoria

Dryland farmers in the Millewa are reminded that the Victoria Government continues to offer a variety of grant programs as well as technical advice and support through Agriculture Victoria for farmers impacted by drought and dry seasons.

Grant Programs Farm Machinery Improvement Grant program – EXTRA FUNDING!

In late April Jaclyn Symes, Minister for Agriculture announced that more farmers in the Millewa region will be able to apply for the Farm Machinery Improvement Grant with a $480,000 boost to extend the program.

A grant continues to be available for up to $10,000 per eligible dryland farm business located in the Millewa to assist in the maintenance of essential on-farm machinery and equipment to meet key operational requirements and prepare for future growing seasons.

Eligible farm machinery includes machinery and equipment that supports cropping or grain production, including but not limited to harvesting, sowing and seeding and may also include tractors, harvesters, seeders and hay baling equipment.

Essential repairs include, but are not limited to, essential maintenance and repairs to meet safety standards, repairs to fix or replace broken/non-operational parts.

For more information and to access the program call the Victorian Farmers Federation on 1 300 882 833 or visit vff.org.au.

The CWA of Victoria's Drought Relief program

A grant payment of up to $3,000 per individual applicant and/or household is available for farming families, farm workers and contractors that are drought-affected and reliant on farming as their primary source of income.

The payment can assist farming families to meet urgent

Dry Times in the Millewa. Photo Mallee CMA

household expenses such as residential rates, food, school expenses, rent, household and medical bills.

This program is being funded through the Victorian Government's Farmers' Drought Fund - Household Financial Relief program announced on 2 October 2019.

To access an application form or to find out more, visit cwaofvic.org.au/drought-relief/

The On-Farm Drought Resilience Grant program has been expanded

The maximum value of the On-Farm Drought Resilience Grant has increased from $5,000 to $10,000 to boost farmers' access to professional services whilst still enabling farmers to invest in drought preparedness infrastructure. Eligible farm businesses can now apply for:

- Up to $5,000 for business decision making activities (with no-contribution required)
- Up to $5,000 for infrastructure investments (with at least 50 per cent co-contribution required)

There are three new eligible infrastructure investments under the Resilience Grant:

- technologies to improve mobile phone connectivity
- weed control (e.g. purchase of registered herbicide)
- soil moisture probes (as an explicit investment under soil moisture monitoring activities).

For more information and to access the On-Farm Drought Resilience Grant program, call Rural Finance on 1800 260 425 or visit ruralfinance.com.au

Farmers are encouraged to apply early to ensure they do not miss out on funding.

Technical Support and advice

Agriculture Victoria remains available to assist Victorian farmers. We want to reassure farmers, particularly those impacted by drought, that we are continuing to provide support services to you and your farming business. However, the way we are doing this during the coronavirus (COVID-19) pandemic has changed.

We have moved from our usual face-to-face client contact to other alternatives. This means we might call you on the phone, send you information via post or email, invite you to a video or teleconference, or even a webinar.

Farmers can call us to access information tailored specifically to their needs on a range of topics and we are running webinars and online workshops. Call 136 186 or visit: agriculture.vic.gov.au/agriculture/ farm-management/farmer-workshops

Keep an eye on our social media and our website agriculture.vic.gov.au/dryseasons for the latest events.

Other Support

Additional support from the Victorian Government is available through groups such as the National Centre for Farmer Health and additional funding has been provided to local health services to support mental health initiatives.

Rural Assistance Commissioner Peter Tuohey has been active in the area and continues to engage with farmers over the phone during social distancing restrictions.

Dry Seasonal Conditions Coordinator Sue McConnell is available for advice about what's available and to share information from across all levels of government and other agencies helping farmers. Sue can be contacted by email at Sue.McConnell@agriculture.vic.gov.au

Further Information

The Rural Financial Counselling Service continues to provide free financial advice to farmers locally, contact the Sun RFCS on 1300 769 489 or visit www.sunrcs.com.au/ for more information.

Sue McConnell, Agriculture Victoria's Dry Seasonal Conditions Coordinator

AGRICULTURE VICTORIA

Consistent benefits from deep ripping sandy soils in the Victorian Mallee

By Michael Moodie

Farming Systems Research Agronomist, Frontier Farming systems, Mildura

This article reports on the latest findings from local R&D trials investigating deep ripping and soil amelioration approaches to increase productivity of Mallee Sandy Soils.

Key messages

- Consistent first-year yield responses to deep ripping have been measured on Victorian Mallee sandy soils, with yield benefits commonly 0.5 to 1.0 t/ha in the first season following deep ripping.
- Short-term yield responses to deep ripping in the dry years tested have not been improved through additional inputs of fertiliser or organic matter (OM) on sandy soils in the Victorian Mallee.

Brief background

There is considerable interest in strategic deep tillage with/without agronomic amendments (fertilisers, organic amendments) aimed at overcoming physical constraints and increasing water and nutrient supply within the soil profile. Strategic deep tillage includes ripping or deep soil mixing and inversion operations (i.e. spading, Plozza Plow) to depths of 30cm and more. To explore this further, replicated trials have been established across four sites in the Victorian Mallee; Ouyen (2017), Carwarp (2018), Kooloonong (2019) and Tempy (2019), with further sites to be established in 2020.

Nutrient placement (Ouyen, 2017-19)

This trial investigated three key fertiliser factors; the depth of placement (surface band at 7.5cm deep, deep band at 20cm deep and deep ripped band at 30cm deep), the nutrient source (N only or a package of N, P, K, S, Zn, Cu, and Mn) and the frequency of addition (all in 2017, or an annual approach of equivalent total input) supplying 90kg N/ha in total. All plots received an annual baseline addition of 20kg N/ha as di-ammonium phosphate (DAP) at sowing and top-dressed application of ammonium sulphate during tillering. The trial was sown to Spartacus barley in 2017, Kord Wheat in 2018 and Spartacus barley in 2019.

Organic matter placement (Carwarp, 2018-2019)

This trial compared the impact of physical intervention alone (deep ripping, spading or a combination of the two), to physical intervention combined with incorporation into the surface soil or deep placement of lucerne hay at 6t/ha (Table 1). For incorporation, lucerne hay was spread on the soil surface before spading with Farmax spader supplied by Groocock Soil Improvement

Deep ripper in action at the Carwarp trial site

Treatment	Physical disturbance	Depth of disturbance (cm)	OM addition (6t/ha lucerne)	Depth of OM placement (cm)
Control	Nil	Nil	+/-	Surface
Spade	Rotary spade	30	+/-	Surface-30
Deep rip_30	Deep rip	30	+/-	30
Deep rip_60	Deep rip	60	+/-	60
Deep rip_30/60	Deep rip	60	+/-	30+60
Spade + deep rip_60	Rotary spade + deep rip	30+60	+/-	Surface-30 + 60

Table 1. Treatments included in the organic matter (OM) placement trial at Carwarp, established 2018.

(http://www.spaders.com.au/). For deep subsoil placement, the same lucerne material was pelletised and metered at a controlled rate behind the rip tine at depth. Deep ripping operations at 30 or 60cm depth were completed with a Tilco® ridged shank at 56cm spacing. The trial was sown to Spartacus barley in the fist season (2018) followed by Razor Wheat in the second year (2019).

Deep ripping with organic matter (Tempy, 2019)

The Tempy trial was sown to Barley in 2019 and comprised of five treatments to compare deep ripping only with inclusion plates and OM addition (details below). All deep ripping treatments were implemented to a depth of 50cm with a tine spacing of 56cm. The OM used was a chicken litter compost blend, applied at 5t/ha (https://www.peatssoil.com.au), in the following treatments;

- control (undisturbed)
- deep ripping (50cm) with rigid shank (Tilco)
- deep ripping (50cm) with inclusion plate (Tilco) operating 150mm below soil surface
- deep ripping (50cm) with inclusion plate (Tilco) plus OM surface applied
- deep ripping (50cm) with OM deep placed behind the ripping shank.

Break crop response to deep ripping and organic matter (Kooloonong, 2019)

The Kooloonong trial was established for a range of break crops; lupin, lentil and chickpea. Each trial comprised of four treatments arranged in a factorial design;

- +/- deep ripping (50cm depth with tine spacing of 56cm)
- +/- surface OM application at 5t/ha (chicken litter compost blend https://www.peatssoil.com.au).

Results/findings

Despite below average rainfall throughout the first three years of the project, positive yield benefits have been observed following deep ripping across all four trial sites in the first season. At the Ouyen trial (2017, year 1) deep ripping at ~30cm provided a yield benefit of 0.8t/ha over the control and the pre-drilled fertiliser treatments (Figure 1). This result reflected a reduction in penetration resistance measured under the deep ripped treatments.

Following the single ripping event at Ouyen in 2017, significant yield benefits were observed for two subsequent seasons, but not in the third season, providing a cumulative benefit of 1.5t/ha. Where ripping was repeat applied on an annual basis, positive yield responses were observed in all three seasons (Figure 1), with cumulative benefit over the control of 2t/ha.

In the first year of the Carwarp trial, mechanical disturbance to 30cm by rotary spading or deep ripping resulted in additional grain yield of 0.5t/ha compared to the unmodified control yield of 0.55t/ha (Figure 2). Deeper ripping to 60cm did not provide a significant yield increase over working to a depth of 30cm only. These responses were observed under very dry conditions, with only 75mm of rainfall post sowing. Another drought was encountered in 2019 with similar low rainfall during the growing season and very little rainfall over the summer fallow.

Consequently, a negative yield effect of 0.5-0.6t/ha was observed in treatments where deep ripping was conducted to 60cm in the previous season. The mechanism of this result is not clear and is still being explored.

In 2019, new sites were established at Kooloonong (Figure 3) and Tempy (Figure 4) demonstrating yield gains across several crop types. Comparing grain legumes at Kooloonong, deep ripping significantly increased the yield of lupin, lentil and chickpea by 0.4, 0.4 and 1.0 t/ha respectively. At Tempy, deep ripping provided a 0.7t/ha increase in barley yield over the control, however adding inclusion plates did not provide any advantage over deep ripping with a ridged shank tine.

While deep ripping has provided clear benefits across these four trial sites, the addition of inputs such as OM or additional fertiliser did not show consistent and/or economic benefits under dry trial conditions. Improving inputs over and above good agronomic practice through subsoil placement (30cm or deeper) of nitrogen or a broader nutrient package (P, K,

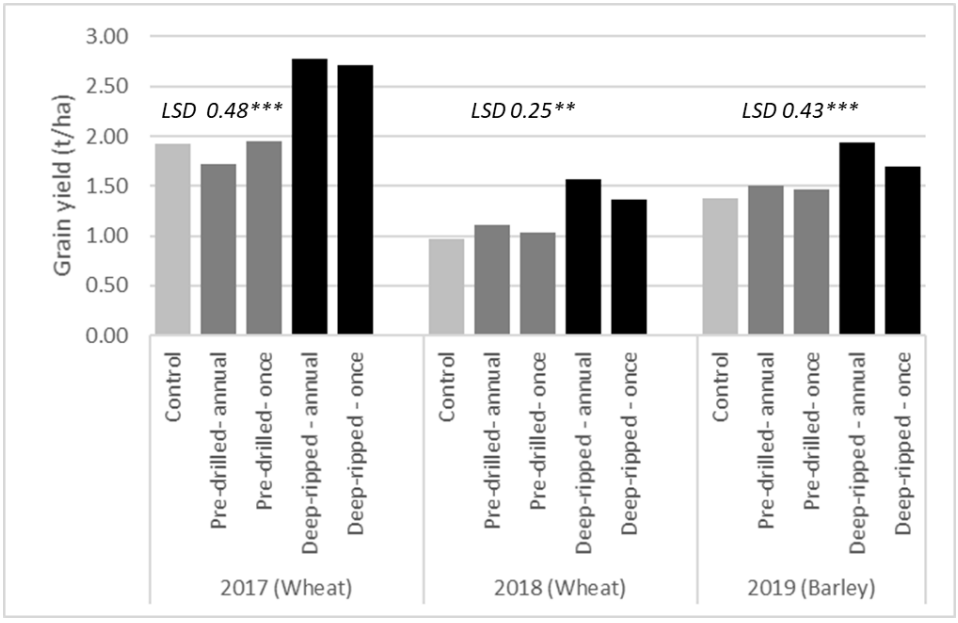


Figure 1. Grain yield (t/ha) response at Ouyen to pre-drilling or deep ripping implemented prior to sowing in (once) or in each season (annual). Only the control treatments are presented which all had equivalent rates and placement of nutrient.

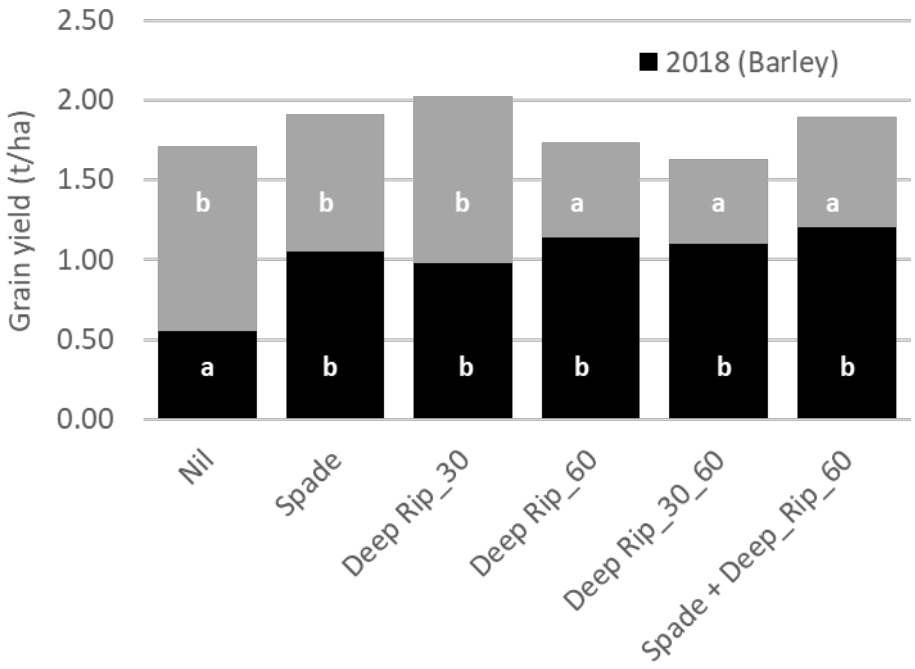


Figure 2. Grain yield (t/ha) response at the Carwarp site to deep ripping and spading treatments without organic matter (OM) addition over two seasons (2018 and 2019).

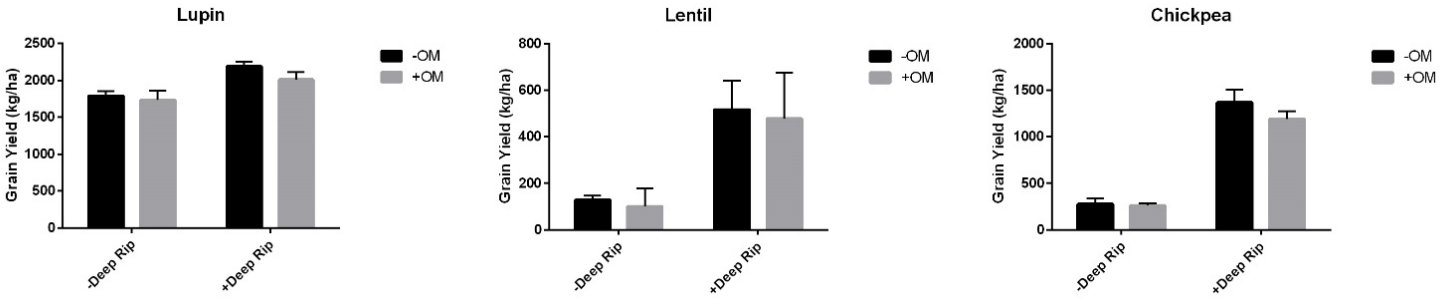


Figure 3. Grain yield of lupin, lentil and chickpea at Kooloonong in 2019 in response to deep ripping and organic matter (OM) addition. Error bars are standard error of mean (SEM).

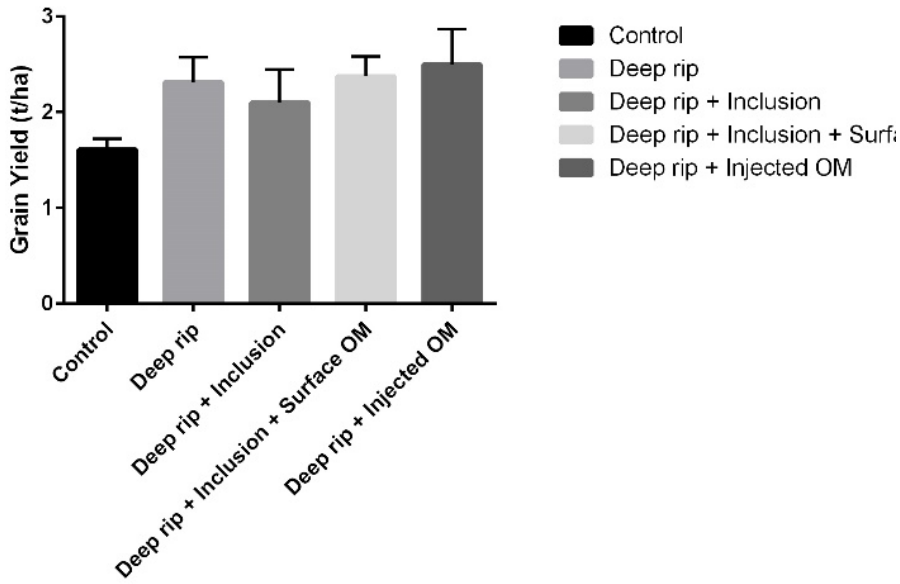


Figure 4. Grain yield of barley in response to treatments implemented at Tempy in 2019. Error bars are standard error of mean (SEM).

S, Zn, Mn, Cu) did not provide a yield benefit at Ouyen. A sister trial at Ouyen looking at the incorporation of organic inputs with rotary spading showed a positive response to the addition of chicken litter and compost (Moodie et al. 2019). However, this effect was unable to be replicated with similar organic inputs at the Tempy and Kooloonong sites in 2019. Lucerne hay was used as an organic source at Carwarp with no positive yield impacts observed across the first two, albeit very dry, years of the trial.

Implications of the findings

The primary constraints to crop water-use in deep sandy soils of the Victorian Mallee appear to include physical barriers to root growth, which restrict uptake of water and nutrients from the subsoil layers. Acidity, strong repellence, and subsoil toxicity were not primary constraints at the focus research sites in this project. Provided there is reliable subsoil moisture, ripping to a depth beneath hard compacted layers provides a good starting place for growers aiming to improve under-performance.

Deep ripping alone provided more consistent yield responses compared to combined approaches, looking to physically ameliorate compaction and boost profile fertility through incorporation of high N organic amendments, although the seasons were drier than average when nutrient responses are expected to be minimal. Before undertaking a deep ripping program, growers should assess the type and depth of the constraint, and choose a ripper which can work into, and under, the compacted and consolidated layers. In some cases deeper ripping operations requiring greater draught are more costly than shallower tillage and do not necessarily lead to higher yield benefits.

Further information

For further information contact:
Michael Moodie
Michael@frontierfarming.com.au
Phone: 0448612892

References

• Moodie M, Macdonald L, Correll R (2019) Deep ripping: an effective first step to lift productivity on deep sands in the Victorian Mallee? In 'Cells to Satellites'. (Ed J. Pratley). Proceedings of the 19th Australian Society of Agronomy Conference,25-29 August 2019, Wagga Wagga, NSW, Australia © 2019. (http://www.agronomyaustraliaproceedings.org/).

Acknowledgements

Trials were undertaken as part of the research and validation work within the GRDC project; 'Increasing production on sandy soils in the low-medium rainfall areas of the southern region' (CSP00203). The trials are a collaboration between Frontier Farming Systems with Mallee Sustainable Farming, CSIRO and UniSA

Capturing the Value of Pulses On-Farm

By Alex Clancy, Audrey Delahunty, James Nuttall, Ashley Wallace, Joe Panozzo, Sahand Assadzadeh and Cassandra Walker.

Agriculture Victoria

Background

Pulse crops are an important part of cropping rotations in broadacre systems across Victoria, providing growers the benefits of nitrogen fixation, weed and disease breaks as well as being a high value crop. Pulse crops are traded based on broad quality grades which are determined subjectively and heavily influenced by visual characteristics e.g. seed shape, size and grain colour. These quality attributes are strongly influenced by a range of abiotic and biotic stresses; including heat waves, frost during grain filling and disease, which can cause discolouration, deformation and/ or shrivelling of grain (Fig. 1a). Like yield, grain quality typically varies across paddocks due to these stresses being attenuated by factors such as soil type, topography, landscape and nutrient availability. This variability can result in downgrading at receival, reducing the average price received across the entire crop.

Increasingly, growers are adopting technologies such as on-farm protein monitors to measure cereal quality, such as wheat and barley, measuring grain at or following harvest to ensure they receive maximum value for their grain. Opportunity exists to maximise on-farm profit through segregation of pulses based on objective quality attributes. Equipping growers with sensor-based tools that can be used (Fig. 1b), post-harvest, will enable informed decisions to be made on how, or where within a farming system to best capture the maximum value for the crop.

Problem

Currently, there is a lack of on-farm technology available to objectively segregate pulse grains based on quality, this has meant that growers can be restricted in their ability to meet specific markets (high-value food, export or stock-feed). New investment by Agriculture Victoria and the Grain Research and Development Corporation through the Victoria Grains Innovation Partnership, will address this gap in knowledge.

Opportunity

A new joint investment between Agriculture Victoria and the Grains Research and Development Corporation (GRDC) is aiming to;

1. Determine the influence of stress, such as frost or heat, on grain quality in pulses (lentil, chickpea and field pea).
2. Defining remote sensing spectral signatures that relate to variation in grain quality of pulses.
3. Develop tools using remote sensing technologies to segregate grain based on quality before it leaves the farm; at harvest and post-harvest (e.g. auger separation), thus capturing higher grain prices.

Recent advancements in sensor-based technologies have allowed for accurate and high-resolution assessment of grain quality. This research seeks to build on these principles by transferring lab-based sensor technologies to on-farm, similar to monitoring and mapping grain protein at harvest.

Research

In 2019, six paddocks were surveyed across Western Victoria (Fig. 2) to build knowledge of the influence of abiotic and biotic constraints and the interaction of landscape and paddock topography on grain quality in lentil.

Within each paddock, a spray track was selected where the maximum topographic and soil type variation was captured.

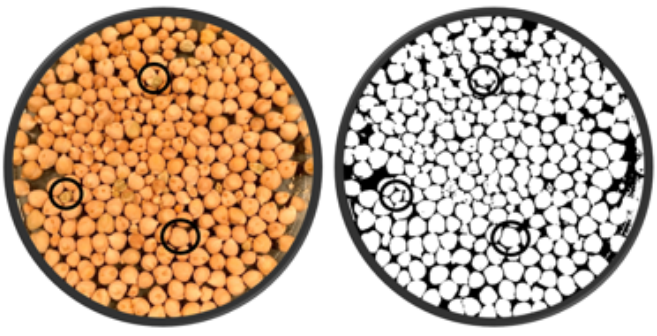


Figure 1. Frost affected chickpea grain, where frost occurred during pod-filling, which caused variable seed size and discoloration (left). An example of how image analysis can be used to identify variable grain sizes in a chickpea grain sample (right).

Along a 750 metre transect, lentil crops were assessed for growth, canopy temperature, yield and grain quality. Throughout the season, the lentils were monitored using a hyperspectral instrument to measure the light reflected by the canopy. These measurements will indicate whether the reflectance of the canopy in-season, can be utilised to predict grain quality at harvest.

This work has confirmed that quality defects increase with the incidence of extreme temperature stresses during grain filling. For example, frost (<0○C) during flowering was shown to have no effect on grain quality of lentil, whereas frost during grain filling caused visible grain defects (Fig 3).

In 2020, this field survey approach will continue where there is greater sampling intensity to support robust calibration of remote sensing instruments. Ultimately this work will help to determine whether characteristics of lentil grain quality can be determined, and managed, similar to yield and protein.

Interested in getting involved?

We are seeking growers who would be interested in providing grain samples at harvest for sensor and laboratory analysis – data to be supplied to participants following analysis.

Acknowledgements

The authors would like to gratefully acknowledge the participating growers and their families, Darrell Boxall, Rob Cole, Hayden Grant, Peter Growler, Lucas Puckle and Jason Robinson, for their time and use of their land during the 2019 season. The work was funded through a partnership between Agriculture Victoria and the Grains Research and Development Corporation (GRDC).

Figure 2. Locations of paddocks surveyed for lentil quality in 2019.

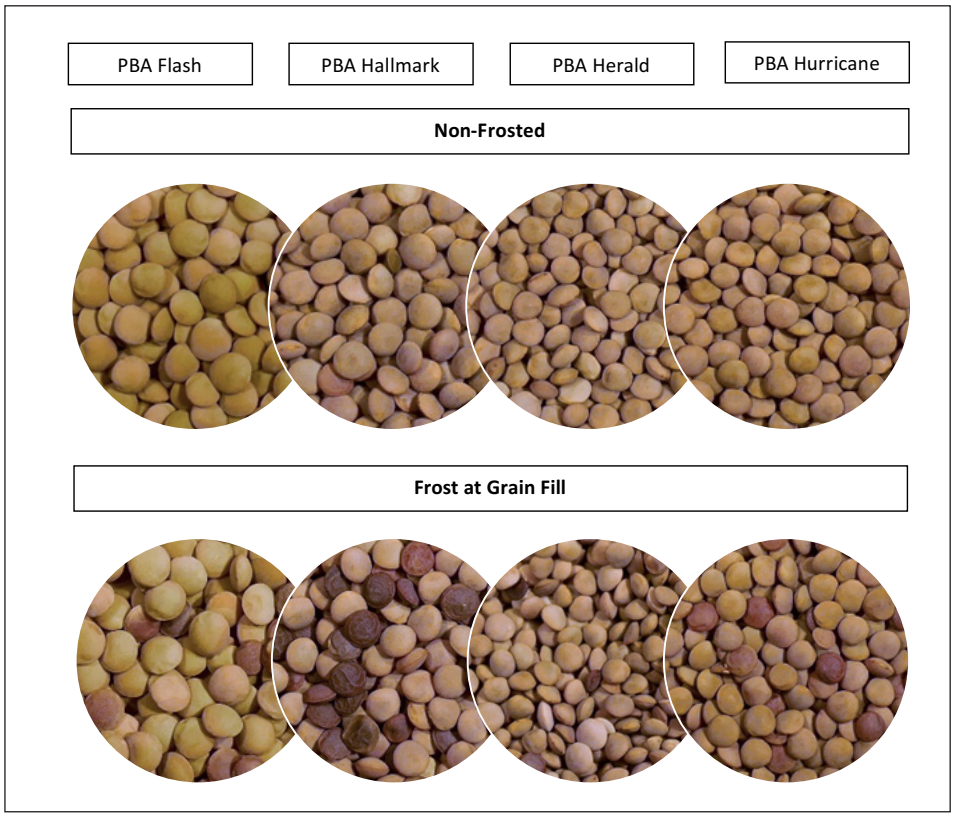


Figure 3. Lentil grain (cv. PBA Flash, PBA Hallmark, PBA Herald, PBA Hurricane) differentially affected by frost during the grain filling period.

Further Information

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AGRICULTURE VICTORIA

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

MSF Farm Talk Podcast Launch

By Tegan Buckley

Mallee Sustainable Farming,Communications and Media Manager

Mallee Sustainable Farming recently launched the 'MSF Farm Talk Podcast' which proudly brings Farmers, Researchers and Ag Industry connections together to chat innovative farming practices to build a sustainable farming future for Mallee growers.

Given that MSF has been at the forefront of delivering research in the Mallee for the last 23 years there is plenty to share including the latest in farming systems work, Mallee seeps, livestock grazing, sandy soil improvements, farmers success stories and more!

"We have so much research written in scientific papers and articles and it's time to bring it to life and make it more accessible so busy farmers can listen to researchers and consultants or other farmers while they are out in the tractor or driving around their farms," says Tanja Morgan, MSF Program Manager.

The first handful of episodes to go live was produced in collaboration with Agriculture Victoria called "Mallee Farming AgVic Series."

This series was produced to assist farmers experiencing drought and dry seasonal conditions. The development of the episodes included in the Mallee Farming AgVic series was funded by the Agriculture Victoria Drought Program. www.agriculture.vic.gov.au/dryseasons

Mallee Farming AgVic Series host, Drew Radford, speaks with a range of Ag specialists to bring updates, new findings, ideas and insights on farming in low-rainfall Mallee regions of SA, VIC & NSW with particular focus on soil sampling and surviving through dry times.

Another series recently released on the MSF Farm Talk Podcast, 'Tackling Weeds Together,' features one introductory episode (more to come in due course!)

Dr Rick Llewellyn (CSIRO & MSF Director) chats with Tegan Buckley (MSF) about an exciting new project that MSF is involved in.

"This new project focuses on Area Wide Management for cropping systems weeds, investigating the weed management, social and economic opportunity. The

The new MSF Farm Talk Application

aim of this project is to take a new approach on weed management," says Tegan Buckley, MSF Communications and Media Manager.

The project will work across three pilot areas: the Darling Downs, the Riverina, and Sunraysia. By understanding the benefits and key principles which influence successful area-wide weed management, localised approaches can be designed and implemented in other regions.

"We're keen to communicate key findings and milestones that come out of this exciting project, in particular, with our focus being on the Sunraysia region. We're encouraging Mallee farmers to get involved in the project. So, if you're a farmer and have weed issues, get in touch with the project team!" says Tegan Buckley.

But wait, there's more! MSF are regularly releasing new podcast episodes and series.

"Topics ranging in farmer health, sandy soils, livestock grazing, and ground cover management strategies are all in the works so keep an eye on our Social Media accounts and the MSF website for more episodes to come!" says Tegan Buckley.

Listen to the MSF Farm Talk Podcast either via the MSF website www.msfp.org.au/podcast or through Spotify, Apple / iTunes or Google Podcasts!

About Mallee Sustainable Farming (MSF)

MSF brings farmers and researchers together to build more efficient, profitable and sustainable farming businesses in the low-rainfall Mallee region across New South Wales, Victoria and South Australia.
In collaboration with Australia's best agricultural and scientific organisations we're delivering industry leading research into no-till systems, soil management, crop rotations and nutrition, soil microbiology, environmental sustainability and agronomy that's changing the face of farming in the Mallee.

Our farmers access the latest developments in sustainable farming methods that are tested on farms in their region and proven to increase productivity, sustainability and profitability.

Did you know that MSF membership is free!? Be sure to head on over to our website and check out the many perks of being a member of Mallee Sustainable Farming.

Contact MSF

Email: admin@msfp.org.au
www.msfp.org.au

Mallee Sustainable Farming

Mallee Farming AgVic Series host, Drew Radford in action.

Inter-row surface cover to reduce evaporation and increase light interception by wheat

By James Nuttall, Audrey Delahunty, Garry O'Leary, Alexander Clancy, Ashley Wallace
Agriculture Victoria

Testing the benefit of reducing inter-row evaporative losses in-crop and manipulating inter-row albedo on wheat growth and yield.

Key messages

- Protecting the crop inter-row using a PVC cover increased wheat yield by 10% in 2019 and 50% in 2018, demonstrating the benefit of water conservation and/or concentration of water shed.
- The colour of the PVC cover modified the light available to the crop and canopy temperature, where a highly reflective inter-row surface increased biomass at flowering.

Background

Managing the inter-row regions of crops by manipulating the surface albedo (reflectance of light or radiation from a surface) and protecting against evaporative losses from soil may improve yield stability of crops. Within rain-fed cropping environments, rainfall during the season can be unreliable, where water storage and conservation within the soil for crop use is vital for buffering dry periods.

The surface albedo and corresponding reflective properties of the inter-row region of crops are likely to influence soil and canopy temperature and the amount of reflected photosynthetically active radiation (PAR) intercepted by the crop. For example, dark coloured soils will absorb more radiation and may increase canopy temperature and stress. If these principles can be demonstrated, then management practices that manipulate albedo, such as canopy shape and surface cover may provide yield benefits, through increasing the proportion of water used by the crop compared with evaporative losses.

Method

A field trial was sown (cv. Kord CL wheat) at Kalkee, Victoria in 2019 (21 May 2019) on a grey Vertosol.

Inter-row cover treatments were:

Protection method (nil; PVC - 225 mm half pipe cover; spray-on polymer (alginate based) and stubble mat at 6t/ha).

Figure 1. Comparison of inter-row white and grey PVC covers in field wheat.

	Flowering biomass (t/ha)	Yield (t/ha)	Grain number (per m2)	Kernel size (mg)	HI
Control	9.83	3.72	11860	32	0.340
PVC white	10.26	4.13	12184	34	0.348
PVC yellow	10.31	4.10	11487	36	0.359
PVC grey	9.50	3.64	10508	35	0.355
Polymer	9.95	4.03	11926	34	0.356
Straw	9.48	3.51	10583	32	0.340
lsd (P<0.001)	0.61	0.33	1100	3	0.013

Table 1. Comparison of wheat (cv. Kord CL) growth for a range of inter-row cover (protection) methods applied from mid-tillering to maturity and are compared to a soil (control). HI, harvest index; lsd is least significant difference.

	Heat sum (crop canopy)	Photosynthetically active radiation (PAR)	
		downwards	reflected upwards
	(°C.hr >32°C)	(µmol/m^2/s)	(µmol/m^2/s)
Control (soil)	106	2487	297
PVC white	110	2528	1096
PVC yellow	125	2567	901
PVC grey	152	2541	296

Table 2. Comparison of micro-climate effects of the PVC inter-row covers due to colour difference and are compared to a control soil. The heat sum is calculated as the sum of °C above 32°C at the crop canopy during the period 5 days prior to crop heading to 5 days post-flowering.

Inter-row albedo where PVC half pipes were finished in three different colours;

- White (maximum reflection)
- Yellow (medium reflection – straw colour)
- Grey (low reflection – grey clay soil).

Results/ Interpretation

Crop growth up to flowering across all inter-row protective treatments was equivalent to the uncovered control, where on average total biomass was 9.9 t/ha (Table 1). For crops where white or yellow PVC interrow covers were applied, flowering biomass was 8% greater than for the grey PVC cover. Comparison of the photosynthetically active radiation (PAR) or light reflected from the white and yellow covers was over three times that from the grey cover (Table 2), indicating that early crop growth may be stimulated by the increase in PAR. For an equivalent trial in 2018, where there was no soil water reserve at sowing, and decile 2 growing season rainfall, the white PVC inter-row cover significantly increased biomass at flowering by 23% (3.4 vs 4.1 t/ha - cv. Scepter).

Wheat yield varied across treatments; white and yellow PVC inter-row covers significantly increased yield by 11 and 10% respectively compared with where there was no inter row cover (Table 1). This increase in yield was due to an 11% increase in kernel size, which was potentially linked with reduced water stress during grain-filling. Crop canopy temperature were higher for the grey PVC treatment with greater heat stress (temperatures above 32°C) between head emergence and flowering (Table 2).

Implications of the findings

In the future, optimal coloured polymer formulations which protect crop inter-row from evaporation and manipulate surface albedo may provide industry with a management option that increases yield, particularly in dry seasons. An important consideration to the development of polymer formulations on-farm is the cost and logistics.

Further information

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Case study - Ian Brown, Cowangie

By Rachel E Jacobson

Agriculture Victoria

The design of Ian Brown's containment areas on his Cowangie property in the Mallee makes the movement of sheep in and out a one-person job. Having been used on his original family property, when he purchased additional land, he planned a design that would make working stock a simpler task.

Ian said the 'wagon wheel' design he used saves time and frustration for handlers and reduces stresses on sheep.

Site selection

After experiencing problems with poor drainage at an existing area on his farm, Ian's priority was to select a site on higher ground with well-draining soil. The area at Cowangie is on sandy-loam soils, with a gently-sloping site and Ian said stock remained relatively dry underfoot, even after substantial rain. Iron panels have been installed on fences for shade and windbreaks and existing trees within are fenced for protection.

Proximity to other infrastructure was also important when choosing a site and the areas are located within walking distance of the existing shearing shed and sheep yards, allowing them to also be used during other activities including shearing. They are securely linked to the sheep yards and shearing shed via a laneway, allowing stock to be funneled simply and efficiently into and out for handling and management.

Water

The Brown's property accesses reliable bore water supply from GWM Water's Murrayville Groundwater Management Area. Water from the system is stored on-farm in a 25,000-litre tank and delivered by pressure pump directly to troughs in the yards. It can be gravity-fed in the case of power failure.

Ian has trialed smaller 50-litre stock watering troughs, 2-3 per pen, mounted approximately 60 cm from the ground. He now uses them in preference to the traditional larger concrete troughs on the ground.

"Constructing the water troughs this way stops the sheep walking through the water, there are no problems with faeces in the water, less food transferred into the water and they're very easy to clean each day."

Design and feeding

The wagon wheel design contains eight yards, each approximately 2,500 square metres, and each with a holding capacity of approximately 300 sheep. The wedge-shaped areas are about 100 metres long. The mouth is a four-metre stock gate, funneling out to a far-end width of approximately 50 metres. Costs have been kept down with the use of 1.15 metre ringlock, rather than mesh panels, and also by using treated pine posts.

"A lot of people think a smaller area is better, but the shape of these pens overcomes the problems you can have getting

Cowangie farmer Ian Brown. Photo Agriculture Victoria

sheep to leave containment where they're well-fed, happy and comfortable," Ian said.

"I really prefer a larger area because there isn't the bank up of faeces and straw and the area stays in much better condition when it's wet," he said.

"I also think sheep need to exercise and they will do that if they're happy and on good feed. You can see the stock exercising up and down the pens kicking and jumping. You know they are content. A bit of space is better for the animals and puts less pressure on fences and posts."

Maintenance

During ideal seasonal conditions all grain, hay and straw is sourced from the property. Hay and straw is fed from the ground and the grain ration is available on slow-feed from commercial feeders, which are replenished every 3-4 days. Ian feeds a mix of lupins and oats, supplemented when required with barley and wheat. The pens are inspected, and water troughs are cleaned every day.

Management

The Browns use their yards to allow pastures to establish and recover. Stock arriving on the property are cleaned in the containment yards, branded, and crutched or shorn. "Managing for disease and the health of the animals is critical," Ian said.

"We walk the yards every day and the close proximity to the sheep means you are quick to identify any health issues. The containment areas make it easy to isolate problems. They also help you to identify shy feeders and you're able to remove them and place them together, so they do better.

"We vaccinate all sheep that come onto the farm with a six-in-one vaccine, and again before they get locked up. It's more expensive, but it covers worm-drench and vaccination for pulpy kidney, tetanus, black disease, oedema and blackleg.

"We're always learning, but containment areas are an important part of our operations. They are another tool in the kit. I think a lot of people could benefit from incorporating it into their system," Ian said.

Photo 1. 50lt cattle water troughs

Photo 2. Corrugated iron for shade

Photo 3. Laneway linking SCA to sheep yard

Further information

For more information on managing during drought and dry seasonal conditions visit www.agriculture.vic.gov.au/dryseasons, contact your local Agriculture Victoria office or call 136 186.

AGRICULTURE VICTORIA

New Mallee trial investigates the relationship between Nitrogen and Soil Carbon

By Kate Maddern

Research Agronomist, Birchip Cropping Group

A new research project, being undertaken by Birchip Cropping Group (BCG), is investigating ways to improve crop biomass production and yield on the poor performing sandy soils common across the Mallee.

The project, supported by the Mallee CMA, through funding from the Australian Government's National Landcare program, is investigating the relationship between increased biomass production through targeted nitrogen (N) applications and whether these practices can improve soil carbon levels under local conditions, and if so, the degree to which this can be achieved. The project is being run in parallel with a secondary project with support from the Wimmera CMA which is investigating the impacts of a variety of soil amelioration techniques including deep ripping, claying and manure spreading on crop biomass and yield.

"Every farm has patches that for some reason, year after year, fail to perform as well as the rest of the paddock. Even with adequate nutrition, disease and weed control" BCG Research Agronomist Kate Maddern explains "crops grown in these patches often don't produce as much biomass during the season, which can carry through to lower yields and/or poor quality at harvest."

Poor performing patches can be due to underlying soil constraints, such as differences in water-holding capacity, a compaction layer, a difference in soil type, or other issues such as sodicity, nutrient deficiencies, salinity or acidity/alkalinity and nitrogen deficiency. Research also suggests that depleted levels of soil organic carbon can also be a contributing factor in crop performance.

"Soil organic carbon is an important contributor to the chemical, physical and biological fertility of soils. Increasing soil organic carbon can help to increase nutrient availability, help to improve soil structure and water-holding capacity and stimulate the growth of beneficial soil micro-organisms" Ms Maddern continued "However, when lower plant production is combined with consistent organic matter removal, through hay cuts, stubble burning or harvesting, soil organic matter and soil organic carbon, the little bits of plant matter in the soil and the carbon derived from that plant matter, can be depleted"

Applicable Learnings from the Wimmera CMA Soil Amelioration Trials

In 2019, BCG, supported by the Wimmera CMA, through funding from the Australian Government's National Landcare program, developed a trial to investigate whether soil constraints could be addressed, and biomass improved, through a combination of addressing sub-soil constraints and whether these practices could increase levels of soil organic carbon. A range of commercial practices were investigated, including clay spreading, deep ripping, fertiliser and manure spreading. The early results of a trial conducted on a poor section of an otherwise productive paddock, near Lubeck in the Wimmera, shows the potential of soil amelioration for Mallee farmers. The trial was located on a sandy gravel rise typical of a Wal Wal Sand, whereas the rest of the paddock was a higher performing black/grey clay loam (Figure 1).

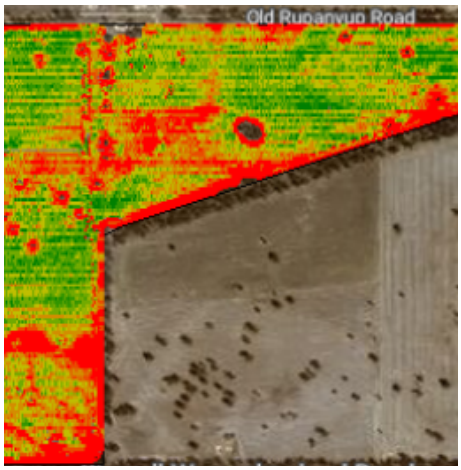

Figure 1: Location of trial (black outline) on 2018 yield map generated on header, where green is higher yielding and red is lower yielding.

The trial showed promising early results, with clear differences in biomass and yield being seen between the different treatments throughout the season

Plant establishment was significantly impacted in those plots that received the clay spreading and deep ripping treatments – unripped treatments showed higher plant establishment than the ripped treatments. Those plots spread

with clay also showed lower plant establishment than those that were not (Figure 2.)

Applying 20 t/ha of manure significantly increased biomass (confirmed by NDVI data) and yield when compared to the control, ripped and clayed treatments. However, manuring also increased protein and screenings in the wheat quality, indicating that the bulkier biomass had 'hayed off' in the dry spring, as the water holding capacity of the sandy soil proved too low for the crop to access adequate moisture to finish.(Figure 3.) (Figure 4.)

Ripping resulted in lower yield than the unripped treatments, with some differences between treatments being statistically significant (Figure 5.) This could potentially be due to the reduced plant establishment seen in the ripped treatments. However, there was no yield penalty associated with the reduced plant establishment and the clay treatments.

A more detailed report on the results of the trial can be found on the BCG website (www.bcg.org.au).

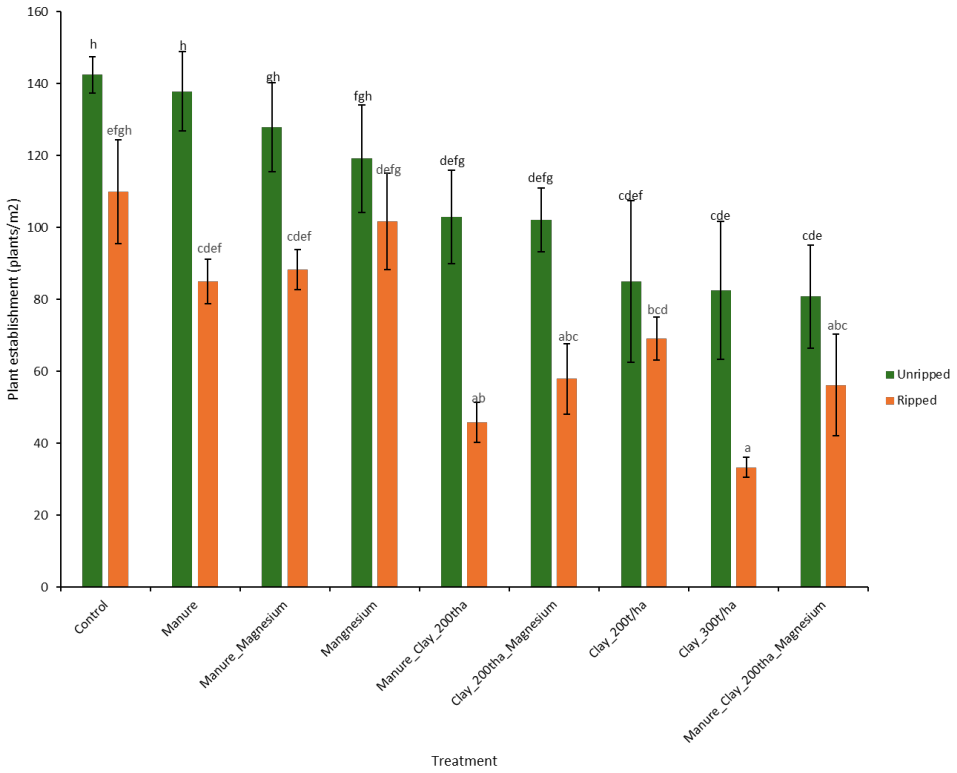

Figure 2:Plant establishment (p<0.001, LSD=34.25, CV=26.7% (95% confidence)) across treatments, displayed with standard error bars. Different letters indicate significant differences.

Overall, the trial demonstrated that the increase in biomass and yield from different soil amelioration techniques varies and does not provide farmers with a one-size-fits-all approach. It confirms that determining which soil amelioration technique best fits your farm and farming system requires an in-depth understanding of the local soil types, the soil constraints present and their impacts on production.

The trial also identified several considerations that farmers exploring deep ripping, claying or manuring should factor into their decision making:

1. When undertaking amelioration that alters the seed bed or sowing depth (claying, ripping, delving, spading etc.), there is a risk of poor plant establishment the following season. To

Figure 3: Visual differences in biomass between treatments at 2/9/19.

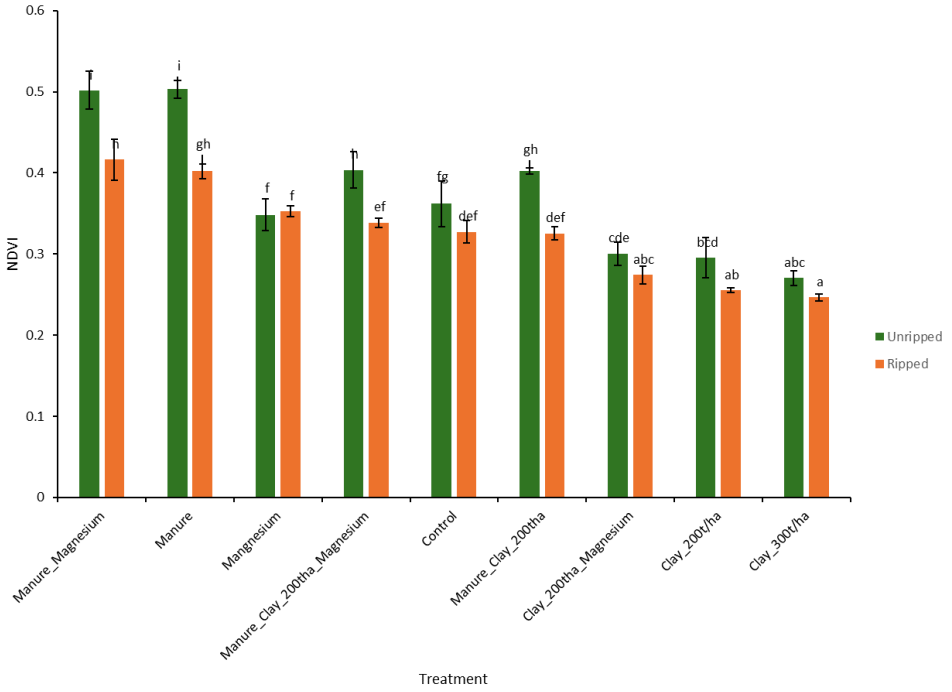

Figure 4: NDVI (greenness) response between treatments at 7/8/2019 ($p<0.001$, LSD=0.040, CV=8.1% (95% confidence)), displayed with standard error bars. Different letters indicate significant differences.

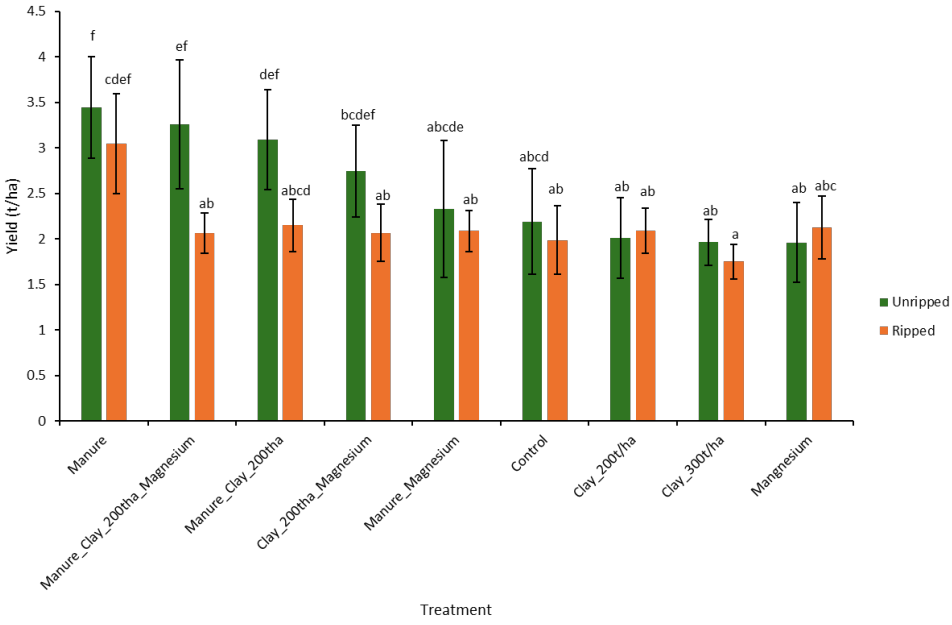

Figure 5: Yield (t/ha) across treatments ($p=0.008$, LSD=0.944, CV=28.2% (95% confidence)), displayed with standard error bars. Different letters indicate significant differences.

minimise the risk of poor establishment, consider cultivating, rolling or incorporating prior to sowing. Choosing a crop type and/or variety with longer coleoptile length may also help to mitigate the risks associated with variable seeding depth.

2. When ripping or claying, the removal of organic matter from the surface may make herbicides 'hotter', increasing the risk of crop phytotoxicity. Pay careful attention to labels to prevent this from occurring.

3. Alternatively, depending on the mode of action, placing large amounts of organic matter on the soil surface, such as chicken litter, may lead to herbicides binding the organic matter rather than reaching the target, potentially reducing herbicide efficacy.

4. Take steps to ensure that the amelioration technique being utilised doesn't cause a larger problem than the one you are trying to resolve. Undertake testing to ensure that ripping or claying do not bring sub-soil acidity, salinity or toxicities such as boron to the surface, where they can have a bigger impact than if they were at depth. Likewise, chicken manure varies from shed to shed. Testing the clay, manure or sub-soil through a laboratory before ameliorating ensures that you are aware of any potential issues – for example, the sample tested for this trial contained salt and boron.

5. If the laboratory results come back clear, consider ameliorating a section or strip in a paddock to ensure that this is the best technique for your soil type, and that you are made aware of any potential issues before conducting the amelioration on a larger scale.

6. While this trial saw a negative response to deep ripping in the first year, other trials have seen a positive yield response to deep ripping. When considering whether or not to deep rip, consider where you are most likely to see a positive response: responsive soil type (sands are more responsive than loams and clays), compaction is an issue at a depth that can be ripped, no other major soil

constraints present, having adequate stored soil water and that the machinery is physically able to rip to the required depth.

Establishing a Nitrogen trial in the Mallee

BCG, with the support of the Mallee CMA and LaTrobe University Associate Professor James Hunt, have finalised the design of a research trial located at Curyo in the Mallee to investigate the application of nitrogen (N) as it relates to soil carbon. The trial has been running for two years and is beginning to show interesting results, and the support from Mallee CMA will allow the trial to be continued for another four years.

"Research undertaken in 2018 determined that nitrogen underapplication is the biggest contributor to Australia's wheat yield gap. It is estimated that Australia currently produces 55% less wheat than it could with our current rainfall due to poor agronomic practices, with 40% of this yield gap being due to underapplication of nitrogen fertilisers." Ms Maddern explained when outlining the need for increased research "Due to the low amounts of nitrogen in the soil, if not enough nitrogen fertiliser is applied, crop yields will be lower than they should have been. Applying too much nitrogen can also cause problems, due to the increase in the cost of production and the increased risk of 'haying off' the crop in a drier season."

"This trial will investigate different nitrogen application rates and strategies that could be used as a tool to increase soil organic carbon, plant biomass and crop yield in Mallee farming systems."

Trial Objectives

Over the next four years, this trial aims to determine:

- Can nitrogen application rates and strategies increase soil carbon?
- Can nitrogen application rates and strategies increase crop biomass?
- Can nitrogen application rates and strategies increase crop yields?
- Can nitrogen application rates and strategies increase farmer profitability?
- Can a 'nitrogen bank' strategy provide farmers with a tool to decrease the complexity of making nitrogen decisions and better manage nitrogen in their farming system?

"Results from the research will be extended through a series of workshops and events will be held over the life of the project to share the results with Mallee farmers and answer any questions they may have – these will be promoted on the events page of the BCG website, through member communication and local and regional media" explained Tom Draffen, BCG Senior Manager Extension and Communication "however due to the restrictions on gatherings implemented during the COVID-19 outbreak in Australia, BCG have enacted a continuity plan in early March to ensure the success of our trials program – due to this the extension events planned for BCG Research Trials will be delivered as Webinars and Digital Workshops until restrictions are eased."

Further information

Information regarding upcoming events can be found at the BCG Website (www.bcg.org.au)

Acknowledgements

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The trial discussed in this article is supported by Wimmera Catchment Management Authority, through funding from the Australian Government's National Landcare Program.

Thank you to Mayo Park Farms for hosting the Wimmera trial and for providing machinery and time to implement the treatments.

Thank you to Paul Barclay for hosting the Mallee trial.

Benefits of a farm business check

By Adriana Robaina

Farm Business Economist, Agriculture Victoria

All businesses, farming or otherwise, have strengths, weaknesses, risks and opportunities.

The On-Farm Drought Resilience Grant Program has increased from $5,000 to $10,000 to boost farmers' access to professional services while still enabling them to invest in drought preparedness infrastructure.

Eligible farm businesses in the Millewa can now apply for:

- Up to $5,000 for business decision making activities (with no-contribution required)
- Up to $5,000 for infrastructure investments (with at least 50 per cent co-contribution required)

Eligible business decision making activities are those that will help farmers make decisions about how to manage drought conditions, reposition the farm business, improve on-farm practices or make a significant farm business change.

Why do a business check?

A business check (or profit and loss analysis) is used to identify the financial strengths and weaknesses of a business. It helps pinpoint the issues, can provide insights into the flow-on effects of your decisions, and makes a great starting point for planning the future with any family members involved in your business. A farm business check should involve an in-depth look at farm finances, including a detailed review of a profit and loss analysis, debt loading and equity.

Photo Credit: Mallee CMA

A farm business check can help you work towards achieving your goals, and provide indicators that can help with decisions such as:

- Is there more potential to develop the business with existing capital?
- Should you restructure finance?
- Are there opportunities to cut some costs with minimal to no impact on profit?

Ideally, farm business checks should be done regularly, using a range of performance indicators and seasons. It's important to know how profit varies with up and down years and where your business can leverage the positives and manage the threats under these conditions, this will help you decide on your business strategies.

As the business is analysed by others involved in your farm investment such as bankers and insurers, it helps to view the business from their perspective to understand what they are looking for.

Further information

Contact your accountant for further advice about undertaking a business check or profit and loss analysis.

For more information about the On-Farm Drought Resilience Grant and to apply, contact Rural Finance on 1800 260 425 or visit www.ruralfinance.com.au

For more information about available drought support support visit agriculture.vic.gov.au/dryseasons or call 136 186.

AGRICULTURE VICTORIA

Trace mineral deficiency in lambs this year

By Justine Severine

Agriculture Victoria

Recent rain has prompted Agriculture Victoria to issue a reminder to sheep producers about the potential for trace mineral deficiency diseases to affect their lambs this year.

Agriculture Victoria Senior Veterinary Officer Dr Robert Suter, said the early season rain that has been welcomed by producers across the state should result in good pasture growth throughout the winter. However, the flush of new pasture increases the likelihood of trace mineral deficiency diseases in lambs born in winter and early spring.

Dr Suter said trace mineral deficiencies can result from ewes grazing lush green feed during the last half of their pregnancy.
"These ewes are likely to have lambs with low or deficient levels of trace minerals selenium, copper, iodine and cobalt," he said.

"Sheep ingest several essential trace minerals from soil intake. This usually occurs when ewes graze short pastures after a dry summer and before the autumn break.

"When there is a lot of early season pasture growth, the intake of trace minerals via the soil is less likely to occur."

Growing animals, such as lambs, also have a higher demand for trace minerals than adult sheep and are likely to suffer a dietary deficiency sooner.

Dr Suter said trace minerals such as copper, cobalt, selenium and iodine are only required in small amounts but are still essential for optimal production, and for life.

Agriculture Victoria Senior Veterinary Officer Dr Robert Suter

The signs of deficiency vary according to the mineral involved:

- Copper deficiency presents most dramatically as enzootic ataxia (or 'swayback'), a condition causing paralysis of the hind limbs of newborn or very young lambs. Less apparent signs include steely wool, anaemia and reproductive loss in older sheep.
- Cobalt deficiency is an ill-thrift disease of reduced appetite and growth, decreased wool production, anaemia and poor reproductive performance. Affected animals often have 'white liver' disease. Diagnosis is based on vitamin B12 levels (vitamin B12 contains cobalt), and treatment is with vitamin B12.
- Selenium deficiency causes 'white muscle' disease with white lesions in the red skeletal and cardiac muscle tissue, leading to lameness or sudden death. Ill-thrift, reduced wool growth, and ewe infertility are also reported signs of deficiency.
- Iodine deficiency results in an enlarged thyroid gland, known as 'goitre' in lambs. There are effects on the developing foetus including reduced foetal size, brain retardation and increased lamb mortality.

Dr Suter said sheep producers in known deficient areas should review their trace mineral supplement strategies to ensure ewes have adequate levels to produce healthy lambs.

"Most of Victoria is iodine deficient; and an appropriate time to supplement ewes is mid-pregnancy," Dr Suter said.

"A good time to do this is at pregnancy scanning.

"Special care must be taken with supplementing ewes with copper, as sheep can be easily killed with relatively small amounts of copper."

Further information

For more information or advice speak to your local veterinarian or Agriculture Victoria animal health and welfare staff.

AGRICULTURE VICTORIA

Dryland farming communities to benefit from new information exchange network

By Glen Sutherland

Northern Mallee Regional Agriculture Landcare Facilitator, Mallee Catchment Management Authority

A new dryland farming-focused Community of Practice was recently launched to improve the flow of information between the research, extension, and industry sectors servicing low rainfall zones.

Twenty - three Regional Agriculture Landcare Facilitators (RALFs) working right across the dryland farming regions of southern Australia recently joined forces to create the Low Rainfall Zone Dryland Farming Community of Practice (LRZDF CoP). The formation of this CoP recognises the many commonalities shared by the low rainfall zones in terms of industry profiles, production systems, farm business models and production issues such as climate variability, weeds, disease, pests and protecting and improving the sustainability of soils. Often what happens in one region may have happened, or is about to happen, in another due to the different seasonal patterns across the continent. Strategies and management actions developed in one area to counter threats to production are, more often than not, relevant to other regions and other states. This is also true for research and development activities to improve farm productivity.

The clear aim of the CoP is to improve information flow between RALFs, mainly on the outcomes of cropping research and development, and sustainable agriculture activities. This improved exchange of knowledge will potentially provide increased benefits to farmers who may not otherwise be aware of the work. This will be achieved by RALFs disseminating new information through their local networks and engagement activities.

Another benefit of the CoP is the potential for early detection of emerging issues impacting farming and passing this information on to the relevant agencies for action. The CoP had its first (video conferencing) meeting in late May 2020 and members agreed to meet (including through digital platforms) quarterly. Work is also underway on establishing dedicated information exchange and communication channels, as well as document sharing arrangements to support the efficient and timely exchange of technical and other information.

One of the first agreed activities of the CoP is the cataloguing and sharing of information about research trials that are being established this season in each of the RALF's regions. The CoP members include RALFs working in low rainfall zones in the Western Australian cropping regions, South Australia, New South Wales, Victorian Mallee and the southern Queensland cropping regions. The members of the CoP are keen to increase the group's membership to include other relevant stakeholders such as farming groups, agronomy service providers and Research, Development and Extension (RD and E) organisations.

The national RALF program was established in 2018 and is a broad network of agriculture-focused facilitators based in each of the fifty-four natural resource management organisations across Australia. RALFs are supported by the Australian Government's National Landcare Program. RALFs directly engage with farmers, farming systems groups, community groups, agricultural industries and supporting agencies about emerging ideas, climate change related activities, land management practices and government initiatives to help improve the sustainability, productivity and profitability of agriculture.

Further information

For further information about the Low Rainfall Zone Dryland Farming Community of Practice please contact:

Glen Sutherland, Northern Mallee Regional Agriculture Landcare Facilitator
Email: glen.sutherland@malleecma.com.au
Phone: 0417 396 973

The Northern Mallee Regional Agriculture Landcare Facilitator is supported by the Mallee Catchment Management Authority, through funding from the Australian Government's National Landcare Program.

Revisiting the Baring Gypsum Wildlife Corridor after three years of revegetation works

By Gareth Lynch

Mallee Catchment Management Authority

There's promising signs at the Baring Gypsum Wildlife Corridor, with strong survival rates among native trees and shrubs since planting began three years ago.

The Baring Gypsum Wildlife Corridor begins at the Bronzewing State Forest, approximately 11km southwest of Patchewollock. Its aim is to link fragmented habitat and facilitate the movement of Malleefowl between Bronzewing State Forest and Wyperfeld National Park. This linkage helps reduce the isolation of fragmented populations, an important step in increasing the viability of Malleefowl populations in the area. It was identified as the highest priority corridor for revegetation in the Mallee CMA region in a 2014 report commissioned by the Victorian Malleefowl Recovery Group and produced by Ogyris Ecological Research.

The Mallee Catchment Management Authority (Mallee CMA) has worked with the Department of Environment, Land, Water and Planning (DELWP) on improving the corridor for several years. The first step was to protect the patches of remnant vegetation already present, as well as future revegetation plantings, from grazing by neighbouring stock. In early 2017, field officers from the Department's Forest Fire Management Victoria (FFMV) installed 4.7 km of stock proof fencing along the corridor's boundaries, protecting an area of 122 hectares. FFMV has

Photo 1: Baring Corridor

Photo 2: Revegetation and fencing undertaken in June 2017

Photo 3: 3 years after planting

continued to be involved with the revegetation works.

Revegetation works began in June 2017, with 13kg of indigenous seed and 5,500 tube stock planted across 40 hectares of the corridor. Six eucalypt species and a mixture of eight medium and small understorey shrub species were planted. Particular care was taken with the choice of the planting methods to optimise plant establishment in relation to the critical issue of soil moisture in our dry climatic conditions. A further 9,475 tube stock were planted between June 2018 and June 2020.

The site has been continually monitored to assess survival rates, with results varying based on soil type, rainfall and frost occurrence. The plantings in sandy soils have done exceptionally well, while frost has been a limiting factor, with survival rates lower in the frost-prone areas. Rainfall has been variable throughout the project duration. However, recent field inspections have shown a high survival rate among tube stock, with some evidence of the direct seeding germinating.

The Mallee CMA, along with its project partners, has identified further strategic landscape links for Malleefowl within the Bronzewing, Berrook and Yaapeet State Forest areas where value could be added to past works and additional Malleefowl corridors established. Funding provided by the Australian Government's National Landcare Program will allow further revegetation of existing Malleefowl habitat corridors in the identified areas. The delivery of works has been made possible through a successful partnership between the Mallee CMA, DELWP, Greening Australia and Ogyris Ecological Research.

Acknowledgements

This project is supported by the Mallee CMA, through funding from the Australian Government's National Landcare Program.

Further information

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Australian Government | National Landcare Program

Landcare in the Mallee – Mallee Regional Landcare Co-ordinator update

By Nelson Burand-Hicks

Mallee Regional Landcare Co-ordinator, Mallee Catchment Management Authority

Training

Training in grant writing, project management and governance is one of the key highlights of Landcare in the Victorian Mallee over recent months.

Mallee Landcare Facilitators recently completed grant writing and project management training. This training was delivered through video conferencing (over 5 sessions) to comply with new social distancing requirements under the COVID-19 guidelines. Positive feedback was received from participants, including the following quote from one our facilitators:

"The training provided great insights, tips and tricks in improving the readability and sentence structure within a piece of writing e.g. grant application or report. It was fantastic to be able to undertake the training in the current conditions."

To increase governance capacity, training was also made available for executive committee members of the broader Landcare community of Victoria, with two workshops on governing a community organisation delivered by webinar to comply with social distancing requirements. This allowed participants across Victoria to participate without having to travel. This training covered the following topics:

- Legal roles of committee/ board members as decision makers.
- Differences between governance and management.
- Legal structure and status of your organisation.
- Importance of rules and legal purpose or objects.
- Four key legal duties of committee/board members.
- Potential liabilities, protecting yourself and your organisation.
- Other relevant laws and additional resources.

These webinars have been recorded and can be made available. If you believe you would benefit from this training, please contact Nelson Burand-Hicks on 5051 4377.

Above: Pest cactus (left) and boxthorn (right) which has since been controlled at Hopetoun through the Victorian Landcare Grant 2019-20 program. Photo credit, Mallee CMA

Victorian Landcare Grant works update

Victorian Landcare Grants (VLG) are funded by the Victorian Government and delivered through the State's ten Catchment Management Authorities. Funding is provided for projects that address local, regional and state land and environment priorities.

In 2019-2020, Landcare groups within the Mallee CMA region were awarded a total of $246,433 under the VLG program. A total of 24 applications received funding for activities including pest plant and animal control, revegetation, biodiversity surveys and community works.

At this point, 50% of all the projects funded are complete, with the remainder to be finished by 30 November 2020.

The Hopetoun Landcare Group was one of the successful applicants, securing funding for pest plant and animal control

works. The works undertaken helped to protect and enhance endangered native vegetation classes and provided critical connectivity, important habitat and foraging opportunities for native fauna.

Regional Riparian Action Plan (RRAP) funded Landcare works

The Regional Riparian Action Plan is Victorian Government program to enhance the health of riparian land through on-ground works.

In September 2019 an Expression of Interest process was undertaken to gather applications from local groups keen to undertake pest plant and animal control works at Merbein, Wallpolla, Nyah, Lalbert or Tyrrell. Through this process, the Nyah Lions Club was successful in obtaining funding for pest plant and animal control across the environmentally and culturally significant landscape of Nyah-Vinifera Park.

The Nyah Lions Club has since engaged a local contractor to complete 15 hectares (ha) of rabbit fumigation and 250ha of pest plant control focusing on Weeds of National Significance.

Above: A contractor undertaking pest plant and animal control works at Nyah-Vinifera Park, through funding from the Victorian Government's Regional Riparian Partnership Program. Photo credit, Mallee CMA

Biodiversity Programs Helping the Mallee's Ecology Thrive

By Stephanie Walters

Mallee Catchment Management Authority

The Mallee Catchment Management Authority (CMA) works with communities across the region to ensure natural resources are managed in an integrated and ecologically sustainable way.

Through funding from the Victorian Government's Biodiversity Response Planning (BRP) and Biodiversity On-Ground Action (BOGA) programs, the Mallee CMA is delivering work to help protect threatened species.

Biodiversity Response Planning

The Mallee CMA BRP projects aim to reduce the impacts pest plants and animals have on threatened species within the Mallee region. These projects contribute to the protection of more than 200 native species within the Mallee region, including state and nationally-threatened species such as the Regent Parrot, Inland Carpet Python, Malleefowl and Murray-Darling Carpet Python.

Throughout 2019-20, the Mallee CMA has coordinated nine BRP programs, including:

- Annuello and Wandown: Enhancing Mallee to Murray bio links
- Cardross: Conserving biodiversity within a peri-urban landscape
- Controlling feral cats in the Mallee for improved management outcomes
- Improving conservation of the Southern Mallee Dunefields
- Mallee Parks: The Cowangie connection
- Robinvale to Nyah: Conserving Robinvale Plain and Murray Fan bioregions
- Safeguarding the Hattah Ramsar Lakes and Raak Plain Catchment Areas
- Tyrrell: Preserving an ancient salina landscape
- Yarrara Ridge: Conserving Victoria's semi-arid environments

Key achievements delivered during 2019-20 include:

- Completing weed, rabbit and fox control works within the Annuello Flora and Fauna Reserve, Wandown Flora and Fauna Reserve, Menzies Nature Conservation Reserve, the Mallanbool Flora and Fauna Reserve and Yarrara Flora and Fauna Reserve managed by Parks Victoria.
- Collaborating with Lower Murray Water to complete weed and rabbit control works on land within the Cardross Lakes system.

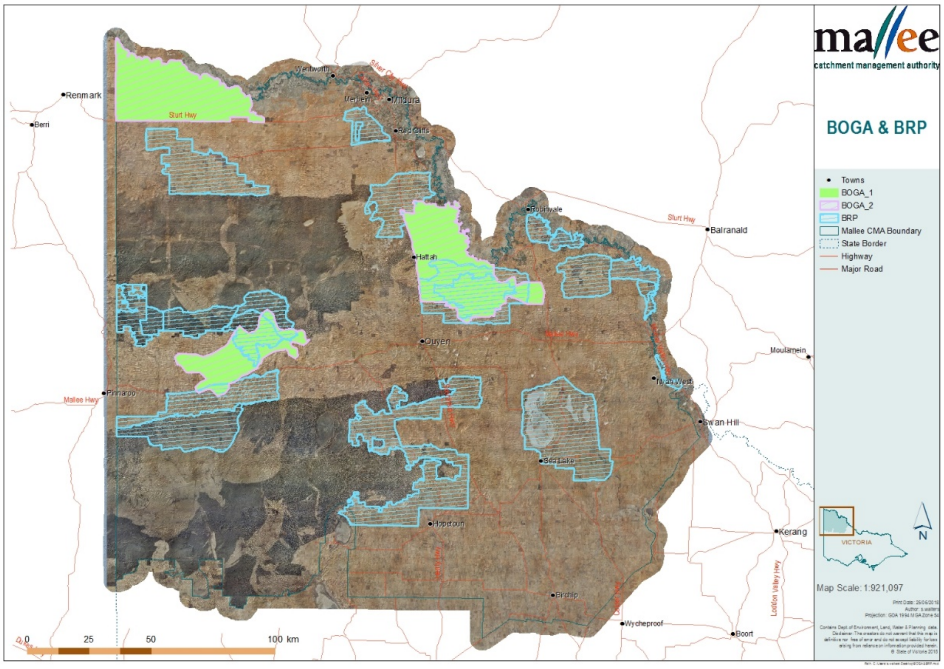

Figure 1: Spatial representation of BRP and BOGA project areas

Figure 2: Active Malleefowl nest identified during native flora and fauna assessments within the BRP project areas.

Figure 3: A carpet python which was identified during native flora and fauna assessments within the BRP project areas.

- Working with Yarriambiack Shire Council to complete weed and rabbit control works on land within the southern Mallee Dunefields area.
- Partnering with Mildura Rural City Council to complete weed and rabbit control works on land between the Murray Sunset National Park and Big Desert Dunefields.
- Completing pig and goat control works within the Carpul Wildlife Reserve, Lake Powell and Murray River Park, managed by Parks Victoria.
- Partnering with private landholders to undertake weed, rabbit and fox control on their properties near the Hattah Ramsar Lakes and Raak Plain Catchment areas.
- Collaborating with Buloke Shire Council to complete weed and rabbit control works on land within the Tyrrell landscape.

During all activities, native flora and fauna observations were recorded, including the following: brown snake, emu, malleefowl, kangaroo, sand goanna, cattle bush, black-faced cuckooshrike, Mallee ringneck parrots, noisy miner and wedgetail eagle. All native flora and fauna observations will be uploaded into the Victorian Biodiversity Atlas.

Biodiversity On-Ground Action

Work delivered under the Mallee CMA's Biodiversity On-Ground Action projects aim to reduce the impacts of pest, plants and animals on threatened species within the Mallee region. These works contribute to the protection of over 200 native species, within the Mallee region, including including state and nationally-threatened species such as the Regent Parrot, Inland Carpet Python, malleefowl and Murray-Darling Carpet Python.

Throughout 2019-20, the Mallee CMA completed the final year of projects that were funded for four years, including: Northern Mallee Woodlands

- Murray to Mallee Connections
- Mallee Dunefields to the Big Desert

Key achievements included:

- Successful native vegetation regeneration within the Lindsay and Mulcra floodplains, following the completion of pig and goat control over the past three years.
- Regeneration of native vegetation between the Murray-Sunset National Park, Hattah-Kulkyne National Park and Annuello Fauna and Flora Reserve, following the completion of stock exclusion fencing.
- Native vegetation regeneration within the Pink Lakes area following the completion of revegetation works. Regeneration was observed when vegetation had regular access to water.

Emerging market for alternative proteins an opportunity for Australian agriculture

By Lauren Sharkey

AgriFutures Australia

Research into the changing landscape of protein production in Australia estimates that there will be an additional opportunity of $19.9 billion for the sector by 2030, of which $3.1 billion is attributed to alternative protein categories.

There is good news for Australian protein producers, with a recent study concluding that there is more than enough room for both animal-based and alternative proteins in the Australian market. Forecast global demand for protein is strong and will accommodate growth in both sectors.

The newly released report, The Changing Landscape of Protein Production, funded by AgriFutures Australia's National Rural Issues Program and delivered by the Australian Farm Institute, provides ground breaking analysis which estimates there will be additional opportunities for the Australian protein sector by 2030. This includes $8.9 billion for Australian animal proteins, $7 billion for traditional plant-sourced proteins, while alternative protein products could deliver a $3.1 billion opportunity for Australian agriculture.

Alternative proteins are those foods that act as a substitute for traditional animal-sourced protein. This includes plant-sourced and non-traditional proteins including plant-sourced meat, dairy and egg substitutes, cultured or cellular meat, insects and algae.

AgriFutures Australia Managing Director, John Harvey said this research provides important analysis not only on the size of the alternative protein trend but more critically on the implications for Australian producers and investors.

"We now have the facts about the aggregate opportunities for Australian agriculture in response to an emerging market for alternative proteins up to 2030. This means we can replace speculation with reliable forecasts to underpin policy, regulatory changes and advocacy positions," said Mr Harvey.

Mr Harvey added that prioritising producing enough protein for the growing global population requires a united front.

"Segregation and competition between traditional and alternative protein producers are not as big a threat as expected." "Enabling traditional and alternative protein producers to work in collaboration – such as using the by-product of insect farming as feed for chickens, pigs or fish – will provide a mutual sustainability benefit," Mr Harvey said.

Australian Farm Institute Executive Director, Richard Heath said while there's been a lot of hype around the potential of so-called 'fake meat' as a disruptor to the livestock industry, this research

Mr John Harvey Managing Director AgriFutures Australia (formally RIRDC). Photo by AgriFutures Australia

shows the emerging market for alternative proteins should not be seen as a threat to existing production systems but as a means of diversifying choices for producers, processors and consumers.

"New demand for animal protein from a growing global population will outweigh any additional market share that alternative proteins may gain in the next decade," Mr Heath said.

AgriFutures Australia's National Rural Issues Program invested in this research as part of its mandate to lead cross-sectoral research into rural issues of national and global significance.

Download the report from AgriFutures Australia.

AgriFutures Australia

SA Seep Site 2: Lachie Singh, Alawoona

Fixing a waterlogged zone growing twice the crop, before it becomes a degraded seep scald, using the Subsoil Extruder to repair sandhill

By Dr Chris McDonough
Insight Extension for Agriculture

Mallee Seeps

Purpose

This demonstration site aims to rehabilitate an emerging seep area while it is still at the soil saturation stage (growing a substantially better crop) before it becomes a degraded saline scald. This site has applied an innovative deep dipping machine that pumped a slurry of manure through the soil profile to 3ha of deep compacted non-wetting sand above the seep area. If successful it could represent a way of ameliorating the recharge zone to achieve far greater water use, in a practical, affordable and efficient way that improves production on sandhills without exposing them to high erosion risk. It will encourage farmers to start to address seep issues before they become a permanent land degradation issue.

Trial/Demonstration Design

The site has been established with 5 treatments, including:

- the deep ripping with slurry injection of chicken manure at both 50cm and 1m row spacings
- deep ripping pig manure at 1m row spacings (40-60cn depth
- deep ripping alone (40-60cm depth),
- over 3ha of sandhill, direct above the crop area becoming waterlogged (see Figures 1 & 2, Photo 1).

As this is an innovative use of a prototype machine in its early stages of development, it proved to be a challenging exercise, and difficult to achieve consistency in ripping depth and slurry flow rates. It was often difficult to mix the manure, and while the aim was to use about 6-8t/ha of manure, there would have been some strips that want out at least twice this rate. The flow rate was generally controlled by speed of the tractor and the density of the slurry which tended to vary throughout each load. Unfortunately the PTO shaft broke on the machine, meaning that only 1 side of the sandhill was treated, rather than the whole rise. Despite these difficulties, the treatments and trial was set up sufficiently to adequately test the validity of this innovative strategy. (This trial was done in conjunction with a small plot replicated trial at Loxton by SARDI were a more even distribution of higher manure rates were obtained).
There were some modifications made to the manure distribution pipe for this trial. The original had a sausage of manure being extruded at 40cm depth. By cutting a slit in the back of pipe, (Photo 2) an improved profiling of the slurry from 20-40cm appeared to be obtained. This should be better for crop roots to follow the fertile organic band, and decrease the likelihood of soil re-compaction.

A soil moisture probe in both the Deep Ripped Chicken Manure Slurry section and the Control section, to measure the treatment's effect on rainfall infiltration, retention and crop water use to 1m depth. This is critical in understanding what differences the soil ameliorating treatment has made to the water dynamics of the sandhill. Unfortunately there was a machinery incident at seeding time that caused a loss of data from the Control probe for a 5 week period.

A piezometer has been placed at the middle of the seep concern area, which is presently growing vastly improved crops due to roots accessing the developing

perched water table below. A rain gauge has been located on a nearby fenceline. At the time of establishment the perched water table level was sitting at 60cm below the soil surface. The soil was sampled and tested at this time at different depths, as well as the water that accumulated in the piezometer. Each of these monitoring items use data loggers to allow for a more accurate assessment of the dynamics of the site over time. Initial soil and water samples have been taken and analysed.

The treatments were visually monitored throughout the season, and dry matter cuts were taken in September. Yield samples were taken with the farmers header from the treatment plots but this proved to be extremely challenging as a result of extremely low yields due to the drought.

Results and Discussion

Sandhill Amelioration in the Recharge Zone

The Effectiveness of the Subsoil Extruder

The basic operational intention of the subsoil extruder is very sound in that it can:

1. break subsoil compaction, allowing crop roots to penetrate deep moisture & nutrients below 20cm;
2. deposit a column of fertile organic matter through the deep soil profile to greatly improve the soil health productive potential of these very poor soils;
3. achieve this with minimal topsoil disturbance, overcoming considerable wind erosion risk issues.

This was demonstrated at both this site and the SARDI Loxton trial site. However, this process did reveal many areas of improvement which should be addressed with the next prototype. The farmers and researchers involved believe it would be better as a tow behind machine, rather than a 3 point linkage. The mixing of water and manure to create the slurry is extremely time consuming, and needs to be improved, and may be more efficiently achieved as a separate operation. A wider machine with more tines would make the operations more efficient. A new improved Subsoil Extruder is presently under construction.

Photo 1. Subsoil extruder in action

Photo 12 shows that the desired effect from the machine was achieved, with a clear example of a manure column created through the sand compaction zone (20-50cm depth). There is a clear proliferation of crop roots through this slot and directly below this into the wet soil below. It is unclear how consistently this effect was achieved, as not every soil pit showed as clear a result. This may have been the result of achieving the right combination of speed and slurry viscosity. I will be interesting to examine how crop roots follow these slots in the future, as they are very fertile and will not re-compact like the sand.

Table 1 shows the nutrient content of the manure when applied at the desired rate of the trial at 6t/ha. This equates to 180kg/ha N and 100kg/ha P for the chicken manure, with other nutrients, which is considerably high for a sandhill. The fact that these nutrient are very concentrated into the specific strips, will also affect the crop differently than when spread evenly across a paddock. It is hoped that the nutrient value supplied from this application will be long lasting, creating higher crop growth and yields and a higher turnover of organic matter and nutrients over time.

Figure 3 shows a startling difference in soil moisture changes down to 1m after only the first few small rainfalls between the ripped and control areas. The lack of soil moisture penetration in the Control section is most likely due to the non-wetting nature of this soil, leaving it to evaporate in the surface. It showed minimal

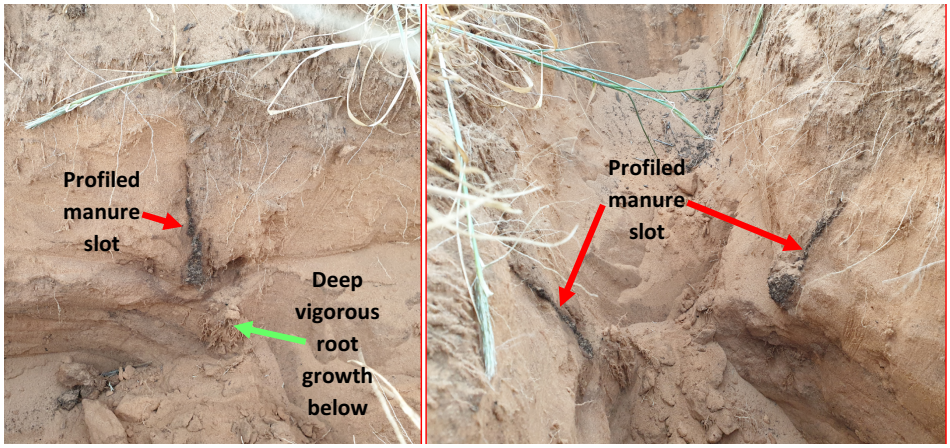

Photo 2. Successful manure profiling by the subsoil extruder showing strong root growth below

moisture increase at 10cm after 3.5mm, and without any build-up of moisture at 30cm until the 8mm rainfall, but no impact on soil moisture sensors below this. Even the 4mm rainfall after had very little impact on the 10cm sensor, which clearly shows that the non-wetting nature of this soil must be addressed for these soils to improve in crop establishmet.

This is in stark contrast to the soil moisture penetration to 70cm after the initial 3.5mm in the Deep Ripped Chicken Manure Slurry section. The following 8mm even made it to 90cm and likely deeper, given the peak and fall of this line with no root growth present. However, each subsoil layer has increased available moisture storage, which was then available to crop growth due to the breaking of the soil compaction layer. It is possible for cereal roots in these soils to penetrate to 150cm. The following 4mm rainfall event was clearly retained within the crop rootzone (Figure 3).

The fact that such small rainfall events can penetrate so deep in the profile is a reflection of the very poor water holding capacity of this sand, and given that each

Analyte	Pig Manure	Chicken Manure
	Nutrients (kg/ha) if applied at 6t/ha	
Total Nitrogen	177	179
Aliminium	5	11
Boron	0.2	0.4
Calcium	142	180
Cobalt	0.01	0.002
Copper	5	1
Iron	7	12
Magnesium	35	47
Manganese	2	4
Molybdenum	0.03	0.07
Phosphorus	55	100
Potassium	163	160
Sodium	33	35
Sulphur	36	34
Zinc	3	3

Table 1. Nutrient analysis results of manures used showing kg/ha applied if 6t/ha was applied

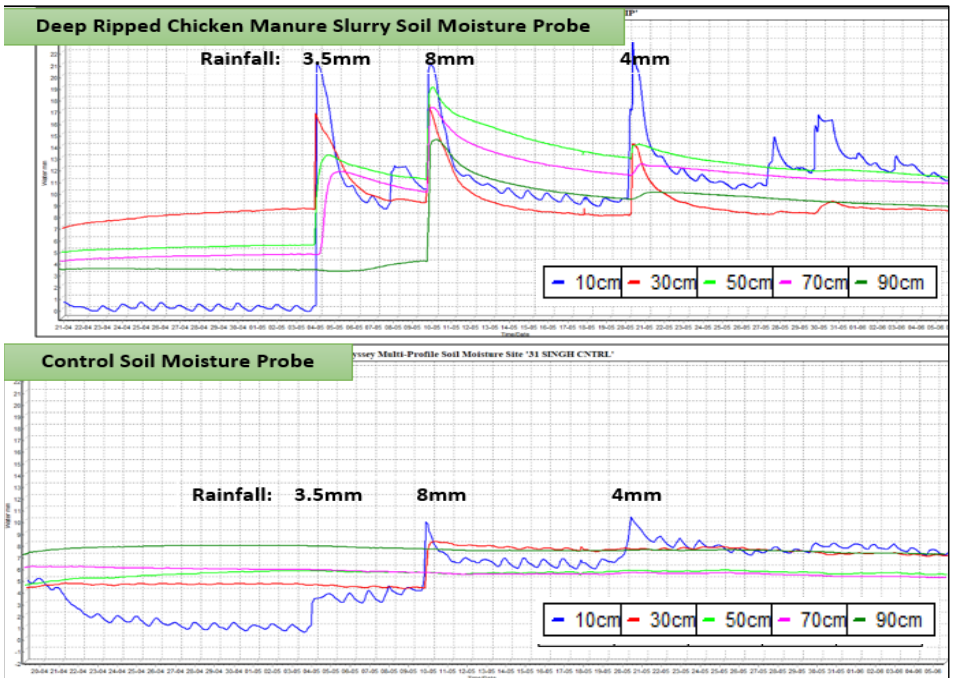

Figure 1. Soil moisture penetration differences between treatments (April 20th to June 5th)

sensor layer rises quickly and then gradually lowers, with no growing roots present, suggests that while moisture has been retained, a percentage has still passed through to lower layers. This result would suggest that from a seep prevention perspective, deep ripping these soils alone may only have limited impact on increasing water use and preventing recharge, if there is no soil amelioration work done with deep mixing of clay or organic matter to hold the moisture within the rootzone for crop use.

The full season moisture probe results (Figure 4) show the clear advantage of the subsoil extruder operation. Crop roots have clearly penetrated into the deeper layers and drawn moisture down close to their mid-autumn levels. By contrast, the Control soil moisture levels have mostly only fluctuated at the 10cm sensor, which may have been used by the crop or lost to evaporation, with some 30cm moisture utilised for a period beginning in late August. There was almost no evidence of any deep soil moisture being utilised by the crop throughout this drought season. While there is missing data for the 19mm rainfall in May, there was no evidence of any recharge occurring in this drought season form the control plots.

The dry matter cuts taken in late September show a clear trend towards improved crop growth in the deep ripped manure slurry treatments. The Chicken Manure at 0.5m rip line spacings may have been adversely affected by poorer crop establishment (seeding into a very soft uneven soil bed). It should also be noted that although each treatment strip is in a very deep non-wetting sand, the Control and Deep Rip strips are more on the crest of the hill, which appears slightly less fertile. The improved crop growth does follow the differences in the soil moisture use recording between the Control and Chicken Manure Extruded sites (Figure 3).

Harvest results from the site proved unreliable, as the drought conditions were to severe and yields too low to be meaningful and comparable

results from the farmers header. The higher crop growth during the season in some plots could not be sustained through to yield in these deep sands. Similarly, in the SARDI trial at Loxton there was no meaningful results obtained from the deep sand, however, the subsoil extruder showed significant benefits in the midslope section of the trial.

It will be important to follow these trends through into the coming seasons, with possible yield results in more favorable years. The farmer is also considering establishing lucerne over the sandhill, which should provide the best long term and all year round high water use option to address the perched water table issue.

The Discharge Zone

Alawoona received less than half its annual average rainfall for 2019 with 137mm (ave 286). The late break and very poor growing season saw most of the heavier soil types produce very little crop yield, as evidenced in Photos 10, 11 & 12. However, in the area above the perched water table at the base of the sandhill, the barley was estimated to be producing at least a 3t/ha crop. While this may be viewed as a positive outcome, it is very clear from other areas in this paddock (Photo 12) and neighbouring paddocks that if no action is taken to address water flows from the Recharge Zone, then this are will quickly develop into an unproductive, bare saline scald.

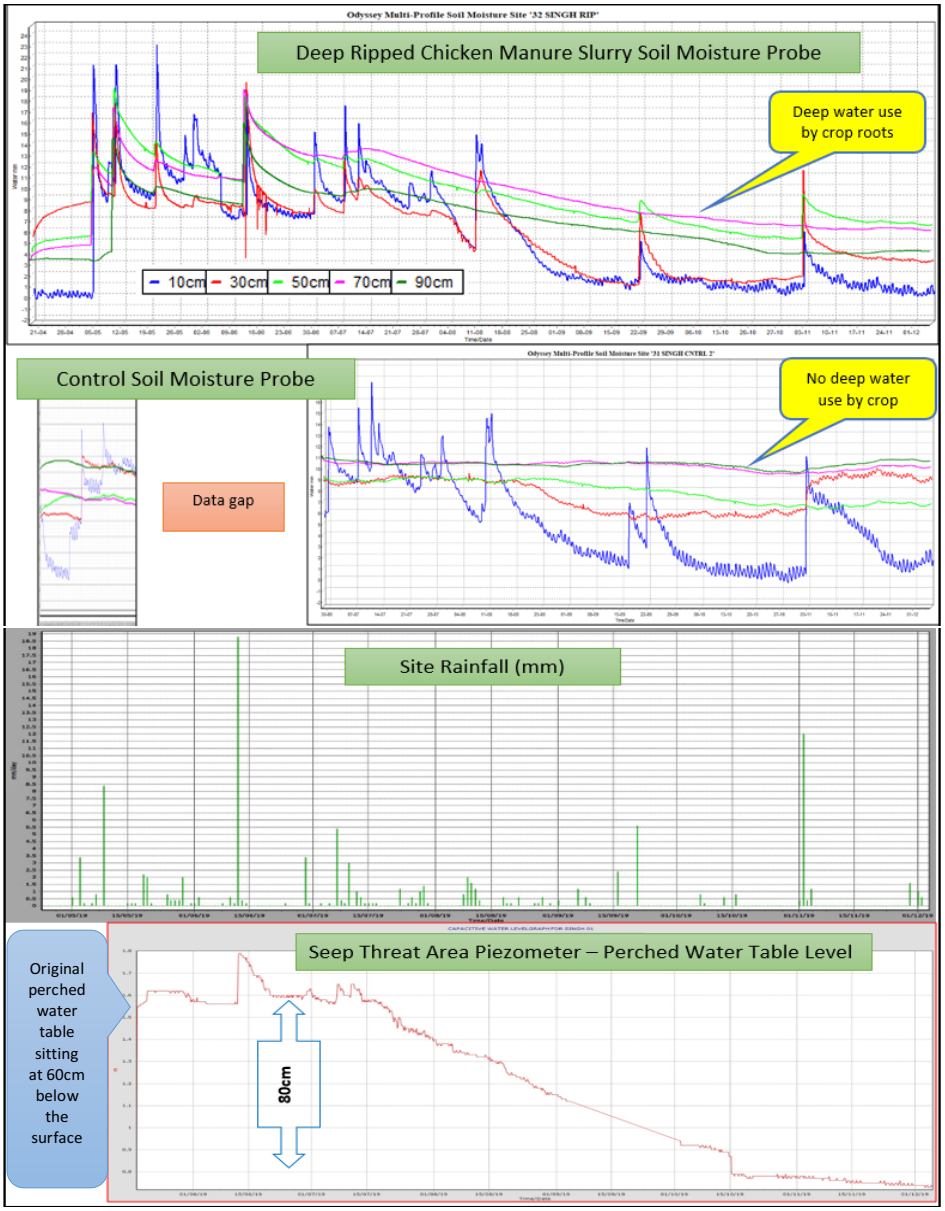

Figure 2. Moisture Probe and Piezometer Readings aligned with Rainfall (April- Dec 2019)

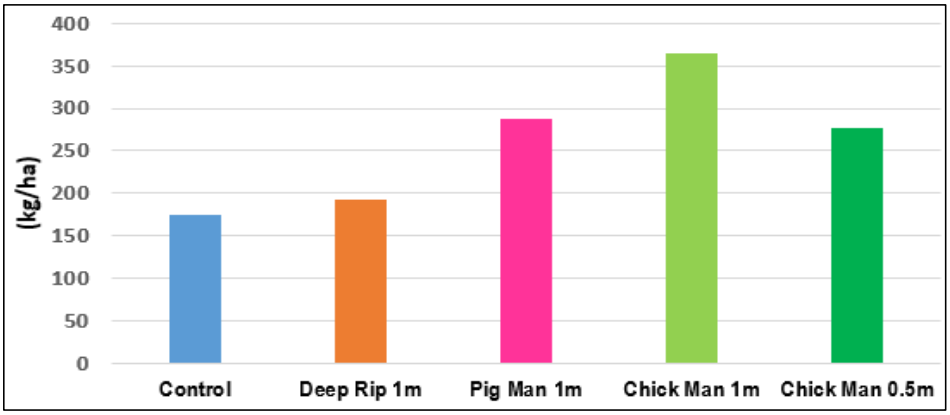

Figure 3. Cereal Rye Dry Matter Cuts, Sept 27, by Treatments and rip line spacings.

Figure 4 reveals a drop in the perched water table of approximately 80cm over the year. This may be more attributable to the lack of high rainfall events, rather than the benefits of the sandhill amelioration at this stage. It is worth noting that there was no impact from the 12mm rainfall in November to the water table, whereas there were brief spikes recorded from much smaller rainfall events in May. This could suggest that the crop roots ability to dry out the subsoil to at least 1m (as evidenced in the Soil Moisture Probe readings) has provided a buffer to absorb this moisture and restrict recharge. This will be keenly monitored in the future.

Conclusions

This demonstration trial has revealed important information

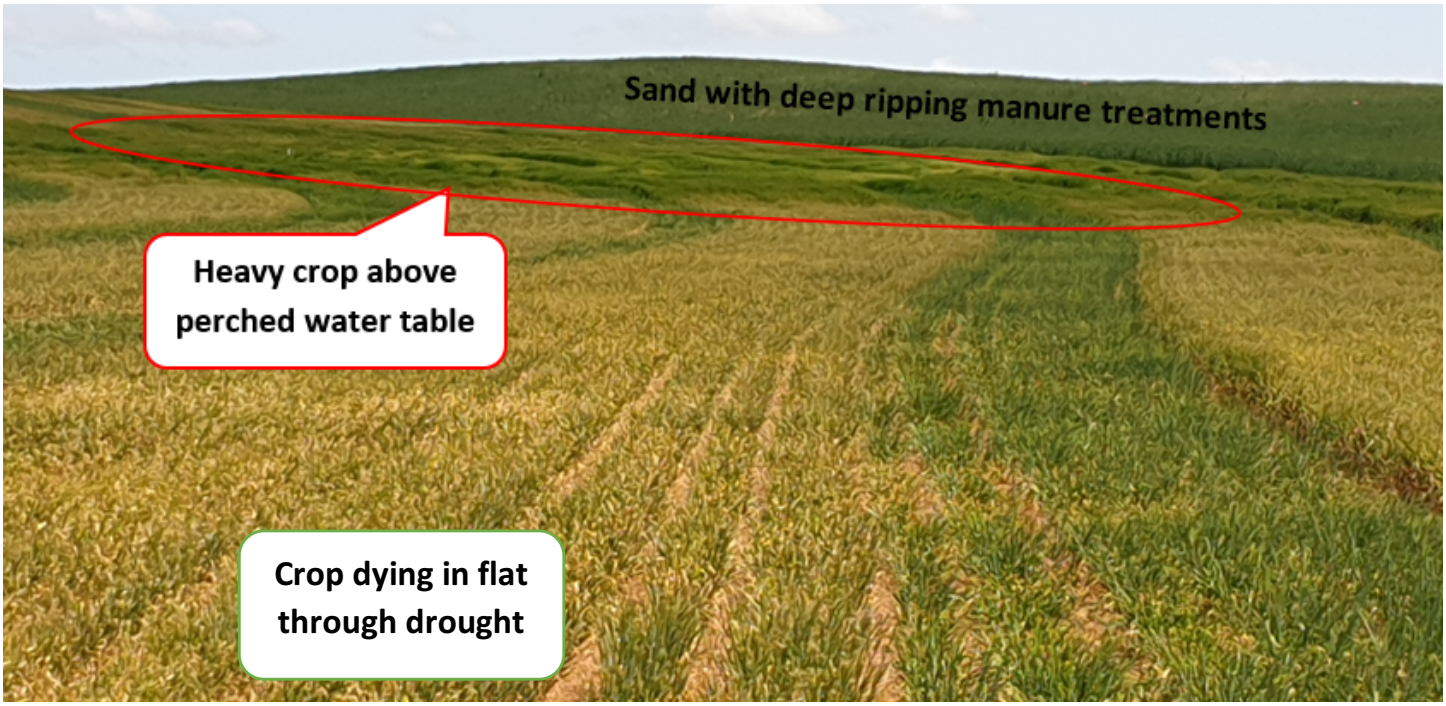

Photo 3. Increased crop growth due to perched water table at the base of the sandhill.

about the water dynamics within these deep sands with very low water holding capacity. It has shown the lack of early moisture penetration due to the non-wetting nature of the soil, which can be corrected through aggressive soil disturbance. There has been a clear advantage of deep ripping to allow crop root penetration past 30cm depth to utilise soil moisture to at least 90cm. Allowing more water to penetrate and be used by the crop will lead to higher crop yields, as well as create a greater buffer to summer rainfalls contributing to recharge.

Soil moisture probe data has also indicated how little water these sands can hold, and even small rainfall events can contribute recharge. Subsoil amelioration with clay, manures or other organic matter may be important tools to help retain more water to be used within the crop root zones.

The innovative use of the Subsoil Extruder has appeared to work well in breaking soil compaction and creating a very fertile organic column to allow for crop roots to penetrate the deeper layers, and provide nutrition to match the increased yield potential of this sandhill in coming years. While there are many modifications that need to be made to this prototype to improve the efficiencies and effectiveness of operations, the Subsoil Extruder has been successful in providing a much safer way of ameliorating subsoils with nutrition organic matter, than alternatives such as spading which can lead to high soil erosion risks.

This site will continue to be monitored over coming years to see if the sandhill amelioration can lead to a sustained reduction of the perched water table below and protection from crop loss, surface scalding and permanent soil degradation, even after higher rainfall years.

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The Last Word...

Mallee's most wanted

By Glen Sutherland

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Is it time for farmers to put their 'mouse eyes' on again? Recent anecdotal reports from the southern Mallee suggest it just might be.

Last season was certainly a mixed bag for much of the Mallee. Handy rainfall events timed nicely throughout the growing season occurred across most of the southern Mallee, resulting in some above average crops, particularly barley. Unfortunately, some extremely windy conditions hit the region just as crops were getting close to harvest leading to some significant amounts of dropped grain.

This current season has seen one of the best early autumn breaks in years across much of the Mallee. However; history has taught us that the combination of a previous season with heavy stubble loads, dropped grain and a good autumn break can see mouse numbers reach levels that may cause crop losses, both in-season and the next.

Studies have shown mice have done well from changes in cropping systems that use less cultivation, stubble retention, more diverse crops, and have fewer livestock. Each of these elements provide mice with better cover, more high-quality food, undisturbed burrows and easy access to sown grain.

Predicting if mice are going to be a problem isn't always straight forward either as it doesn't always follow that a good year will be followed by serious mouse problems the next. Also, problematic mice breeding may only be taking place at isolated locations, between properties and even individual paddocks.

Monitoring and keeping records of mice activity, particularly in a suspect year, is a good idea. This year may be shaping up to be one of those years where we will need to be keeping an extra eye out for mice activity as early as harvest. Headers make a useful elevated platform to see what is going on in the paddock. Mice tend to use the same pathways to and from their burrows and nesting sites. These are evident as distinct runs or pads left in the soil and become more noticeable with higher numbers of mice. There may not be a direct relationship between mice numbers in farm sheds and dwellings and those seen in the paddock, but it's a good idea to actively monitor paddocks more closely if mice are seen more frequently indoors.

Regular inspections of paddocks should continue to take place throughout the growing season. Signs of damage include patches where crops have significantly thinned or failed to emerge, usually with the presence of nearby burrows and or evidence of mouse holes in rows where seeds have been excavated. In maturing crops, damage may include gnawed stems and damaged or missing seed heads.

Another way for farmers to get an understanding of what is happening with mice in their district is to use the smart phone MouseAlert App and website. This app helps farmers record data about mice on their farms. The information is then available to all to view via a Google maps platform.

Knowing that you have a problem, or potentially may have a mouse problem, is critical to planning a response. The GRDC Mouse Control Fact Sheet is a good resource to help with your planning and is available online at:
https://grdc.com.au/resources-and-publications/resources/mouse-control

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