MALLEEFARMER

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Featuring:

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Mice update and Management Recommendations

Monitoring wind erosion and management practices in the Victorian Mallee - observations of the 2019 and 2020 seasons

And Much More

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

CONTENTS

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Cover Photo, 180 Degree camera used to capture research trial photos, Photo: Stacey Solomon Frontier Farming Services

Chair's Report

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

There's a wide range of research organisations and partner agencies that generously share their knowledge in each edition of the Mallee Farmer, helping to ensure Mallee farmers have access to the latest information from cutting-edge research and trials across the region. This edition is no exception, with excellent contributions from Agriculture Victoria, Landcare, La Trobe University, Birchip Cropping Group, Frontier Farming Systems, Mallee Sustainable Farming and the Mallee Catchment Management Authority (CMA).

Among the highlights of this edition:

- Frontier Farming Systems takes us inside immersive agriculture to see how virtual reality is changing the way farmers connect with research trial sites, field days and workshops;
- Agronomist Michael Moodie talks us through the final findings of research undertaken to determine if some crops commonly grown in the Mallee are more susceptible to frost;
- We look at the effect of deep ripping on pulse crop yields and profitability at five trials sites across the Mallee;
- Agriculture Victoria considers the impact of wind erosion and land management practices in the Victorian Mallee during the 2019 and 2020 seasons; and
- La Trobe University and Birchip Cropping Group share ways of managing nitrogen fertiliser to profitably close yield gaps.

Of course, no edition of the Mallee Farmer is complete without The Last Word from Regional Landcare Facilitator Glen Sutherland. This time he's got his finger on the pulse with the mice plagues in New South Wales and the implications this has for mice

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management decisions in the Mallee this cropping season.

However, my personal favourite in this edition is the article about Tempy Primary School students becoming Malleefowl Ambassadors. They have taken citizen science to the next level and embarked on a fascinating semester of work learning about this unique bird. Not only have they hit the books and done research into the Malleefowl's habitat and characteristics, they have also spent valuable time with local Malleefowl experts. This has given the students a unique insight into everything from learning how to monitor Malleefowl nests to First People's connections to megapodes, Aboriginal astronomy and the Malleefowl. Field trips around the Mallee have reinforced these learnings and helped the students get a first-hand understanding of the Malleefowl's environment. To top it off, the Tempy Primary School students will present the findings of their citizen science project to the Victorian Malleefowl Recovery Group's meeting in Patchewollock during May. Congratulations to the students and everyone involved in this work! It is truly wonderful to see young Mallee residents so actively engaged in learning about this region's incredible species.

Finally, a sincere thank you to everyone who has contributed to this edition of the Mallee Farmer. I hope it is read cover-to cover by people right across our region (and beyond!). The support provided by the community and the Australian Government's National Landcare Program ensures the Mallee Farmer continues to be a valuable resource.

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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Free benchmarking and profit assessment of your farm business

By Sam Henty
Agriculture Victoria Farm Business Economist

Join the Livestock Farm

The Livestock Farm Monitor estimates the economic performance of surveyed livestock and cropping farms by collecting detailed physical and financial farm information.

Agriculture Victoria is offering sheep, beef and cropping farmers the opportunity to participate in this respected, rigorous and long-running benchmarking program.

Positions are available for individual farms and farm discussion groups across Victoria in 2021. Participation is free and all information is treated as highly confidential.

Each farm receives an annual individualised farm report with graphs and data from the reporting year as well as all previous years of participation.

A participating farm business can use the results from this report to compare itself over time and help identify the critical variables to inform and provide confidence for on-farm decision making.

The report offers a trusted and un-biased source of information that can assist farm businesses with conversations with financial institutions, consultants and industry.

Farm Performance in Northern Victoria

In 2019-20, surveyed farms in Northern Victoria experienced a year of contrasting rainfall conditions and mixed farm performance.

Regional average farm profits increased from 2018-19, but were still below the 10-year average.

To take advantage of good lamb, mutton and beef market prices, surveyed farms chose to increase the quantity of beef and sheep sold.
High prices and increased livestock inventories led to the highest average gross farm income recorded by the project in Northern Victoria.

Dry conditions experienced from July through to December 2019 represented the third consecutive year surveyed farms received below average winter and spring rainfall.
To offset reduced grazed pasture availability in spring, livestock diets on most farms were supplemented with purchased feed.

As rainfall improved in 2020, so did the average rate of fertiliser application.

The combination of expenditure on supplementary feed and fertiliser increased annual average variable costs to the highest level recorded by the project in Northern Victoria.

Notably there was large variation in the variable costs between surveyed farms representing different management strategies in the difficult operating conditions.

About the Livestock Farm Monitor Project

The Livestock Farm Monitor Project is Agriculture Victoria's primary source of farm level information for sheep, beef and cropping production practices, resource use, and economic well-being.

The results of this annual survey provide the farm-level data required to inform Agriculture

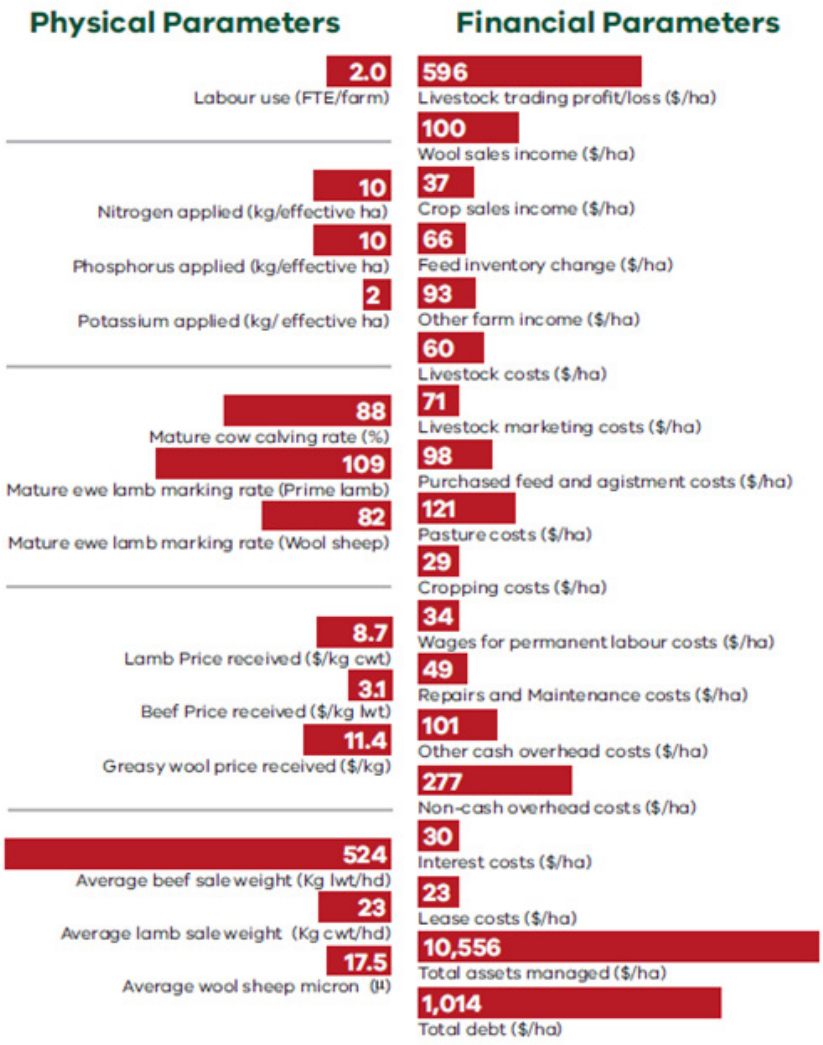

Figure 1 Average physical and financial farm performance values from 2019-20 Northern Victorian Livestock Farm Monitor participants.

Victoria on decisions that have a farm level impact and to inform the direction of future policy design, research themes and service delivery programs.

Farmers who participate in the project increase understanding of their farm business which builds resilience and improves ability to adapt to change.

The latest annual report can be found on the Agriculture Victoria website with farm performance data collected by the 2019-20 project also available as an interactive report.

For further information about getting involved please contact Sam Henty via email:

sam.henty@agriculture.vic.gov.au

AGRICULTURE VICTORIA

Managing N fertiliser to profitably close yield gaps

By James Hunt, La Trobe University, James Murray and Kate Maddern, Birchip Cropping Group

Take Home Messages

- Making N fertiliser decisions based on Yield Prophet® or an environmentally appropriate N Bank target maximises profit, stops soil organic N decline and prevents accumulation of excessive mineral N.
- N decisions based on 50 per cent Yield Prophet® or 125 kg/ha N bank strategy apply more N (60-80 kg/ha) and are $100/ha per year more profitable than the national average N fertiliser rate (45 kg/ha N).
- The most profitable strategies all have neutral to positive N balances (more N applied in fertiliser than removed in grain) indicating soil organic N is not being mined.

Background

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

On farms with no legume pastures, most of the crop N supply must come from N fertiliser. Grain legumes do not provide enough N to support

yield of subsequent crops at the intensity at which they are currently grown. N fertiliser is a costly input and use of it increases cost of production and value-at-risk for growers. Growers fear that over-fertilisation will result in 'haying off', which reduces both yield and quality. There is also concern that over applied fertiliser not used by crops is lost to the environment by leaching, volatilisation and denitrification. Consequently, efforts are made to match N fertiliser inputs to seasonal yield potential. This is difficult in southern Australia due to the lack of accurate seasonal forecasts for rainfall. The difficulty in matching N supply to crop demand, and a tendency for growers to be conservative in their N inputs, is the cause of the large proportion of yield gap that can be explained by N deficiency.

In 2018 Birchip Cropping Group (BCG) and La Trobe University commenced a multi-year experiment to evaluate the potential for different N management systems to profitably close the yield gap and slow organic matter decline; with being the third season of the experiment.

Aim

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

Paddock Details

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

System	Treatment	Description
Nil	Nil	No nitrogen applied other than in starter fertiliser
Replacement	-	Amount of N removed in grain applied as fertiliser N in the following season
National average	-	National average N fertiliser (45 kg/ha N) applied each season
Nitrogen banks (kg/ha N)	100	Soil mineral N + fertiliser = 100 kg/ha N
	125	Soil mineral N + fertiliser = 125 kg/ha N
	150	Soil mineral N + fertiliser = 150 kg/ha N
Yield Prophet® probabilities	100per cent	Yield with lowest yielding season finish on record
	75 per cent	Yield with lower yielding quartile season finish (decile 2.5)
	50 per cent	Yield with median season finish (decile 5)
	25 per cent	Yield with higher yielding quartile season finish (decile 7.5)

Table 1. Nitrogen management systems and treatments used in the experiments.

Trial Details

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

Trial Inputs

N fertiliser:
Refer to Table 2 for nitrogen fertiliser applications in 2020 and 2019 BCG Season Research Results (pages 106 to 113) for results from 2018 and 2019. All nitrogen fertiliser has been top-dressed as a single application of urea during winter.
Starter fertiliser:
2018: Urea @ 35 kg/ha at sowing (host farmer management)
2019: Granulock Z @ 60kg/ha at sowing
2020: Granulock Z @ 60kg/ha at sowing
The experiment was kept free of weeds and disease as per current best practice management.

Method

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

1. Matching N fertiliser to seasonal yield potential

(Yield Prophet®)
2. Maintaining a base level of fertility using N fertiliser (N banks)
3. Replacing the amount of N removed in grain each year with fertiliser in the next season (replacement)
4. Applying national average N fertiliser rate (45 kg/ha) each season (national average)

All systems were compared to a nil control to which only starter fertiliser was applied. Within the Yield Prophet and N bank systems there were different treatments targeting different yield potentials (Table 1). In the Yield Prophet® treatment, water limited potential yield was determined at different levels of probability and the amount of N required to achieve these yields applied, assuming a requirement of 40 kg/ha N per t/ha wheat yield and 80 kg/ha N per t/ha canola yield (Figure 1). For the N bank treatments there were different target levels of N fertility (N banks). N fertiliser rate in these treatments were calculated as the N bank value minus soil mineral N (kg/ha) measured prior to sowing. All gross margins were calculated using values from the 2019 SAGIT Gross Margin Guide (SAGIT 2019).

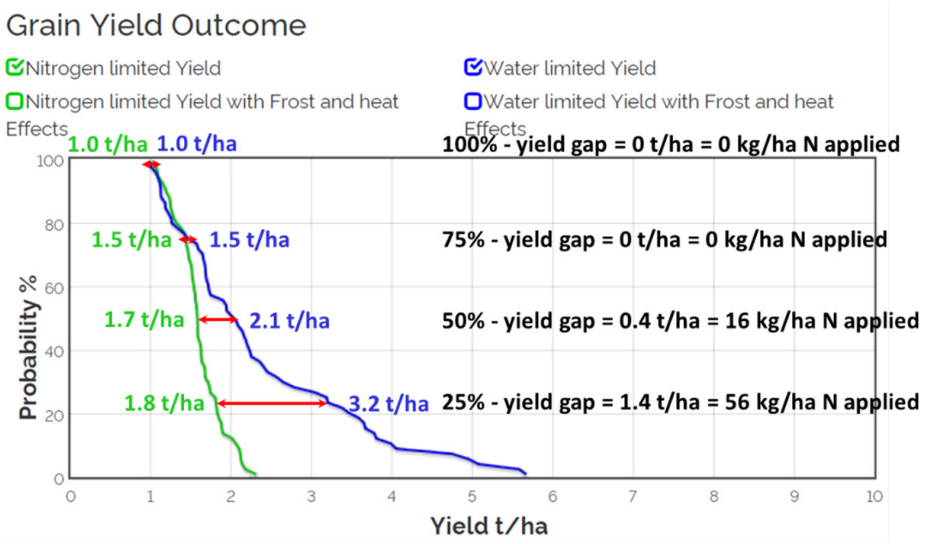

Figure 1. An example from 2018 of how Yield Prophet® is used to determine water limited potential yield given probabilities of different season outcomes and how this is used to calculate a yield gap and N fertiliser rate required to close the yield gap.

Results and Interpretation

2018 & 2019 results

Please see 2019 BCG Season Research Results (pages 106 to 113) for results from the 2018 and 2019 growing seasons.

2020 Results

There were large differences between treatments in soil mineral N measured prior to sowing in 2020 (Table 2). There was a strong positive relationship between 2-year N balance (fertiliser applied minus N removed in grain in 2018 and 2019) and soil mineral N measured prior to sowing in 2020 (Figure 2). Based on linear regression of treatments with a positive N balance, 73 per cent of fertiliser N applied in 2018 and 2019 that was not used in

System	Treatment	Soil mineral N (kg/ha)	Top dressed N (kg/ha)	N supply (kg/ha)	Yield (t/ha)	Protein	Gross margin ($/ha)
Nil	Nil	59	0	66	2.9	7.9	$385
Replacement	-	55	35	97	3.8	8.8	$588
National average	-	52	45	104	4.0	9.3	$605
Nitrogen banks (kg/ha N)	100	64	29	100	3.8	9.0	$573
	125	62	57	126	4.1	9.8	$626
	150	116	25	148	3.7	9.4	$573
Yield Prophet® probability	100per cent	59	0	66	3.2	8.0	$489
	75per cent	71	56	134	3.8	9.8	$563
	50per cent	85	84	176	4.0	10.6	$620
	25per cent	101	128	236	4.5	11.1	$701
Sig. diff. LSD (P=0.05)		**<0.001 20**	**- -**	**<0.001 20**	**<0.001 0.2**	**<0.001 0.6**	**- -**

Table 2. Soil mineral N measured prior to sowing, top-dressed N, crop N supply, grain yield, protein and gross margin for different treatments in the experiment in 2020.

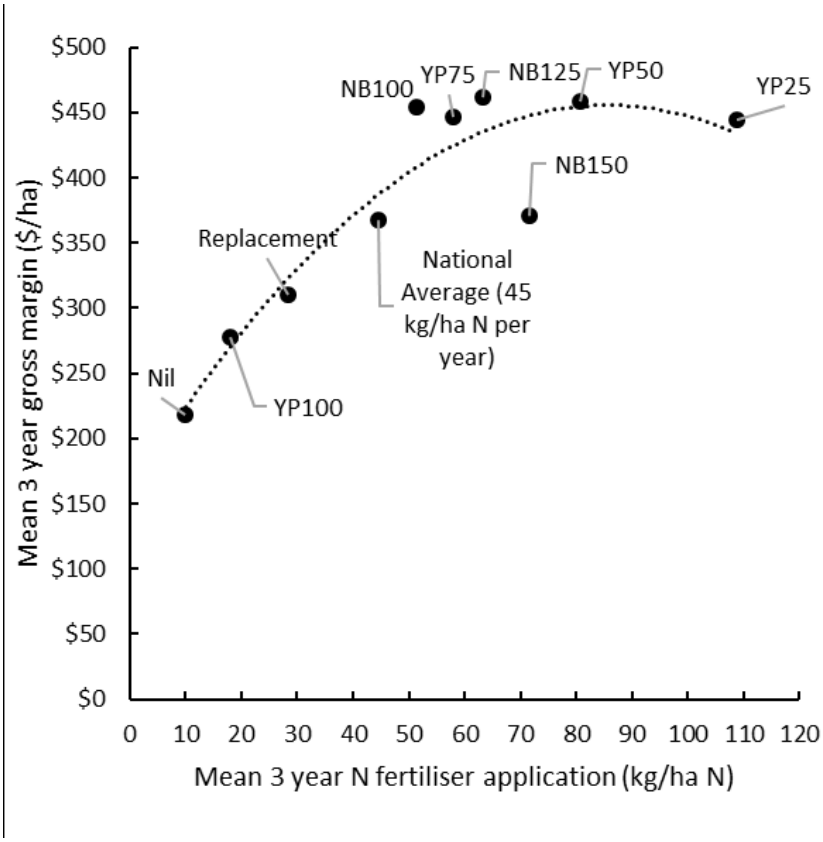

Figure 3. The relationship between mean 3-year fertiliser application and mean 3-year gross margin for the different treatments. The quadratic function fitted by least-squares regression is of the form y = -0.04x2 + 6.94x + 158.48, R^2 = 0.85.

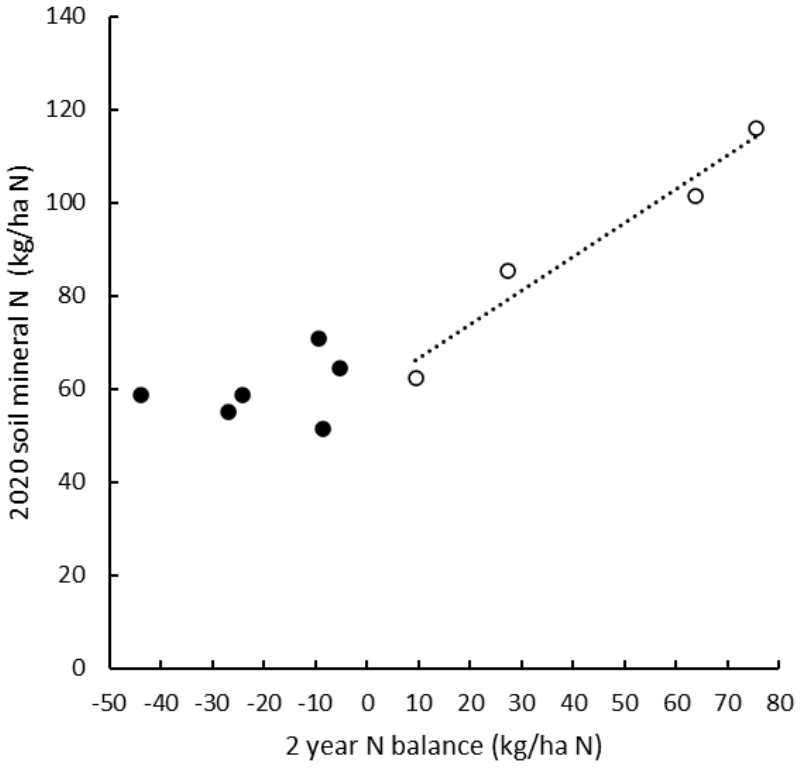

Figure 2. The relationship between 2-year N balance (2018-2019) and soil mineral N measured prior to sowing in 2020. The linear regression is fitted by least-squares regression to the positive N balance values only and is of the form y = 0.73x + 59.24, R^2 = 0.95.

grain production was available as mineral N prior to sowing in 2020. This is consistent with 2019 season results.

In a relatively favourable growing season grain yield, protein and gross margin responded positively to N supply and both were maximised in the treatment with the highest total N supply (Yield Prophet 25 per cent - Table 2) to which 128 kg/ha fertiliser N was applied. Based on a grain protein content of 11.1 per cent, this was also likely the only treatment in which yield was not limited by N supply (Unkovich et al. 2020).

3-year averages

Comparison of the different systems over the three years of the experiment shows that the Yield Prophet 50per cent and N Bank 125 kg/ha N treatments are most profitable, with several other treatments (Yield Prophet 25per cent and 75per cent and Nitrogen Bank 100 kg/ha) not far behind. All these treatments on average apply more fertiliser N than the national average of 45 kg/ha (Figure 3), and the Yield Prophet 50 per cent and Nitrogen Bank 125 kg/ha have on average returned ~$100/ha per year more profit than the national average.

The two most profitable treatments also had a neutral to slightly positive 3-year N balance (Figure 4), indicating that soil organic N is not being mined and that soil organic matter is likely being maintained. This contrasts to the national average which has a 3-year N balance of -20 kg/ha N which based on the soil C:N ratio at the site of 9.7 suggests ~194 kg/ha of soil organic carbon has been lost.

Commercial Practice and On-Farm Profitability

Growers should soil test and use an environmentally appropriate fertiliser N management strategy such as Yield Prophet® or Nitrogen Banks to maximise profits. In this experiment, profit has been maximised at much higher rates of fertiliser N (60-80 kg/ha N or 130-174 kg/ha urea per year) than is usually applied in the district. Long term profitability is likely to be increased by growers being less conservative with N fertiliser applications, particularly for those consistently achieving cereal grain proteins of less than 10.5 per cent (i.e. ASW). Growers in low rainfall regions with heavy textured soils can be confident that the majority of applied N not used in year of application will remain in the soil for use in subsequent seasons and is not a lost cost.

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

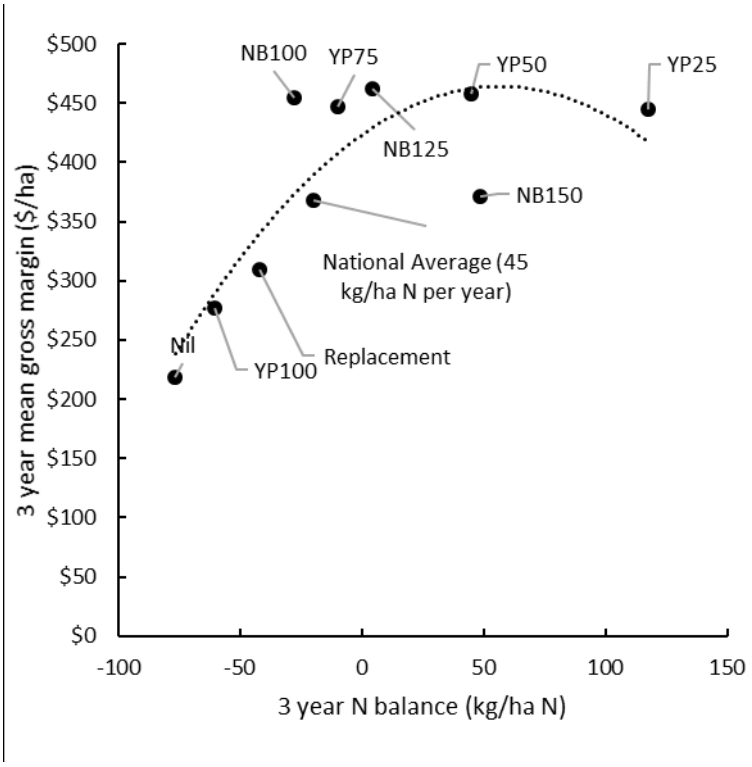

Figure 4. The relationship between 3-year N balance and 3-year mean gross margin for the different treatments. The quadratic function fitted by least-squares regression is of the form y = -0.01x2 + 1.44x + 423.05, R^2 = 0.70.

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Acknowledgements

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We thank Paul Barclay for hosting the experiment.

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LA TROBE UNIVERSITY

mallee catchment management authority

Deep ripping increases the grain yield and profitability of pulse crops grown on deep sandy soils in the Mallee region

By Michael Moodie, Mallee Sustainable Farming/Frontier Farming Systems, Sundara M.M.R. Mawalagedera, Agriculture Victoria, Department of Jobs, Precincts and Regions and Jason D. Brand, Grains Innovation Australia

This article reports on the effect of deep ripping on the pulse crop yield and profitability at five trials sites across the Mallee over the 2019-2020 seasons.

Key Points

- Deep ripping led to large yield benefits in all pulse crops except for lupins grown on deep sandy 'dune" soils.
- Yield benefits were greatest in chickpea and faba bean where deep ripping led to 160 per cent more grain produced than in corresponding unripped treatments.
- The profitability benefits from deep ripping over the past two seasons was more than $250/ha for all pulse crop except for lupins.

Background

The production of all pulse crops, except for lupin, is constrained on the sandy 'dune' soils within Mallee cropping paddocks. These "deep sands" make up approximately 20-30 per cent of the cropping soils in the region and commonly have high penetration resistance within the top 0.5 m of the profile. Recent research within this region has demonstrated significant yield improvements to wheat and barley crops by alleviating physical soil constraints by deep ripping. This article reports on the effect of deep ripping these sandy dune soils on the productivity of pulse crops (lentil, chickpea, faba bean, lupin, field pea and vetch) at five sites across the Victorian and South Australian Mallee over the 2019-20 winter crop seasons.

Experimental sites

Replicated field trails were located in commercial paddocks at Kooloonong (2019 and 2020) and Speed 2020) in the Victorian Mallee and at Lameroo (2019 and 2020) in the South Australian Mallee. Within each paddock, trials were located on a deep sandy dune soil that was identified as a constrained soil for the purpose of growing pulse crops. Each trial included a deep ripping treatment which was implemented within one month prior to sowing. All deep ripping treatments used a Tilco A66 tines spaced at 56 cm apart. The target of depth of deep ripping was 500 mm and this was achieved at all sites except Lameroo in 2019 where a subsurface clay layer limited ripping depth to 400 – 450 mm.

Results

Trial management

Pulses were sown at crop specific plant densities (lentil: 120, chickpea: 35, field pea: 40, faba bean: 20 lupin: 45 and vetch: 70 plants/m2). At sowing, all experimental plots were fertilized with Granulock Z (N-11, P-21.8, K-0, S-4) + Zn (1.0) at a rate of 50 kg/ha. All plots were inoculated with the specific rhizobium for each crop type (N, G or E/F) and pre-emergent herbicides and rates were also adjusted for each crop to minimise the risk of damage in these high-risk sandy soils. Fungicides, herbicides, and insecticides were applied to ensure trials were not impacted by disease, weeds, and insect

Site	Kooloonong (2019)	Kooloonong (2020)	Lameroo (2019)	Lameroo (2020)	Speed (2020)
Lentil					
Unripped	114	735	112	384	658
Ripped	498	1488	304	1070	1424
LSD (p<0.05)	251	480	151	226	327
Chickpea					
Unripped	270	799		1140	482
Ripped	1280	2249		2170	1391
LSD (p<0.05)	269	438		465	367
Narrow Leaf Lupin					
Unripped	1762	2548	860	2070	1745
Ripped	2100	2812	1108	1539	1968
LSD (p<0.05)	287	ns	155	ns	ns
Field Pea					
Unripped			549	1619	933
Ripped			1056	3212	1960
LSD (p<0.05)			486	1071	217
Vetch					
Unripped			771	368	913
Ripped			1135	1343	1480
LSD (p<0.05)			380	411	318
Faba Bean					
Unripped		515		1114	75
Ripped		1959		2203	435
LSD (p<0.05)		522		575	105

Table 1. Grain yield (kg/ha) of pulse crop trials with or without deep ripping treatment at five different Mallee sites over two seasons (2019 and 2020). The least significant difference (LSD, p<0.05) is reported for each trial.

Crop	Average Yield Benefit (t/ha)	Average Grain Price ($/t)	Increase Gross Margin ($/ha)
Lentil	0.6	615	277
Chickpea	1.1	575	546
Narrow Leaf Lupin	0.1	534	9
Field Pea	1.0	415	373
Vetch	0.6	600	317
Faba Bean	1.0	468	360

Table 2. Gross margin of the average yield benefit between unripped and deep ripped pulses across the five trial sites. The price used in the gross margins were the average January grain price from 2020 and 2021 for each pulse crop.

Consultant, Sam Trengove, discussing the impact of deep ripping on rooting depth and pulse production at the 'Legumes on sands' trial site - Lameroo Field day September 2020.

pests. At maturity, each crop was harvested with a small plot harvester and grain yields were recorded.

Findings

Grain yield

Deep ripping resulted in a significant increase in the grain yield of pulse crop at all sites (Table 1). Chickpea (4 sites) and faba bean (3 sites) were the most responsive pulse crops to deep ripping with an average yield increase of 169 per cent in ripped relative to unripped treatments. Lentils were present in all trials with deep ripping providing a mean yield benefit of 130 per cent. Both field pea and vetch were grown at three trial sites with deep ripping doubling the mean grain yield of both these crops. In contrast to the other grain legumes, deep ripping only provided a small yield benefit in lupin. A significant deep ripping response was only observed in the drier 2019 season at Kooloonong and Lameroo while there were no significant responses at any sites in 2020

Profitability

A gross margin analysis showed that the average yield response observed across the trial sites was highly profitable (Table 2). The average chickpea yield response to deep ripping was 1.1 t/ha and this would have improved gross margin by approximately $550, after accounting for an annualised cost of deep ripping of $40/ha. Field pea and faba beans had a similar yield boost from ripping which led to more than $350/ha profit. The average yield response to deep ripping of lentil and vetch was lower at 0.6 t/ha, but this still led to approximately $300/ha gross margin. Lupin was the only pulse crop that did not produce an economic benefit from deep ripping in these trials.

Implications of the Findings

Deep ripping led to large yield benefits in all pulse crops except for lupins grown on deep sandy 'dune' soils. Yield benefits were greatest in chickpea and faba bean where deep ripping led to 160 per cent more grain produced than in corresponding unripped treatments. The profitability benefits from deep ripping over the past two seasons was more than $250/ha for all pulse crops except for lupins. Furthermore, the profitability of the farming system is likely to be improved with subsequent cereal crops benefiting from increased nitrogen supply and the legacy effects from the deep ripping operation.

While these trials have shown large productivity and profitability benefits, farmers considering deep ripping should also evaluate the operational risks. For example, deep ripping before a pulse phase requires high levels of residual stubble to ensure adequate ground cover is maintained while care also needs to be taken with pre-emergent herbicides to minimise risk of crop damage. Trafficability of heavy machinery is also an issue that needs to be managed post ripping, therefore rolling with heavy steel drum rollers is recommended to reconsolidate the surface and provide better flotation for the seeder and self-propelled sprayers.

Acknowledgments

This work was part of the Grains Research and Development project DAV00150 and the Mallee Sustainable Farming project "Improving groundcover options with legume production in sands" funded by the Murraylands and Riverlands Landscapes Board.

LANDSCAPE SOUTH AUSTRALIA MURRAYLANDS AND RIVERLAND

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

Mallee Sustainable Farming

Monitoring wind erosion and land management practices in the Victorian Mallee – observations of the 2019 and 2020 seasons

By Martin Hamilton

Land Management Extension Officer, Agriculture Victoria

Background

Wind erosion affects agricultural productivity, ecosystem health, native vegetation and air quality.

The impact of wind erosion on agricultural soils can be significant through loss of nutrient rich soils and damage to emerging seedlings from soil movement, which reduces sustainable agricultural production and reduces crop yield.

Agriculture Victoria used satellite imagery and conducted field surveillance to monitor dynamic conditions, such as crop cover, management and ground cover, in the Mallee in 2019 and 2020. Satelite imagery products identify actively growing green vegetation (photosynthetic vegetation) and senescent vegetation (non-photosynthetic or dead vegetation). This data distinguishes cereal, legume and canola crop types, as well as pasture and bare ground in dryland agricultural areas, on an annual basis. This approach uses a fractional cover product that calculates the percentage of pixels from the dataset, within a discrete area, that is achieving the wind erosion protection threshold of greater than 50 per cent ground cover. Whereas, the bi-annual field surveys capture land management, crop types, the presence of livestock and evidence of erosion.

Ground cover levels of more than 50 per cent are considered to be protected from wind erosion. Land management practices and ground cover levels are used to assess the levels of ground cover likely to offer soil protection at harvest and throughout summer and autumn.

Findings

The 2019 below average growing season rainfall produced low crop biomass in the northern Mallee, who also missed out on the large summer rainfall recorded in the southern Mallee. This had a significant effect on the amount of ground cover that was still remaining in autumn 2020. After an average to dry summer the 2020 cropping season started with confidence, with the rainfall break arriving in mid-March. The total rainfall for the year was average across most of the Malllee, this contributed to the lower amounts of bare ground record in the region during the 2020 cropping season.

Management actions such as windrow-burning and livestock grazing were used in the southern Mallee to remove lost grain and to reduce trash levels after the

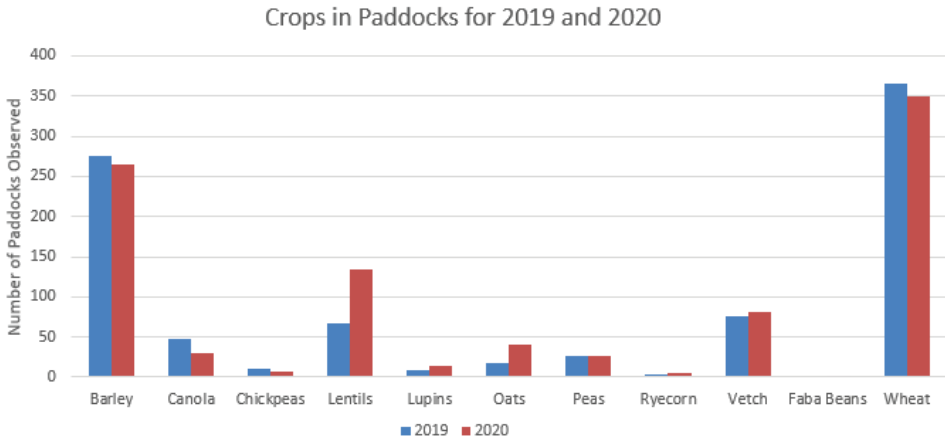

Figure 1: Crop types observed in paddocks from 2019-2020

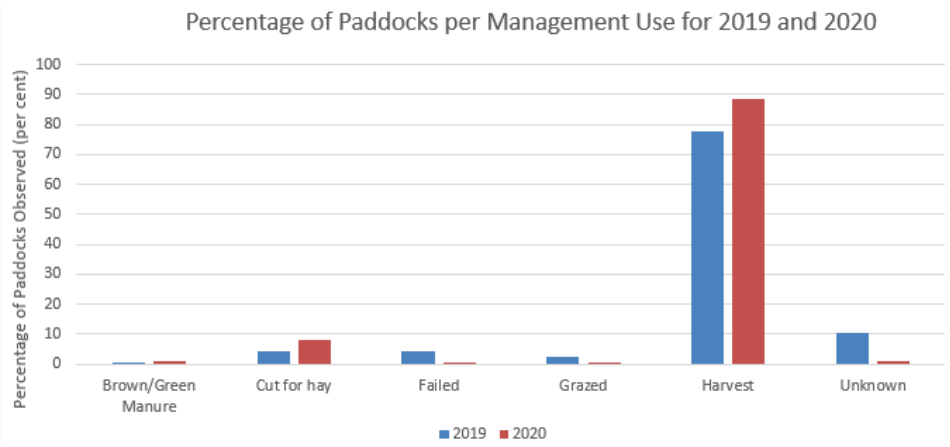

Figure 2:Management uses of observed paddocks from 2019 - 2020

good 2019 harvest. Phone interviews with farmers indicated an awareness of good ground cover management, suggesting they had assessed the risks associated with these actions.

The 2020 roadside surveys recorded an increase of 57 cropped paddocks compared to 2019. There was a substantial increase in surveyed paddocks sown to lentils, rising from 65 to 135 paddocks, as seen in Figure 1. A large increase in oats, from 18 to 40 paddocks was recorded. Decreases in paddocks sown to both wheat and barley were recorded, by 15 and 11 paddocks respectively, as well as a reduction in the canola paddocks. The decrease in canola could be attributed to the lower summer rainfall not providing enough stored soil moisture for farmers to have confidence in growing canola, as compared to the 2018/19 summer rainfall.

At the time of the 2020 survey it appeared that 88.7 per cent of the cropped paddocks were intended for harvest, an increase of 11 per cent of paddocks compared to 2019 (Figure 2). Paddocks intended for hay in 2020 made up 8.3 per cent of the cropped paddock; brown or green manures made up one per cent and 0.6 per cent of the crops were being grazed. In 2020 0.6 per cent of crops appeared as though they would fail which was a large improvement on the 4.3 per cent in 2019.

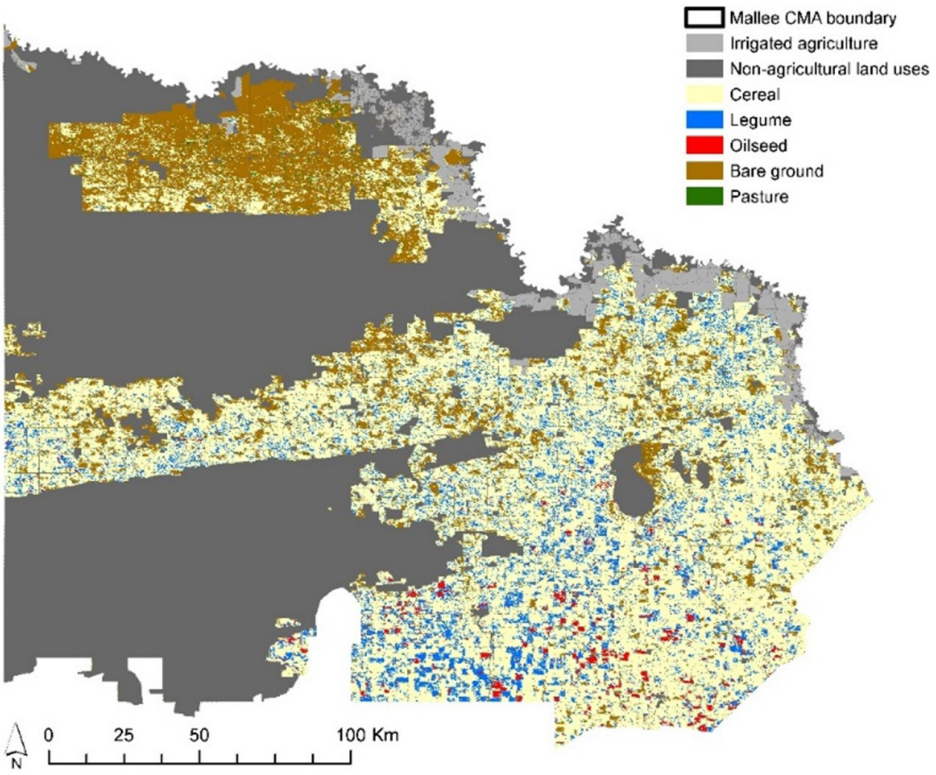

Figure 3: Dryland agriculture land cover (derived from satellite imagery) for 2019

Annual dryland crop type maps were produced for each year across the Mallee CMA region. Each map identifies cereal, legume and canola crop types, as well as pasture and bare ground in dryland agricultural areas. Cereals are the dominant crop type grown across the Mallee CMA, with 66.6 per cent and 71.5 per cent of dryland agricultural areas sown to cereals in 2019 and 2020 respectively (figure 3 and 4). The second most common crop type is legumes, with 11.3 per cent and 16.25 per cent of dryland agricultural areas sown to legumes in 2019 and 2020 respectively. Oilseeds account for a small proportion of dryland agricultural crops in the Mallee. Less area was sown to oilseeds in 2020 compared to 2019. These regional-scale patterns are consistent with those observed at a paddock scale during the 2019 and 2020 roadside surveys (figure 1).

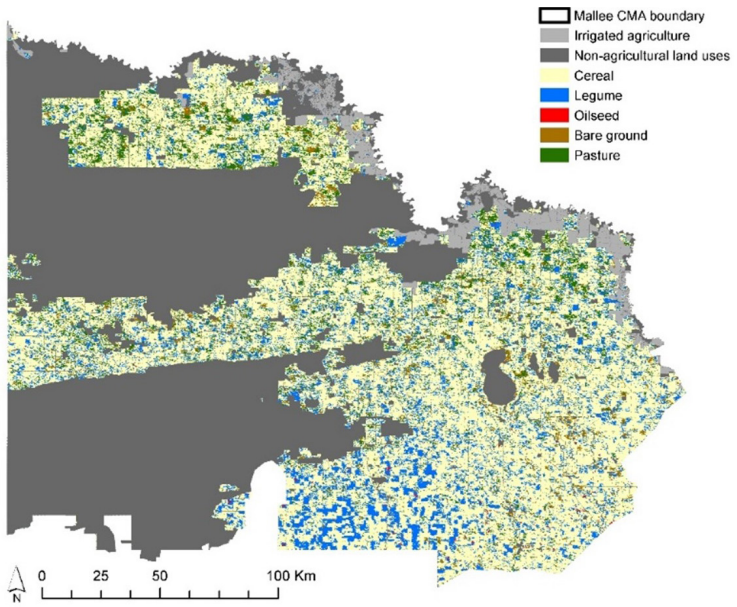

Figure 4: Dryland agriculture land cover (derived from satellite imagery) for 2020.

Areas of bare ground were largely observed in the northern Mallee during 2019. During 2019, about 20 per cent of dryland agricultural areas were bare ground (figure 3), which could be attributed to the low rainfall recordings in areas of the

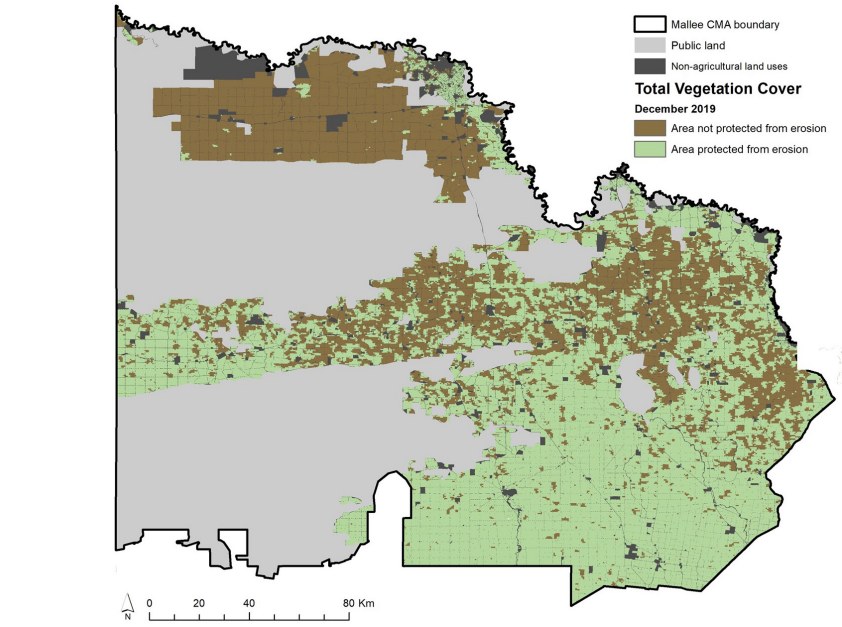

Figure 5:Area protected from wind erosion (> 50 % TVC) during December 2019

northern Mallee. In comparison, bare ground accounted for less than 4 per cent (figure 4) of dryland agricultural areas during 2020.

The area protected or not protected (above or below 50 per cent total vegetation cover) after harvest in 2019 and 2020 can be seen in Figures 5 and 6. December 2019 and December 2020 show a similar proportion of area protected from wind erosion, 61.0 per cent and 62.5 per cent respectively, however the maps show that in 2019 the areas not protected from wind erosion were concentrated in the northern Mallee, while in 2020 the areas not protected included a greater proportion of the eastern Mallee.

In Summary

Rainfall was below average across the Mallee in 2019, this had a significant impact on the northern Mallee whereas average rainfall was recorded across the Mallee in 2020.

Cereals are the dominant crop type grown across the Mallee. The most recorded cereal crop over both years was wheat, followed by legumes. Oilseeds accounted for a small proportion of crops in the Mallee, with less area sown in 2020 compared to 2019.

The increased rainfall in 2020 meant that there was less bare ground and more area cropped observed during October. Despite the difference in rainfall over the two years the land area protected from wind erosion was very similar in both 2019 and 2020.

Acknowledgement

This project is supported by the Mallee Catchment Management Authority through funding from the Australian Government's National Landcare Program.

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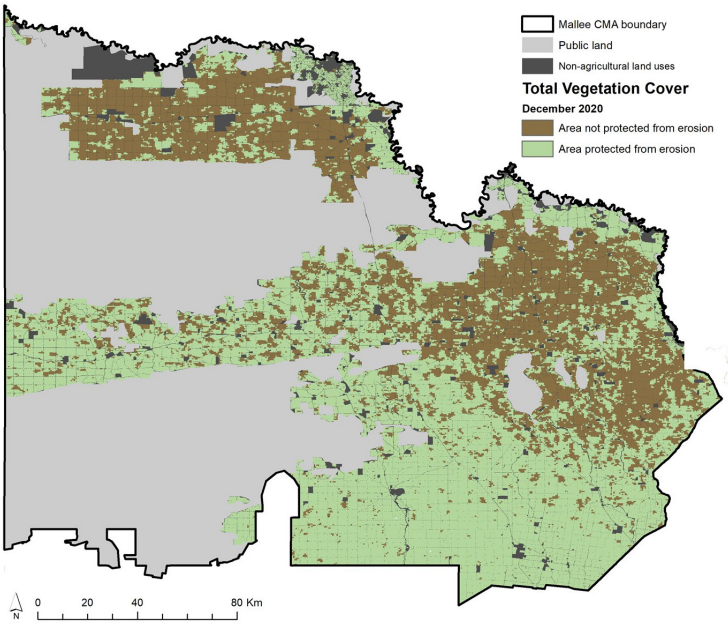

Figure 6: Area protected from wind erosion (> 50 % TVC) during December 2020

French serradella pasture continues to show potential on Mallee sands

By Roy Latta

Frontier Farming Systems

Summary

Serradella is being assessed as a multi-purpose (forage, hay, seed) alternative to vetch and annual medic on deep Mallee sands. While it has not shown any clear benefit over vetch in productivity to date the expectations are that it will be more productive on neutral pH "lupin" soils. It does provide the option for very (up to 1-year), early seeding due to the delayed seed softening of the on-farm produced seedpod.

As an alternative to annual medic, serradella may provide on-farm seed supply and improved productivity on the deep sands. The areas where it falls short in the annual medic comparison are in the later maturity of the current major cultivar Margurita, and possibly a lack of hard seed available to regenerate following a cropping phase. 2021 may provide some answers when regeneration of serradella and annual medic following a wheat phase will be measured.

2015 – 2018

In the 2019 Autumn edition of the Mallee Farmer, serradella was introduced as a potential alternative to vetch and annual medic on Mallee sands. The article summarised a four-year study which commenced at Walpeup in 2015 on a neutral pH sand over sandy loam. The comparison included serradella seedpods and annual medic sown with barley in April 2015 and Volga vetch, sown into a barley stubble in April 2016. The 2016 pastures were allowed to regenerate in 2017, followed by wheat in 2018.

In 2016 the vetch produced more biomass than the serradella and annual medic. The legumes regenerated as a second-year pasture in 2017 with the serradella producing almost 6 t/ha of biomass, the annual medic 3.5 t/ha, while the vetch failed due to low plant populations. The wheat yield and grain protein content were higher in 2018 following serradella.

The study supported further evaluation of serradella as an option for sandy soils as it was more productive than the annual medic, as opposed to vetch it provided the opportunity to establish the pasture in the year prior to the pasture phase, and it provided a 2-year pasture phase option for weed or disease control. However, successful on-farm seed supply needed to be assured to provide better or comparative economics to vetch and annual medic.

2018-2021

A further 4-year pasture research and development project including serradella, annual medic and vetch commenced in 2018, with the expressed aims of assessing;

1. *'new' legume pasture species for their adaptability to alternative establishment times* Serradella and annual medic established successfully in 2019 from autumn 2018, February 2019 and May 2019 sowing, vetch from a May 2019 sowing (it was not included in earlier sowing times).

2. *their productivity on certain soil types* In 2019 vetch produced 2.5 tDM/ha, annual

French Serradella trails helping determine biomass quality and amount. Photo Roy Latta

	2016		2017	2018	
	Biomass (tDM/ha)	Seed yield (t/ha)	Biomass (tDM/ha)	Wheat (t/ha)	Protein (per cent)
Serradella pods	3.5	1.45	5.8	3.2	10.6
Annual medic	3.4	1.28	3.5	2.4	10.2
Volga Vetch	4.7	1.86	0.1	2.6	8.9

Table 1 2016 biomass (tDM/ha) seed yields (t/ha) and 2017 biomass (tDM/ha) of the forage legumes and the subsequent 2018 wheat yields (t/ha) and protein contents (per cent)

1. medic 2 tDM/ha and serradella 1.6 tDM/ha on a red Mallee sandy loam. In 2020 on a deep sand serradella and vetch produced more biomass (7.5 tDM/ha) than annual medic (5 tDM/ha).

2. *the ability for their seed to be machine harvested and retained* In 2020 on deep sand vetch yielded 2 t/ha of seed, serradella 1 t/ha of seed pod. This constituted 80 per cent and 50 per cent of their total seed production respectively. The annual medic was not harvestable.

3. *the response in the cropping phase of the rotation to the new legume pasture species* In 2020 there was no difference in the wheat grain yield (~2.6 t/ha) or protein content (~12.5 per cent) that followed the 3 pasture species.
4. *In 2021 their hard seed characteristics that may support a viable pasture after a cropping phase will be assessed.*

Further information, contact details and more reading
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This project is supported by funding from the Australian Government Department of Agriculture, Water & Environment as part of its Rural R&D for Profit program, the Grains Research and Development Corporation, Meat and Livestock Australia and Australian Wool Innovation. The research partners include the South Australian Research and Development Institute, Murdoch University, the Commonwealth Scientific and Industrial Research Organisation, the WA Department of Primary Industries and Regional Development, the NSW Department of Primary Industries and Charles Sturt University, as well as grower groups.

Virtual Reality Technology and Agriculture Extension

By Glen Sutherland

Mallee Catchment Management Authority

What Is Virtual Reality (VR)?

VR has been around in various forms for a while with the two main types being immersive and non-immersive. Immersive VR is most often associated with entertainment, particularly in computer-based gaming where players literally immerse themselves into a very different reality where they can move through various virtual 3 dimensional landscapes. Immersive VR requires users to wear virtual reality headsets and use hand controllers that generate realistic projected images, sounds and even sensations. The technology enables the user to actively participate in artificial environments, seeing, moving through and even interacting with virtual features or items.

VR and its Application in Agriculture Extension.

More widespread is the non-immersive VR technology that utilizes 360-degree photography and computer programing to generate visual products allowing the user to navigate around defined areas. An example of this is the common method of marketing property with prospective buyers able to move around and through listings without leaving their home or office computer. The 360-degree photography in combination with video, audio and graphics is currently being effectively used to pioneer a new way of conducting agricultural extension through the Mallee Sustainable Farming Immersive Ag project. This project was created to help overcome the challenges of distance and time, allowing farmers to view field days and trials anywhere, anytime using a smart phone, tablet or computer screen. Immersive Ag brings the trial site to the viewer offering 360 vision on the screen and the ability to move through and compare trial plots. Check out the impressive catalog of these virtual field days, crop walks and workshops at https://immersiveag.com.au/

Frontier Farming Systems Stacey Solomon demonstrating the immersive virtual reality technology to Mallee Sustainable Farming board member and Millewa farmer Chris Hunt. Photo provided by Mallee CMA

Can agriculture benefit from Immersive VR?

The ability for immersive VR technology to provide benefits to the dryland agriculture sector is being investigated through research and development currently underway at Mallee Sustainable Farming's Mildura shared facility. Stacey Solomon has recently joined the Frontier Farming Systems (FSS) team to lead the ongoing work with the Immersive Ag project, including the potential application of immersive VR technology in agriculture extension. FSS delivers research, development and extension projects servicing broadacre agriculture and regularly collaborate with industry stakeholders including Mallee Sustainable Farming.

A focus of Stacey's work is the application of VR and how it might be used to effectively augment the current Immersive Ag suite of virtual products, including how to connect more farmers with research trial sites, field days and workshops. Stacey is also investigating the future direction of immersive and non-immersive VR in agricultural extension to find ways of providing access to extension events in real time, live view to bring engagement activities to a broader audience, as they are happening.

Acknowledgement

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

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Don’t Cross the Tick: Ehrlichiosis In Dogs

Photo: Mallee CMA

Victorian dog owners and veterinarians are reminded to be on the lookout for a new dog disease which is
spread by the brown dog tick biting dogs.

Ehrlichiosis was found for the first time in Australia in the Kimberley region in mid-2020. It is now found across mainland Australia apart from Victoria and the ACT, after being confirmed in South Australia recently.

Victoria’s Chief Veterinary Officer Dr Graeme Cooke said symptoms could include fever, lethargy, loss of appetite, weight loss, cloudy eyes or conjunctivitis, pain, stiffness, nosebleeds, bruising on the gums or belly, and enlarged lymph nodes.

To date, no dog originating from Victoria has tested positive to ehrlichiosis, also known as canine monocytic ehrlichiosis (CME), a bacterial disease caused by Ehrlichia canis (E. canis).

“With dogs travelling readily around Australia, we need to be particularly mindful of these symptoms if they have come from another state or territory with confirmed cases and brown dog ticks present.

“Reduce the risk of bringing the disease into Victoria by adopting or purchasing dogs within the state and avoid bringing dogs into Victoria,” Dr Cooke said.

“Protect your dogs from ehrlichiosis by regularly checking them for ticks, using effective tick control and seeking veterinary advice promptly if they become unwell. Be particularly vigilant if you’ve been interstate with your dog.”

Ehrlichiosis is potentially a deadly dog disease for which there is no vaccine, but antibiotics may assist in managing the disease if treated early.

“This is a notifiable disease in Victoria, which means it must be reported to the Emergency Animal Disease Watch Hotline on 1800 675 888 when suspected,” Dr Cooke said.

“You should regularly check your dog for ticks by running your fingers through their coat, on the skin, paying attention to the head, neck, ears, chest, between their toes and around their mouth and gums.

“If your dog is unwell or you find any abnormal bumps or ticks, make sure you promptly arrange to take your dog to the vet. Discuss with your vet the testing system in place for ehrlichiosis in Victoria.

“Put a tick in a clean ziplock bag and take it to your local veterinarian to submit for identification. Freeze the bag with the tick first if you cannot take it to a vet immediately. If you are unsure about what is an appropriate tick control product to use, then consult your Veterinary advisor.”

On rare occasions humans can become infected through the bite of an infected tick. Please seek medical advice if you feel unwell after being exposed to ticks.

For more information, visit the Agriculture Victoria website or call the Customer Contact Centre on 136 186.

www.agriculture.vic.gov.au

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Restoring Buloke Woodlands in the Mallee: the Buloke Woodland Regeneration Trial

By Cameron Flowers

Introduction

The Buloke Woodlands of the Mallee form part of the 'Buloke Woodlands of the Riverina and Murray Darling Depression ', an Endangered Ecological Community listed under the Environment Protection and Biodiversity Conservation (EPBC) Act 1999. Extensively cleared for agriculture and grazing, these woodlands now exist as scattered remnants on private and public land, with many remnants in poor condition. Buloke Woodlands are not just important for the diversity of plant species they contain; they also provide habitat for a distinctive suite of fauna species, including several threatened species such as the south-eastern Red Tail Black Cockatoo, the White-browed Treecreeper and Major Mitchell's Cockatoo.

Lack of regeneration of both canopy and understorey species is a major threat to the ongoing survival of these woodlands. Many remnants now have only veteran Buloke trees present and lack vital mid-storey and ground layer components.

Landholders value the Buloke woodland on their properties and are interested in on-ground actions to protect and enhance them, but what are the best techniques to restore structure and diversity to these important remnants?

The Buloke Woodlands Regeneration Trial

The Mallee CMA (MCMA), in partnership with the Arthur Rylah Institute (ARI, Department of Environment, Land, Water and Planning), is delivering a four-year project (2019 - 2023) to improve our knowledge of Buloke Woodland management and promote restoration techniques which improve the condition of degraded remnants on farmland.

The focus of the project is a 13-hectare demonstration site established on private property near Birchip in 2019 to experimentally trial a set of targeted restoration techniques for Buloke Woodlands. The demonstration site also provides a 'local' site where knowledge can be exchanged between ARI, MCMA, landholders and the community through field days and information sheets. The success of the trialled restoration techniques will be evaluated over the four years of the project, contributing to filling knowledge gaps for effective Buloke Woodland restoration and management in the Mallee region.

The Trial Design

An intact Buloke woodland has a canopy of Buloke (Allocasuarina luehmannii) and, less commonly, Slender Cypress Pine (Callitris gracilis) over a mid-storey of small trees and tall shrubs. The ground layer consists of small shrubs, herbs and Wallaby and Spear grasses (Figure 1). The restoration focus of the demonstration site will encompass all the vegetation layers of the Buloke Woodland community.

Restoring the canopy

Five regeneration techniques to enhance Buloke recruitment were employed around the base of 10 mature Buloke trees (Table 1). Slender Cypress-pine tubestock was also planted at 10 locations in the remnant.

Restoring the mid-storey

Is tubestock planting or direct seeding a more effective technique to restore the small trees and tall shrubs of the mid-storey of Buloke Woodlands? To investigate this, tubestock of five species were interplanted at four locations throughout the remnant. The species planted were typical of Buloke Woodlands: Umbrella Wattle, Weeping Myall, Golden Wattle, Hooked Needlewood and Weeping Pittosporum. Direct seeding was undertaken on multiple rip-lines 50 to 100 metres in length throughout the site. A single tyne rip per line was used to minimise soil

Treatment	Details
Shallow ripping	Ground was ripped at three short rip lines to encourage suckering.
Tubestock planting	Buloke seedlings were planted and survival and growth of tubestock will be monitored.
Seed scattering	Buloke seed was scattered and seed germination rates will be monitored.
Natural regeneration	Bare ground soil microsites were established to encourage natural regeneration.
Control	A plot which was not cleared of vegetation was also established to act as a control against which the success of the natural regeneration plot can be assessed.

Table 1: Regeneration treatments for the overstorey

Figure 1. Buloke Woodland on private property highlighting the three structural layers present and what should occur within those layers Credit: Claire Moxham, ARI

Direct seeding of the mid-storey at the demonstration site. Credit: Claire Moxham, ARI

disturbance. The species within the direct seeding mix were: Umbrella Wattle, Golden Wattle, Berrigan, Pimelea Daisy-bush, Weeping Pittosporum, Hedge Saltbush and Senna species.

Restoring the understorey

A Buloke woodland remnant in good condition will have an understorey of grasses, herbs and small shrubs. An ecological burn in three open grassy areas of the demonstration site is planned for late April this year to enhance the understorey of the demonstration site. The burn aims to promote the germination of hard-coated native seed in the soil seed bank and reduce the cover of annual exotic grasses. As fire is not frequent in Buloke Woodland, a very cool, low intensity burn will be undertaken across three (10 x 40 m) plots, with control plots (no burn) also established to assess the efficacy of this technique.

Citizen Scientists Contribute to Monitoring

Detailed annual monitoring of all restoration treatments will be undertaken by ARI to enable the effectivity of the trialled restoration techniques to be evaluated. Citizen scientists will also be involved, with a subset of the restoration techniques being monitored by students from Birchip P-12 School. This monitoring can be undertaken monthly, quarterly or annually and will increase the data available for evaluation by ARI; as well as providing the students with hands-on experience of Buloke woodland ecology, management and monitoring.

Promoting Buloke Woodland Restoration to Landholders and the Community

An important aim of the project is to enable land managers, landholders, citizen scientists and scientists to learn together about Buloke Woodland restoration through a series of events, such as field days, where knowledge and information about the ecology and management of Buloke Woodlands and the success of restoration techniques can be shared. Planned field days during 2020 were cancelled due to Coronavirus (COVID-19), but field days are now being planned for 2021 through to 2023. In addition, a number of information sheets about Buloke Woodland ecology and restoration will be produced.

References

Moxham, C. (2020). Buloke Woodland regeneration trial: design and implementation plan. V2. Unpublished Report for the Mallee Catchment Management Authority. Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Victoria.

Further Information

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

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Buffel Grass Invading the Mallee

By Fiona Murdoch
Mallee Conservation

Buffel Grass (Cenchrus ciliaris) is a high-risk, environmental weed at the early stage of invasion in Victoria. It is well-established in other states where it was introduced for pasture and to stabilise soil because it is fast-growing and easy to establish. It is long-lived, deep-rooted and drought tolerant and each plant produces thousands of seeds. That's the perfect recipe for a weed.

Whilst introducing Buffel might have seemed like a good idea at the time, it has now invaded and completely altered conservation reserves in the Northern Territory and South Australia. Areas of native vegetation which were once diverse have been transformed into a monoculture of Buffel Grass. Recent studies have shown that the future risk to biodiversity from Buffel is equal to the threat posed by feral cats and foxes.

Buffel Grass flower closeup. Photo MCMA

Buffel Grass in flower Sturt Highway Cullulleraine. Photo MCMA

One of the most devastating effects of Buffel Grass invasion is that the high fuel load completely alters fire regimes. Buffel Grass fires are bigger, hotter and more frequent and this is a threat to wildlife, native vegetation like large old trees, and is also a significant threat to community safety.

Buffel Grass has lots of tiny seeds which can spread via clothing but currently Buffel is mostly spread by vehicles and machinery. Infestations in Victoria are small and scattered, generally along the major transport routes. Regional Roads Victoria and other agencies have responded quickly to treat infestations detected since the weed was first recorded in Victoria in 2014.
Buffel Grass is a summer growing weed and can really take off in years with good summer rainfall. This summer, small patches of actively growing and seeding Buffel were removed from Kulkyne Way, Nangiloc; near Abbotsford Bridge, Yelta and near Paws Resort, Merbein. These small infestations had the potential to spread unnoticed into our communities and bushland. Well done to the Victorian Government's Working for Victoria Mallee team, supervised by the Department of Environment, Land, Water and Planning, for doing these works. Ongoing monitoring will be needed following control because the soil-stored seed can remain viable for up to five years.

Any suspected occurrences of Buffel Grass in the Victorian Mallee can be reported to Loddonmallee.environment@delwp.vic.gov.au, lodged on iNaturalist for verification, or reported directly to the land manager. All sightings will be followed up.

Single Buffel Grass Red cliffs. Photo MCMA

Identification

After summer rain the Buffel tussocks are thick, lush and green 0.2-1.0 metres high with a red/purplish tinge at the base of the stems. The fluffy, purple flower heads are quite distinctive and look similar to a miniature version of Fountain Grass which is grown in gardens, however the Buffel seed head is only 10-15 cm long. When it is not actively growing, particularly in winter, the Buffel Grass leaves dry off to a hay colour and can appear dead.

More information

Factsheet to assist with identification - https://www.pir.sa.gov.au

Buffel as an invader of dryland ecosystems - https://theconversation.com

Tempy Primary School students become Malleefowl Ambassadors

By Marissa Shean

Local Landcare Facilitator, South Eastern Mallee Landcare Consortium

If you want to know anything about Malleefowl just ask a Tempy Primary School student! They're in the know with all the facts and quirks about the iconic Mallee birds.

Tempy Primary School were recipients of funding support through the Malleefowl Recovery Group and Mallee Catchment Management Authority's (CMA) Citizen Science program to undertake a project educating the students about the endangered Victorian Malleefowl.

The project educates primary school students on the unique characteristics of the endangered Malleefowl that resides in close proximity to their school. The students are on a mission to learn more about the unusual characteristics of this unique bird; its lifecycle and the importance of minimising threats to ensure its survival.

Increasing the students knowledge will teach them more about what strategies they can utilise to minimise threats to the Malleefowl including erecting more distinguishable signage on roadsides, campaigning for control of foxes and feral cats in Malleefowl habitat and revegetating to help repair cleared and fragmented habitats.

The project involves teaching Tempy Primary School students to be citizen scientists. The children will be involved in all areas of analysing, storing and processing data. It provides the primary school students with an opportunity to contribute to 'real' scientific research with the resulting data being used for public information and conservation. Citizen science monitoring programs promote and foster environmental awareness and stewardship.

The project has been auspiced through the Mallee Landcare Group Inc.

During Semester One 2021, the Tempy Primary School students have been utilising the

Kelly Mott from Parks Victoria discussing Malleefowl habitat with Tempy Primary school students. Photo, Mallee CMA

Malleefowl Recovery Group's 'The Malleefowl Education Kit' as part of the P-6 Science Curriculums focus and inquiry model on background learning and understandings relating to Malleefowl; Geography Curriculum focus on Parks areas; Aboriginal and Torres Strait Islander histories and cultures; Art curriculum and using digital technologies for scientific and tracking purposes.

Tempy Primary School students have been busy learning from local Malleefowl enthusiasts including;

- Louise Nicolas and Michael Gooch (Malleefowl Recovery Group Volunteers) who presented about characteristics of the Malleefowl and monitoring active and inactive Malleefowl nests throughout the Mallee.
- Ricky Marks and Annette Harbrow (Mallee Tours) guided students on a tour through the Mallee woodlands which contained two active Malleefowl nests. The students learned about the diet of the Malleefowl and identified the tracks and scats of other native birds and animals. The tour ended with a lesson in seed collection and propagation by Tony & Bev Bingley on their 6000-acre property that has been revegetated and planted from local seed. The students pitched in to help revegetation work and planted their own tree on Tony and Bev's property.
- Mallee CMA Field Officers Cameron Flowers & Derrick Boord who presented on Malleefowl habitat fragmentation and landscape linkages that included a bus trip to a Mallee CMA revegetation site at Bronzewing Reserve.
- Kelly Mott, Parks Victoria presented to the students on her local knowledge of how Malleefowl are inhabiting and moving between the Parks, private land and occasionally roadsides.
- William Hannah-Rodgers from Forest Fire Management Victoria presented to the students about cultural heritage engagement empowering the future generation through connection, respect and knowledge of First People's connections to megapodes and understanding of Aboriginal Astronomy and the Malleefowl.

The Tempy Primary School students have been invited to present the findings of their Citizen Science project to the Victorian Malleefowl Recovery Group's Reporting Back meeting in Patchewollock in May, which they are most excited about.

Acknowledgement

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Victorian Malleefowl Recovery Group inc.

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Investigating frost susceptibility on Clearfield varieties treated with imidazolinone herbicide

By Michael Moodie

Mallee Sustainable Farming/Frontier Farming Systems, Declan Anderson and Ray Correll, RHO Environmetrics

This article reports on the final findings of the SAGIT frost project investigating if Clearfield varieties are more susceptible to frost with and without imidazolinone herbicide.

Key Points

- The outcomes of the 2020 trials were consistent with similar trials conducted in 2018 and 2019.
- On average there was no indication that varieties with the Clearfield trait, or that the application of imidazolinone herbicide, caused crops to be more susceptible to frost damage.
- Observations that Clearfield crops are more susceptible to frost damage could be due to how they are managed in the farming system rather than the Clearfield gene.
- The greatest determinant of the level of floret sterility in cereal crops was time of sowing.
- High levels of floret sterility were observed in fast spring wheat varieties sown before the start of May.
- In lentils the highest grain yield was achieved with earlier sowing despite higher levels of frost damage while delayed sowing was a better approach in field peas.

Brief Background

Frost is a major constraint to profitable grain production in the Mallee and there is concern that the incidence and severity of frost events in the region is increasing. The Clearfield system has been widely adopted by Mallee farmers over the past decade. The Clearfield system uses crop varieties that are tolerant to imidazolidine herbicides with imidazolinone herbicides such as Intervix® applied in crop to kill problem weeds such as brome grass. However, there is concern amongst Mallee agronomists and farmers that the widespread adoption of Clearfield crops is corresponding with an increased incidence of frost damage and that this may be due to Clearfield crops having greater susceptibility to frost than conventional crops. To investigate this issue Mallee Sustainable Farming (MSF) received funding from the South Australian Grain Industry Trust (SAGIT) to determine if Clearfield varieties and/or the application of imidazolinone herbicides of crops commonly grown in the Mallee were more susceptible to frost.

Experimental sites

Two replicated field trials were established near Loxton in 2020 on a sandy loam soil type. The first trial compared conventional and Clearfield varieties of wheat with each pair of varieties having similar phenology. A summary of the varieties and their grouping is provided in Table 1. Each Clearfield variety also had two herbicide treatments, unsprayed or sprayed with Intervix® at the label rate (0.75 L/ha). Intervix® was not applied to the conventional varieties. Each varietal pair was sown across four sowing dates with irrigation applied to achieve germination at TOS 1. Irrigation was applied using dripper tape to apply 10 mm of rainfall in the seed row. The four TOS were:

- TOS1 19th April (Irrigated)
- TOS2 29th April
- TOS3 8th May
- TOS4 22th May

Crop	Conventional Variety	Clearfield Variety
Wheat	Axe	Hatchet
Wheat	Gladius	Kord
Wheat	Mace	Razor
Wheat	Trojan	Sherriff
Lentil	PBA Bolt	PBA Highland XT
Lentil	PBA Jumbo2	PBA Hurricane XT
Field Pea	PBA Oura	GIA Ourstar

Table 1. Varieties used in both trials classified by conventional or having the Clearfield trait

TOS	TOS1	TOS2	TOS3	TOS4	Average	LSD
Axe Hatchet	78.0	66.5	25.5	7.4	44.4	7.9
Gladius Kord	32.9	12.9	7.4	6.4	14.9	
Mace Razor	59.7	43.4	16.3	10.6	32.5	
Trojan Sherriff	43.2	16.2	16.2	10.3	21.5	
Average	53.5	34.7	16.4	8.7		*8.3*

Table 2. Mean percent floret sterility for each varietal pair for each sowing time. The LSD for comparing averages within a TOS is 8.3 and for comparing varietal pairs averaged across TOS was 1.3.

Floret sterility was measured for each treatment by taking three 0.25 m x 4 interior row cuts from each plot during dough formation (Zadoks 81-87). Thirty were then collected by randomly selecting stems from the upturned combined sample. Floret sterility was then calculated as fraction of number of grains set and the total number of florets per spikelet. Grain yield was then measured after removing the outside rows so that grain yield was measured only from the four internal plot rows to avoid edge effects. Growth stage monitoring using the Zadoks growth scale was also completed regularly during late winter and early spring to determine the sensitive flowering stage.

A second trial compared conventional and Clearfield varieties of lentils and field pea using a similar methodology as described for the cereal (barley and wheat) trial. The varietal pairs are shown in Table 1. Each Clearfield variety also had two herbicide treatments, unsprayed or sprayed with Intervix® at the label rate (0.75 L/ha). Intervix® was not applied to the conventional varieties. Sowing times for the pulse trial corresponded with the cereal trial sowing times. The percentage of frosted pods was determined by collecting 12 plants from each plot during the late pod filling stage by placing a piece of dowel across each plot at three locations and removing the plants at the intersection between the four internal rows and the dowel. All pods were then removed from each of the 12 plants to determine the total number of pods and then pods were inspected to determine the number with visual symptoms of frost damage. The ratio of frosted pods to total pod number was then calculated. Dry matter was measured by taking a quadrat cut (6 rows x 1 m) at the end of pod fill. Grain yield was measured by machine harvesting all six plot rows.

For both trials' temperature sensors were installed at canopy height to determine the incidence and severity of frost at the site. There were two severe frost periods that are likely to have damaged treatments within both trials (Figure 1):

- Late July – Early August: Nine days with temperate below

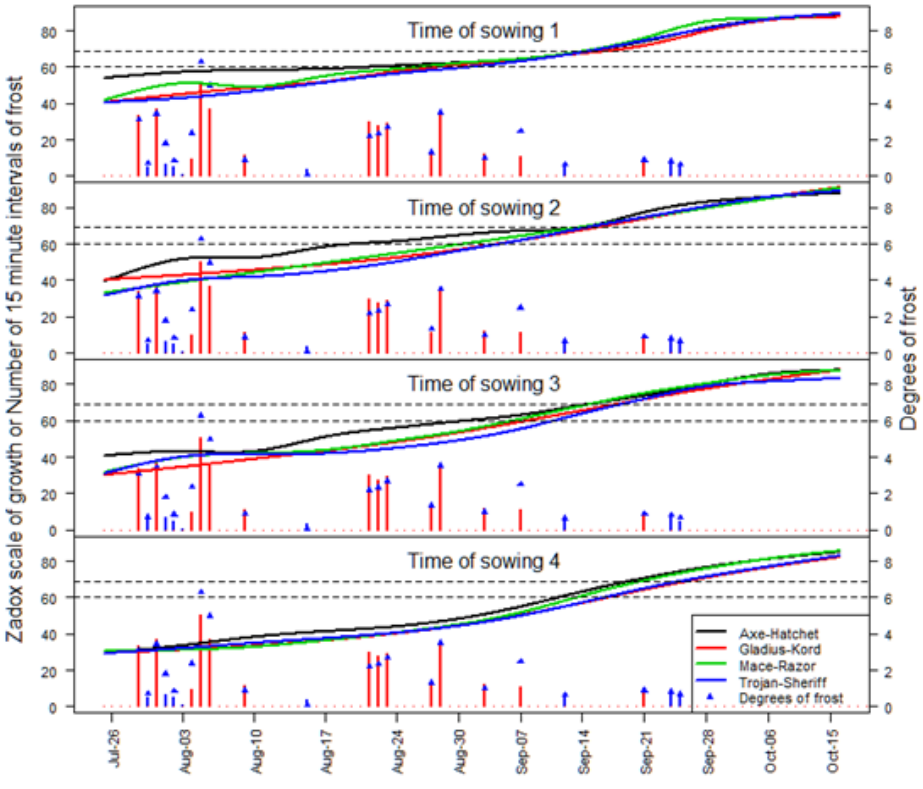


Figure 1. Relationship between Zadoks scores (left y axis) for each time of sowing and frost incidence in 2020. The red vertical lines represent the number of 15-minute intervals where the temperature at canopy height was below 0oC (right y axis) and the triangle symbols are the number of degrees less than 0oC of the minimum reached (right y axis).

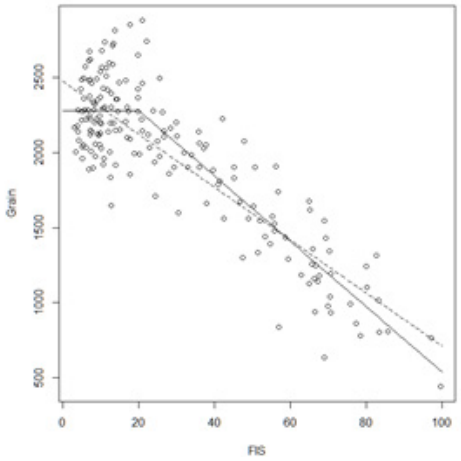


Figure 2. Relationship between wheat grain yield and floret sterility (FIS)

- 0oC at canopy height with a minimum temperature up to 60C below zero at canopy height
- Late August: 5 events with temperate below 0oC at canopy height with a minimum temperature up to 40C below zero at canopy height

Findings

Cereal Trial

Floret sterility decreased with delayed sowing with an average of 53.5 per cent floret sterility across all varieties at TOS 1 and 8.7 per cent at TOS 4 (Table 2). The Gladius-Kord pair consistently had the lowest levels of floret sterility (Table 2). The was no significant difference in floret sterility between Clearfield and conventional varieties or sprayed or unsprayed Clearfield varieties. There was a large difference between the varietal pairs sown at TOS 1 but that difference was not statistically significant at plots sown at TOS 4.

For TOS 1, there was a high level of floret sterility (78 per cent) in the Axe - Hatchet pair, but the severe frost events had occurred before flowering (Figure 1). The TOS 1 sown plots of Mace - Razor had approximately 60 per cent damage and again the frost had occurred before flowering. The frost events during August are most likely to have affected the plants at around ear emergence (Zadok's stage 50 – 60).

The Gladius- Kord and Trojan – Sherriff pairs were at an earlier stage and therefore these varietal pair were less affected. The TOS 2 sown plots showed little damage on Gladius – Kord and Trojan – Sherriff pairs although their Zadok growth stages were only slightly behind Mace - Razor. The later sown plots had apparently not reached a vulnerable stage before the main frost events.

There was a strong relationship (R2 = 0.747) between floret sterility and grain yield with a loss of 18 kg/ha of grain yield for each one percent sterile florets (Figure 2). However, there was evidence that a simple regression does not give an adequate representation. An alternative 'Bent-stick' model was a significant improvement – that model had plateau of 2282 kg/ha for FIS up to 19.8 per cent, and then a linear decrease of 22kg/ha for each unit of floret sterility (Figure 2).

There were highly significant effects of both TOS and the varietal pairs together with their interaction on grain yield (Figure 3). The lowest grain yield was from TOS 1. There was no significant difference in grain yield between TOS 3 and TOS 4. The Axe-Hatchet pair had lowest yield but there was no difference between Gladius-Kord and Trojan-Sherriff. The Axe-Hatchet pair produced only 1010 kg/ha at TOS 1. There was some variability between the conventional and Clearfield

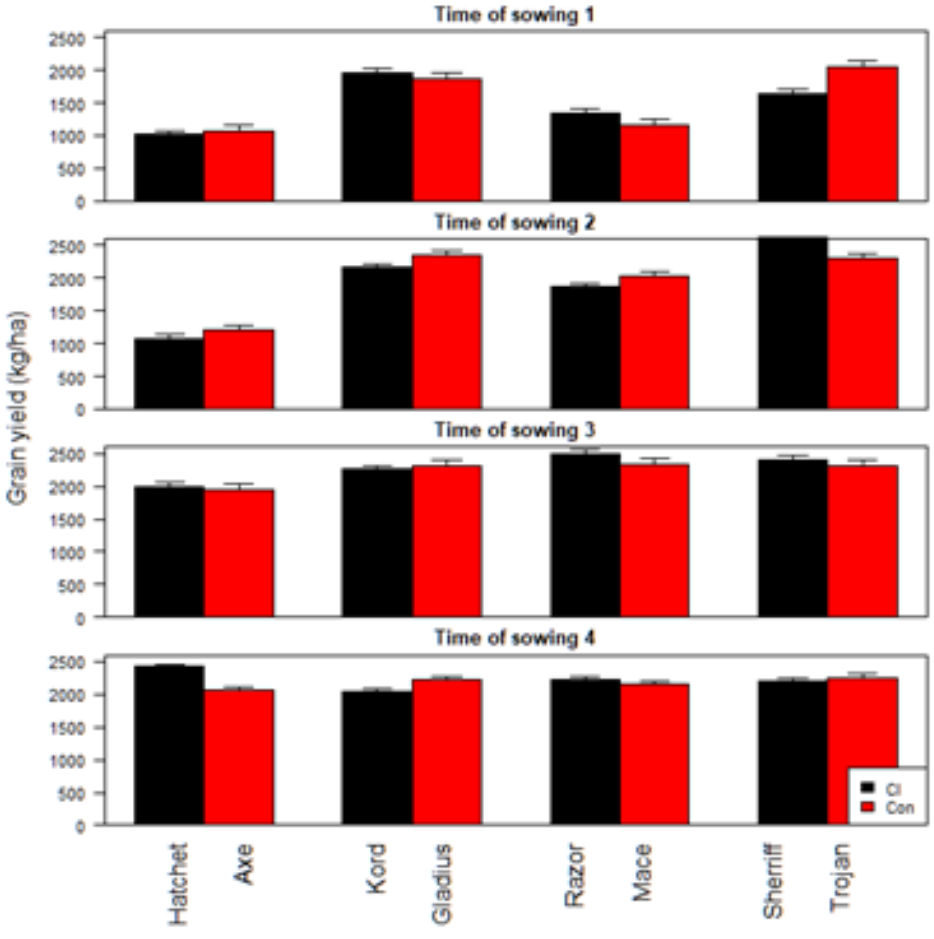


Figure 3. Grain yield for each varietal pair comparing conventional and Clearfield verities at each time of sowing.

	TOS 1	TOS 2	TOS 3	TOS 4	LSD	p value
Yield	1082	1146	1038	772	284	0.019
per cent frosted pods	10.93	4.78	0.97	0.36	3.48	<<0.001

Table 3 Effect of time of sowing on grain yield (kg/ha) and the percent of frosted pods of Lentils

	TOS 1	TOS 2	TOS 3	TOS 4	LSD	p value
Yield	1287	1159	1171	1685	NA	0.138
per cent frosted pods	6.00	7.86	1.81	0.86	5.87	0.037

Table 4 Effect of time of sowing on grain yield (kg/ha) and the percent of frosted pods of Field Pea.

varieties both among pairs and among TOS but on average the difference was 5 kg/ha and not statistically significant.

Pulse Trial

Overall, the pulse crops were less affected by frost than the cereal crops at Loxton in 2020. In contrast to cereal crops where the critical period for yield development is the lead up to flowering, the most sensitive stage for pulse crops is post flowering and pod development. At Loxton in 2020, cool and wet conditions in September and October provided an extended growing season which helped pulse crops to compensate production lost to frost damage.

For lentils, grain yield was reduced with delayed sowing even though the percentage of pods lost to frost was higher with earlier sowing (Table 3). As with cereals, there was no effect of Clearfield varieities or Clearfield herbicide application on either the level of frost damage or grain yield.

In contrast with lentils, the maximum yield of field pea was achieved at the last time of sowing (Table 4). The two earliest sowings were damaged significantly by frost and consequently had a lower harvest index. Favourable spring conditions also favoured later sowing of field peas and the field pea disease bacterial blight was also identified in the trial. Therefore, there were a range of both biotic and abiotic factors that led to later sowing of field peas being the best option in 2020.

Implications of the Findings

The outcomes of the 2020 trials were consistent with similar trials conducted in 2018 and 2019. The greatest determinant of the level of floret sterility in cereal crops was time of sowing. Sowing wheat before the start of May resulted in the highest levels of frost damage which in turn negatively impacted grain yield. This impact was somewhat mitigated in 2020 by sowing the combinations of Gladius – Kord or Trojan – Sherriff.

These varieties were slightly slower in their development and therefore escaped significant floret sterility at TOS 2 (29 April). As with previous trials, there were instances where the individual Clearfield varieties were slightly more affected by frost than the corresponding conventional varieties. However, these effects were not always consistent across all pairs and on average there was no indication that varieties with the Clearfield trait or the application of Intervix® herbicide were more susceptible to frost damage.

Pulse crops were less effected by frost than cereal crops at this site in 2020, although early sowing did increase the number of frosted pods in both lentil and field pea. For lentil, yields were maximised by accepting a higher level of frost damage in early sown crops rather than delay sowing to minimise frost damage. In field pea, delayed sowing improved grain yield, however this benefit may not have only been due to reduced frost damage but also due to disease and other biotic and abiotic factors.

Acknowledgements

This project was funded by the South Australian Grain Industry Trust (SAGIT): Project code MSF218. Thank you to Bulla Burra (Loxton) for hosting the trial site over three years.

Ensure your livestock are ‘fit to load’

By Deb Banks

Regional media and communications Department of Jobs, Precincts and Regions

Livestock producers, agents and transporters are being reminded that sheep and cattle must be ‘fit to load’ for the journey ahead.

The reminder comes at a time when above average livestock sales continue on the back of strong sheep and cattle prices.

Unfortunately, Agriculture Victoria occasionally observes welfare issues in livestock transport and in many cases, this is partly due to the fact that the responsible person doesn’t have a good understanding of how to assess livestock that are ‘fit to load’.
So, what does ‘fit to load’ mean?

Livestock that are fit to load are not suffering from conditions that could cause, or would be likely to cause, increased pain or distress during transport. That is, they are healthy and strong enough to make the intended journey.

To determine whether livestock are fit to load they must be inspected prior to loading. This inspection is made by all persons along the supply chain, as each person in charge of the animal takes on responsibility for the welfare of that animal. This includes producers, farm workers, transporters, and livestock agents.

Abattoirs and saleyards also have a duty of care to the livestock they receive.

It is important that producers only present animals that are fit for transport, remembering that the transport driver may refuse to load any livestock that is not fit.

When assessing livestock, consider the following questions;

- Is it lame? That is, the animal cannot walk on its own, bearing weight on all legs
- Is it too weak to undertake the journey, emaciated or visibly dehydrated?
- Is it suffering from severe visible distress, injury or disease? For example, eye cancers, ingrown horns, udder infection, or open wounds
- Is it suffering from any condition that could cause it increased pain or distress during transport?
- Is it blind in both eyes?
- Is it in late pregnancy?

If the answer is yes to any of the above questions, the animal is not fit for transport. And if in doubt, leave it out.

If an animal is deemed to be unfit for transportation the person in charge must not allow that animal to be transported, and must make appropriate arrangements for the care, treatment, or humane destruction of that animal.

Most locations have a knackery service available to help with humane destruction and disposal of unfit animals.

Ensuring all livestock are fit to load protects the integrity of Victoria's livestock industries, ensuring state, national and international markets remain open.

For further information on animal welfare contact your local Animal Health staff at Agriculture Victoria or contact the Customer Call Centre on 136 186.

For more information about Land Transport Standards can be found on the Agriculture Victoria website www.agriculture.vic.gov.au/transporting-livestock or producers can refer to the MLA fit to load guide at www.mla.com.au/fittoload.

This MLA national fit to load guide will help producers, agents, buyers and transporters decide if an animal is fit to be loaded for transport by road or rail to any destination within Australia

Nominate a Landcare Champion for a 2021 Victorian Landcare Award

The Victorian Government is inviting nominations for the 2021 Victorian Landcare Awards which recognises individuals and community groups across Victoria for their outstanding contributions to preserving the unique Australian landscape.

The Landcare Awards are coordinated nationally by Landcare Australia, with each state and territory coordinating their own awards ceremony. The Department of Environment, Land, Water and Planning through the Victorian Landcare Program coordinates the Victorian Landcare Awards ceremony.

In addition to the eight national award categories, Victoria awards additional categories which are independently sponsored at a state level.

The Awards are a celebration of the significant work undertaken by groups, networks and individuals who contribute their time and care to the conservation of Victoria's land, water and biodiversity.

The Victorian Government is proud to support and celebrate the efforts of those environmental volunteers who are working to protect our land, water and wildlife, and the communities who love and depend on them.

2021 Victorian Only Categories

- Joan Kirner Landcare Award ($1,000)
- Landcare Network Award ($500)
- Environmental Volunteering Award ($500)
- Urban Landcare Award ($500)
- Dr Sidney Plowman Travel and Study Award ($4,000)
- Heather Mitchell Memorial Fellowship ($4,000)
- Environmental Youth Action Scholarship ($2,000)

2021 National Categories

- Australian Government Individual Landcarer Award ($500)
- Australian Government Partnerships for Landcare Award ($500)
- Australian Government Landcare Farming Award ($500)
- Coastcare Award ($500)
- Landcare Community Group Award ($500)
- Woolworths Junior Landcare Team Award ($500)
- Indigenous Land Management Award ($500)
- Young Landcare Leader Award ($500)

For more information or to submit an application – please visit https://landcareaustralia.org.au/landcare-awards-2021/%20

Nominations close Wednesday 30 June.

Mice Update and Management Recommendations

By Glen Sutherland
Mallee Catchment Management Authority

Recent media coverage (since January 2021) of severe mice plagues impacting significant areas of New South Wales are a very timely reminder about mice management decisions this cropping season.

The current situation as reported by the Grains Research and Development Board, CSIRO (GRDC Monitoring mice in Australia – March 2021) and various regional news outlets, is that the plagues roll on unabated in mostly Central and Northern parts of NSW despite heavy rainfall and cooler weather.

Reports of increasing mice numbers are also filtering in from part of the Riverina, Mulwala and areas around Echuca in Victoria (ABC Regional Radio). Mouse abundance in Victoria is recorded as moderate to high but patchy (Fig 1.) Mice numbers in the Victorian Mallee are currently moderate to high, but again patchy with numbers greater in areas that received any of those fluky rainfall events over summer, particularly if these areas also had dropped grain still in the paddock from last season. Mice numbers have also been observed to be increasing in the areas round Birchip, especially on the heavier soils.

CSIRO mouse specialist, Steve Henry, predicts that mice numbers will be low to moderate around Walpeup by the end of autumn with numbers in other parts of north west Victoria being possibly higher. Steve's

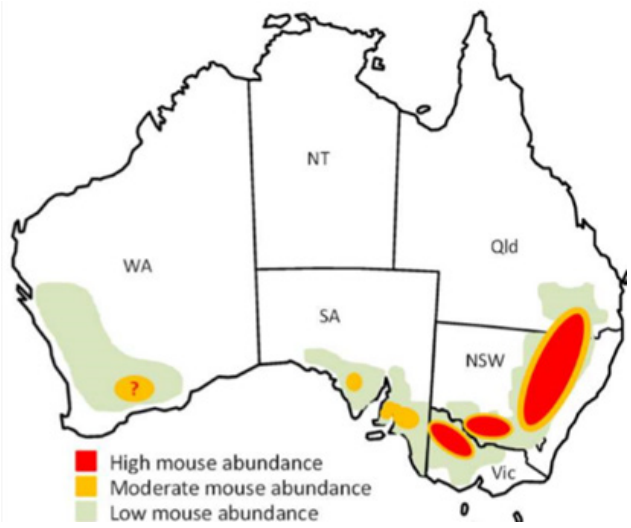


Fig 1. Approximate locations of mouse abundance (GRDC Monitoring mice in Australia Issue 24– March 2021)

predictions indicate farmers should be maintaining a higher degree of alertness of what mice numbers are doing in their paddocks, particularly paddocks with a history of mice problems. A reliable method of determining mice densities in late summer is keeping an eye out for active burrows 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, which often happens as night time and daytime temperatures begin to drop.

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 (www.mousealert.org.au). 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 where other data on mouse number can be observed.

If mice are present during sowing baiting straight off the planter box has proven to be effective as this presents readily accessible baited grains on the paddock surface. This works best when little or no alternative food is available to the mice.

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

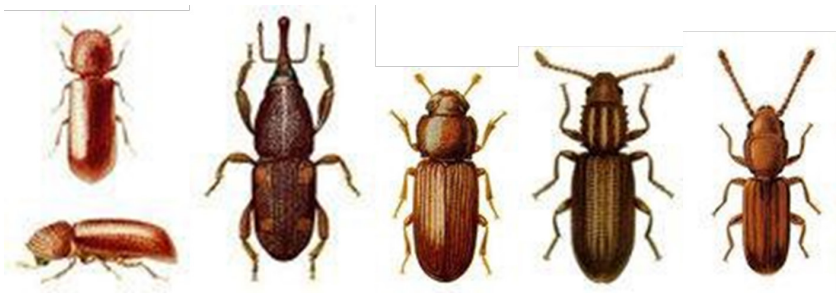
mallee catchment management authority

Seeking farms to visit - FREE - National monitoring of stored grains pests resistance

By Caitlin Langley

Southern Cropping Systems, NSW Department of Primary Industries

Have you seen these about your silos? Would you like us to take a look for you, free of charge?



The National Phosphine Resistance Monitoring program is funded by the Grain Research Development Centre (GRDC) via grain grower levies and aims to identify any resistance in stored grain insect populations to phosphine gas across Australia.

Phosphine resistance is a nationally significant issue that affects the integrity of our grain commodities by lowering quality, price and marketing opportunities.

New South Wales Department of Primary Industries Stored Grains Entomology team has been contracted to sample farms throughout Victoria and South Australia, and we are enlisting the assistance of industry to connect with local growers in these states.

Having grain sampled as part of this project is free and farmers who would like to take part simply need to get in touch to arrange a time to have their property sampled.

Alternatively, you can send the insects to our lab by placing samples in a sealed container or zip-lock bag with some grain via Australia Post.

Grain sampling is quick and easy, taking 30 minutes to an hour to complete by a trained technician. You can nominate a time to meet on farm or agree on a day that the technician can drop in on your property to sample.

To have grain tested it will require:

- Contacting our technician
- Providing the technician with pin drop to your property and/or a street address and contact details
- Answer a few questions regarding the type of grain and its treatment history (this can be done over phone or in email if unable to attend during visit)
- About half a bucket to a full bucket of grain for sampling (this can be returned to your storage once finished)
- If live insects are present in grain, these are sieved out and collected
- Insects found are cultured and will be tested for phosphine resistance once there is sufficient numbers

For more information:
https://www.youtube.com/watch?v=JbuI2wysd7o&feature=youtu.be

Or contact Caitlin Langley, Technical Assistant - Entomology - Southern Cropping Systems NSW Department of Primary Industries, Agriculture
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Australian Government

National Landcare Program

mallee catchment management authority

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