UNFS

Upper North Farming Systems

2014

RESULTS

UPPER NORTH FARMING SYSTEMS ANNUAL RESULTS BOOK

CONTENTS

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Collation and editing of this report was undertaken by Rufous and Co on behalf of the Upper North Farming Systems Group.
Printing and distribution was undertaken by Cheriton Consulting.

THANK YOU TO OUR FUNDING BODIES AND PARTNERS

Caring for our Country; Department of Agriculture, Fisheries and Forestry; GRDC; Department of Water and Natural Resources; Rural Solutions SA; Northern and Yorke NRM Board; Eyre Peninsula NRM Board; SARDI; and Rufous and Co.

Without the support and funding from these organisations and funding programs the Upper North Farming Systems Group would not remain viable.

A Message from the Chair

2014 was a busy year for UNFS with many events held. In terms of the season it was of mixed fortunes for the Upper North district

An early start in mid-April led to many farmers taking advantage of the great soil moisture. May was unusually warm resulting in good early crop vigour and pasture growth. On the downside the warm weather increased pest issues such as green peach aphids and lucerne fleas that slowed odd paddocks up a bit.

Winter was exceptionally wet setting crops up with good yield potential. The rainfall however stopped in August and the frosts started. The Upper North received a good rain in September saving some of the potential. Harvest was early and resulted in average to above average yields across the district.

A week of extreme low overnight temperatures in August froze crops and browned pastures. Severe stem frost was observed in crops around Willowie, Hammond and Amyton. In Response UNFS played a part in organising an emergency frost workshop held in Morchard with committee member Matt Foulis and Mick Faulkner presenting information on identifying stem frost, an issue many growers hadn't seen before. As well as monitoring for the frost damage, the workshop explored many of the management options available to those hit.

UNFS gained funding from GRDC for a bus trip interstate in July for members to visit fellow low rainfall groups Mallee Sustainable Farming Systems and Central West Farming Systems. 20 members enjoyed the trip visiting other low rainfall farmers and trial sites.

The annual field day was well attended in the new time slot in August with a good mixture of livestock and cropping topics and an afternoon field tour of the onion weed trial site and post pasture seeder demonstration. 2014 was the first year where we ran a spring crop walk. The half day event was very well attended starting with learning about crown rot with Marg Evans at the crown rot demo at Booleroo. A tour around the Booleroo NVT trial site with Rob Wheeler gave attendees the lowdown on what wheats suit our district. A look at the Nitrogen trial site followed in Kumnicks barley crop along with a BBQ to finish the day. It was a particularly icy finish for Barry Mudge and Matt McCallum who took part in the ice bucket challenge raising money for Motor Neuron Disease. The Low Rainfall Collaboration Group initiated this within its groups to support Geoff Thomas (Low Rainfall Collaboration Group Coordinator) whose wife has MND.

UNFS held a strategic planning workshop run by Janette Long in February where members, sponsors and committee members worked through the strategic planning process to establish the future direction of UNFS. The committee are currently working on the results of this workshop and will adopt a Strategic Plan for the Group towards the end of 2015.

UNFS has undergone some significant changes in the past few years and the committee is currently again reviewing the current structure to ensure the viability of Upper North Farming Systems into the future. The new UNFS committee will be structured for the future of the organisation. This will be presented at the AGM on the 6th of August.

On behalf of the UNFS Committee I extend a massive thank you to those who have contributed to Upper North Farming Systems throughout 2014. Whether it be in terms of major funding bodies or sponsors, without the ongoing support UNFS would cease to function.

A Big Thankyou to the current committee members and especially the Executive Officer/Project Manager Ruth Sommerville for the effort put into keeping the organisation running smoothly.

Good luck with the season ahead and I look forward to seeing you at one of our events during the season.

Joe Koch
Chairperson, Upper North Farming Systems

Upper North Farming Systems Contact List

Upper North Farming Systems

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Upper North Farming Systems Project List 2014

UNFS Project #	Other Names/ References	Full Name	Funding Source	Responsible Person/Contractor
201	Crop Sequencing	Profitable Crop sequencing in the low rainfall areas of South Eastern Australia	SARDI	Micheal Wurst
202	Fodder Shrub Systems/ Perennials	Demonstrating Innovative Inter-row pastures in Fodder Shrub Systems. Project #GMX-OC12-00352	DAFF	Micheal Wurst
203		Profit and Risk Management	Low Rainfall Collaboration Project	Barry Mudge Consulting
204	Carbon Project/ 8511 UNFS Increase and Maintain Soil Carbon	Perrenial Pasture Mgmt Systems for Soil Carbon stocks in cereal zones, SA. Action on the Ground (AOTGR1-44)	DAFF	Jodie Reseigh
206	SDAI	Better Surface Cover under Grazing	NYNRM Board	Micheal Wurst/ Mary-Anne Young
207	Pasture Production Zoning	Adoption of pasture production zoning in the Southern Flinders Ranges	NYNRM Board/ Minister SEC	Ruth Sommerville/ Michael Wurst
208	Onion Weed/ Community Grants 2013	Implementation of specific management strategies for onion weed under stubble retention	NYNRM Board	Ruth Sommerville
209		Yield Prophet	Sturt Grain /UNFS	Barry Mudge
210	Nitrous Oxide	Efficient Grain Production compared with N20 Emissions	Birchip	Micheal Wurst
211	GRDC Stubble Initiative	Maintaining Profitable farming systems with retained stubbles in Upper North SA	GRDC	Ruth Sommerville
212	2014 Low Rainfall Bus Trip	Eastern Low Rainfall Zone Bus Tour. Industry Development Award 2013 IDA10772	GRDC	Matt McCallum, Joe Koch
213	2014 Annual Field Day	GCS10778 - Conference Sponsorship - UNFS - Annual Field Day	GRDC	Ruth Sommerville
214	Overdependence on agrochemicals	Overdependence on agrochemicals	GRDC/CWFS	Barry Mudge/Andrew Ware (SARDI)
215	Spot spray Weed Technology	More Effective weed control and reducing pesticide use in broadacre landscapes by using optical sensing devices to detect and "spot spray" weeds	NRM Board Community Grant Program 2014/2015	Matt McCallum
216	Controlled Traffic	Application of CTF in the low rainfall zone	ACTFA	Matt McCallum

UNFS 2013/2014 Financial Year Report – General Operating

PROFIT AND LOSS STATEMENT FOR THE YEAR ENDED 30 June 2014

	2014 $	2013 $
INCOME		
Project Administration Charges		
Carbon Account	3,000.00	3,000
Perrenials Account	-	6,091
Grazing Account	-	10,000
Fodder Account	1,605.00	-
Nitrous Oxide	1,000.00	-
	5,605.00	19,091
Project Income		
Group	-	1,027
Crop Sequencing	-	30,000
Profit & Risk Manangement	-	20,000
Better Surface Under Grazing	30,036.36	-
Lower Rainfall Bus Trip	10,890.00	-
Yield Prophet	3,500.00	-
Retired Projects	-	1,425
Field Days	2,718.18	-
Zoning	13,000.00	-
Nitrous Oxide	11,650.00	-
GRDC Stubble Initiative	130,643.24	-
	202,437.78	52,452
Hire of Plant	4,220.00	1,200
Interest Received	1,900.10	556
Sponsorship	136.36	5,000
Subscriptions	736.33	2,800
TOTAL INCOME	215,035.57	81,099
EXPENSES		
Advertising & Promotion	-	354
Bank Charges	124.68	95
Finalise Projects		
-Fodder Scrub Systems Project	130.60	-
-Perennial Pasture Project	3,702.02	-
	3,832.62	-
Project Costs		
Crop Sequencing	14,545.45	-
Field Days	-	100
Fodder Shrub Systems	-	6,230
GRDC Stubble Initiative	68,195.11	-
Stubble & Pasture Cover		
Grazing Systems	-	21,545
Profit & Risk Management	-	9,400
Better Surface Under Grazing	-	39,950
Yield Prophet	2,465.00	1,395
Pasture Production Zoning	15,300.00	-
Retired Projects	-	5,025
Nitrous Oxide	11,434.00	-
Onion Weed	3,050.00	-
	114,989.56	83,645
Management Fees	-	14
Carbon Bank Account	12.00	-
Perrenials Bank Account	2.00	-
	14.00	14
Merchandise	1,831.37	-
Office Expenses	27.27	-

PROFIT AND LOSS STATEMENT FOR THE YEAR ENDED 30 June 2014

	2014 $	2013 $
Publications	3,995.00	-
Minor Plant Purchases & Repair	4,148.95	-
Treasurer Expenses	3,520.91	-
TOTAL EXPENSES	132,484.36	84,108
OPERATING PROFIT AND EXTRAORDINARY ITEMS	82,551.21	(3,009)
Retained Profits at July 1	21,365.86	24,375
PROFIT AVAILABLE FOR APPROPRIATION	103,917.07	21,366
RETAINED PROFITS	103,917.07	21,366

In the 2013/2014 Financial Year the Upper North Farming Systems Group operated two projects outside of the general operating accounts; The Carbon Project (AOTGR1-44) (UNFS project #204) and the Perennial Pasture Project (Demonstrating Innovative Inter-row pastures in Fodder Shrub Systems. GMX-OC12-00352) (UNFS project #202). This is a requirement of the contract with the funding bodies. The reports for these two projects are below:

UNFS 2013/2014 Financial Year Report – Carbon Project

Perennial pasture management systems for soil carbon stocks in cereal zones, South Australia

Income		
Interest Received	$	5,800.96
Sundry Income	$	12.00
Grant Department of Agriculture, Fisheries & Forestry	$	174,727.00
	$	180,539.96
Less Expenses		
Bank Fees	$	30.00
Administration Fee General Account	$	3,000.00
Project Expenses	$	142,716.50
	$	145,746.50
Excess Expenditure over income	**$**	**34,793.46**
Balance Sheet		
Opening Balance	$	169,255.19
Net Income/(Loss)	$	34,793.46
Equity	**$**	**204,048.65**
Assets		
BankSA	$	206,648.79
GST Adjustments (admin fee 2013)	$	300.00
GST Account	$	-
	$	206,948.79
Less Liabilities		
GST owed to General ac	$	2,900.14
	$	2,900.14
Balance	**$**	**204,048.65**

UNFS 2013/2014 Financial Year Report – Perennial Pasture Project

Perennial Pasture Establishment Project

Income		
Interest Received	$	26.08
Perennials Income	$	-
	$	26.08
Less Expenses		
Administration Audit Fees	$	600.00
Bank Charges	$	4.85
	$	604.85
Loss	**-$**	**578.77**
Balance Sheet		
Balance Brought Forward	$	3,066.04
Loss Current Year	$	578.77
Total Funds Shortage	$	3,644.81
Assets		
Bank Balance	$	-
	$	-
Liabilities		
Owed to General Account	$	3,644.81
Balance at Close of Project	**-$**	**3,644.81**

Yield Prophet® in the Upper North

Author: Barry Mudge
Funded By: Emerald Grain, Participating Growers and the GRDC Stubble Initiative
Project Title: Yield Prophet® in the Upper North
Project Duration: 2014 Growing Season
Project Delivery Organisation: Barry Mudge Consulting

Key Points:

- **Yield Prophet® provides an estimate of crop yield expectations and nutrition requirements which can be updated as the season progresses**
- **In previous years, the final yields predicted by the Yield Prophet® model have usually been quite close to the actual yields obtained. However, at some sites in 2014 (particularly east of the ranges), predicted yields from the model showed significant differences from actual yields. This may have been due to incorrect selection of soil characteristics into the model which may have been accentuated by the reliance on stored water to finish the crops in the dry spring.**
- **The Yield Prophet® model remains an important decision support tool, particularly for in-crop nitrogen management.**

Project Report:

Background

Thanks to on-going sponsorship from Emerald Grain (ne Sturt Grain), Yield Prophet® was run across the Upper North again in 2014. A total of 9 sites were selected with deep soil sampling undertaken at the start of May. Soils were analysed for moisture content and nitrogen along with other parameters to enable the appropriate soil classification to be selected for the Yield Prophet® program. With the excellent start across the district, water limited yield potential was expected to be high. Yield Prophet® can give an indication of this potential and, amongst other things, some indication of site specific Nitrogen needs to reach potential.

Yield Prophet® outputs were regularly updated throughout the season, with results e-mailed to members.

How Does Yield Prophet® Work

Yield Prophet® is the web-based interface which allows us to access outputs from the crop production model, APSIM. Inputs include detailed soil characterisation information along with measurements of soil water and deep nitrogen status at the start of the season. Specific crop information (sowing date, variety, fertiliser applications etc.) along with daily rainfall data are then entered for each site to provide us with updated estimates of yield expectations if historical rainfall patterns are repeated (see Figure 1). It is important to recognise that the results are for a specific location, from which we extrapolate the results to other locations based on our knowledge of the particular characteristics of each location.

Yield Prophet® can provide us with an estimate of yield expectations as we move through the season, which can be used to aid management decisions (e.g. value of fungicide applications) and possibly giving more confidence in forward marketing of grain. It also provides an ongoing estimate of the Nitrogen(N) status of the crop and can be used to assess the value or otherwise of applying additional N.

The cost to run Yield Prophet® is an annual subscription of $180 ($120 if a member of BCG Cropping Group) plus the cost of the soil sampling. Once the subscription has been made, there is no limit on the number of times the information can be updated throughout the year. In 2014, the UNFS Yield Prophet® program was funded through generous sponsorship from Sturt Grain, plus a $200 contribution from growers whose paddocks were included in the program.

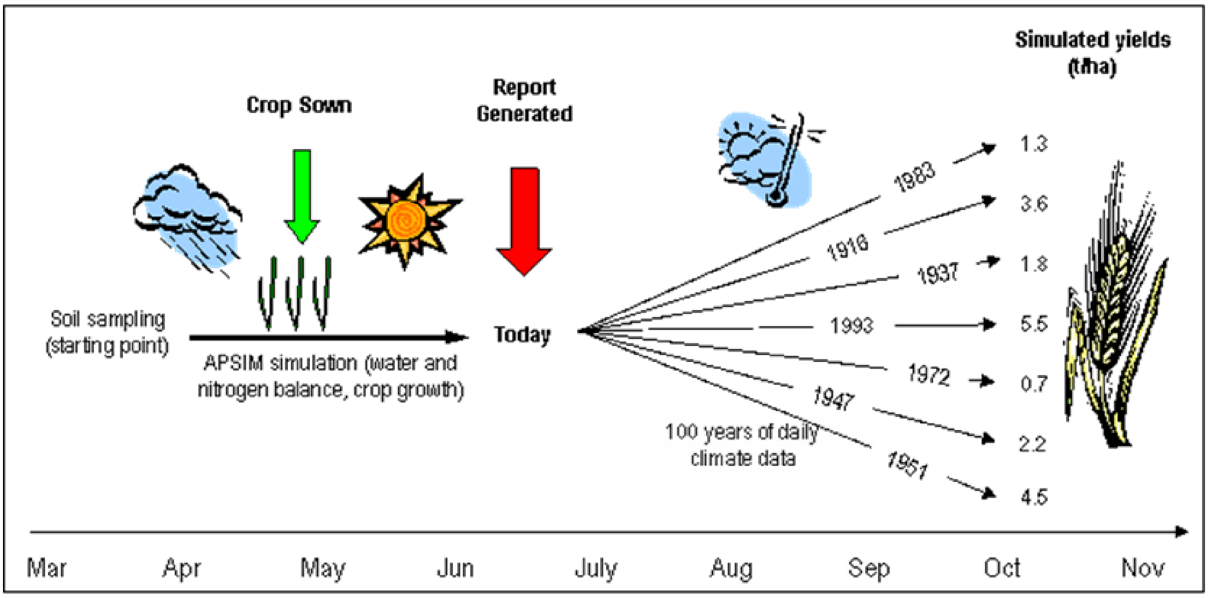


Figure 1. Diagrammatic representation of Yield Prophet®

How did Yield Prophet® perform in 2014

In previous seasons, Yield Prophet® has been shown to be quite good at predicting crop yields in a range of seasons. In 2014, it again proved to be a good tool, although results from some sites fell short of expectations.

UNFS Yield Prophet® Site locations for 2014 are shown in Figure 2. Comments on individual sites are as follows:

Hilder (4 km N Quorn)- This was an early sown Axe wheat crop on vetch stubble from 2013. The model struggled to get this site correct- the modelled growth stage was always behind the actual growth stage, and yield prospects visually were much better than the model was suggesting. In the final analysis, frost had a significant influence on this site. Broom indicated that the better parts of the paddock, unaffected by frost were yielding up to 3.0 tonne/Ha. The modelled final yield of 1.2 tonne/Ha fell well short of this. This was disappointing given that the site had been previously subject to a full soil characterisation and all soil parameters were well-known.

Barrie (3 km North of Willowie)- This was a site on some rising ground, in an area known to have sub-soil constraints which limits rooting depth. In the setting up of this site, and based on the inspection of the soil cores at initial sampling, we restricted rooting depth to 0.7 metres. Early in the season, the model showed the site had quite good yield prospects, but a good seasonal finish would be required. As the season turned dry, modelled yield prospects declined with the final modelled yield being around 1.3 tonne/Ha.
According to Peter's yield monitor, actual yield was up to about 3.0 tonne/Ha i.e. considerably higher than the modelled yield. There may be two explanations for the discrepancy

- The good early season rainfall had an effect on transient salinity, resulting in the crop roots being able to exploit more of the root zone than normal
- Although quite dry, the cool spring had a beneficial effect on grain fill during the ripening period.

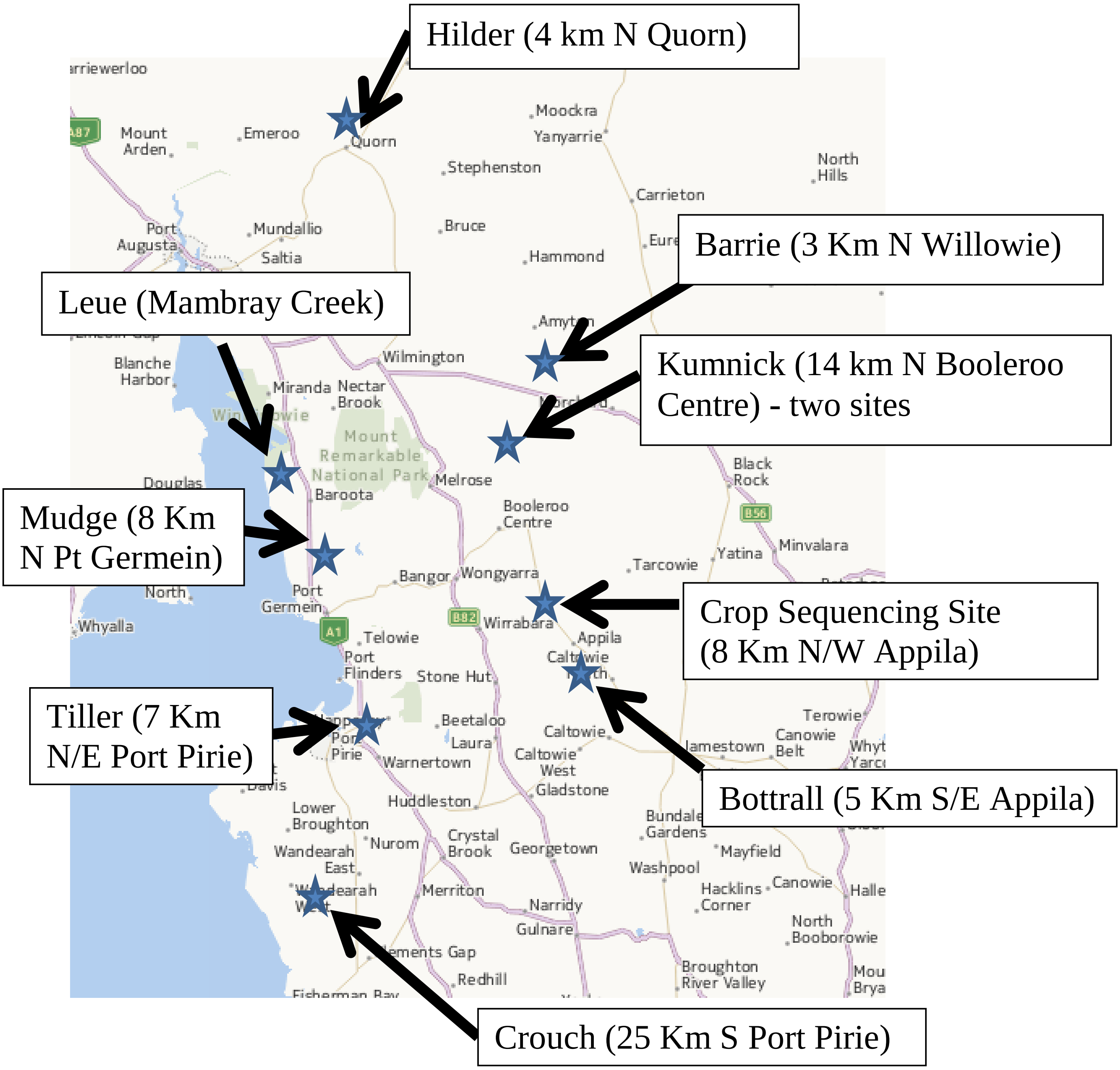


Figure 2. Yield Prophet- Site locations in 2014

Kumnick (14 km N Booleroo Centre)- two sites. The two sites in this paddock were selected based on results from an EM 38 survey. The expectation was that the site showing high EM figures may suggest a higher level of subsoil constraints (e.g.salinity) and possibly a lower yield potential. Selected soil parameters also took this into account (the low EM site used a Port Germein mallee loam soil while the high EM site used a more constrained Morchard soil).

Site was planted early (April 24) to Hindmarsh barley yield prospects according to the model consistently showed higher yield potential from the low EM site. Final yields as shown on the yield map completed for the paddock were actually the opposite. The high EM site yielded around 4.0 tonne/Ha which was identical to the predicted yield. The low EM site, on the other hand, yielded around 3.2 tonne/Ha against a predicted yield of 5.3 tonne/Ha. This may reflect some nutritional compromises (perhaps some leaching of N?) which may not have been picked up by the model. *Crop Sequencing Site (8 Km N/W Appila)*- This site on Ian Keller's property was to use information collected for the Crop Sequencing project. Unfortunately, the soil sampling information was not available to use in the Yield Prophet program so the site was not used in 2014.

Bottrall (5 Km S/E Appila)- Late sown (early July) crop of Axe wheat so this was an interesting site to test the model under more extreme circumstances. As would be expected, the dry spring took its toll and yield expectations dropped substantially later in the season. Actual final crop yield of 1.15 tonne/Ha was below the YP model expectations of 1.5 tonne/Ha.

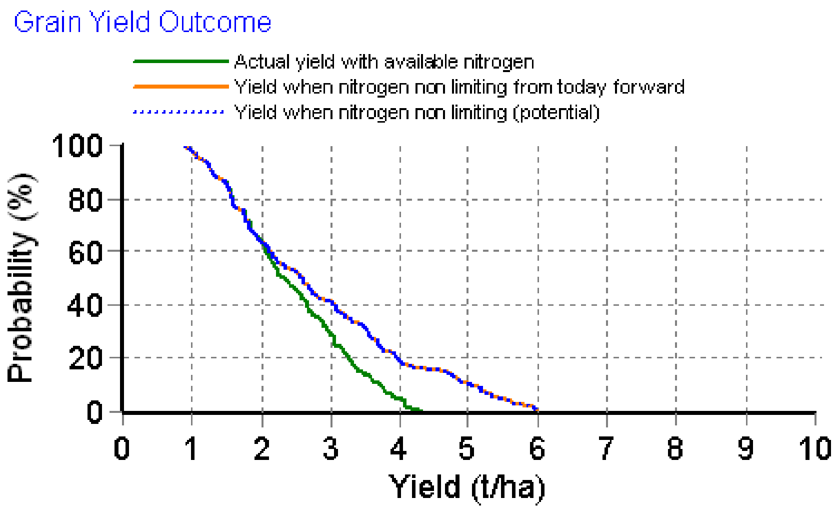
Crouch (25 Km S Port Pirie)- Kord CL wheat sown onto a large Oaten Hay crop from the year before. The expectation was that the site would be compromised for nutrition following the hay crop, but soil testing showed reasonably good levels of starting N. Graeme and Chris undertook a nitrogen rate trial on the site which was monitored by SARDI as part of a Nitrogen Rate response trial. Yield results from the N response trial were inconclusive. The paddock averaged around 3.2 tonne/Ha which was reasonably in line with the Yield Prophet prediction of around 3.5 tonne/Ha.

Tiller (7 Km N/E Port Pirie)- Grenade CL wheat back on wheat from the previous year. Final yield was 2.2 tonne/Ha against a predicted yield of around 2.6 tonne/Ha. Slightly lower yields may reflect rotational and variety compromises. Interestingly, this site also contains a moisture probe. During a spring field walk, soil moisture levels as measured by the probe were very similar to those estimates being produced from the Yield Prophet® model. This provides some reassurance that the model is working well at this location. This site has previously had a full characterisation done, so soil parameters are well known.

Mudge (8 Km N Pt Germein)- Mace wheat back on peas. This site experienced very high rainfall early in the growing season. Soil type is a deep mallee loam which was saturated to at least 1.3 metres post sowing and most likely experienced leaching of available N. A total of 110 kg N was applied in 3 applications post sowing- the decision to apply this high level of N was largely taken in response to the prediction by the Yield Prophet® model of inadequate N at this site. Final yield of 4.2 tonne/Ha was slightly higher than the modelled yield of around 3.6 tonne/ Ha. Even given the high level of N applied, final quality was APW which suggests the nitrogen supply was converted to yield.

Leue (Mambray Creek)- Very early sown wheat crop. Finished well ahead of any spring moisture stresses, but showed a minor level of frost damage. Paddock averaged around 2.5 tonne/Ha- after allowing for a level of frost damage, the Yield Prophet® predicted yield of 3.0 tonne/Ha would be fairly close.

Figure 3: An example of the yield probability graphs produced by the Yield Prophet model



Summary and Conclusions

Performance of the Yield Prophet® model in previous seasons has generally been very good. In 2014, sites west of the ranges provided generally good correlations between the predicted yield and final yield. While some sites east of the ranges showed final yield results with significant variation from that predicted by the model. Possible explanations for this include:

- Incorrect selection of soil characteristics. There is considerable variation in the water holding capacity of soils. The model requires selection of an appropriate soil. There are only a limited number of soils which have been fully characterised in the Upper North. We have built up reasonable knowledge of the water holding capacity of soils in the Upper North but small errors in soil selection can result in significant influences on yield prediction.
- Distribution of rainfall through the season. The substantial early season rain may have had some unforeseen consequences. There was likely to have been leaching of N at at least one site. Transient salinity levels may have also been affected which would alter Plant Available Water.

However, the Yield Prophet® remains a very useful decision support tool, particularly for in-crop management of Nitrogen requirements. The UNFS will again seek sponsorship to run the program in 2015.

Acknowledgements

Emerald Grain (incorporating Sturt Grain) for their generous sponsorship and to Gary Wehr from Sturt Grain for assisting with soil sampling.
GRDC for funding through the Stubble Initiative
Broome Hilder, Ben Carn, David Kumnick, Peter Barrie, Joe Koch, Don Bottrall, Graeme and Kris Crouch, Brian Tiller and Brian Leue for their provision of trial sites and input during the year.

Onion Weed Control (Chemical)

Author: Peter Baker, Fenceline Consulting
Funded By: Northern and Yorke NRM Board Community Grants 2013 and the GRDC Stubble Initiative
Project Title: Implementation of specific management strategies for Onion Weed under stubble retention – Chemical Control Trial
Project Duration: 2013-2014
Project Delivery Organisation: Fenceline Consulting

Key Points:

- **Paraquat Treatments provided 100% control of all sizes of Onion Weed.**
- **Ally Treatments (metsulfuron) were slower than paraquat, however provided 100% control.**
- **Double knocks improved the speed of burn off and control.**
- **Glyphosate does not provide complete control of onion weed and recovery can occur.**
- **Glyphosate mixed with Pyresta or Starane Advanced showed reduced glyphosate efficacy.**
- **Glyphosate mixed with Valor and Sharpen showed no increase in control compared to glyphosate applied alone on all sizes of onion weed.**

Project Report:

Aim:

Assessment of the chemical control options for effective control of Onion Weed without cultivation.

***Trial Design*:**

A replicated trial was conducted at Mount Robert, approximately 15km North East of Booleroo Centre in South Australia in 2014. Trial design consisted of a randomized complete block with 4 Replicates. Plot size was 3m x 10m.

Image 1: Onion Weed Trial Site at Mount Robert at Application of Timing 1.

Introduction:

Onion Weed (*Asphodelus fistulosus*) management options in no till cropping, low-input rangeland grazing systems and other non-cultivated areas are often limited to hygiene practices, reduced total grazing pressure and chipping or spot spraying to prevent or delay new infestations. As part of the Maintaining Profitable Farming Systems with Retained Stubble initiative, funded by the Grains Research and Development Corporation (GRDC), the Upper North Farming Systems Group has investigated a range of onion weed control options to reduce the need for cultivation. To support this the Northern and Yorke NRM Board, through its community Grants Program in 2013, provided funding to undertake a replicated chemical control trial to review the efficacy of the current registered chemistry options for Onion Weed control.


Image 2 (left): Onion weed sizes at application T1, (large on the left, medium each side of shovel, small on the right) *Image 3 (right):* Other weeds were in high numbers in the trial area and assessed under the trial as well. This included medic and stemless thistle, shown here at application T1.

Treatment List

Treat #	**Single Double Knock**	**Applied at T1**	
1	Single	Untreated	
2	Single	Glyphosate450 1.0L + LVEster680 0.35L + Ally 5g + BS1000 0.2%	
3	Single	Glyphosate450 1.5L + LVEster680 0.50L + Ally 5g + BS1000 0.2%	
4	Single	Glyphosate450 1.5L + BS1000 0.2%	
5	Single	Glyphosate450 3.0L + BS1000 0.2%	
6	Single	Paraquat250 1.0L + BS1000 0.2%	
7	Single	Paraquat250 2.0L + BS1000 0.2%	
8	Single	Alliance 3.0L + BS1000 0.2%	
9	Single	SpraySeed 2.0L + BS1000 0.2%	
10	Single	Untreated	
11	Single	Glyphosate450 1.5L + Ally 5g + BS1000 0.2%	
12	Single	Glyphosate450 1.5L + Pyresta 0.5L + BS1000 0.2%	
13	Single	Glyphosate450 1.5L + Sharpen 26g + Hasten 1% + BS1000 0.2%	
14	Single	Glyphosate450 1.5L + Valor 30g + Hasten 1% + BS1000 0.2%	
15	Single	Glyphosate450 1.5L + Starane Advanced 0.2L + BS1000 0.2%	
		Applied at T1	**Applied at T2**
16	Double Knock	Glyphosate450 1.0L + LVEster680 0.35L + Ally 5g + BS1000 0.2%	Paraquat250 1.0L + BS1000 0.2%
17	Double Knock	Paraquat250 1.0L + BS1000 0.2%	Paraquat250 1.0L + BS1000 0.2%
18	Double Knock	Glyphosate450 1.5L + LVEster680 0.50L + Ally 5g + BS1000 0.2%	Paraquat250 1.0L + BS1000 0.2%
19	Double Knock	Paraquat250 2.0L + BS1000 0.2%	Paraquat250 1.0L + BS1000 0.2%

Application Details

Timing 1 (T1) – Applied 21st May 2014 Timing 2 (T2) – Applied 9th June 2014

Equipment: 3 metre Hand Boom Unit, Application Volume: 100 Litres / Hectare, Nozzles: Lechler IDK120-015, Pressure: 2.1Bar, Speed: 6Kph

Weeds Present at Application; Initial populations on the trial area at T1 were:

Onion Weed -	- Small Seedlings up to 10 shoots	- 64 per square metre
	- Medium 15cm to Large Plants	- 15 per square metre
Stemless Thistle	- Mainly Large Plants	- 3 per square metre

Assessments
Plant Counts were conducted across all plots at T1 with follow up assessments at 56 (37) and 159 (140) days after application (DAT) T1 (T2). Counts were conducted with a 0.25m2
Percent Weed Control: This assessment was a visual assessment conducted at 5 timings during the trials, at 19 (0), 37 (18), 56 (37), 103 (84) and 159 (140) DAT T1 (T2).

Results
The greatest level of Onion Weed control weed was achieved by mixes containing either paraquat (Gramoxone250®, Alliance®, Sprayseed250®) or mesulfuron (Ally®) applied alone or in a mixture. Double knock treatments provided rapid burn down and control of Onion Weed. However, the final percentage control achieved by the double knock was equal to that of the T1 tank mixes containing paraquat or mesulfuron, with 100% control achieved by both treatment types. As a result, in this trial the double knock was not necessary when using paraquat or mesulfuron at T1.

The control of seedling Onion Weed was achieved by nearly all treatments in the trial (*Fig 1)*. Glyphosate applied alone provided 90-98% control, although not significant this would still allow plant survival and potential for seed set.
Glyphosate mixtures with either Pyresta® or Starane Advanced® appear to have caused significant antagonism to the Glyphosate, resulting in lower levels of control of onion weed than Glyphosate applied alone. The addition of Sharpen® to Glyphosate did not improve or reduce the level of onion weed control. The addition of Valor® to Glyphosate resulted in 100% control of small onion weed plants.
All treatments which included the active ingredient paraquat provided rapid seedling onion weed control and resulted in 100% control. All treatments with Ally® resulted in 100% control, although results took longer to be achieved. Speed of control may have a significant impact on timing of applications and prevention of seed-set.

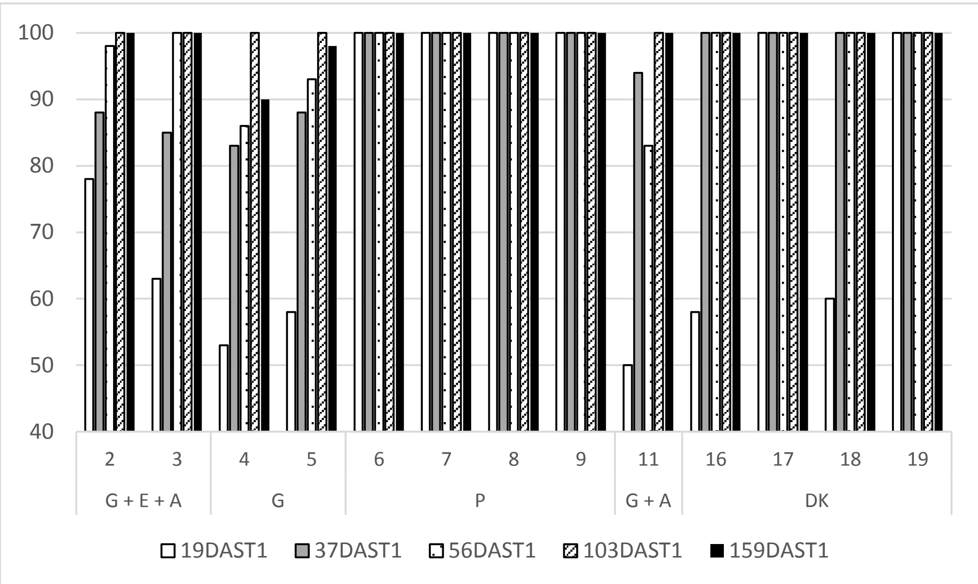


Figure 1: Percent Control of small Onion Weed plants.:Speed of control and level of regeneration was affected by the tank mixes. Glyphosate + Ally +/- LVE Ester resulted in 100% control, however Paraquat as a single knock or a Double Knock application resulted in faster knock-down. Note: G = Glyphosate, E = LVE Ester, A = Ally, P = Paraquat, DK = Double Knock.

As the size of the onion weed increases the treatments that included paraquat or Ally, continued to provide 100 percent control and were significantly better than any other treatment, (Fig2 and 3). As the onion weed size increased the glyphosate applied alone resulted in lower rates of control at both 1.5 and 3.0 litres/ha. Although not significantly less than the best results, it would still be considered a less than desirable outcome to manage seed set. The addition of either Pyresta or Starane Advanced to glyphosate has continued to be an antagonist resulting in significant reductions in control as the onion weed plant size increases. The addition of Valor® to glyphosate has not improved efficacy on the larger onion weed plants, but no reduction in efficacy has occurred. The addition of Sharpen may have added a slight improvement to the glyphosate treatment on larger weeds but efficacy improvements were not significant.

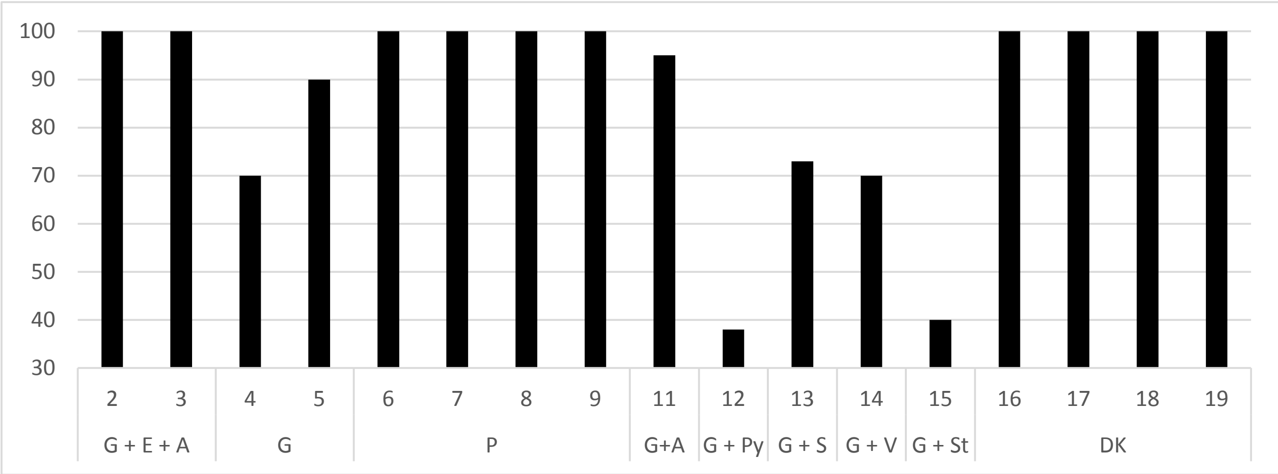


Figure 2: Percent Control of Medium Sized Onion Weed 159 DAT T1. See Table 1 for Treatment Details. Note: G = Glyphosate, E = LVE Ester, A = Ally, P = Paraquat, Py = Pyresta, S = Sharpen, V = Valor, St = Starane DK = Double Knock.

The trial area had a good even coverage of medic pasture. All of the treatments in the trial have shown no safety to medic with only the Paraquat250 at 1L/hectare applied at timing 1 showing some plant survival at levels less than 5% of the initial population. A non-replicated strip of paraquat at 1L/ha was sprayed at T2 outside of the trial area. It was observed of this treatment that the medic has survived quite well with some biomass reduction and reasonable onion weed results (Image 4). It may be that delaying the timing of chemical application may be of some benefit in retaining a medic pasture cover and getting a seed set (Note: this was an observation and not a recommendation, further evaluation into this observation is required). The trial also had stemless thistle *(onopordum acaulon)* throughout the trial area and all treatments resulted in 100% control at 56 DAT.

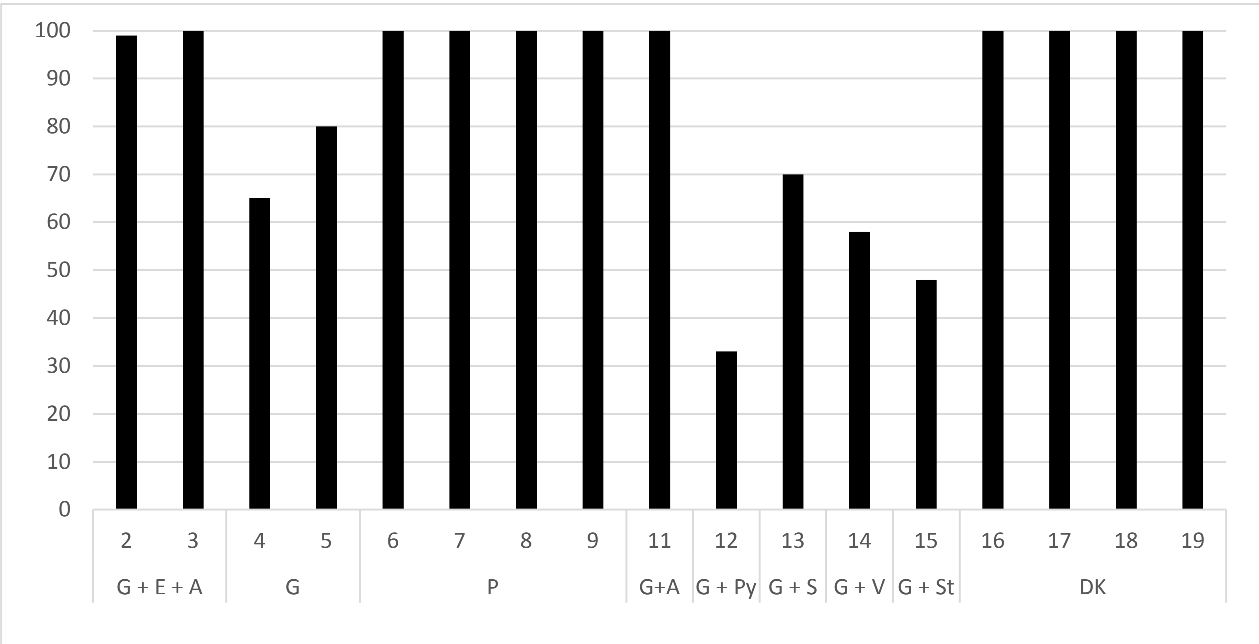


Figure 3: Percent Control of Large Established Onion Weed 159 DAT T1. See Table 1 for Treatment Details. Note: G = Glyphosate, E = LVE Ester, A = Ally, P = Paraquat, Py = Pyresta, S = Sharpen, V = Valor, St = Starane DK = Double Knock.

Acknowledgements
Site Co-Operators: Joe & Robert Koch
Supply of Chemical: Sommerville Spraying, Northern Ag and DOW AgroSciences
Supply of Equipment: DOW AgroSciences

Image 4: Demonstration strip of paraquat250 at 1L/ha applied at T2.

Product Details

Trade Name	Manufacturer	Herbicide Group	Active Ingredient
Various	*Various*	M	450g/L glyphosate (present as the isopropylamine salt)
Gramoxone250	Syngenta	L	250g/L Paraquat (present as paraquat dichloride)
Sprayseed250	Syngenta	L	135g/L Paraquat (present as paraquat dichloride) 115g/L Diquat (present as Diquat Dibromide)
Alliance	Crop Care	L Q	250g/L amitrole 125g/L paraquat (present as paraquat dichloride)
LVEster680	Crop Care	I	680g/L 2,4-D (present as the 2-ethyl hexyl ester)
Ally	DuPont	B	600g/kg Metsulfuron
Pyresta LV	Sipcam	G I	2.1g/L Pyraflufen-ethyl 421g/L 2,4-D (present as 2-ethyl hexyl ester)
Starane Advanced	DOW	I	333g/L Fluroxypyr (present as meptyl ester)
Sharpen WG	Nufarm	G	700g/kg Saflufenacil
Valor 500WG	Sumitomo	G	500g/kg Flumioxazin

Image 5: PARAQUAT 1L/HA_T1 103 Days after Application

Image 6: GLYPHOSATE 1.5L, LVESTER 0.5L, ALLY 5G_T1 103 Days after Application

Image 7: GLYPHOSATE 1.5L _T1 103 Days after Application

UNFS Variable Rate Nitrogen Trial

Author: Matt Foulis *(Northern Ag)*
Funded By: GRDC Stubble Initiative
Project Title: Variable Rate Nitrogen Trial – Maintaining profitable farming systems with retained stubbles in the Upper North of SA.
Project Duration: 2014
Project Delivery Organisation: Upper North Farming Systems

KEY POINTS:

- Each soil zone was nitrogen responsive at varying levels.
- Low EM zones (sands and sand-loams) were very responsive - 41-61% increase in yield achieved by applying the top rate of urea.
- High EM zones (clay-loams) were moderately responsive - 10-22% increase in yield achieved.
- Applying high rates of Nitrogen to high EM (clay-loam) zones proved to be un-economical.

PROJECT REPORT:

With Nitrogen(N) being the nutrient required most in broadacre grain production and evidence suggesting that N inputs are destined to increase significantly over the next decade, the industry is continuously looking at more efficient ways to apply and utilise N. Variable rate technology has been introduced and implemented for some time now. Since the introduction of this technology growers have been using it for many purposes including nutrition, soil amelioration (liming and gypsum), irrigation, crop density, and crop protection. The purpose of this trial was to investigate the possible advantages of varying nitrogen rates over different soil types on a field in the Upper North.

BACKGROUND:

The paddock used for this trial is located 13km North of Booleroo Centre on David Kumnick's property and was sown to Hindmarsh Barley. This paddock was chosen due to its known soil type variation and local representative climatic conditions. To carry out the trial successfully the paddock was split into four zones using an overlay of yield data and an EM38 map.

Paddock Location	13km North Booleroo Centre
Paddock History	2012 TT Canola, 2013 Mace Wheat
Seeding Date	24/4/2014
Seeding System	Knifepoint & Press wheels
Variety	Hindmarsh @ 60kg/Ha
Seeding Nutrition	19:13:0:9 @ 120kg/Ha
Post Em Nutrition	Urea @ 50kg/Ha 29/5/2014
	Urea (Trial) @ 0,50,100kg/Ha 14/6/2014

SOILS:

The paddock was split into four soil zones (Fig 3); High EM (145.3), Med/High EM (103.8), Med/Low EM (72.9), and Low EM (40.7). The soil tests were done at booting, meaning the crop had used a large amount of the available N, hence the quite low nitrogen values. Nitrate values were the lowest on the low EM lighter soils which was likely due to leaching.

SOIL TEST RESULTS (10-60CM)									
	COLOUR	*pH (WATER)*	*pH (CaCl2)*	*EC (WATER)*	*CHLORIDE*	*NITRATE N*	*AMMONIUM N*	*SULPHATE S*	*BORON*
ZONE				dS/m	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
RED (EM 40.7) Low EM	RED	9.2	8.4	0.06	<10	<0.5	<.6	1.1	0.52
ORANGE (EM 72.9) Med/Low EM	BROWN	9.4	8.3	0.23	20	0.6	<.6	20	5.8
GREEN (EM 103.8) Med/High EM	BROWN	9.6	8.3	0.34	90	0.6	0.7	27	12
BLUE (EM145.3) High EM	RED	9.6	8.6	0.36	46	0.8	<.6	22	11

Table 1: Soil test results for the four paddock soil zones.

Severe sulphur deficiency was also noted on the light sandy soil, which is expected to have had a detrimental effect on yield. Another issue of note from the soil tests was the high levels of boron measured on both of the high EM soil zones. At these levels toxicity can possibly be an issue.

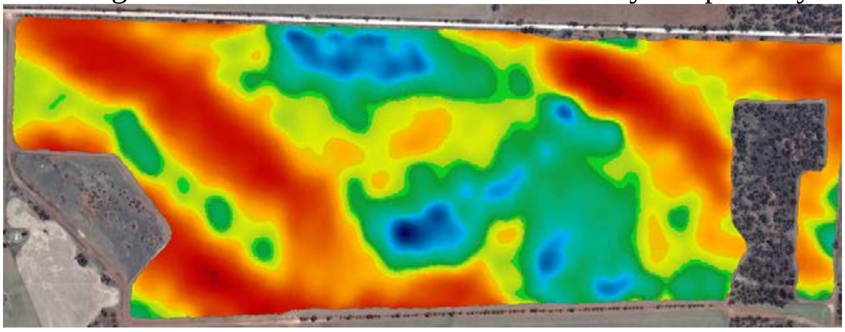


Figure 1: EM38 map

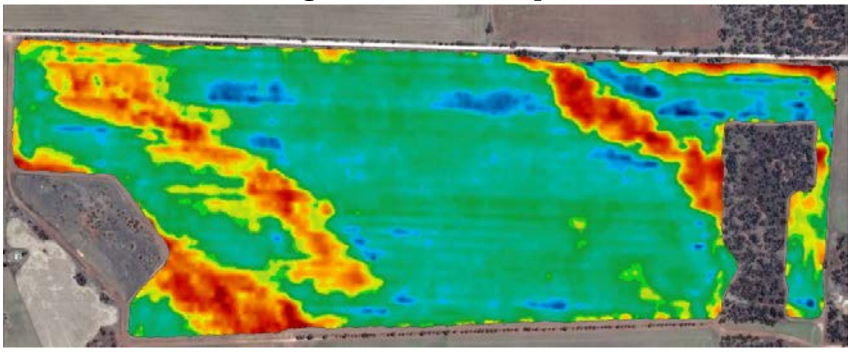


Figure 2: 2013 yield map

The trial layout incorporated all four soil zones with two treatment replicates (North & South). The three treatments were Nil Urea, 50Kg/Ha Urea and 100Kg/Ha Urea. The Grower initially planned on using a blanket rate of 50Kg/Ha over the field. This was therefore treated as the standard for the paddock.

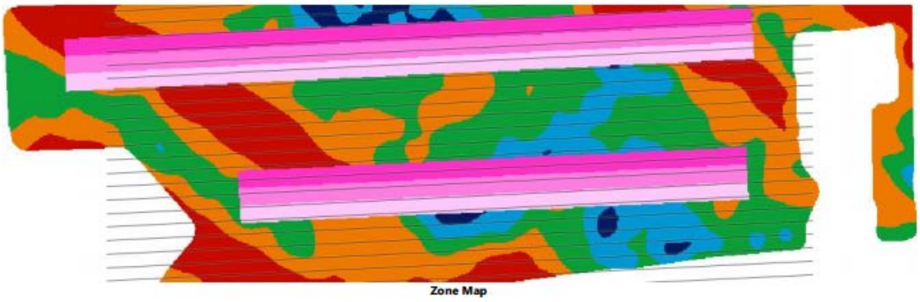
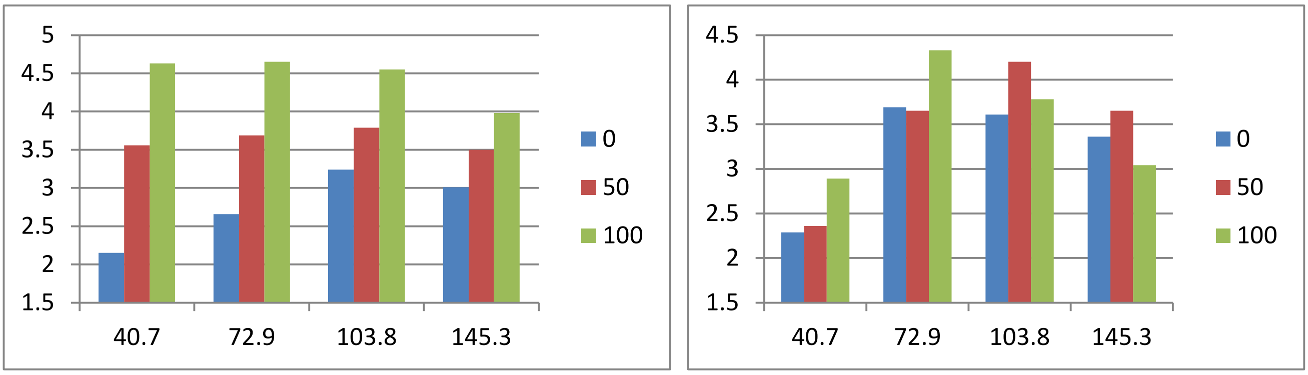


Figure3: Paddock zone map & trial plan

RESULTS:



Northern Replicate

Southern Replicate

Figure 4: Yield response to applied N over the different soil types on both trial replications. High EM (145.3), Med/High EM (103.8), Med/Low EM (72.9), and Low EM (40.7) Source: Michael Wells (PCT-Ag)

Both trial replications vary slightly from one another when comparing yield data over each soil zone. The two lighter soils, however, consistently show that as N is applied to these zones yield increases. The two heavier soil zones varied significantly between both sites, which is likely a result of varying soil textures, subsoil constraints and topography. The northern replicate was more responsive to N on these heavier zones at the 50kg/Urea/Ha treatment, compared with the southern replicate which was more responsive to the 100kg/Urea/Ha treatment.

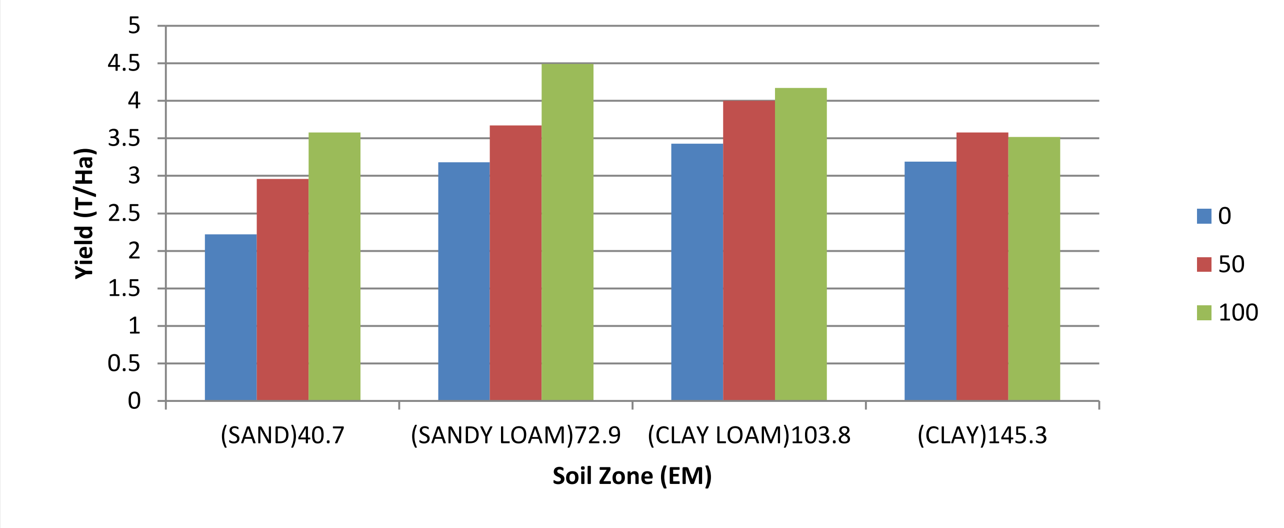


Figure 5: Combined field data displaying yield response to applied N over the four different soil zones

When combining the data from both replicates it is possible to see trends in N responsiveness a little clearer. The barley yield on the sandy soil (EM40.7) increased 33% and 61% for the 50 and 100kg/Urea/Ha applications respectively. The sandy loam soil zone (EM72.9) displayed increases of 15% and 41%, the clay loam (EM103.8) 17% and 22% and the heavier clay zone (EM145.3) 12% for the 50Kg/Ha and only 10% for the 100kg/Ha application.

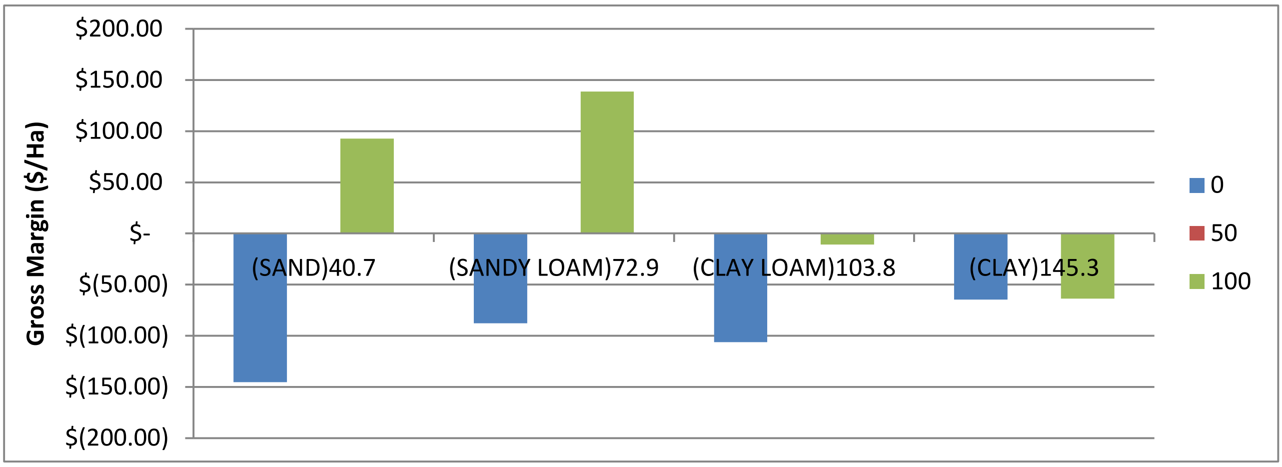


Figure 6: Gross margin returns in $/Ha over the four different soil zones, using 50kg/Urea/Ha as the base treatment and assuming Hind1 barley at $230/T and cost of urea at $500/T.

Using 50Kg/Ha rate of urea as the benchmark treatment, the financial analysis found that nil treatment of urea post seeding yielded poor economic returns over each soil zone, with the sandy site displaying the poorest return of -$145.20/Ha, and the clay soil zone the highest but still a loss of -$64.70/Ha. The 100kg/Ha treatment on both the sand and the sandy-loam soil zones yielded exceptional returns in comparison to the benchmark rate with returns of $92.60/Ha and $138.60/Ha respectively. However, both the clay-loam and clay zones displayed losses when the high treatment was applied, the loam-$10.90/ha and the clay -$63.80/Ha.

	OPTIMAL TREATMENT	AREA (HA)	BENEFIT/HA	TOTAL BENEFIT
(SAND)40.7	100	14.85	$ 92.60	$ 1,375.11
(SANDY LOAM)72.9	100	27.68	$ 138.60	$ 3,836.45
(CLAY LOAM)103.8	50	24.38	$ -	$ -
(CLAY)145.3	50	14.34	$ -	$ -

Table 2: Economic benefit of optimal N levels applied over each soil zone across the whole paddock. *Source: Michael Wells (PCT-Ag)*

A total profit of $5,211.56 would have been returned if the optimal treatment was applied to each zone in comparison to using a blanket benchmark treatment approach across the whole paddock (Table 2).

SUMMARY:

This trial has demonstrated that although all soil zones have responded positively to applied nitrogen, the level of responsiveness is highly variable. When considering nitrogen management decisions in the future for this field there are a number of other factors which should be considered. These include timing, topography (which is likely to influence water behaviour, evaporation losses and frost), a better understanding of subsoil constraints, and most importantly soil moisture status.

Based on current agronomic information of the field and the results achieved from this trial, in 2014 the application of 50kg/Urea/Ha on the two heavier, high EM zones and 100kg/Urea/Ha on the two lighter, low EM zones would prove the most profitable post seeding nitrogen application. Varying the rate of nitrogen over this paddock would provide significant financial benefit, whilst also reducing risk.

ACKNOWLEDGEMENTS:

- **Michael Wells**, Yield data analysis and trial setup - *PCT Ag*
- **Jessica Wells**, trial setup - *Pringles Crouch*
- **David Kumnick**, Grower & data collection.

Image 1: Jessica Koch, Pringles Ag+ Crouch Rural, showing the John Deere soil moisture probe results from the variable rate N trial paddock, demonstrated at the Spring Crop Walk in September. This site was also used to ground truth the Yield Prophet model through comparisons with the Soil Moisture Probes across two soil types.

Application of Automated "Spot Spray" Technology in the Upper North

Author: Matt McCallum and Ruth Sommerville
Funded By: Northern and Yorke Natural Resource Management Board - 2014 Community Grant, and GRDC Production and Environment Partnerships project.
Project Title: More effective and reduced pesticide use in broadacre landscapes by using optical sensing devices to detect and “spot spray” weeds”
Project Duration: 1/11/2014 to 30/6/2015
Project Delivery Organisation: Upper North Farming Systems

Key Points

- Summer weed control is proven to increase yield, but is becoming a major cost and some summer weeds are difficult to control
- Cost savings of 20-90% were achieved across 20 paddocks using the WEEDit™
- A major benefit of Spot Spray Technology is the ability to use high rates of chemical to spot spray hard-to-kill weeds such as fleabane and stinkweed.

Background and Benefits of Optical Sensing Spray Technology:
A number of commercial companies now produce optical sensing devices that can be utilised to detect plants by measuring the Near Infrared Reflectance (NIR) reflected by their chlorophyll when exposed to a light source. When combined with a solenoid that switches on and off a spray nozzle, this technology can be used to “spot spray” weeds.

At this stage the optical sensing technology does not discriminate between crops and weeds, so it is used when there is no crop present, predominantly in summer, in autumn before the crop is sown, and for chemical fallow. Herbicide use can be reduced by 50-90% during these periods of the cropping cycle by using this technology.

The benefits to the environment are also significant;

- Reduced pesticide use by 50-90% resulting in reduced potential impacts on soil biota and contamination of water resources.
- Reduced chance of spray drift.
- Increased success of controlling “hard-to-kill” summer weeds e.g. fleabane, onion weed, saltbush type weeds.
- Reduced practice by farmers of intensive grazing of summer weeds resulting in soil erosion.
- Substantially less water is used for spraying which helps preserve water resources.
- Reduced reliance on cultivation to control “hard to kill” weeds, resulting in reduced erosion risk and increased soil health.

Aims of the Project:

- To evaluate the suitability of "spot spray" technology to control weeds on farming land in the Upper North.
- To monitor weed control success on "hard to control" summer weeds such as fleabane, onion weed, saltbush type weeds.
- To record the reduction in pesticide and water use using "spot spray" technology compared to conventional spraying.
- To raise awareness amongst the community about the potential benefits of "spot spray" technology.

Results from the UNFS Paddock Demonstrations

A demonstration version (12m) of the WEEDit™ was hired and used to evaluate the suitability of automated "spot spray" technology to control weeds in 20 paddocks across the Upper North during the summer fallow period in 2014. The technology worked very well, and in summary;

- Cost savings of 20-90% (average 70%) were achieved per spray application
- It could detect small weeds, about the size of a 20c piece. The ability to detect small plants was reduced if the weeds were stressed.
- Weeds with blue-coloured leaves (e.g. annual saltbush, jersey cudweed, stemless thistle) were detected
- It was successful at detecting weeds that were half-dead from a previous spray. This makes it suitable for applying double knocks to hard-to-kill weeds e.g. fleabane.

Extension Activities

UNFS held a number of field days throughout the project life that examined this technology. In particular 4 events were held in Orroroo, Crystal Brook, Laura and Nelshaby in February and March 2015. The Laura and Nelshaby events were held in conjunction with the local Ag Bureau.

There are currently two companies importing the technology into Australia. Crop Optics Australia import the WeedSeeker™, and Hawkeye Precision import the WEEDit™. Local agents for these units in the Upper North are AgTech Services (Michael Zwar - WeedSeeker™) and Croplands (WEEDit™). These companies were invited along to the events in the Upper North to demonstrate the technology to the farming community. Over 100 farmers attended these demonstrations. We appreciate the support AgTech Services and Croplands have provided to this project.

Image 1 and 2, Potato weed sprayed at one of the demonstration paddocks before and after treatment with spot spray technology.

Image 3 and 4: Members getting a run down on the WEEDit and Weedseeker Technology.

Herbicide control of Statice - preliminary results

Author: Ben Fleet, Christopher Preston & Gurjeet Gill
Funded By: GRDC funded research UA00149
Project Title: Improving Integrated Weed Management practices of emerging weeds in the southern and western regions.
Project Delivery Organisation: The University of Adelaide, School of Agriculture, Food & Wine

Key Points

- Statice has become a problematic weed for some growers in the Upper North, particularly around Wandearah / Warnertown.
- Statice can be difficult to control, however this preliminary study has demonstrated that some herbicides can provide a high level of control.
- More research is required to better understand the ecology of statice and assess herbicide efficacy under field conditions.

Project Report

Statice (*Limonium lobatum*) is a weed that has been present, at low levels, across southern Australia for many years. However, it has become problematic for some growers in the Upper North, particularly in the Wandearah/Warnertown district. While the majority of statice seems to establish in autumn-winter, there can be some germination later in the season. According to some growers, effective herbicide control of statice can be quite difficult to achieve.

A large replicated pot study was conducted at the Roseworthy Campus to evaluate a wide range of herbicides for controlling statice. Results from this preliminary research will be used to better target future field research. Statice seed was collected near Port Germein after crop harvest in 2013 and grown out in pots during winter 2014. Statice plants were grown to late rosette/start of stem elongation stage before herbicide treatments were applied and assessed 30 days later (Table 1).

The study demonstrated quite a wide range in statice control from different herbicide treatments (Table 1). Igran (terbutryn) mixed with either Logran (triasulfuron) or with MCPA provided effective control of statice (90-99%), which supports previous PIRSA research. Consistent with this previous work, Diuron + MCPA (86-93%) gave good weed control that was further increased by the addition of metsulfuron (99%). Among the new broadleaf herbicides Conclude (floasulum, MCPA) was quite disappointing (41% control) but Precept (pyrasulfotole, MCPA) was highly effective (99% control). MCPA amine seemed to have greater activity on statice than 2,4-D amine. Legume crops and pastures are often a weak link where statice seed-bank can increase. Among herbicides commonly used in legumes, Eclipse (metosulam), Raptor (imazamox), Bonanza (diflufenican) & Broadstrike (flumetsulam) all provided low levels of control (≤20%). However, Buttress (2,4-DB) showed some potential to control statice in legumes with 78% control. The knockdown herbicide Raze (glyphosate) 41% provided less control than Biffo (glufosinate) 100%. Although herbicide rates used for these two knockdown herbicides were not identical, there was a marked difference in their effectiveness on statice. A new experimental herbicide provided a very high level of control, which was encouraging for further research.

Image 1,2: Statice plant and flower.

Table 1. Herbicide control of statice at 30 days after the treatment; weed control was assessed on a linear rating scale.

Treatment	% Control *(30DAA)*
Untreated Control	0 *a*
Eclipse (100g/L metosulam) @ 50mL + Activator @ 0.5% wv	10.6 *ab*
Raptor (700g/kg Imazamox) @ 45g + Activator @ 0.2% wv	17.5 *b*
Bonanza (500g/L diflufenican) @ 200mL	19.4 *b*
Atrazine @ 1kg + Hasten @ 1% wv	19.4 *b*
Broadstrike (800g/kg flumetsulam) @ 25g + Activator @ 0.2% wv	20 *bc*
Broadstrike @ 25g + Uptake @ 0.5% wv	20 *bc*
Flagship @ 1.5L	25 *bc*
Flagship (200g/L fluroxypyr) @ 1L	30.6 *bc*
Verdict @ 75mL + Uptake @ 0.5% wv	30.6 *bc*
Lontrel @ 300mL	32.5 *bc*
Amine Advance @ 1.5L	32.5 *bc*
Affinity force @ 100mL + MCPA amine(750) @ 330mL	35 *c*
Amine Advance @ 1.1L + Ally @ 5g	37.5 *c*
Logran (750g/kg triasulfuron) @ 15g + Hasten @ 1% wv	38.8 *c*
Conclude (7g/L Florasulam, 357g/L MCPA LVE) @ 700mL + Uptake @ 0.5% wv	40.6 *c*
Jaguar (250g/L bromoxynil, 25g/L diflufenican) @ 1L	40.6 *c*
Raze (510g/L glyphosate) @ 1L	40.6 *c*
Raze @ 1L + Goal @ 75mL	42.5 *c*
Glean @ 20g + Activator @ 0.1% wv	43.8 *cd*
Raze @ 1L + Sharpen @ 18g + Bonanza @ 1% wv	45 *cd*
Cutlass (500g/L dicamba) @ 280mL	49.4 *cd*
Amitrole-T @ 4L	50 *cd*
Cutlass @ 280mL + Amine Advance 700 @ 500 mL	58.1 *d*
MCPA amine (750) @ 1.4L	61.9 *de*
Broadside (280g/L MCPA ester, 140g/L bromoxynil, 40g/L dicamba) @ 1.4L	63.8 *de*
Jaguar @ 1L + MCPA LVE @ 500mL	76.9 *e*
Buttress (500g/L 2,4-DB) @ 3L	78.1 *ef*
Eclipse @ 35 mL + MCPA LVE @ 350 mL + Lontrel @ 100 mL + Activator @ 0.5% wv	78.8 *ef*
Diuron (900g/kg diuron) @ 480g + MCPA amine (750) @ 330mL + Activator @ 0.125% wv	86.3 *ef*
Igran @ 550mL + Logran @ 15g	89.5 *ef*
Igran @ 275mL + Logran @ 7.5g	91.3 *ef*
Diuron @ 280g + MCPA amine (750) @ 330mL + Activator @ 0.125% wv	92.5 *f*
Igran @ 550mL + MCPA amine (750) @ 330mL	95 *f*
Igran @ 550mL + Logran @ 7.5g	96.3 *f*
Precept (250g/L MCPA ester, 50g/L pyrasulfotole) @ 1L + Hasten @ 1% wv	99.3 *f*
Igran (500g/L terbutryn) @ 850mL + MCPA amine (750) @ 330mL	99.4 *f*
Igran @ 550mL + MCPA amine (750) @ 330mL + Ally @ 5g	99.4 *f*
Diuron @ 280g + MCPA amine (750) @ 330mL + Ally @ 5g + Activator @ 0.125% wv	99.4 *f*
Precept @ 1L + Bonanza @ 200mL + Hasten @ 1% wv	100 *f*
Biffo (200g/L glufosinate) @ 4L	100 *f*
Experimental herbicide @ 800g	100 *f*
Experimental herbicide @ 800g +Hasten @ 1% wv	100 *f*
P<0.001, LSD=15.226, CVrep = 3.6%	
Note: Some of the herbicides evaluated in this trial are not registered for controlling statice and have been used for research purposes.	

The results of this study show some herbicides can provide effective control of statice. Some of these herbicides will be further investigated in the field next year.

Acknowledgements

The authors would like to thank Barry Mudge and Philip Johns for providing seed and support. We also thank Malinee Thongmee and Ryan Garnett for their technical support.

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Managing for Profit and Risk Management:
Whole of Project Summary

Author: Geoff Thomas
Funded By: GRDC through the Low Rainfall Collaboration Group
Project Title: Low Rainfall Collaboration Group Profit Risk Management Project
Project Duration: Three years from 1/7/2011 to 30/6/2014
Project Delivery Organisation: Geoff Thomas, Manager, Low Rainfall Project

Farmers have been seeking guidance for years as to how they can improve the fit of their various farm systems components to improve profitability and reduce risk.

In the past a lot of attention has been placed on agronomic considerations and hence a concentration on varieties, rates, seeding dates, row spacing type work. Similarly with livestock we have seen work on grazing cereals and other crops. While all of this has a place, farmers are now seeking more and more advice on how they fit the various technologies together to best effect. That "best effect" no longer just means production as it often did in the past – farmers now see profitability, reduced inputs and management of risk as the major drivers.

The Low Rainfall Project established an initiative funded by GRDC in which local staff worked with farmer groups to develop "model " farms based on real local figures and use this to explore various on farm issues across the Southern Low Rainfall Zones.

The intent of the project has been to focus on decision making in terms of **profitability** rather than **productivity** alone, taking into account the risks associated with the production and marketing process. Consequently, the project has heavily focused on the economic consequences of decision making. It recognises that each manager will have a different attitude to risk which will in turn, influence the decision process. A prescriptive process is not seen as the solution- what works well for one farmer will not necessarily work well for a neighbour.

The project has aimed to improve decision making amongst local farmers by improving the **knowledge** and understanding of the economic relationships which exist in our farming systems, and improving **skills** of participants to assess the economic consequences of their decision making in critical areas within their farm business.

The outcomes of the project are complex and vary from region to region but overall there is no doubt that it has played an important role in establishing farm business as an important focus area.

Summary of Outcomes:

- Farm business skill programs are being demanded by a wide range of farmers and consultants and have now become a core component of most groups. In several cases further projects have been developed using a wide range of funding.
- Some regions concentrated on teaching the basics of farm business to younger farmers.
- Two groups have used the project to support about 40 people, usually women, gaining the Diploma of Agribusiness.
- In several cases local accountants have been used in the programs adding to their knowledge base as well as that of farmers and consultants. Both accountants and consultants are seen as key players in the future development of farm business skills.

Some of the main areas addressed by farmers through the use of their local farm models have been:

- Any analysis of the farm business based on averages is misleading at best and often dangerous. Analysis must take into account the impacts of good and bad seasons.

- The risk management focus needs to be on methods to limit downside losses in poor years without substantially compromising gains in better years.
- The merits of buying vs leasing vs share farming.
- The importance of succession planning and overcoming the barriers to expansion.
- The best balance between livestock and cropping on farm.
- The importance of planning cropping programs and inputs according to the different capabilities of various types of land on the farm using the options of crop type/variety, livestock, or leaving paddocks out altogether if the season opening is dodgy.
- The importance of capital investments in managing risk. Making the right machinery decisions based on need/reliability and not just on tax considerations.
- The need for researchers and farmers to assess research outcomes in terms of the impact on the whole farm business in terms of profit and risk. The model farm approach allows this.

The Mallee Case Study:
The following "messages" arose from the analysis by farmers, issues which have application across the entire low rainfall farming zone:

- It is difficult (both financially and practically) to maintain nitrogen inputs in long term continuous cropping farming systems. Profits in the high rainfall seasons are being constrained as farmers are unwilling to fertilise to the levels required to reach potential yields. More 'natural' nitrogen is required in farming systems through more frequent legume phases in paddock rotations.
- Farmers are relying on expensive chemical bills to maintain current high input farming systems which is in-turn increasing risk. Lower cereal intensities and a greater proportion of break crops and pastures in the rotation are required.
- Livestock play an important role in moderating financial losses incurred from cropping in poor seasons. Businesses that choose to remove livestock need to find alternative methods to reduce risk. Examples include finding greater off farm income or maintaining higher levels of equity.
- Maintaining investment in machinery is a large cost and increases risk considerably. Generally, greater critique of machinery investment decisions is required by considering carefully what type of machine is required to reliably complete the task required. Shifting a greater proportion of machinery investments into profitable seasons is another strategy to reduce financial exposure in poor seasons.

So where to from here:
Participating groups will continue to roll out the results of this project. In addition there will be further development of two main areas:

- The development of a simple tool for farmers and consultants to use with their own figures to assess various decisions. This is being developed by a team led by Michael Moodie and Ed Hunt and whilst it is based on Mallee and Eyre Peninsula data it will have wide application. It will be validated by Bill Malcolm of Melbourne University before being rolled out in mid-2015.
- Working with CSIRO to further apply the tool to assess research results in terms of their impact on profit and risk on farm. This will be done with the results of the Mallee Karoonda trials at first but then applied more broadly.

Low Rainfall Collaboration Group – UNFS Project Delivery Profit - Risk Project Summary

Author: Barry Mudge
Funded By: GRDC through the Low Rainfall Collaboration Group
Project Duration: Three years from 1/7/2011 to 30/6/2014
Project Delivery Organisation: Barry Mudge Consulting and Rural Solutions SA

Key Points:

- **Low rainfall mixed farming systems have always been exposed to the vagaries of climate and other risks and history has demonstrated on-going capacity to adapt.**
- **The effective management of risk in these systems has always been given a high priority, and thriving businesses are well versed in appropriate systems to achieve this.**
- **A key to this has been the adoption of mixed cropping and livestock programs, producing products in demand on world markets. Analysis completed in this project has confirmed the strength of this system in managing risk.**
- **The relatively small scale of many Upper North farm businesses means that it will continue to be a challenge to produce sufficient returns to meet household requirements and allow a surplus for growth.**
- **Analysis has shown that these lower productivity regions are capable of producing commodities competitive with other regions provided appropriate structures are implemented.**

Project Report:

Background

Primary producers in low rainfall (LR) environments such as the Upper North are being challenged in the face of increasing costs and the potential for climate change to continue to produce commodities competitively in a modern agricultural world. They are questioning all aspects of their farming systems to identify improvements which can be adopted to maintain viable and sustainable businesses. Decision making in this environment is complex. Management focus is on decision making skills which can cope with risk and uncertainty.

The intent of the project has been to focus on decision making in terms of **profitability** rather than **productivity** alone, taking into account the risks associated with the production and marketing process. Consequently, the project has heavily focused on the economic consequences of decision making. It recognises that each manager will have a different attitude to risk which will in turn, influence the decision process. A prescriptive process is not seen as the solution- what works well for one farmer will not necessarily work well for his neighbour.

The project has aimed to improve decision making amongst local farmers by working in two areas:

- Improving the **knowledge** and understanding of the economic relationships which exist in our farming systems, particularly in regards to their various components and how these fit together. Key areas of study include; the ability of these low rainfall environments to compete with more climatically favoured areas; key business settings and structures; implications of climate variability and change; and stress testing the systems i.e. how resilient is the system to a change in productivity or commodity pricing.
- Improving **skills** of participants to assess the economic consequences of their decision making in critical areas within their farm business, including both strategic and tactical areas.

The project has been delivered using collaboration across industry and has included input from Rural Solutions SA (Michael Wurst, Mary-Anne Young), SARDI Climate Applications Unit (Peter Hayman, Bronya Alexander) CSIRO (Anthony Whitbread, Andrew Moore) and Barry Mudge Consulting. The project collaborated with the GRDC funded 'Grain and Graze 2' to reach a broader audience.

A series of regional meetings were held with local farmers to identify specific areas of concern. One on one meetings helped to further understand specific issues. Follow-up group meetings then provided for feed-back specific analysis and facilitated up-skilling of participants. While recognising that key financial analysis would be better completed on an individual business basis, the project adopted the use of case studies to more efficiently use the limited resources available.

Key Findings of the Project

General Profitability

- Lower rainfall farming systems have shown to be very adaptable to change
- We are in the fortunate position that the broadacre products (grain and livestock) being produced in the UN region are in demand on world markets and generally commanding a price which is allowing consistently positive gross margins given reasonable seasonal conditions. There is no indication that demand for these products will diminish in the future - if anything, the opposite will apply.
- LR farming systems have shown to be very resilient but are likely to have limited capacity for further absorption of adverse change to productivity (or pricing)
- There is a high degree of risk associated with farming in these environments. Break-even seasons are typically about Decile 3. Risk management focus needs to be firmly on methods to limit downside losses in poor seasons without substantially compromising system gains in better years
- Quantifying risk profiles can be beneficial in improving the understanding of seasonal risk exposure
- @Risk is a useful tool but requires significant expertise to use and further work to ensure its validity - https://www.palisade.com/risk/
- Profitability in LR areas can still be satisfactory at average yields and is competitive with higher producing regions, providing scale efficiencies can be obtained
- The small scale of many of the local businesses presents on-going challenges which need to be addressed if longer term aspirations of farm business succession are to be achieved
- Cost control policies need to be well developed to limit the potential for substantial losses in poor production years. Margins make money, not necessarily technology. Ensure that expenditure is appropriate for *your* circumstances.
- Productivity gains in some areas of the Upper North have been poor over the past couple of decades (although currently showing some sign of improvement). Capital gains from land ownership may be poor if productivity gains remain low
- Farmers looking to expand their businesses in areas showing low productivity gains have an advantage with land values being held down

Enterprise Balance

- Enterprise balance between cropping and livestock has little effect on profitability in average years, but the ratio of cropping to livestock changes the risk profile considerably in more extreme years.
- Continuous cropping in this environment is highly risky given the possibility of an extended run of poor seasons which can be a feature of the region.
- Livestock only systems, from a financial perspective, are currently not favoured in this environment due to their inability to take advantage of better type seasons. These should only be considered in high equity, low debt situations.
- Shifting fundamentals in pricing of lamb vs wool suggest that livestock production systems should be aiming increasingly at the meat market rather than wool production alone.

Cropping

- Variable costs typically only amount to about half the costs of growing wheat in this environment- the balance of the costs are overheads, machinery ownership costs and labour and management input. There is some capacity to affect these by structural settings of the farm business.
- Different seasonal phases substantially impact the ability of farm businesses to survive. These seasonal phases (both good and bad) tend to occur for several years at a time. The millennium drought from 2002 to 2008 was a very difficult period.
- Options which increase the natural responsiveness of these farming systems should be pursued with vigour. An example is the use of highly productive legume based pastures to provide sufficient Nitrogen supply to allow cereal crops to maximise yields in wet years.
- Indicators which improve the likelihood of better outcomes from opportunity cropping may be able to be used to increase chances of successful yields.

Machinery

- Some simple analysis of the full costs of machinery ownership can be informative when looking at alternatives
- As a rough rule of thumb, about half the costs of machinery ownership are overhead costs which occur irrespective of whether you operate the machine or not

Landscape

- Crop and Pasture Production Zones- There is potential to increase production and reduce costs by identifying production zones (areas which have significantly different production levels) across a property and managing these zones differently. The use of Satellite Imagery, in particular NDVI (in the absence of yield maps) could have potential in establishing production zones.

Livestock

- Given that stocking rate is the number one profit driver in a livestock business, there is considerable potential to lift stock carrying levels across the district. This, however, will require increased emphasis on active management of livestock and exit strategies in years of poor pasture production.

Conclusions and Recommendations

1. At the initial meeting of farmers under this project, farmers identified a number of weaknesses in their systems. To address these, farmers need to recognise and accept the need for change. This change is likely to be uncomfortable.

2. Producers need a more robust approach to identifying weaknesses in their farming and business structures. This may require up-skilling of producers but could also involve accessing skills externally to the business. Currently, there is increased focus on the use of Farm Advisory Boards as a means of improving decision making across the farm business. The use of benchmarking programs which allow comparison with leading producers should be encouraged. Such programs do not appear to be widely available or utilised at the moment.

3. The identified smaller scale of many of the Upper North primary producers is likely to cause on-going issues in being competitive. Innovative approaches to addressing scale are to be encouraged. One approach could be to investigate the benefits of collaborative farming using a number of local case studies.

4. Producers need to effectively separate the two businesses of land ownership and commodity production to more appropriately identify business profit drivers. A producer may be quite willing to receive low wages in return for being involved in the production industry but it is important to identify whether this is the case.

5. Analysis should be encouraged wherever possible to support decision making. Use of programs such as @Risk have a role to play in this process and efforts to increase its robustness are encouraged. Simple analysis should also be encouraged to aid intuitive decision making.

6. A conservative approach to managing risk is an admired characteristic of primary producers in lower rainfall environments and provides resilience in adverse circumstances. However, focus should also be on recognising the negative consequences of risk adversity at the expense of identifying upside opportunities.

7. The lack of basic farm business management knowledge and analytical skills remains an impediment to the industry. GRDC have recently undertaken significant investment in this area with their Farm Business Update programs for growers and advisors, the production of factsheets on important business principles and provision of courses to advisors.

Canola Establishment under Various Stubble Management Treatments Pre-Sowing

Author: Ruth Sommerville, Joe Koch, Matt McCallum and Todd Orrock
Funded By: GRDC Stubble Initiative
Project Title: Maintaining profitable farming systems with retained stubbles in the Upper North of SA.
Project Duration: 1/7/2013 to 30/6/2018 – Trial 2014
Project Delivery Organisation: Upper North Farming Systems

Key Points:
- Local seeding machines successfully established canola into a heavy barley stubble
- There was no benefit in pre-sowing cultivation or burning to plant establishment.

Background to the trial
In recent years, canola has proven to be a profitable break crop for the Upper North. Successful crop establishment is critical in achieving maximum yield potential. Typically, about 40-60% of sown canola seeds establish as plants, which is quite low compared to cereals (typically 80%). However, if conditions for canola are favourable, establishment can be as high as 80%. Being a small seed, canola is more vulnerable to poor establishment caused by inadequate seed to soil contact, marginal soil moisture conditions, and sowing depth (either too deep or shallow). Sowing canola into heavy stubble (>4t/ha) can reduce emergence, crop growth and yield. If sowing canola in these conditions, growers may revert to stubble burning, and/or pre-sowing tillage (usually with fertiliser) to help overcome the potential negative effects of stubble.

This trial aimed to demonstrate whether current seeder set ups within the region are capable of successfully sowing canola into heavy stubble.

The paddock used is at Booleroo Centre and was used for the 2013 Barley Seeder Demonstration. It is characterised by having two fairly distinct soil types. One is a higher yielding friable loam, and the other is a lower yielding sodic clay soil. In this demonstration four different machines were used across three pre-sowing treatments and two soil types.

Table 1: Seeder units used in the canola establishment under different stubble treatment demonstration.

Owner	Bar	Tynes	Box and Press Wheel Configuration
Todd Orrock	Primary Sales Precision Seeder	10" spacing, double shoot	Tow Between In-Frame press wheels
Gavin Schwark	2013 Flexi Coil 5000HD Airdrill	Agmaster 15mm points, 10" spacing, Primary Sales Double Shoot Boots	Tow Between 100mm In-frame press wheels
Joe Koch	2004 Bourgault 8810	Agmaster Double Shoot and 12mm points, 9.5″ Row Spacing.	Tow Behind Gang Press Wheels
Andrew Walter	Bourgault Para Link	10'" spacing, single shoot	Tow Behind In-frame press wheels

Each machine was calibrated in the paddock and the seed weighed in and out of the boxes to ensure accurate seeding rates. The canola seed used was certified to ensure uniform germination potential.

Three pre-seeding stubble treatments were applied to the Hindmarsh Barley Stubble;

1. Retained stubble (5t/ha)
2. Burnt stubble
3. Cultivated pre-sowing with knife points

The demonstration site was sown on the 17^{th} of April 2014 with 3 kg/ha of ATR Bonito canola and 120 kg 27:13. The paddock had been treated with a pre-emergent herbicide application (1.5L Treflan + 1L Rustler) post stubble management and prior to sowing. Plant counts were conducted on 12/6/2013.

Image 1: Burnt Stubble (left), cultivated stubble (middle) and standing stubble treatments prior to seeding.

Results and Discussion

Variation in plant counts across the paddock range from 19 to 76 plants/m2, with an overall average of 44 plants/m^2 (Table 1). This is within the GRDC guidelines of an average target of 40-70 plants/m^2 for low rainfall regions.

On average, retained stubble resulted in even plant establishment rates across soil types (Figure 1). In contrast the burnt and cultivated stubble treatments resulted in varied plant establishment across the two soil types. The burnt treatment resulted in higher plants numbers on the loam soil type, but lower establishment on the clay. Conversely, the cultivated treatment appeared to have a negative effect on the loam soil and a slightly positive response on the clay. Three of the seeders performed similarly on average across the different treatments and soil types. The seeder provided by Andrew Walter resulted in poorer plant establishment in all treatments where stubble was not retained, suggesting that this machine has been set-up to perform at its optimum in retained stubbles.

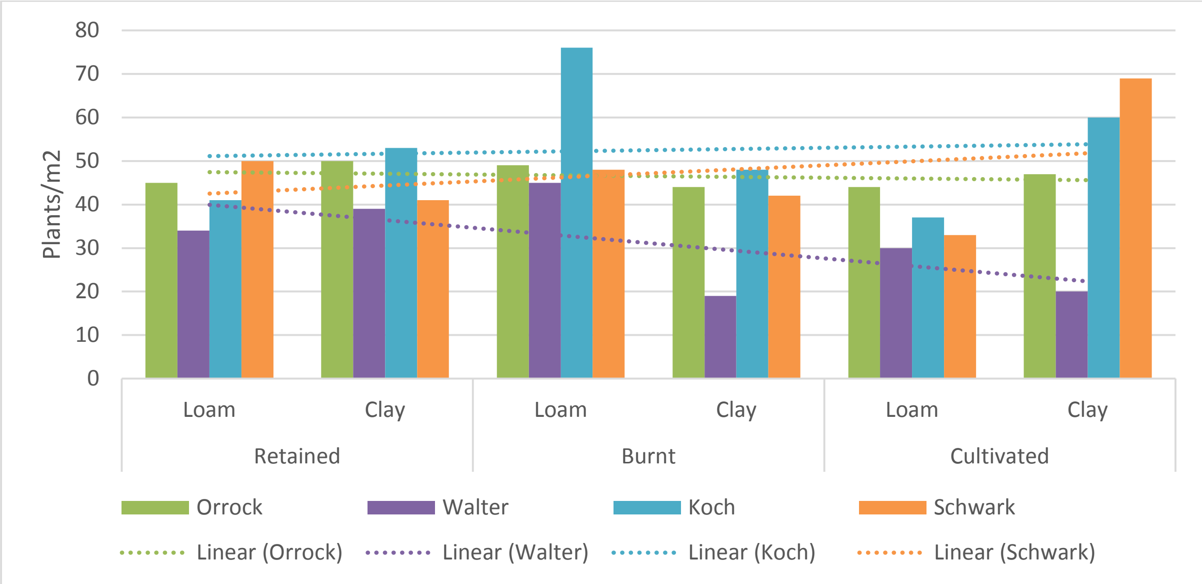

Figure 1: Plant Establishment resulting from pre-seeding stubble treatments sown using four commercial seeding units.

Table 1. Canola establishment under different treatments and soil types

Seeder	**Retained**		**Burnt**		**Cultivated**		**Average of seeder**
	Loam	Clay	Loam	Clay	Loam	Clay	
	Plants/m2		Plants/m2		Plants/m2		
Orrock	45	50	49	44	44	47	46
Walter	34	39	45	19	30	20	31
Koch	41	53	76	48	37	60	53
Schwark	50	41	48	42	33	69	47
Average	43	46	54	38	36	49	

	Retained Plants/m2	**Burnt** Plants/m2	**Cultivated** Plants/m2
Average all data	44	46	42

	Loam	**Clay**
	Plants/m2	
Average all data	44	44

This demonstration site supported the hypothesis that the seeding units being used within the Upper North are set up and capable of sowing into high stubble loads and resulting in plant establishment rates within the optimum window for the low rainfall environment. It showed that it is unnecessary to burn or cultivate a paddock prior to sowing canola to get good crop establishment, and in many circumstances stubble removal or incorporation reduced plant establishment rates.

Plant establishment is not the sole reason for burning or cultivation, and as such there are circumstances where burning or cultivating a paddock prior to sowing will be a viable option. Burning and cultivation can be valuable tools in managing for pests, such as snails and earwigs, and weeds, in particular herbicide resistant or hard to control weed populations.

It is important to consider the full impact of burning and cultivation both in the paddock and to the overall efficiency and viability of the farm operation. In particular, many farmers do not consider the labour cost or machinery cost of these activities; Is controlling snails with burning more cost effective than using a bait when you consider the labour cost, the lost opportunity cost resulting from delays to the sowing program, reduction in soil organic matter and soil health, the increased soil erosion risk and the potential reduction in plant establishment? Is cultivating a paddock to control and/or stimulate weed germination a cheaper and more effective option than herbicide control when considering the cost of operating the tractor, the extra labour required to undertake the cultivation, the erosion risk and the potential reduction in plant establishment? It may still be the most effective option and least risky for your operation, but ensure that you understand the opportunity costs of your actions to the whole of the farm enterprise, not just the target pest or weed.

In the Upper North it will be rare that there are stubble loads high enough (7-10t/ha stubble residue) to cause a significant issue at seeding to reduce seeding efficiency. The stubble loads experienced in the Upper North will on average be able to be sown through and produce effective canola establishment without burning or cultivation. Undertaking burning or cultivation was shown in this demonstration to have a negative impact on canola plant establishment.

Further reading
http://www.grdc.com.au/Resources/Publications/2009/08/Canola-best-practice-management-guide-for-southeastern-Australia

Acknowledgements:
- Todd Orrock - grower co-operator
- Todd Orrock, Joe Koch, Andrew Walter and Gavin Schwark for providing their machinery and time to enable this demonstration to be sown.



Image 2: Resulting soil cover from burning (top left), cultivation (top right) and standing stubble (bottom).

Post-pasture Sowing Demonstration: No-Till vs Cultivation

Author: Ruth Sommerville, Joe Koch, Matt McCallum and John Carey
Funded By: GRDC Stubble Initiative
Project Title: Maintaining profitable farming systems with retained stubbles in the Upper North of SA.
Project Duration: 1/7/2013 to 30/6/2018
Project Delivery Organisation: Upper North Farming Systems

Key Points:

- All machines tested in this trial successfully established a no-till wheat crop after pasture
- On average across all machines, there was no positive response to pre-sowing cultivation on yield

Background to the demonstration trial

Pre-sowing cultivation after 2-3 years of pasture remains a common practice in the Upper North. Reasons for this practice include,

- Surface compaction by livestock, particularly on heavier soil types, resulting in poor crop establishment with no-till and possible reduced yield
- Cultivation to control woody and other hard to kill weeds which are prevalent after a longer pasture phase

This trial aimed to demonstrate whether current seeder set ups within the region are capable of successfully sowing wheat into a pasture with no-till. Four different machines were used across cultivated and uncultivated areas of the paddock at "White Cliffs", Booleroo Centre. The machines used were commercial units set up and modified to suit each individual farmer's needs (Table 1).

Table 1: Seeder Units used in the Post Pasture Sowing Demonstration

Machine Specifications	**Owner**
John Shearer Universal, Agmaster 12mm points and 70mm press wheels, 9" spacing	John Carey
Flexi Coil 5000 Airdrill, Agmaster points, 100mm press wheels, 10" spacing	Gavin Schwark
Bourgault 8810, Agmaster points, 70mm press wheels	Tony Jarvis
Ausplow DBS, 10" paralellogram, 70mm press wheels	Dustin Berryman

Over twenty treatments were implemented in this paddock scale demonstration, however only ten of these treatments are examined in this paper, shown in Table 2.

Table 2. Treatments examined in the comparison of no-till and cultivation effects on post pasture wheat establishment.

Treatment Number	Grower	Treatment
1	Carey	No-till
2	Carey	Cultivated January
3	Carey	Cultivated April
4	Carey	Cultivated January and April
5	Jarvis	No-till
6	Jarvis	Cultivated April
7	Schwark	No-till
8	Schwark	Cultivated April
9	Berryman	No-till
10	Berryman	Cultivated April

The treatments were sown to Mace wheat (75kg/ha) on 21/5/2014 with 120kg/ha of 32:10 fertilizer. Trifluralin at 1.3L/ha was the pre-emergent herbicide used. Plant counts and sowing depth were conducted on 18/6/2014. Ryegrass numbers were assessed on 21/8/2014.

The paddock was harvested using a commercial harvester and the paddock yield mapped. The yield maps have not been presented here as the other treatments have made the comparisons difficult visually. The additional treatments included in this demonstration paddock to create farmer discussion at field days were fertiliser rates (0, 60, 180kg/ha 32:10), sowing speed, deeper working and increased pre-emergent herbicide rate (2.6L/ha). These treatments did show differences when yield mapped and will be explored further in future demonstration paddocks.

Results and Discussion

On average, the no-till and the April cultivated treatments had similar plant numbers and average sowing depth (Table 2). However, the range in seed depth appeared to be less pre-sowing cultivation. This would indicate that the tynes were under more pressure in the no-till plots, and more tyne movement resulted in a greater variation in seed depth. Conversely, where the soil was cultivated prior to sowing, the tynes were likely to be under less pressure resulting in a more even seed placement.

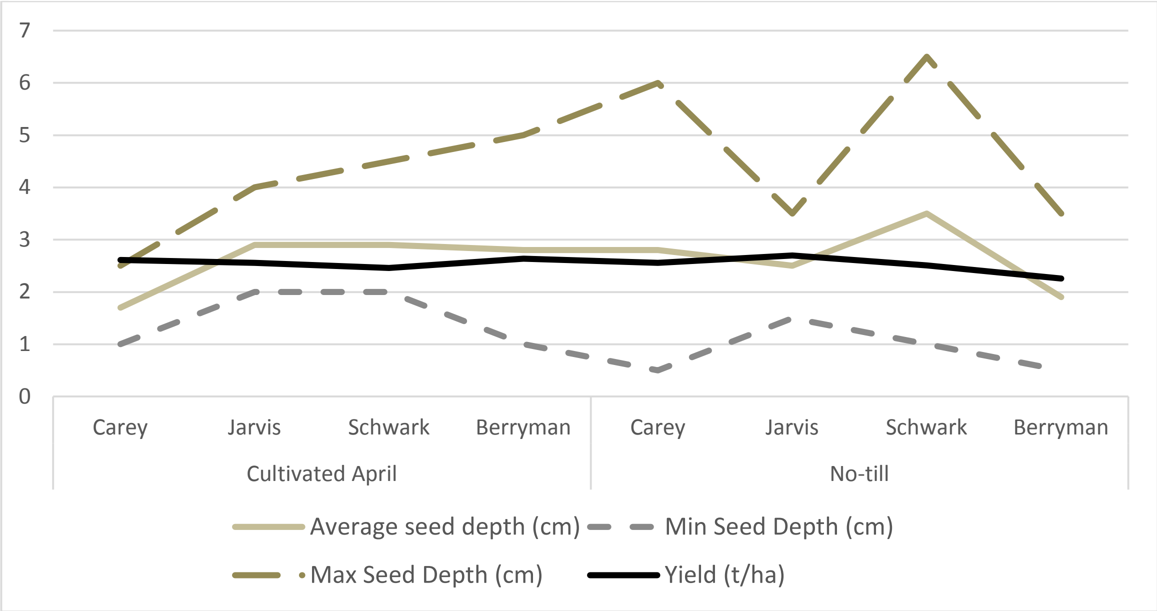

Figure 1: Seed Placement and the Resulting Average Yield of the four machines in cultivated and no-till post pasture sowing demonstration.

Table 2. Crop establishment and yield results

Grower	Treatment	Plants/m2	Average seed depth (cm)	Range in seed depth (cm)		Yield (t/ha)
Carey	No-till	120	2.8	0.5	6.0	2.56
Carey	Cultivated January	142	2.8	1.5	4.5	2.25
Carey	Cultivated April	109	1.7	1.0	2.5	2.61
Carey	Cultivated January and April	104	3.9	3.0	5.5	-
Jarvis	No-till	108	2.5	1.5	3.5	2.70
Jarvis	Cultivated April	116	2.9	2.0	4.0	2.56
Schwark	No-till	136	3.5	1.0	6.5	2.51
Schwark	Cultivated April	149	2.9	2.0	4.5	2.46
Berryman	No-till	136	1.9	0.5	3.5	2.26
Berryman	Cultivated April	104	2.8	1.0	5.0	2.64
	Average No-till	125	2.7	0.9	4.9	2.51
	Average Cultivated	124	2.6	1.5	4.1	2.50
	Average all data	122	2.8	1.4	4.6	2.51

Yield varied from 0.76 to 4.03t/ha across the paddock according to the yield map. Most of the yield variation was due to soil type with higher yield on the limey rising ground and the lower yield on the clay soil type. On average, there was no positive response to cultivation on yield (Table 2 and Figure 1). In many plot comparisons, yield decreased with cultivation, however the data has not been statistically analysed due to the lack of replication.

The assessment of impact on Annual Ryegrass populations found Ryegrass numbers to be low across the paddock (<1/m2) and there was no difference between treatments. Most of the ryegrass was present in the crop furrows and on the shoulder of the press wheel furrow. This would indicate that Trifluralin is still working well in this paddock, and a pasture phase is helping to preserve this chemistry. There was some variation in ryegrass numbers on different soil types. There was little ryegrass on the loam, but some patches of ryegrass (20-45 plants/m2) on the lower lying clay soil type.

Summary

- On average this demonstration showed limited to no gain in plant establishment from working the paddock prior to sowing with plant numbers of 125/m^2 for no-till treatments and 124/m^2 for cultivated treatments.
- On average this demonstration showed limited to no gain from working the paddock prior to sowing with an average yield of 2.51t/ha for no-till treatments and 2.50t/ha for cultivated treatments.
- All machines successfully sowed through the un-cultivated post pasture soil conditions, though for some machines it did result in reduced precision of seed placement. In poorer season breaks, or with other crops this could have a significant effect on plant establishment.
- There is a significant cost to working a paddock prior to sowing in time, machinery costs and fuel. There needs to be a significant benefit of working the paddock prior to sowing to warrant this input. The gross margins of working this paddock in 2014 prior to sowing would have resulted in a significant loss in comparison to direct sowing of the post pasture phase.
- Cultivation prior to sowing will result in significant losses of stored soil moisture. The effect of this was seen in the two plots worked in January with reduced yield in the January only working and reduced plant establishment in the dual cultivation treatment.
- This demonstration showed limited benefit for weed population control through cultivation, though the total weed levels were low across the paddock.

Acknowledgements:

- John Carey - grower co-operator and yield data collection
- John Carey, Gavin Schwark, Tony Jarvis and Dustin Berryman for providing and operating their equipment to get the demonstration sown.
- Michael Wells PCT Ag - yield data analysis

Image 1: UAV footage taken on the 7/08/2014 clearly shows no visual difference between no-till and cultivated strips which run Left to Right across this image. The different seeders and other treatments run Top to Bottom in this image, clear fertiliser responses are visible in the middle of the photo.

Barley grass management in cropping systems of southern Australia

Author: Ben Fleet, Lovreet Shergill, and Gurjeet Gill
Funded By: GRDC
Project Title: UA00134 Improving IWM practices in southern region – Emerging Weeds & UA00149 Improving IWM practices of emerging weeds in the southern and western regions.
Project Delivery Organisation: University of Adelaide, School of Agriculture, Food & Wine

Key Points:

(a) Increasing incidence of Barley grass (*Hordeum spp*) in cropping paddocks in southern Australia is likely to be due, at least in part, to selection of more dormant biotypes.
(b) In some districts, barley grass management is becoming difficult because of the development of Group A resistance. However, there still appear to be several effective herbicide alternatives for barley grass control in broadleaf crops.
(c) Upper North had high levels of herbicide resistance in barley grass, particularly compared to Eyre Peninsula. However, some highly resistant paddocks have been identified on Eyre Peninsula (EP).
(d) Integrated weed management strategies are critical to delay resistance and prolong the effectiveness of our cheap and effective herbicides.

Project Report

In a survey by Fleet and Gill (2008), farmers in low rainfall districts in South Australia and Victoria reported increasing incidence of barley grass in their crops. Research by Fleet and Gill (2012) has shown that weed management practices used in cropping systems have selected for increased seed dormancy, which is likely to contribute to greater abundance of this weed species in field crops. Presence of increased seed dormancy in this grass weed species enables it to escape pre-sowing control tactics used by the growers. In this paper we will report results of studies undertaken to develop management strategies for barley grass. This trend for selection of increased seed dormancy in barley grass mirrors change in seed behaviour of brome grass (Kleemann and Gill 2013).

Recent release of pyroxasulfone (Sakura) in Australia has been an important development in the management of barley grass in wheat. In many field trials undertaken on the EP over 4 years, Sakura consistently provided effective control of barley grass in wheat (e.g. Fleet and Gill 2010) (Figure 1). Unfortunately, many farmers are still using cheaper but inferior herbicide options for barley grass, which can lead to large build-up in weed infestations.

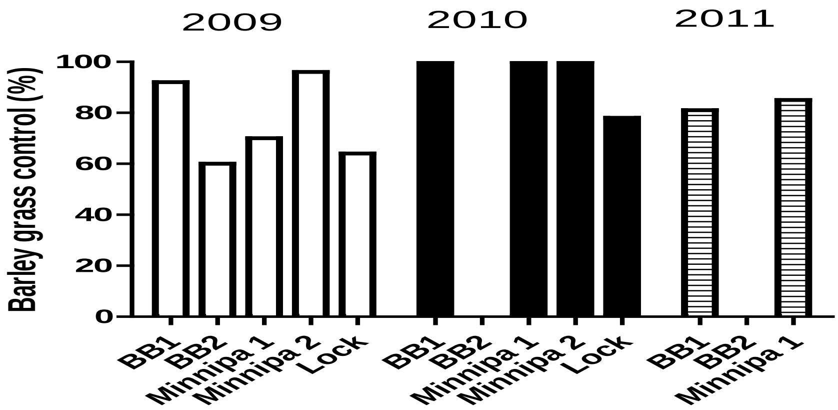

Figure 1. Effect of Sakura at the recommended rate (118 g/ha) on barley grass control in wheat at trial sites on the EP. Weed control is expressed as reduction in barley grass seed production. BB = Buckleboo; 1 and 2 represent time of sowing.

In some locations like Port Germein and Baroota districts, it is now almost impossible to control barley grass in pulse crops. This is mainly due to the presence of Group A (fop & dim) herbicide resistance (Figure 2). Currently in these locations barley grass control is reliant on growing Clearfield cereals and the use of imidazolinone(Imi) herbicides(Group B). This management strategy is at high risk of collapsing due to the development of Group B herbicide resistance. Resistance to Group B herbicides can develop quickly when large weed populations are sprayed regularly with Group B herbicides. The extent and nature of this resistance needs to be better understood and effective management strategies to manage resistant Barley grass in pulse crops developed. One of these populations was collected from Baroota, near Pt Germein and screened for resistance. There is no doubt that the repeated exposure of Baroota population to Group A herbicides has resulted in the evolution of high levels of resistance (Figure 2). Resistance has now been confirmed in this population to quizalofop (Targa), haloxyfop (Verdict) and clethodim (Select).

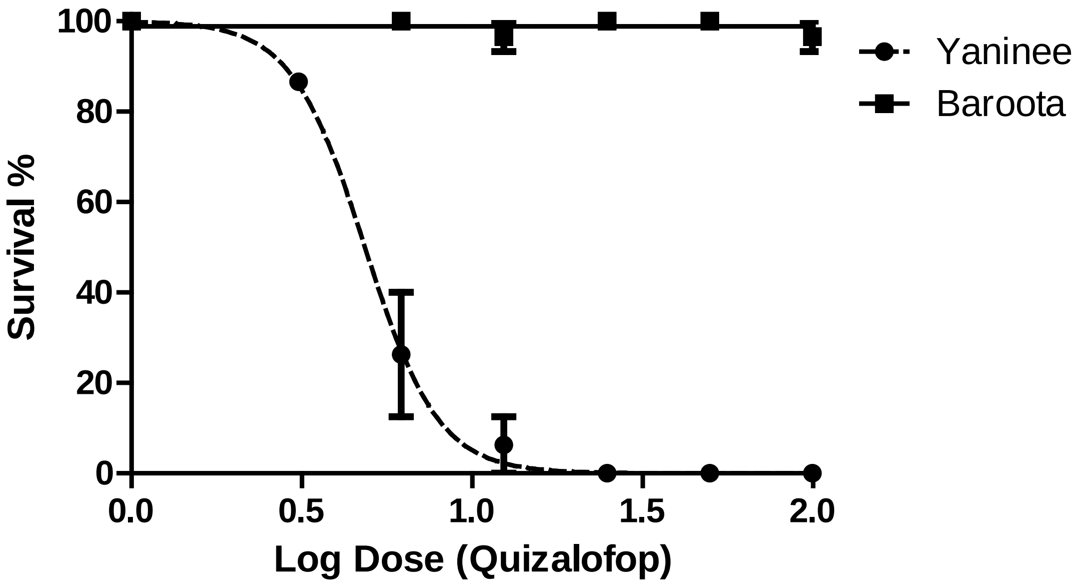

Figure 2. Effect of quizalofop on the survival of barley grass field population from Baroota (Pt Germein) showing 100% resistance and the susceptible population from Yaninee showing a dose response to the herbicide. Herbicide rates are 0, 1/8, ¼, ½, 1, 2, & 4 x field rate (300 mL/ha of herbicide)

Survey results for fop (Group A) herbicide resistant barley grass are shown in Table 1. Barley grass fop resistance is at a low frequency across EP, particularly in comparison to the Upper North (UN) where almost 50% of barley grass has some level of resistance. While at quite a low frequency, some paddocks on EP have been identified with very strong resistance. Resistance is obviously developing and extra care needs to be taken to delay further resistance development. Always follow up fop applications with another control measure such as a pasture/crop-top or a hay-cut and remember that multiple applications of the same herbicide group in one season will increase selection for resistance more than a single application.

Table 1. Survey results of barley grass with quizalofop (Group A) resistance on EP & UN. Resistance means more than 20% survival, developing resistance means less than 20% survival but more than 0%.

	Random survey samples			Targeted paddock samples
	Paddocks surveyed *(% with Barley grass)*	**Populations with Fop resistance**	**Populations developing Fop resistance**	**Populations with Fop resistance**
Upper North	24 *(80%)*	15.4 %	31 %	83 %
Eyre Peninsula	83 *(80%)*	1.7 %	3.3 %	17%

Survey results for Imi & sulfonylurea (SU) (Group B) herbicide resistant Barely grass are shown in Table 2. While no Barley grass was found to be resistant (>20% of population surviving), low levels of resistance were identified. The level of developing Imi resistance is of concern, but not surprising given the reliance on these herbicides in controlling Barley and Brome grass. Levels of Imi resistance were lower in the UN, but likely to increase rapidly with the increased selection pressure on Imi herbicides due to loss of Group A herbicides in many paddocks.

Table 2. Survey results of barley grass with Imi and SU (Group B) resistance for EP & UN. No populations were found to be fully resistant to any Group B herbicides. Resistance means more than 20% survival, developing resistance means less than 20% survival but more than 0%.

	Developing resistance to Imazamox (Raptor)	**Developing resistance to Imazamox + Imazapyr (Intervix)**	**Developing resistance to Sulfosulfuron (Monza)**
Upper North	0 %	0 %	21 %
Eyre Peninsula	4.5 %	3 %	7.5 %

Presence of high levels of resistance to Group A herbicides is a major concern for pulse crop weed management. In order to investigate the performance of alternative herbicides on Group A resistant Barley grass, a field trial was conducted at Baroota in 2012 and Mambray Creek in 2014. Sakura, Raptor (imazamox) and propyzamide provided excellent control of barley grass, which was reflected in significant increases in grain yield of field peas (Table 3). Outlook (dimethenamid) appeared to be relatively ineffective early in the season but its performance improved with time and it may have a useful role in field peas. Some of the experimental herbicides also showed some encouraging results controlling barley grass in field peas.

Management strategies for barley grass

- Weed management needs to focus on driving down the seedbank numbers. Ideally where barley grass is prevalent, two consecutive seasons of high control, e.g. pasture (winter clean + pasture-top) followed by wheat (Sakura), should largely deplete the seedbank. Where Group A resistance is already present, the pasture phase could be brown manured with a knockdown herbicide prior to barley grass seed set. It is recommended to implement a combination of cultural and chemical control strategies to manage barley grass infestations. Maintaining barley grass infestations at a low level could reduce the risk of herbicide resistance.
- Management of barley grass populations with high seed dormancy could be improved by seeding these paddocks later in your seeding program. This increases the likelihood of achieving an effective control with a knockdown herbicide.
- Alternatively in situations of an early season break, when temperatures are warmer, these paddocks could be sown early to encourage higher crop competition against barley grass that will germinate later when temperatures fall. Crop competition can also be improved by narrower row spacing and increased seeding rates. These sowing time adjustments would be more appropriate for EP where many barley grass populations have developed increased seed dormancy.
- Preserve Group A & B herbicides, by using multiple control tactics, e.g. whenever Group A herbicides are used in pulse or pasture, be sure to also include a pasture/crop-top to control any survivors.

Table 3. Effect of different herbicide treatments on the reduction in group A resistant barley grass seed production at Baroota (SA) in 2012 and Mambray Creek (SA) in 2014.

Treatments	Seed set reduction (%)	
	2012	2014
Propyzamide (500g ai) @ 2L/ha IBS	-	100
Sakura @ 118 g/ha IBS	99	97
Propyzamide (500g ai) @ 1L/ha IBS	100	95
Experimental-3 @ 1.5L/ha IBS	-	90
Raptor @ 45 g/ha + BS1000 0.2% PE	100	90
Trifluralin @ 2L/ha IBS + Experimental-2 @ 3kg/ha EPE	-	81
Experimental-1 @ 1.5L IBS	-	81
Outlook @ 1 L/ha IBS	93	78
Boxer Gold @ 2.5 L/ha IBS	74	66
Trifluralin @ 2L/ha + Avadex Xtra @ 2L/ha	71	65
Experimental-4 @ 500mL/ha	-	59
Diuron 900@ 1kg/ha + Trifluralin @ 2L/ha IBS	78	52
Pendimethalin @ 2L IBS	-	52
Trifluralin @ 2L/ha IBS	68	49
Terrain @ 180g/ha IBS	-	45
Terrain @ 240g/ha IBS	-	44
Control	0	0
LSD (P=0.05)		15.98

Note: Some of the herbicides evaluated in this trial are currently not registered for use in field peas.

Acknowledgements
Research on barley grass reported here was undertaken in GRDC funded projects (UA00105, UA00134 & UA00149). The authors would also like to thank Rob Dennis, Barry Mudge, Brian and Neville Leue for providing trial sites and support. We also thank Malinee Thongmee and Ryan Garnett for their technical support.

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A Comparison of Efficient Grain Production and Nitrous Oxide Emissions

Authors: Michael Wurst, Rural Solutions and DeAnne Ferrier, Birchip
Funded By: Australian Government Department of Agriculture, Action on the Ground
Project Title: 'Efficient grain production compared with N_2O emission' AOTGR1 – 956996-222
Project Duration: 2013-2015
Project Delivery Organisation: Rural Solutions SA on behalf of UNFS / Birchip Cropping Group

Key Points:

- Nitrous oxide (N_2O) losses appear to be minimal from dry-land low to medium rainfall farming systems; with the highest peak emissions of only 4.0 g N_2O-N/ha/day[1] measured following rainfall.
- N_2O emissions from legume stubble over summer and following synthetic nitrogen fertiliser application in-crop were all low.
- An increase in soil water was the major driver of N_2O emissions.

Project Report: Nitrous Oxide Losses from Dry-land Cropping

The use of all types of Nitrogen (N) fertiliser has increased in the last few years even in the lower rainfall districts as farmers have moved towards greater cropping intensity and become more confident in utilising stored soil moisture and nitrogen levels to predict grain yields. The greater use of nitrogen fertiliser brings both economic and environmental risks including losses of nitrogen as the greenhouse gas nitrous oxide (N_2O).

Nitrous oxide is responsible for 4.7% of Australia's greenhouse gasses, and 78% comes from agriculture (Department of the Environment, 2014), increasing the interest in reducing N_2O emissions through improved fertiliser use. It should be noted that nitrous oxide emissions come from a range of sources including nitrogen fertiliser, fossil fuel combustion and some manufacturing processes.

The two main processes of N_2O emissions in agricultural soils are nitrification and denitrification. The major factors influencing these processes are soil water content, changes in oxygen availability, soil mineral N, soil temperature and the availability of easily decomposed carbon (Fig 1). Warm, moist soils generally favour nitrification, while larger losses from denitrification occur with warm, wet (often waterlogged) soils.

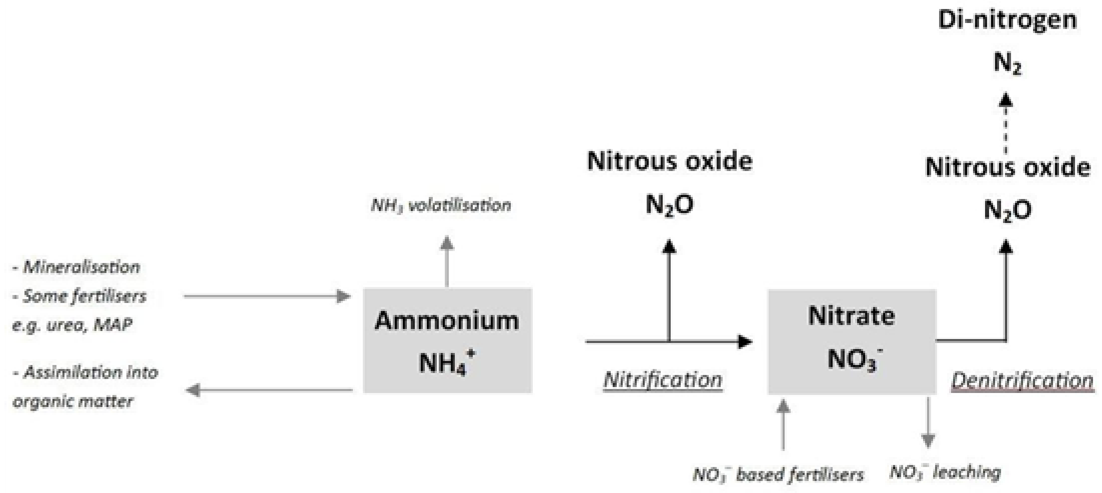

Figure 1: Two key processes (nitrification and denitrification) contributing to N_2O generation in agricultural soils. (Source: Wallace & Dowling, 2014).

As part of this project N_2O emissions were measured after rain in various stubbles over summer and in paddocks top-dressed with urea products in-season. These trials were conducted in low rainfall sites at Condobolin, Mildura, Birchup and Booleroo Whim. All Nitrous Oxide emissions were low, however emissions generally increased following rainfall, most likely due to higher soil moisture levels stimulating the soil microbes responsible for nitrification and potentially also denitrification.

Differences in N_2O emissions from various nitrogen sources (urea, polymer coated urea, ENTEC® (ammonium stabiliser) urea and Green urea) were difficult to measure because of the low emission levels produced. The highest emission recorded was 4.0 g N_2O-N/ha/day from field pea stubble in February following 69 mm at Condobolin. At most other sites emissions peaked at less than half these levels. If emissions reached a maximum of 4.0 g N_2O-N/ha/day for 365 days, annual emissions would equate to 1.5 kg N_2O-N/ha/year, however the likelihood of this occurring is low for low rainfall cropping areas. Previous studies, such as those summarised by Barton et al. (2014), indicate that emissions from various farming systems can range between 0.3 to 16.8 kg N_2O-N/ha/year, making results from this project comparatively low.

The environmental impact of N_2O is significant due to the large global warming potential of N_2O, approximately 300 times the warming potential of carbon dioxide (CO_2). In low to medium rainfall dry-land cropping, in particular sandy soils, waterlogging events are infrequent, reducing the risk of denitrification resulting in N_2O losses being very low. Other industries such as sugar cane, intensive pasture production and many horticultural industries where N inputs are far higher and irrigation is often used have significantly higher N_2O emission levels.

On-Farm Profitability

If we assume a theoretical paddock with maximum emissions of 4.0 g N_2O-N/ha/day (1.5 kgN_2O-N/ha/year) the nitrogen loss would be only $1.95/ha/year, assuming $600/tonne of urea. Despite relatively low cost, there are still opportunities to reduce emissions and increase profitability and production by altering the timing of fertiliser application and applying the best product at the correct rate.

Best management of N fertiliser application can be achieved by following the ‘four R’s’:

- Right rate – use soil and crop testing to determine yield potential
    - Use seasonal outlooks to better estimate rainfall and yield potential
    - N-rich strips to gauge potential for crop response to N fertiliser
    - Yield Prophet® or soil moisture probes for monitoring plant available water
    - N sensors in combination with variable rate application to adjust N fertiliser rates.
- Right time – apply at Growth Stage 30 just before a significant rainfall event
- Right place – some applied pre or at seeding but most post sowing
- Right product – will depend on the type of application equipment available, cost of products and the potential for N losses.

Carbon Farming and Nitrogen Fertiliser

Greenhouse gas emissions are reported in carbon dioxide equivalents (CO_2-e) and the 1.5 kgN_2O-N/ha/year emission level is the equivalent of 702 kg of CO_2-e. Even at a carbon price of $23/ha, the value of N_2O emitted from the ‘theoretical farm’ example used above would only be $16/ha/year. However, as mentioned above, the likelihood is emissions for low rainfall cropping systems are far lower than the 1.5 kg N_2O-N/ha/year, which would correspond to a lower cost of emissions.

Currently the potential for farmers to participate in carbon markets relating to N_2O emissions and fertiliser use in the Australian dry-land cropping industry is very limited, with generally low emissions from most of the cropping zone and particularly the low rainfall areas.

Notes:[1] N_2O-N/ha/day is the amount of nitrous oxide gas emitted from a hectare of land in a day.

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Farmers Managing Climate Risk

Author: Kym Fromm, 08 86581183, fromms@bigpond.com
Funded By: Grains Research & Development Corporation, Meat & Livestock Australia, Cotton Research and Development Corporation, Rural Industries Research and Development Corporation, Sugar Research Australia
Project Title: Managing Climate Variability Climate Champion Program
Project Duration: Ongoing
Project Delivery Organisation: Managing Climate Variability Research and Development Program. http://www.climatekelpie.com.au/farmers-managing-risk/climate-champion-program

Key Points:
The Managing Climate Variability (MCV) Climate Champion program aims to help farmers manage climate risk by:

- Giving farmers the best climate tools, products, practices and seasonal outlooks, and an understanding of how they might use that in their farm business
- Giving climate researchers a chance to interact with farmers and get feedback about what regions and industries need from research.

Project Report:
20 Australian farmers from around Australia, representing most major agricultural commodities, currently take part in the program. They have opportunities to:

- Talk with researchers about the tools and information they need to help them manage climate risk
- Trial early research products and practices, and possibly influence the research
- Influence how research findings are communicated to farmers
- Help farmers in their region and industry learn how to deal with the variable and changing climate.

In the last year, the farmers taking part in the program have advised researchers and policymakers about issues such as:

- What kind of tools and forecasts are needed at certain times of year for different production systems, and trigger dates/points
- The user-friendliness of the Bureau of Meteorology website
- What producers need to know about accuracy/skill of forecasts
- Drought policies and the need for integrated financial skills on-farm
- The need for predictions of extremes and seasonal conditions.

And, through the program and its workshops, the MCV Climate Champion farmers have pointed out the usefulness of sessions/information about:

- The progress of forecasting models and their accuracy, depending on the time of year and phase of El Nino
- Forecasts for frosts and extreme heat
- Putting risk management practices in context from a strategic/tactical/operational perspective
- Changes to regional climate – in particular, extremes at critical times for production

Kym Fromm represents the Upper North district as one of these MCV Climate Champions and has highlighted that several aspects of research presented to the group may be of interest to UNFS group producers, such as:

- Modelling that projects the likely changes to regional temperatures and extremes in SA, and how close the projections are running to the highest rates of change

- Reactions of crops to higher carbon dioxide levels (in progress at Horsham, Vic)

Farmers are seeing more coverage in mainstream media, as well, about their management strategies and resilience in the face of the increasingly variable climate. Channel 7 in Adelaide, for instance, has been keen to talk to farmers about this.

Some examples of research and projects that the MCV Climate Champion farmers have contributed to include:

- Understanding social and economic conditions and processes which drive resource managers to make more significant, transformative shifts (CSIRO)
- Meeting with BOM to advise on the best way to present forecasts and TV spots for farming businesses
- Giving feedback to BOM about their monthly climate outlook videos to make them producer-friendly and understandable
- Feedback about native pastures to MLA
- Surveys about the Break and Fast Break email formats
- Talks to non-farmers about farming and food production/security to ABARES and the Department of the Environment
- Talking farmers' adaptation to national climate change researchers
- Having farmers contribute to DPI Agricultural Knowledge Brokers' understanding of managing climate variability

and more…

Kym is keen to continue to act as a conduit of information between Upper North farmers and researchers from around Australia – presenting the region's issues and concerns as critical for ongoing profitability and productivity. The research can and needs to take into account our heavy soils and low rainfall. Through the network of farmers and researchers, we can benefit from seeing how other people get around management changes they have to make, and trying out new ideas.

Kym believes that by taking part in the MCV Climate Champion program, he can help get information directly to UNFS farmers much more quickly than the usual, longer timeframe it can take. If the region continues to get record hot years, pastoral country will encroach into our cropping land, and it will completely change the way we farm. We have the opportunity to lead these management changes by having access to the best information and sharing that between us.

Please contact Kym if there is any climate information or research you'd like to ask or hear about, or suggest to researchers as a priority.

How does changing management practices influence soil carbon stock and other production factors?

Authors: Jodie Reseigh, Michael Wurst, Amanda Schapel
Funded By: Australian Government, UNFS, Eyre Peninsula NRM Board, CSIRO and Rural Solutions SA.
Project Title: Perennial pasture management systems for soil carbon stocks in cereal zones, South Australia (AOTGR1 – 44)
Project Duration: 2012- 2015
Project Delivery Organisation: Rural Solutions SA, CSIRO

Key Points:

- Four management practices were investigated to determine their effect on soil carbon stock
- Carbon stocks between 17.4 – 36.3 t/ha with an average 27.5 t/ha were identified prior to any changes in management practice in 2012.
- Carbon stocks between 17.3 – 41.1 t/ha with an average 27.7 t/ha were identified after changes in management practice in 2014
- 35-45 % of organic carbon is distributed in the 0-10 cm and 30 % in the 20-30 cm depth.
- Mid and Upper North Red Brown Earth sites from the National Soil Carbon and Research Program (SCaRP) identified carbon stocks between 20 – 67 t/ha with an average of 38 t/ha for cropping land
- Large changes in plant biomass were observed at sites
- Changes in plant biomass may take some time (5-10 years) to show up as a significant change in soil carbon stock.

Project Report:
The project investigated four on-farm management practices that have the potential to increase soil carbon stock in the Upper North and Eyre Peninsula of South Australia. Demonstration sites were monitored and soil sampled in 2012 prior to the implementation of any change in management, with management practices commencing in 2012/13. Sites were monitored annually for pasture and surface cover, plant biomass, frequency of perennials and the soil re-sampled in 2014 to monitor soil carbon changes. In total, thirteen demonstration sites were established and ten were located in the Upper North. The discussion below relates specifically to three of these sites.

Table 1: Summarised results of variables measured by a change in management

Management option	SOC Stock	Water erosion risk	Ground cover	Plant biomass	Perennial plants
Unviable cropping land	↔	↔	↑ 10%	↑	↔ change in composition
Degraded land	↔	↔	↑ 90%	↑	↑
Introduction and/or increase perennials	↑	↑	↓ 2012 ↑ 2014	↑	↔

↔ No change, ↑ increase, ↓ decrease SOC – Soil Organic Carbon

Unviable cropping land - Mark Ludgate
The demonstration paddock had a history of cropping until 2004, which was typically sown to cereal followed by a self-regenerating pasture. When taking over the property in 2005, Mark decided to no longer crop the paddock. In the absence of cropping, onion weed became dominant particularly following summer rains in 2011/12. In April 2013 the paddock was sprayed achieving > 95% control of the onion weed. In May, 2014 the paddock was sprayed with Gramoxone®, spread with Wallaby grass and medic seed then rotationally grazed in spring.

The Onion Weed provided reasonable cover so there was only a 10% increase in ground cover by 2014 with no increase in the number of perennial plants/m^2 but there was a large change in pasture composition as seen in Figure 1.

Soil Organic Carbon (SOC) 0-30 cm: 2012 concentrations varied between 0.7 – 1.0 % with a stock of 30.6 t/ha and 2014 concentrations were between 1.0 – 1.5 % with a stock of 31.9 t/ha (medium to low compared to SCaRP). Although there wasn't a significant increase in SOC stocks, the increase in above and below ground biomass from the perennial grasses should result in increases in SOC stock over time.

Figure 1. Management practice: Unviable cropping land before (left) and after (right) change in practice. Note: the change in pasture composition from Onion weed to annual grasses and Wallaby grass.

Degraded land – Andrew Weckert (Scald)
Prior to purchasing the property in 2012 the demonstration paddock was set stocked. Post 2012, grazing was for 4-10 week periods with 400-600 ewes and lambs. In June 2013, 8 t/ha of medic straw was spread onto a 0.2 ha scald area, and spread with Wallaby grass (4-5 kg/ha) in late June and Windmill grass spread (3 kg/ha) in late August of the same year.

The before and after photos (Figure 2) show the dramatic increase in ground cover and plant biomass. There was a large germination and subsequent increase in the numbers of perennial plants per square metre in 2013 but competition effects decreased plant number in 2014 as plants grew.

SOC 0-30cm: 2012 concentrations varied between 0.43 – 0.45 % with a stock of 17.4 t/ha and 2014 concentrations were between 0.48 – 0.52% with a stock of 17.3 t/ha (very low compared to SCaRP). Although there wasn't a significant increase in SOC stocks, the increase in above and below ground biomass from the perennial grasses should result in increases in SOC stock over time.

Figure 2. Management practice: Degraded land before (left) and after (right) change in practice. Note the increase in plant biomass and ground cover of native Wallaby and Windmill grass.

Land managed for increased perennial component – Barry Mudge
The demonstration paddock had not been cropped since 2001 due to poor yields and subsequently grazed between April to August with 375 ewes + lambs. In May 2013, ripping was undertaken in preparation for planting of forage shrubs and in July, 6 m strips were sprayed with glyphosphate to control annual grasses and other weeds. Approximately 2,000 mixed forage shrub (Eyres Green oldman saltbush, River saltbush, Creeping saltbush and Silver saltbush) seedlings were planted in mid-July. This was lightly grazed in November and December 2014.

Over time, there was a slight increase in the water erosion risk due to the ripping and spraying of the 6m spray strips. Once forage and pasture plants establish and grow this risk will be reduced. The percentage ground cover followed a similar pattern. There was no change in the number of perennial plants in the inter-row between the forage shrubs.

Soil organic carbon 0-30cm: 2012 concentrations varied between 0.55 - 0.66 % with a stock of 23.7 t/ha and 2014 concentrations were between 0.67 - 0.94 % with a stock of 29.4 t/ha (low compared to SCaRP). There was a significant increase in SOC stocks resulting from increased SOC concentrations not just in the 0-10 cm depth, but throughout the remaining 10-30 cm of the soil perhaps as a result of improved root growth from ripping.

Figure 3. Management practice: Land managed for increased perennials (left) and after change in practice (right).

Summary
Mid and Upper North Red Brown Earth sites from the National Soil Carbon and Research Program (SCaRP) identified carbon stock between 20 – 67 t/ha with an average of 38 t/ha for cropping soils. Prior to implementation of the management change, the Upper North sites had carbon stock between 17.4 – 36.3 t/ha with an average 27.5 t/ha and two years after the change stocks were between 17.3 – 41.1 with an average 27.7 t/ha, all below the SCaRP average. These sites have the potential to increase carbon stock. For each change in management practice, large changes in plant biomass were observed. However, the increase in above and below ground biomass may take a number of years to be reflected as a stable increase in organic carbon stock due to the effect of establishing the sites. For example; ripping can result in an initial loss of soil carbon but over time promotes deeper and more extensive root exploration resulting in more organic carbon in the soil.

RURAL SOLUTIONS SA
Government of South Australia
Eyre Peninsula Natural Resources Management Board
CSIRO
Australian Government

Surface Cover Grazing Systems Trial

Author: Mary-Anne Young
Funded By: GRDC Stubble Initiative
Project Title: Surface Cover Grazing Systems Trial
Project Duration: 2014-2017
Project Delivery Organisation: PIRSA Rural Solutions SA and UNFS

Key Points:

- Trials are underway investigating the effects of rotational grazing versus set stocking of stubble residues on surface cover and soil characteristics in arable paddocks.
- Early rain in 2014 disrupted the trial's implementation but initial results on a stubble / self-sown pasture grazed in June indicated no difference between set stocking and rotational grazing on surface cover.

Project Report:

Experiences of farmers using rotational grazing on stubbles (putting high numbers of stock on paddocks for short periods of time) suggest that more surface cover remains and less tracking is evident compared to paddocks where a lower stocking density for longer periods is used.

This theory is being tested on Don Bottrall's paddock at Appila. The **Bottrall** paddock of 17 ha was wheat stubble from the 2013 season. It was split into approximately half, and an ungrazed or "control" strip was left in the middle.

The western end was left for set stocking while the rotationally grazed area was further subdivided into 3 areas.

The intention was that once the electric fences were set up, the sheep would be moved onto the trial.

However, bushfires and early rains thwarted our plans with the result that the sheep went onto the paddock in June for 18 days.

Image 1: The Bottrall paddock displaying the three treatment zones, Set Stocking (S), Control (C) and Rotational Grazing (R). The Rotational Grazing zone was divided into three sub-zones.

The original mob of 220 ewe lambs was split in two; one half going onto the set stocking area for 18 days, the other half rotated through the 3 subdivisions for 3 days at a time.

Assessments of surface cover were made (dry matter t/ha; proportion of bare ground / surface cover; and an erosion risk rating system used by the Department of Environment, Water and Natural Resources) prior to the sheep going onto the paddock and immediately after their removal.

Table 1: The Bottral Paddock Results. There was no significant difference in surface cover between the 2 treatments:

	Dry Matter t/ha	**Surface Cover %**	**Surface Cover Rating***
Control	1.99	97	2
Rotational Grazing	1.44	91	3
Set Stocking	1.50	91	3

* 1 = full cover; 8 = bare ground

While it was not measured, there was obviously more “green pick” on the rotationally grazed areas.

Stock tracks were counted on the grazed areas and it was found that while the number of tracks overall was about the same, one of the rotationally grazed areas had far more tracking than the other two. The reason for this is unclear but it is possible that because the sheep in this subdivision ran out of water one day, they were walking around looking for water more that day.

Aerial photos of the trial were taken using a UAV. While it is not yet possible to use the aerial imagery to measure cover, the images provide a good indication of the cover remaining after the sheep were removed.

Image 2: Aerial view of rotational grazing area in foreground, control strip and set stocking background, 26/06/14.

The paddock was sown to wheat in July 2014. After harvest in 2014 the paddock was subdivided and tested again. The results from the 2015 grazing are yet to be analysed. This paddock will continue to be grazed in this trial for the following 2 seasons to assess the longer term effects of grazing system on stubble and soil characteristic within a paddock used primarily for cropping.

Acknowledgements:
Thank you to Don Bottral for the use of his paddock and his effort in erecting the fencing and rotating the sheep. Thank you also to Jim Higgins, who was originally going to be part of the trial but the seasons and lack of stubble cover have meant that the trial was not possible. Thankyou also to Joe Koch for the loan and operation of his UAV to obtain the aerial imagery of the trial site.

Soil-borne diseases in UNFS stubble retention systems

Authors: Margaret Evans (SARDI), Greg Naglis (SARDI) and Michael Wurst (Rural Solutions)
Funded By: GRDC
Project Title: DAN00175 - National crown rot epidemiology and management program
Project Duration: 5 years
Project Delivery Organisation: SARDI (national management – NSW DPI)

Key Points:

- Crown rot and rhizoctonia were the most common of the soil-borne cereal diseases present at medium to high risk levels. Take-all and Common Root Rot were less common but some paddocks had significant risk levels.
- The newly available tests for yellow leaf spot and white grain Clade 1 shows inoculum of these diseases is present in most paddocks, often at high levels (risk categories have yet to be developed for these diseases).
- Crown rot inoculum was lower between old cereal rows than on them which means that sowing between old cereal rows has potential to reduce yield losses from crown rot in the Upper North.
- PreDicta™ B soil sampling protocols now include adding a small piece of stubble from each stop along the sampling transects (15 pieces in all).
- If soil sampling between old cereal rows to assess risk levels, it will be important to consider whether to add extra stubble to the sample and how to interpret the results.
- Breaking up stubble and moving it around (e.g. heavy grazing, chaining) will increase the risk of yield loss from crown rot. This has particular implications for choice of timing when soil sampling to assess crown rot risk and when deciding whether sowing between old cereal rows will assist in managing yield loss from crown rot.

Project Report:

Stubble retention systems, particularly those where cereals dominate rotations, favour build-up of stem and crown diseases such as crown rot, take-all, common root rot, yellow leaf spot and white grain. This survey was undertaken to see whether inoculum of these diseases was widely distributed in the area covered by the Upper North Farming System Group and whether sowing between old cereal rows would have potential to reduce the risk of yield loss from crown rot.

Methods

Soil samples were taken from 13 paddocks in the Upper North (covering an area bounded by Booleroo Centre, Orroroo, Melrose, Mambray Creek and Warnertown) over the period May 6-8. Paddocks were sampled on 5 angled transects with a total of 45 soil cores (1 cm diameter, 10 cm deep) being taken from each paddock (3 stops on each transect, 3 soil cores at each of the stops). Random samples were taken where no old cereal rows were present. Where old cereal rows were present, samples were taken on row. In some paddocks separate samples were taken from on and between the old cereal rows. In some instances, a second sample was taken, to which extra stubble was added – one piece of stubble from each of the 15 stops made to take samples. Samples were sent to the PreDicta™ B service for analysis.

Results and discussion

The following diseases were not detected in any of the 13 paddocks:

cereal cyst nematode	phytophthora root rot of chickpeas
stem nematode	white grain Clade 2
take-all (oat strain)	eyespot
Pratylenchus penetrans	crown rot - *Fusarium culmorum*
Pratylenchus teres	blackspot of peas - *Phoma koolunga*

The following diseases were present but will not be discussed in this article:

- Root lesion nematodes (*P. neglectus*; *P. thornei*) - low risk in most paddocks.
- Blackspot of peas (*Didymella/Phoma*) – not present in six, medium to high risk in five.
- Pythium root rot of chickpeas – present in all paddocks (new test, no risk categories).

Diseases detected (see Table 1):

- Rhizoctonia – medium to high risk in seven paddocks.
- Crown rot – medium to high risk in six paddocks.
- Take-all – medium risk in two paddocks.
- Common root rot (*Bipolaris*) – medium to high levels in two paddocks.
- White grain clade 1 – medium to high levels in 5 paddocks (new test, no risk categories).
- Yellow leaf spot – medium to high levels in eight paddocks (new test, no risk categories).

Inoculum levels were consistently lower between the old rows when compared with on the old rows for crown rot (Table 2), yellow leaf spot and white grain Clade 1 (data not presented). This was not the case for rhizoctonia, where sample location often made no difference to inoculum levels detected (data not presented). Rhizoctonia hyphae readily grow through the soil to infect new plants, while yellow leaf spot and white grain infect *via* air-borne spores which means that sowing between old cereal rows is not a useful management tool. For crown rot in the Upper North, sowing between old cereal rows may assist in reducing yield losses.

It is important to follow correct sampling protocols when assessing the risk of yield loss from crown rot. Samples taken for nutrient assessments require that stubble be removed from the sample and are not suitable for assessing crown rot risk. The effect of stubble can be seen for Upper North paddocks (Table 2), where the addition of extra stubble pieces increased the crown rot inoculum levels and usually increased the risk category as well. This is consistent with findings from a number of surveys done in SA and nationally and as a result, PreDicta™ B soil sampling protocols now include adding a small piece of stubble from each stop along the sampling transects (15 pieces in all).

These results are a reminder that any paddock management operations which break up stubble or move stubble away from the old cereal row will also increase the risk of yield loss from crown rot. Crown rot infection depends on direct contact between stubble and the plants of the next crop. This means that heavy grazing, chaining etc. have the potential to increase the crown rot risk and if soil sampling is undertaken prior to these operations it may significantly underestimate the crown rot risk.

When assessing the crown rot risk between old cereal rows, there are three choices – do not add the extra stubble pieces, add the extra stubble pieces from the standing stubble on row, or add extra pieces only from stubble which has fallen between the rows. Adding no stubble will give you the base risk level which will indicate whether it is likely to be beneficial to sow between the old cereal rows. Adding the extra stubble pieces from the old cereal row will give the highest risk level. The actual risk level will depend on how heavily infected the stubble is and how much of that stubble comes into contact with the plants and stems of the next crop.

Table 1: Levels of inoculum present for a range of diseases in the soil of commercial paddocks in the Upper North of South Australia, sampled 6-8 May 2014. ***Note*** – There are no validated risk categories available for common root rot (*Bipolaris*), yellow leaf spot or white grain Clade 1.

Disease	Twin Creek	Black Rock	Wepowie 1	Booleroo Centre 1	Booleroo Centre 2	Booleroo
Crown rot (*pseudo*)	46		163	3,088	41	
Rhizoctonia	11	66	28	12		47
Take-all				15		
Common root rot			17	13		43
Yellow leaf spot			medium	low	medium	high
White grain, clade 1	low	low	low	high	medium	high

Disease	Melrose 1	Melrose 2	Wepowie 2	Mambray Creek 1	Mambray Creek 2	Port Germein	Warnertown
Crown rot (*pseudo*)		8	119	136	210	23	878
Rhizoctonia	65	60	71	7	87	103	21
Take-all			6				33
Common root rot	12	128	625			68	43
Yellow leaf spot		medium	medium		medium	high	high
White grain, clade 1		low	high	low	medium		low

- Below detection
- Low risk
- Medium risk
- High risk

Table 2: Effects of on and between row sampling and of adding stubble pieces to the levels of crown rot (*Fusarium pseudograminearum*) inoculum detected.

Location	Sample type	Stubble	
		Not added	Added
Mambray Creek 2	Random	210	753
Booleroo	On		
	Between		
Wepowie 2	On	119	2,236
	Between	6	380
Warnertown	On	878	2,734
	Between	32	2,490

Acknowledgements
Thanks to Upper North Farming Systems Group members who allowed access to paddocks.

Fungicides for crown rot management

Author: Margaret Evans (SARDI), Alan McKay (SARDI) and Jack Desbiolles (UniSA).
Funded By: GRDC
Project Title: DAS00136 - New fungicide technologies for crown rot management.
Project Duration: 3 years
Project Delivery Organisation: SARDI

Key Points:

- To date SARDI/UniSA field trials funded by GRDC project DAS00136 and previous GRDC projects have not been able to show that application of fungicides to seed results in significant yield gains in the presence of crown rot.
- Fungicides applied to seed or in furrow at seeding can provide some suppression of pathogen growth within the plant early in the season (measured using DNA techniques) but this effect is not detectable by early grain fill.
- In-crop spray applications targeted at the base of plants at early tillering have shown inconsistent, small yield benefits with variable results between sites and seasons.
- SARDI will continue to investigate early and in-crop fungicide applications in combination with other management options (e.g. time of sowing) and is seeking to evaluate new chemistries with greater activity on *Fusarium* spp to evaluate.

Project Report:

In collaboration with UniSA, SARDI have undertaken five trials at Hart, Roseworthy, Pinery and Hamley Bridge to compare fungicide chemistries and application methods for crown rot control over the period 2012-2014. Treatments have included fungicide application to seed (including Rancona® Dimension @ 320 mL/100 kg seed), fluid fungicides applied in furrow at seeding (including combinations with in-crop sprays) and in-crop spray treatments. In addition, earlier SARDI trials funded by GRDC have assessed seed treatments for crown rot control in four trials (2008-2011) at Cambrai, Roseworthy and Hart.

Effects of treatments on pathogen growth through the plant were assessed by measuring fungal DNA concentrations in plant tissue at early tillering and early grain-fill through the PreDicta™ B analytical service. Crown rot severity was measured using visual assessment of basal stem browning and white head expression.

Results

Due to commercial in-confidence agreements data cannot be presented here.

In general, limited reductions in crown rot expression were found and reductions in fungal DNA concentrations in plant material seen at early tillering were no long apparent by early grain-fill. Usually there were no yield improvements due to fungicide application and the largest improvements (2%-8%) were obtained using fungicides banded at seeding, sprayed in-crop or a combination of these methods. Yield improvements due to these treatments were variable and inconclusive across seasons and sites.

Data indicate that using currently available fungicides as seed treatments, banded at seeding or as in-crop sprays are most likely to have benefits when used in conjunction with other management options such as inter row sowing.

Sowing early in 2014 – How did it work?

Author: James Hunt, Brad Rheinheimer (CSIRO Agriculture), Rob Wheeler, Amanda Pearce, Ian Ludwig, Andrew Ware, Leigh Davis, John Nairn, Stuart Sherriff (SARDI), Mick Faulkner, Jeff Braun, Lou Flohr (AgriLink Agricultural Consultants), Sarah Noack, Peter Hooper (Hart Field Site Group)
Funded By: GRDC
Project Title: CSP00178, CSP00160
Project Delivery Organisation: CSIRO, SARDI, AgriLink Agricultural Consultants, Hart Field Site Group
Keywords: early sowing, slow maturing wheat, winter wheat, time of sowing, frost

Take home messages

- Despite wide-spread stem frost, in the majority of 2014 Time of Sowing (ToS) trials in SA highest yields still came from mid-late April sowing.
- Based on one year of data, Trojan (mid maturing) complements Mace (fast maturing) in a cropping program and allows growers to sow earlier and achieve higher yields (16%) than they could with Mace alone sown in its optimal window.
- Existing slow maturing wheat cultivars from other states are poorly adapted to most regions in SA.
- For growers in frosty environments wishing to sow before ~20 April, EGA Wedgetail is the safest option evaluated in these trials, but yields are likely to be less than Mace sown in its optimal window.

Background

In SA the time at which wheat flowers is very important in determining yield (Figure 1). With farm sizes increasing and sowing opportunities decreasing, getting wheat crops established so that they flower during the optimal period for yield is difficult. Whilst no-till and dry-sowing have been used successfully in SA to get more area of crop flowering on time, an opportunity exists to take advantage of rain in March and April to start sowing crops earlier than currently practiced. This is a tactic which **complements** dry sowing. Earlier sowing is now possible with modern no-till techniques, summer fallow management and cheaper insecticides and fungicides to protect against diseases associated with early sowing.

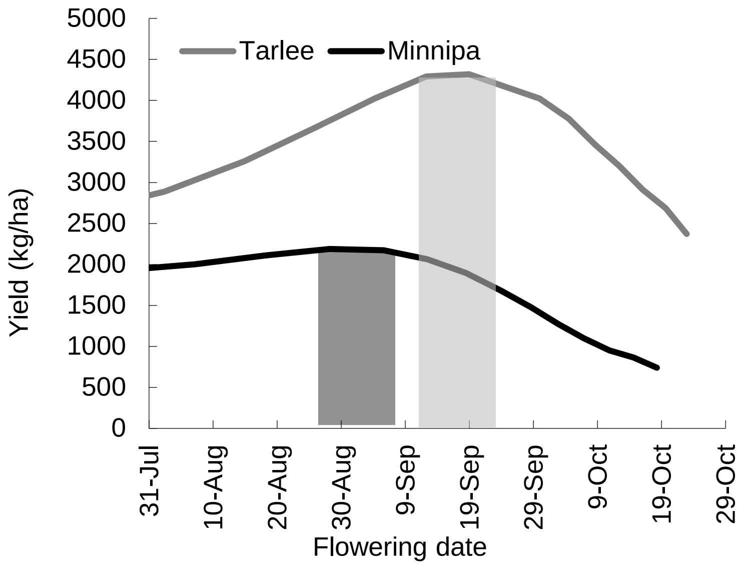

Figure 1. The relationship between flowering time and yield at Minnipa and Tarlee – optimal flowering periods are highlighted by light and dark grey boxes. Curves are derived from APSIM from 120 years of climate data and with a yield reduction for frost and extreme heat events. Optimal flowering periods are late August-early September at Minnipa, and mid September at Tarlee.

However, in the last few decades wheat breeding has focused on mid-fast maturing varieties which are only suited to sowing in late April-May. Sowing earlier than is currently practiced requires cultivars which are not widely grown in SA, and which are much slower to mature, either through having a strong vernalisation/cold requirement (winter wheats) or strong photoperiod/day length requirement (slow maturing spring wheats – Figure 2).

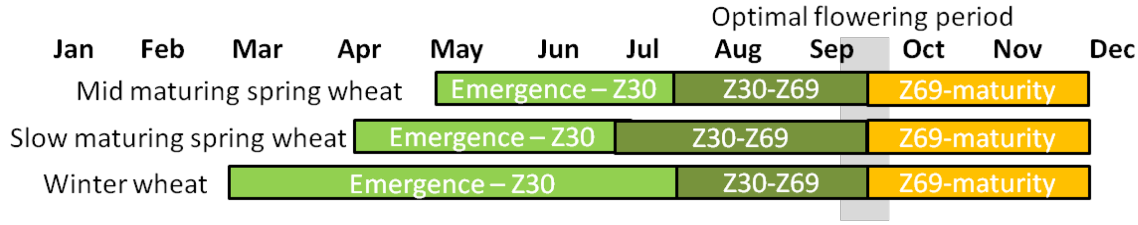

Figure 2. Diagram showing pattern of development in winter and slow maturing spring wheat relative to mid maturing spring (most currently grown varieties in SA are mid to fast). When sown at their optimal times, they all flower during the optimal period in a given environment. Winter wheats also have a very flexible sowing window and if well adapted will flower during the optimum period in a given environment from a broad range of sowing dates.

GRDC funded research in NSW has demonstrated that slow maturing varieties sown early yield more than mid-fast varieties sown later when they flower at the same time . This is because early sowing increases rooting depth and water use, reduces evaporation and increases transpiration efficiency. Early sowing of slow maturing varieties is a way of increasing yield potential with very little initial investment.

APSIM modeling indicates that even with SA's Mediterranean climate, adoption of slow maturing varieties to allow early sowing has potential to increase whole-farm wheat yield, particularly in mid-high rainfall zones (Table 1). GRDC have funded a series of trials across rainfall zones to experimentally evaluate the suitability of early sowing in SA.

Table 1. Average farm wheat yields from 50 years of simulation at different locations in SA assuming either current practice (mid-fast varieties sown from mid-May including dry sowing) or the addition of a slow maturing variety to the cropping program which can be planted from 1 April, but is only sown when planting opportunities arise (occurs in ~60% of years).

LOCATION	AVERAGE FARM YIELD – CURRENT PRACTICE (T/HA)	AVERAGE FARM YIELD – EARLY SOWING (T/HA)	YIELD BENEFIT FROM EARLY SOWING (T/HA)	YIELD BENEFIT FROM EARLY SOWING (%)
Conmurra	4.0	6.1	2.1	53%
Cummins	3.3	4.0	0.8	24%
Minnipa	2.1	2.2	0.1	5%
Port Germein	1.9	2.1	0.2	11%
Tarlee	3.5	4.0	0.5	14%

Methodology

GRDC early sowing trials in SA are at 5 locations (Cummins, Minnipa, Port Germein, Tarlee and Conmurra) and each has 3 times of sowing (aimed at mid-April, early-May, late-May) and 10 wheat lines (6 commercial, 4 near-isogenic lines, or NILs, in a Sunstate background). The commercial lines are described in Table 2. Hart Field Site Group also planted a similar early sowing trial, and there are also trials funded by SAGIT evaluating different wheat lines for early sowing in the Mid North and upper YP.

Table 2. Commercial wheat varieties used in the SA trials at Cummins, Minnipa and Port Germein.

Variety	Maturity	Comments
Manning (Conmurra only)	Very slow winter (very strong vernalisation, unknown photoperiod)	White feed – Resistant to BYDV but only adapted to environments with a very long, cool growing season
SQP Revenue (Conmurra only) (NIL match: W46A)	Slow winter (strong vernalisation, unknown photoperiod)	Red feed – also adapted to long cool growing seasons, it is widely grown in SW Victoria and SE SA.
EGA_Wedgetail (NIL match: W8A)	Mid maturing winter (strong vernalisation moderate photoperiod)	APW (default in SA – APH in NSW) - The early sowing and dual purpose standard in SNSW and an excellent grain-only option. May be too slow in most of SA, only has APW quality and can be quite intolerant of problems associated with alkaline soils (CCN, boron, aluminium).
Rosella (NIL match: W7A)	Fast maturing winter (strong vernalisation weak photoperiod)	ASW - Slightly faster than Wedgetail and trials in Victoria has shown better adaption to alkaline soils. However, being 29 years old it is at a distinct yield disadvantage to modern spring wheats.
EGA_Eaglehawk (NIL match: W16A)	Very slow maturing spring (moderate vernalisation, very strong photoperiod)	APW (default in SA – APH in NSW) Very slow maturing photoperiod sensitive spring wheat that will flower at the same time as Wedgetail from a mid-April sowing but hit Z30 ~3 weeks earlier, therefore not as suited to grazing.
Forrest (NIL match: W16A)	Very slow maturing spring (weak vernalisation, very strong photoperiod)	APW - Very slow maturing photoperiod sensitive spring wheat which performs well in higher yielding environments
Bolac (Tarlee and Conmurra only)	Slow maturing spring (moderate vernalisation, moderate photoperiod)	AH – Bred for the HRZ of SW Victoria but has performed well when sown early in the low rainfall regions of the western Riverina in NSW.
Estoc	Mid maturing spring (weak vernalisation, strong photoperiod)	APW - probably the slowest maturing recently released variety with good adaptation to SA. Not suited to sowing much before 20 April in most environments.
Trojan	Mid-fast maturing spring (moderate vernalisation, moderate photoperiod)	APW - Has demonstrated good adaption to SA and has an unusual photoperiod gene which may allow it to be sown in late April and flower at the optimal period
Mace (NIL match: Sunstate)	Fast maturing spring (weak vernalisation, weak photoperiod)	AH - No introduction necessary! SA main-season benchmark and in the trial as a control from a mid-late May sowing.
Cobra (Conmurra only)	Fast maturing spring (weak vernalisation, weak photoperiod)	AH – very similar maturity to Mace but based on NVT results may out yield it in higher yielding environments.

Results

Results from all experiments are presented in Table 3. At 4 out of 5 sites, Trojan sown in mid to late April was the highest or equal highest yielding treatment. Slow maturing cultivars bred in other states (e.g. EGA Wedgetail, EGA Eaglehawk and Rosella) showed poor adaptation to all sites.

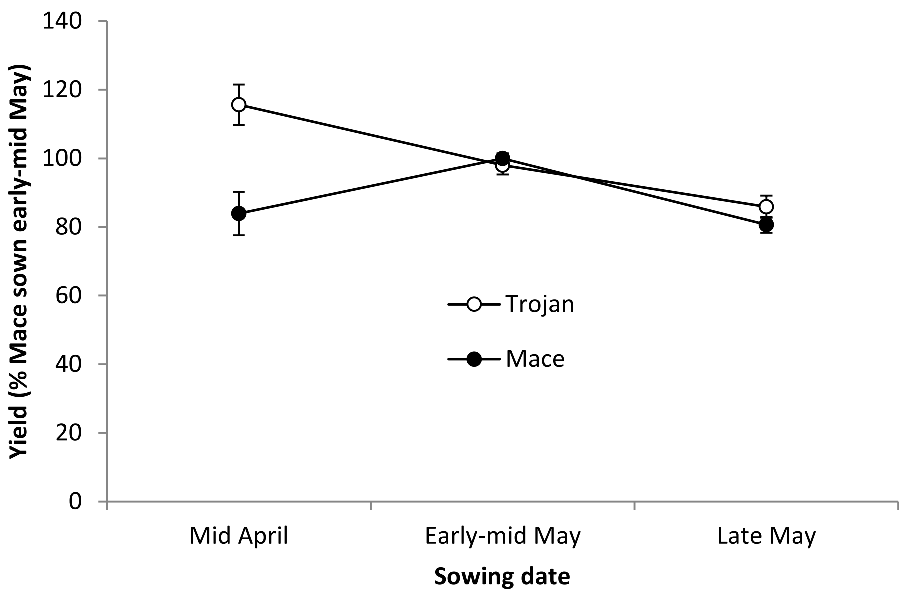

Figure 3. Mean yield performance (Minnipa, Cummins, Port Germein, Hart, Tarlee) of Trojan and Mace at different times of sowing relative to Mace sown in its optimal window of early-mid May. Error bars are standard error of means.

Table 3. Grain yield for 5 out of 6 early sowing trial sites in SA in 2014 (results for Conmurra not available at time of preparation). Treatments known to have been affected by frost are marked with an asterisk.

		Time of sowing			
Location	**Cultivar**	**11-Apr**	**13-May**	**28-May**	
Cummins	**EGA Wedgetail**	4.0	2.9	3.7	
	Rosella	4.0	4.1	2.5	
	EGA Eaglehawk	3.8	2.9	2.7	
	Estoc	4.3	4.7	3.8	
	Trojan	4.9	5.0	4.4	
	Mace	2.6*	5.1	4.1	
	P-value	<.001			
	LSD (P=0.005)	0.6			
		11-Apr	**13-May**	**28-May**	
Minnipa	**EGA Wedgetail**	2.9	2.2	2.1	
	Rosella	2.7	2.4	2.1	
	EGA Eaglehawk	3.0	1.8	1.7	
	Estoc	4.0	2.7	2.6	
	Trojan	4.6	3.1	3.0	
	Mace	3.7	3.0	2.8	
	P-value	<.001			
	LSD (P=0.005)	0.2			
		11-Apr	**30-Apr**	**20-May**	
Port Germein	**EGA Wedgetail**	2.5	1.9	1.7	
	Rosella	2.2	1.7	1.6	
	EGA Eaglehawk	3.0	2.1	1.9	
	Estoc	4.4	3.5	3.4	
	Trojan	5.2	4.2	3.9	
	Mace	4.3	4.3	3.7	
	P-value	<.001			
	LSD (P=0.005)	0.5			
		14-Apr	**8-May**	**2-Jun**	
Hart	**EGA Wedgetail**	4.5	4.0	3.0	
	Rosella	4.3	3.7	2.8	
	Trojan	5.7	5.3	3.7	
	Mace	3.9*	4.7	3.3	
	RAC1843	0.8*	3.6	3.5	
	P-value	<.001			
	LSD (P=0.005)	0.3			
	Cultivar	**14-Apr**	**29-Apr**	**12-May**	**30-May**
Tarlee	**Rosella**	5.5	5.4	4.6	3.5
	Bolac	6.1	6.1	4.6	3.7
	Trojan	6.6	7.4	6.1	4.6
	Mace	4.1*	7.4	6.4	5
	P-value	<.001			
	LSD (P=0.005)	0.6			

Putting early sowing into practice in SA

Based on the 2014 trial data, growers in SA could improve whole-farm yields by including Trojan in their cropping program to complement Mace (Figure 3). Trojan has an unusual photoperiod sensitivity allele inherited from a European parent which is rare in Australian cultivars. This allele seems to delay flowering from an April sowing relative to Mace quite successfully (Table 4).

Table 4. Flowering dates for Trojan and Mace from different times of sowing at Minnipa in 2014.

Flowering date - Minnipa	Time of sowing		
Cultivar	11-Apr	13-May	28-May
Trojan	6-Aug	10-Sep	17-Sep
Mace	8-Jul	6-Sep	13-Sep

Despite performing strongly from a mid-April sowing in these trials, it is not recommended that Trojan be planted this early in the majority of SA locations as it incurs excessive frost risk. As a rough rule of thumb, it is best suited to being planted ~10 days earlier than Mace. As an example of how it may fit in a program, if 10 May is the optimal sowing time for Mace in a given environment, then the optimal sowing time for Trojan is 1 May. If a grower has a 20 day wheat sowing program and wants to grow half Trojan and half Mace, to maximize whole farm yield they should start with Trojan on 25 April, switch to Mace on 5 May and aim to finish on 15 May.

Sowing mid-April in low-frost environments such as Port Germein carries little risk, and as the results from this year show, significant yield gains (0.9 t/ha relative to Mace) can be achieved by sowing Trojan in mid-April purely because its longer growing season allows it to accumulate more dry matter.

For growers in frosty environments who wish to sow earlier than is safe with Trojan/Mace, EGA Wedgetail is probably the best option in most environments. However, because of its poor adaption to SA even if sown in early-mid April it is unlikely to yield as well as Mace sown in its optimal window. In this set of trials there was an average yield penalty of 0.5 t/ha between EGA Wedgetail sown mid April and Mace sown in mid-May. Grazing early sown EGA Wedgetail would offset some of the reduction in income compared to mid-May sown Mace.

Remember that early sown crops require different management in order to get the most out of them;

- Don't dry-sow slow maturing varieties (EGA Wedgetail, EGA Eaglehawk), they will flower too late if not established early. There needs to be seed-bed moisture and ideally some stored soil water to get them through to winter.
- If growing winter wheat (EGA Wedgetail) and not grazing, sow at lower plant density and defer N inputs until after Z30.
- Pick clean paddocks – winter wheat at low plant densities is not competitive with ryegrass and common root diseases are exacerbated by early sowing.
- Protect against diseases associated with early sowing – barley yellow dwarf virus (imidicloprid on seed backed up with in-crop insecticides at the start of tillering if aphid pressure high), *Septoria tritici* in some areas (flutriafol on fertilizer and timely foliar epoxiconazole applications at Z30 & Z39). Many slow maturing varieties also have poor resistance to stripe rust (flutriafol on fertilizer and timely foliar fungicide application at Z39).

Conclusion

Despite a frosty July and August, highest yields in most trials came from mid-April sowing with Trojan being the stand-out performer. Trojan complements Mace in a cropping program and extends the sowing window about ten days earlier. EGA Wedgetail was the best performing variety suited to very early sowing, but even sown early it yields less than Mace planted in its optimal window.

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Trojan provides a surprise in 2014 Wheat Trials

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Funded By: GRDC National Variety Trial Program
Project Delivery Organisation: SARDI

The widely adapted wheat variety, Corack, which has dominated statewide wheat trials for several years running was just beaten by the new variety, Longreach Trojan when yields were averaged across all trials in 2014. Another new variety, Cosmick, and the increasingly widely grown Mace, just trailed the two leading varieties.

These varieties were among 28 commercial varieties tested at 28 SARDI managed, National Wheat Variety Trial (NVT) sites across South Australia in 2014. The trials, funded by GRDC, also tested a further 24 advanced lines from wheat breeding companies operating throughout Australia.

In a season of extremes, 2014 was characterised by excellent rains throughout autumn in most districts, prior to very wet conditions through early winter, followed by extremely dry August and spring conditions in all districts. Overall annual rainfall was in the decile 4 to 7 range across most of cropping area of SA, slightly higher in the north east of Eyre Peninsula and lowest on record, in large areas of the mid and lower South East. Long periods of very cold temperatures during August and early September were experienced in many areas and resulted in the failure of 5 trials across the Northern Mallee and central and eastern Eyre Peninsula due to frost damage. These were at Rudall, Kimba, Warramboo, Nangari and Wunkar, with results from these sites considered invalid for public release despite average yields ranging from 2.02 to 3.25 t/ha across these sites.

In spite of the cold winter, frosts and dry spring conditions, the remaining 23 valid trials all produced surprisingly good results, with grain yields across all sites averaging 3.11 t/ha, which was around 10% below the 5 year (2009-2013) average of 3.46 t/ha and the 3.44 t/ha achieved in 2013. The individual site yields ranged from 0.57 t/ha at Mitchellville, to 4.79 t/ha at Paskeville, with all trials sown between May 6th and June 17th (Wolseley was resown due to early mice damage). The majority of trials were sown relatively early, viz, prior to mid-May while very dry conditions in the South East prevented sowing much before the last week of May.

The generally average winter temperatures and above average through to record winter rainfall across much of the State during June and July, favoured the prospects for record yielding crops and wheat fungal diseases. However very dry conditions commencing in August and proactive disease control, saw little impact from stripe rust or any other disease in trials. It must be reminded that wheat NVT's are managed for disease control, using up-front (Impact®) and in-crop fungicides where diseases are detected and have the potential to cause significant yield losses. Within many districts, well above average crop potential and dense crop canopies in mid-winter, were then subjected to severe frosts and extremely low rainfall events during spring.

Overall, the 2014 seasonal conditions tended to favour mid flowering and maturing varieties, a trend seen in many recent years. Across all NVT's in SA, the mid to later flowering APW quality new variety, Longreach Trojan, produced the highest average yield of 3.39 t/ha across sites, just above Corack (3.37t/ha) and 2 to 3 percent above the leading AH varieties, Cosmick and Mace respectively. Generally within each SA region, all of these top four varieties featured in the high rankings and jockeyed for top position although interestingly, Mace and Corack did not perform as well across central and upper Eyre Peninsula and were replaced by Cobra and Katana in the top four rankings. Sensitivity to very cold temperature leading to lowered pollen production and viability has been implicated in the poorer performance of Wyalkatchem and the derivatives, Corack and Mace in some districts in 2014. The new midseason flowering Intergrain variety, Cosmick, performed similar to Mace in most regions but was significantly lower ranked on Yorke Peninsula. Many of these top yielding varieties were also among the highest yielding in 2011, 2012 and 2013 trials

Trailing the four leading varieties were Katana, Wyalkatchem, Scout, Cobra, Shield and Emu Rock, averaging 7 to 9 percent below Trojan respectively. The commercially still popular varieties, Gladius, Axe, Correll and Yipti, averaged 11 to 14 percent below Trojan and again showed they are well outclassed for yield relative to newer varieties.

Scout has performed well in more recent and wetter seasons, but was again less dominant under drier spring rainfall conditions. The new imidazolinone tolerant variety, Grenade^{CLPLUS}, continues to demonstrate that it is a good alternative to Justica^{CLPLUS} and Kord^{CLPLUS} with equal or superior yields in most situations, although yielding below Kord^{CLPLUS} in the Mallee in 2014. Grenade^{CLPLUS} also averaged 1.3 kg/hl higher test weights than Justica^{CLPLUS} and similar to Kord^{CLPLUS} on average in 2014.

Despite the low spring rainfall, trials produced surprisingly good grain quality at most sites. The grain quality in 2014 wheat NVT's was generally similar to that produced in 2013. Across all sites, grain protein varied from 9.5 to 13.4 percent and averaged 11.4 percent, compared with 11.8 percent in 2013. Test weights averaged 81.9 kg/hl, similar to the average of 82.5 kg/hl in 2013. No site was found to average below the new 76 kg/hl minimum specification for milling wheat, although test weight averages were low at highly stressed Keith and Mitchellville sites and provided some good varietal discrimination. Across all trial sites, grain screenings declined slightly from 2.7 percent in 2013 to 2.4 percent in 2014. Only two sites, Keith, and Conmurra produced average screenings above 5 percent, reflecting the extremely dry winter and spring conditions experienced in the South East. Again this provided some varietal discrimination, although not greatly. In 2014 NVT grain samples, no black point, sprouted or white grain was observed. Falling number tests were performed on a range of susceptible varieties from all trials and no sites fell below the 300 minimum standard.

Within trials, Cosmick joined with Corack and Mace to produce grain with relatively low protein while Trojan produced more acceptable protein levels for its high yield. Corack, Mace and Scout have shown this characteristic in previous seasons also. While these low grain proteins are mostly a direct result of high yields, higher nitrogen fertilization rates should be considered if growing these varieties for premium high protein grades.

Estoc continues to provide benchmark high test weights along with Trojan, while more moderate test weights were recorded within Cobra, Espada, Justica and Shield. Correll, which in previous years has shown a propensity for low test weight, was again the lowest ranking variety along with the soft wheats, Barham and Orion.

Cosmick, Shield and Correll produced the highest average screenings across all sites although putting them in perspective they were only around one percent higher than the average of all varieties. Perhaps of more concern with these varieties was the number of occasions where their screenings equal or exceeded 5%, with Cosmick recording 7 from 23 observations.

Durum Wheat

Across the 6 central region durum NVT sites, average site yields were 3.75 t/ha, and 1.5 to 17.5 percent below the bread wheat site averages in the Mid North and Yorke Peninsula sites respectively.

Saintly and WI802 produced the highest average yields within the Mid North and Yorke Peninsula trials respectively, but Yawa joined these varieties with equal highest yields when averaged across all sites. The newly released variety, DBA Aurora averaged 4 percent lower yield, resulting from lower performances at the two highest yielding sites, Turretfield and Paskeville.

While variety yield rankings were clearly impacted by the dry spring conditions, quality was also affected. All 6 trials and all varieties exceeded minimum test weight specification but two sites failed to make DR1 for protein but did classify as DR2. As expected, the highest yielding varieties were graded DR2 at sites with average protein around 13 percent. Discrimination of varieties for screenings was again good, given the dry spring test, but only the Wokurna site produced average screenings above the 5 percent DR1 limit. The new variety Yawa continues to produce highest screenings and failed to meet DR1 at any site whilst the newest variety DBA Aurora, produced low average screenings similar to Tamaroi and made DR1 at all sites. Only Caparoi and DBA Aurora made DR1 based on screenings at all sites and Caparoi produced the most consistent high quality grain, meeting DR1 standards based on protein and screenings at most sites.

Full data on the varieties and their performace in 2014 is available at www.nvtonline.com.au

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-SARDI NVA staff at Clare and Waite NVT and herbicide tolerance trial management

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Compass Directs the Way in 2014 Barley Trials

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Funded By: GRDC National Variety Trial Program
Project Delivery Organisation: SARDI

For the third consecutive season, the new potential malt barley, Compass, showed its dominance by out-yielding all other varieties in 2014 barley trials across SA. Compass produced the highest average yield of 4.11 t/ha among 29 released varieties tested at 20, SARDI managed, NVT sites across South Australia. The trials, funded by GRDC, also tested a further 13 advanced lines from barley breeding programs operating throughout Australia.

Excellent autumn rains in most districts except the South East, resulted in the 2014 trials being sown very timely during the period May 8th at Paruna and Darke Peak to June 17th at Bordertown, with the majority sown around the middle to third week of May.

Seeding was followed by widespread very wet conditions through early winter and then very cold, dry and frosty conditions in August and early September. Spring remained very dry but mild in all districts and while many grain producers were pessimistic of a good harvest, all barley NVT trials were harvested and surprisingly, produced statistically good results.

There were no significant differences in grain yield between varieties for the Cummins trial which was unusual and likely resulted from waterlogging during winter. Site mean yield across all 20 NVT sites ranged from 1.95 t/ha at Lameroo to 5.6 t/ha at Turretfield with an average across the state of 3.68 t/ha compared to 3.70 t/ha in 2013 and 3.34 t/ha in 2012. However the similarity in state grain yield between 2013 and 2014 masked some major differences in regional conditions. Compared to 2013, Upper Eyre Peninsula averaged 0.2 t/ha higher, Lower Eyre Peninsula 0.4 t/ha lower, Yorke Peninsula was the same, the Mid North 1.2 t/ha higher, the Murray Mallee was the same, and the South East a dramatic 2.5 t/ha lower than the previous year.

Good early season rainfall and warmer than average early winter temperatures set up high yield potential and while conditions were favourable for foliar diseases, the incidence and level of infection wasgenerally low. Across sites, net form net blotch at Minnipa was the only foliar disease to cause some yield loss but root diseases were more prevalent, with Predicta B tests showing high levels of rhizoctonia at Elliston, Lameroo, Piednippie and Port Clinton.

Many trials were sprayed early with fungicide to control net blotches and leaf rust as seen in grower's crops in many districts, thus preventing significant damage within trials. This management strategy was introduced in 2012, and all sites have been additionally treated with fertilizer amended fungicides (flutriafol) since 2012.

While barley trial grain yields in 2014 were generally similar to 2013, the dry spring conditions and generally high yield potential did create significant pressure on grain size and grain receival quality parameters. Across all trials, average grain protein increased slightly from 11.2 percent in 2013 to 11.9 percent in 2014. Average test weights were improved, from 67.8 to 69.95 kg/hl, screenings increased from 3.4 per cent to 7.3 percent and retentions declined, from 75.7 to 69.0 percent in 2014.

Some of the reduction in average receival quality was due to modest performances by some later maturing and lesser adapted varieties such as Gairdner, Macquarie, Maltstar and SY Rattler. However, many sites suffered from the dry spring and in particular Bordertown, Brentwood, Crystal Brook, Darke Peak, Keith, Minnipa, Paruna and Port Clinton experience considerable pressure on grain size.

Early season flowering varieties were generally those most favoured by the dry spring conditions in 2014. Even at the locations with grain yield greater than 5 t/ha (Salters Springs, Bute and Turretfield) the later maturing varieties such as Flinders, Gairdner, Oxford, Westminster and Wimmera were lower yielding than the leading early and mid-maturity varieties.

Compass, the most recent release from the University of Adelaide Barley Breeding program, led LaTrobe, a new malting accredited release from the WA based Intergrain Breeding program by 3 percent when averaged across all sites. LaTrobe was formally accredited as a malt variety in early March 2015 while Compass is still undergoing testing with a final judgement expected in March 2016. Compass led the next group of regularly high yielding varieties, Hindmarsh, Fathom, Keel and Fleet by 4, 5, 5 and 8 percent respectively.

Midseason flowering Commander and a group of similar or later flowering and maturing varieties comprising Bass, GrangeR and Oxford averaged 13 to 18 percent below Compass with Buloke and Scope also well below, at 12 and 13 percent respectively.

Among the top four leading varieties for yield, Compass, LaTrobe, Hindmarsh and Fathom, Compass led in all districts except the Mid North where only one percent separated these varieties. However across all districts, only in the mallee was there a large difference separating Compass from most varieties.

Within trials, Compass produced grain with relatively low protein, slightly lower than in LaTrobe and Hindmarsh while Fathom produced more acceptable protein levels for its high yield. Compass, Commander and Buloke have shown this characteristic in previous seasons also. While these low grain proteins are mostly a direct result of high yields, lower protein in malting varieties will improve probability of malting classification, but also may produce grain below minimum protein specification where nitrogen nutrition is very low.

Schooner, Bass and Flagship continued to display good test weights in 2014 NVT, along with LaTrobe and Hindmarsh, while more moderate test weights were again seen in Fathom, Compass, Commander and Fleet.

The top varieties for grain yield achieved Feed1 screenings at high frequency while Hindmarsh exceeding the 10% limit at only three locations, Fathom and LaTrobe at only two locations, and Compass only at Keith.

Grain retention levels also varied considerably between sites in 2014 and average values for individual trials range from 90% for Arthurton down to just 39% at Crystal Brook. Gairdner achieved the 70% retention limit for Malt1 in just 2 of the 13 trials it was tested, while Commander and Compass achieved the grade at 13 of the 20 trial locations. Bass and Skipper continued their good record for plump grain, and Compass returned the highest values among the established and potential malting varieties. Maritime again showed good grain size stability, achieving the retention limit in 17 of the 20 trials, demonstrating further breeding gains in malting barley are possible.

Further information can be found at the NVT website, nvtonline.com.au and specific varietal information can be found in the 2015 Crop Variety Sowing Guide, and the recently updated 2015 Crop Variety Disease guide at pir.sa.gov.au

Canola Variety Sowing Guide 2015

Andrew Ware, SARDI, Port Lincoln/ Minnipa

At the time of writing there have been three canola varieties released since the publication of the 2014 Canola Variety Sowing Guide. Of these, Hyola® 970CL, is a dual purpose grain and graze winter type, and needs an extended growing season to maximize grain production. Hyola® 750CL, is a high herbage production, long season variety with seed only available in 2016. The third is a new early/mid season hybrid Clearfield® tolerant variety, Pioneer® 44Y89.

The number of entries in Canola National Variety Trials (NVT) planted across South Australia was smaller in 2014 than it has been in previous years. Hence the choice of varieties available to growers will also be smaller than it has been in previous years. This is due to a couple of factors. The first being Canola Breeders (WA) ceased operations in July 2013. The breeding program has been taken over by one of its partner companies, NPZ Australia and will continue the breeding program. However many of the previously released varieties, such as CB Jardee HT, will no longer have seed available. The second is, Pacific Seeds has ceased breeding open pollinated triazine tolerant varieties. This means that it will not be possible to purchase these varieties, such as Crusher TT, for planting in 2015.

Speciality and Juncea Types

In recent years a number of specialty canola varieties have been released. These include the Victory® varieties and Monola® varieties. These varieties have a different oil profile than commodity canola that is more suitable for use in the food industry. Agronomically speciality canola is the same as commodity canola. Speciality canola is being offered to growers in closed loop marketing systems, attracting a significant premium price. Production contracts for these varieties are available in the South East and Mid North.

Juncea canola is being developed as a drought and heat tolerant alternative to canola for the low rainfall environments. In 2014 juncea varieties were not included in NVT trials across South Australia. Seednet are investigating possible options for these varieties into the future and have breeding trials at a number of low rainfall locations across the state. Sales of Juncea canola must be segregated from regular canola.

Varietal selection

The selection of the most suitable canola variety for a particular situation needs consideration of maturity, herbicide tolerance, blackleg resistance, relative yield, oil content and early vigour.

- The weed species expected may dictate the need for a herbicide tolerant production system (e.g., triazine tolerant or Clearfield). It should be noted that a triazine tolerant variety will incur a yield and oil penalty when grown in situations where they are not warranted.
- Blackleg has the potential to be a very destructive disease in canola and its management through varietal selection, fungicides and cultural practices are important in maximising yield potential. Varietal blackleg resistance and/or fungicide use should be considered, particularly when rotations are close.

When decisions are being made on canola varietal choice, NVT provides an excellent, unbiased resource. Data from the NVT website (www.nvtonline.com.au) and any observations you might make from trials in 2014 will greatly add to the confidence you have on selecting a new variety. Since 2011, NVT trials have been sown with the same fungicide treatment on all varieties so that the reaction to blackleg will be more difficult to assess from looking at the trials.

A revised version of the Blackleg Management Guide with resistance data on newly released varieties can be found on the GRDC website: www.grdc.com.au.

Canola Varietal Characteristics

CONVENTIONAL VARIETIES

AV-Garnet. Mid-early to mid to maturing. Medium height. High oil content. Rated MR for blackleg (resistance Group A). NVT 2006-2014. Bred (B) by DPI Victoria. Marketed(M) by Nuseed Pty Ltd.

AV-Zircon. Mid-early to mid to maturing. Medium height. Rated MR for blackleg. High-very high oil content. NVT 2010-2014. B DPI Victoria and Nuseed Pty Ltd. M Nuseed Pty Ltd.

Hyola® 50. Mid to mid-early maturing hybrid. Blackleg resistance of R (resistance groups A,D). NVT 2005-2014 B Canola Breeders International. M Pacific Seeds.

Nuseed Diamond. Early-mid maturing hybrid. Nuseed indicate a blackleg rating of R-MR (resistance groups A,B,F). Medium plant height. NVT 2012-14. B/M Nuseed Pty Ltd.

Victory V3002. Early–mid maturing conventional specialty (high stability oil) hybrid. Blackleg resistance of R-MR (resistance Group C). NVT 2011-2014. B Cargill & DPI Victoria. M:AWB - closed loop.

Withdrawn and no longer available: CB™ Agamax, CB™ Tango CΦ

HERBICIDE TOLERANT - ***Notes on recently released Clearfield (imidazolinone tolerant) varieties***

Archer. Mid-late maturing hybrid. High oil content. Medium plant height. Blackleg rating of MR-MS. NVT 2011-13. M Heritage Seeds.

Carbine. Early-mid maturing hybrid. Moderate-high oil content. Medium plant height. MR-MS Blackleg rating (resistance group A). NVT 2011-13. M Heritage Seeds.

Hyola® 474CL. Mid-early maturing hybrid. High oil and high protein content. Medium-tall plant height. Fits medium-low to high rainfall areas, and exhibits excellent hybrid vigour. Blackleg resistance rating R (resistance groups B,F). NVT 2011-14. B/M Pacific Seeds.

Hyola® 575CL. Mid maturing hybrid. High oil content. Medium plant height. Blackleg resistance rating R (resistance groups B,F). Tested in SA NVT 2010-14. B/M Pacific Seeds.

Hyola® 577CL. Mid maturing hybrid**.** Very high oil content. Very high yield, medium – tall plant height. Adapted to medium-high rainfall areas. Blackleg resistance rating R. Resistance group to be advised. NVT 2013-14. B/M Pacific Seeds.

Hyola® 971CL. Late maturing winter Grain n Graze hybrid. Extremely high biomass, good grain yield and oil content. Autumn and Spring sowing grain and graze option for very high rainfall or irrigated zones. Provisional blackleg rating of R-MR (resistance group A). Not tested in NVT trials. M Pacific Seeds.

Pioneer® 43C80 (CL)Φ. An early maturing variety. Moderate oil content. Adapted to low rainfall areas. Medium plant height. Blackleg resistance rating of MR-MS. NVT 2008-2009, 2011-2012. B/M DuPont Pioneer.

Pioneer® 43Y85 (CL). Early maturing hybrid. Moderate oil content. Medium plant height. Blackleg resistance rating of MR (resistance group A). Suited to low rainfall areas and short season growing zones. NVT 2011-14. B/M DuPont Pioneer.

Pioneer® 44Y87 (CL). Early-Mid maturing hybrid. Moderate-high oil content. Medium plant height. Suited to medium rainfall areas. Blackleg resistance rating – MR(resistance group A). NVT 2012-14

Pioneer® 44Y89 (CL) (tested as PHI-1305) is an early-mid season (4) for low to medium rainfall zones suitable replacement for 44Y84 CL. It has a shorter plant height and is slightly earlier than Pioneer 44Y87CL. It is rated R-MR for blackleg resistance (resistance groups BC). NVT 2013-14.

Pioneer® 45Y86 (CL). Mid maturing hybrid. High oil content. Replacement for 46Y83(CL). Blackleg rating of MR-MS (resistance groups A,B). NVT 2010-14. B/M DuPont Pioneer.

Pioneer® 45Y88 (CL). Mid maturing hybrid. Moderate-high oil content. Medium plant height. Suited to medium-high rainfall. Blackleg resistance rating R-MR (resistance group A) B/M DuPont Pioneer. NVT 2012-14

XCEED™ Oasis CLⓟ. First herbicide tolerant Clearfield tolerant juncea canola released in Australia. Early maturing open pollinated variety. High oil content. Blackleg rating of R. Blackleg resistance group D. NVT 2008-13. EPR applies. B DPI Victoria/ Seednet. M Seednet.

XCEED™ X121 CL. The first hybrid Clearfield® tolerant juncea canola. Four days later than Oasis CL. Excellent early vigour and branching ability and has high oil content. X121 CL has excellent pod shattering tolerance and is suitable for direct harvest. Blackleg resistance of R (resistance group G). B Seednet in conjunction with GRDC.

Notes on recently released Triazine tolerant (TT) varieties

ATR Bonitoⓟ Early-mid season maturing variety. Short-medium height. Blackleg rating of MR (resistance group A). NVT 2012-14. B/M Nuseed. EPR of $5 per tonne (GST ex) applies to ATR Bonito.

ATR Gemⓟ Early-mid maturity triazine tolerant variety. High oil content. Medium plant height. Blackleg resistance rating of MR (resistance group A). NVT 2011-14. B/M Nuseed Pty Ltd.

ATR-Stingrayⓟ. Early maturing variety. Short height. Moderate-high oil content. Blackleg resistance rating MR (resistance group C). NVT 201-14. B Nuseed Pty Ltd and DPI Victoria. M Nuseed Pty Ltd.

ATR Wahooⓟ Mid maturity variety. Medium plant height. Blackleg rating of MR (resistance group A). NVT 2012-14. B/M Nuseed. An EPR of $5 per tonne (GST ex) applies to ATR Wahoo.

Hyola® 450TT. Early to mid-maturing hybrid. Medium plant height. Provisional blackleg resistance rating of R (blackleg rotation groups A,B,D) NVT 2013-14. B/M Pacific Seeds.

Hyola® 559TT. Mid-Early maturing TT Hybrid. High oil content. Medium plant height. Ideally fits medium-low right through to high rainfall areas. Blackleg resistance rating R, (blackleg rotation groups A,B,D). NVT 2012-14. B/M Pacific Seeds.

Hyola® 650TT. Mid to mid-late maturing hybrid. Medium-tall plant height. Blackleg resistance rating of R(resistance groups A,B,E). NVT 2013-14. B/M Pacific Seed

Hyola® 750TT. Super Hi-Biomass Mid-Late maturing Hybrid. Medium-tall plant height. Adapted to high to very high rainfall areas. Provisional Pacific Seeds blackleg resistance rating of R-MR(P). Rotation Blackleg Group to be advised. NVT 2014. B/M Pacific Seeds.

New Release due in 2016.

Pioneer Atomic HT. Mid maturing hybrid. Medium height. Moderate-high oil content. Suited to medium to high rainfall zones. Provisional blackleg rating of MS (P). NVT 2012-14. M DuPont Pioneer

Pioneer Sturt TT. Early-mid maturity open-pollinated variety. Moderate oil content. Shor-medium plant height. Adapted to the low and medium rainfall areas. Blackleg rating of MS-S. NVT 2011-14. M DuPont Pioneer. EPR applies (PBR/EPR rights NPZ Australia Pty Ltd).

Monola® 314TT. Early-Mid open pollinated specialty oil variety. Medium plant height. Nuseed indicate a blackleg rating of MR. NVT 2013-14. B/M Nuseed Pty Ltd

Withdrawn and no longer available: Bonanza TT, Henty HT, Jardee HT, Junee HT, Nitro HT, Crusher TT, Hyola 444, Hyola 555, Hyola 656, Monola 413 TT, Monola 605 TT.

Upper North Farming Systems 2014 Bus Tour Summary
Eastern Low Rainfall Zone – July 21-25th

Author: Joe Koch
Funded By: GRDC Industry Development Award
Project Title" Eastern Low Rainfall Zone Bus Tour IDA10772
Project Delivery Organisation: UNFS

On the 21st of July a group of 19 young and old farmers embarked on an informative and valuable bus tour visiting fellow low rainfall zone farming systems groups, Mallee Sustainable Farming (MSF) in South Australia/Victoria and Central West Farming Systems (CWFS) in New South Wales. This trip was funded by the GRDC through its Industry Development Program.

The Group had an early start, departing Booleroo Centre at 7.30am on the Monday morning. After some picks up's along the way there was a quick stop at Morgan for an iced coffee break before heading across the border into the Millewa region of northern Victoria. The first farm visit was at Ron and Nick Hard's property 'Yarrara', where along with Michael Moodie from MSF, we were hosted for lunch. We discussed the history of their farm and the Hards' explained how they managed the variable soil types of the Mallee. Some challenges included grain logistics with large distances for export and the use of on-farm storage. Their approach to grain storage, in particular grain marketing after harvest, generated good discussion within the group. We then looked at the MSF paddock scale crop sequencing demonstration on their farm that incorporated different rotations using peas canola and wheat.

At Chris and Colin Hunts the MSF paddock scale variety trial compared the best varieties of the district. Clearfield(CL) crops were grown in this country to combat Brome Grass. The residual effect of Clearfield chemistries meant more CL wheat and canola varieties were chosen to manage impacts of crop damage the years following the use of these chemicals. Here we inspected soil pits, located on the sand hill, mid slope and swale areas, showing how each soil type changed within a short distance. It was quite noticeable how the crop of peas changed in growth next to the pits. This site was also part of an ongoing Precision Ag (PA) focus paddock with variable rate trials and implementation of full PA over a number of years. As the daylight faded the group checked out a paddock of Wedgetail wheat (a long season winter variety). Michael Moodie discussed how the farmers in the area had been using Wedgetail to capture late summer rainfall events without the wheat running to head like spring wheats due to the cold vernalisation requirement of winter wheats. He also discussed the ability of Wedgetail to be grazed and how it was pretty hardy. The idea of having a variety like Wedgetail in the silo to sow in a paddock or two in the event of a late summer rainfall event generated a lot of discussion and interest within the group.

The day drew to a close a short way down the highway into Mildura, with the sampling of a few cold beers at the brewery followed by a generous feed of pizza and pasta.

On day two, the group departed Mildura early then stopped in Redcliff to check out "Big Lizzie", a historic steam driven tractor used in the 1920's for carting goods and clearing scrub. After enjoying a vanilla slice in Ouyen, the group headed back towards South Australia to the MSF Murrayville Seeder Trial. This trial compared different tyne and seeding configurations over the 3 very different soil types. A lot of work had gone in to the trial. Michael Moodie explained how different tyne systems resulted in significant differences in plant establishment and soil treatment in different soil types. The spring tyne set up's had gaps in the seed row then a big rush of seed due to breaking out over the limestone rocks, resulting in uneven plant establishment in the seed row. The hydraulic tyne set up had less of this affect due to the smooth return of the tyne to working position when breaking away.

At Managatang John Aentz met the bus and gave a tour of his Saltbush and Enrich Perennial Forage Shrub Site. John explained why the wider row spacing were better with "Eyre's Green" (Saltbush Variety). John had 110ha of saltbush and could lamb his ewes down and keep all his sheep off his pasture after they were spray topped until harvest when the sheep could then graze the stubbles. It was quite evident the saltbush was pushing down the water table as scalded areas that resulted from historic cropping practices were improving.

As we drove in the gate of Gav Howley's property at Kyalite to inspect a field pea trial the sun was setting so instead, with refreshments in hand, Gav showed us around his machinery shed. We looked at a Weed Seeker and by coincidence it was being serviced at the time by the machinery dealer, Hawkeye Precision. This was great as we got a full run down on how the machine worked. Gav explained his Weed Seeker set up with twin lines. With this configuration he can apply a blanket rate of chemical then use the secondary line with the Weed Seeker to target the bigger and harder to kill weeds. This was particularly beneficial for the first spray after the summer rain where there was a good germination of volunteers and weeds. Any follow up summer sprays would then be done just using the Weed Seeker boom spray line. Gav also talked through his DBS airseeder with liquid fertiliser and explained how by using liquid his workload at seeding time had reduced.

After a very frosty departure on Wednesday morning from Balranald we ventured across the frozen Hay Plains to Merriwagga. John Small, Central West Farming Systems (CWFS), met us at their Long Term Rotation and Tillage Trial Site. The trial has been running for 16 years with a large amount of local farmer involvement. Agronomist Barry Haskins led us over the trial explaining the advantages and disadvantages of each rotation. The continuous wheat on wheat for 16 years certainly created interest as it was the second most profitable treatment behind the wheat – wheat – break crop treatment. As we walked through the trial Barry pointed out the weeds and grass issues in wheat on wheat and windmill grass in the chemical fallow treatments. Participants had a go at using a push probe on each of the treatments. Noticeable plough pans where found in tillage treatments and extra moisture profile found in the wheat-fallow-wheat treatment. Barry also explained the early nitrogen release as a result of the tillage treatments and how the non-tillage treatment usually caught up later in the season.

We had a BBQ lunch then moved on to 'Davies Farm' at Lake Cargelligo. The topic here, led by John Small, was on 'Managing Barley Grass and Fleabane and lifting wheat yields in long term continuous cropping paddocks using brown manure crops and strategic tillage'. The Davies' were green manuring Peas and Lupins and getting good grass weed control along with nitrogen, root disease and moisture benefits the following year in their wheat crop. The practice of green manuring wasn't widely adopted in the area. There was an interesting discussion on how the Davies' had gone full zero till for a number of years but then had to purchase a Point and Press wheel seeder as they used prior to purchasing their Disc seeder. By running two different seeding machines they could use trifluralin on certain paddocks to help control barley grass. They also commented on the cost of maintaining the disc seeder each year, approximately $12,000 and two weeks labour, and how it was just too expensive to use the disc machine over the whole farm.

That evening, we moved on to Condobolin where at a dinner at the local hotel we heard from guest speaker Chris Baker, AgnVet Consultant, on 'Emerging trends and lessons learnt by producers about retaining stubbles and minimum tillage in the Condobolin district'. Chris spoke very well about the challenges they faced in the area, which were very similar to challenges of the farmers in the Upper North. A notable comment he made was how not one system is a perfect farming system and that in a low rainfall farming area the farming system has to be flexible to be viable.

On the Thursday morning, following a BBQ breakfast at Condo Ag Station, Ian Menz from the NSW DPI led a discussion on 'What is the best approach to establishing the pasture phase in cropping paddocks?" Ian explained how a skip row approach wasn't good as it result in too much bare ground. The best was to under sow the medic or Lucerne with 10kg oats to add stubble. Ian then explained the problem growers in the area were facing with flaxleaf fleabane. There was a great discussion as most of the participants were unaware of what a fleabane plant looked like or its ability to spread easily. Ian explained how it was hard to control, the effects of letting it go and a number of control methods they were using to combat fleabane in the area.

We then hopped back on the bus for a farm visit at Kiagarthur Station; a sheep, lucerne, wheat and cotton property, with the occasional cow thrown in the mix. The sheer size and scale was amazing with the farm size of 30,000 hectares. It took the whole morning to drive from one side of the farm to the other. The biggest paddock was 1030ha with an average paddock size of 600ha (the same size as some participant's whole farms). The Manager explained the cotton aspect of business and the costs and operations required to grow it. The station had a full commitment to using contractors to carry out all operations. They had a huge grain storage facility, where stored grain was then value added through livestock feedlots within the business. It was noted by a number of participants on the lack of rotation and how the cropping could be more profitable if managed better.

The next farm visit was to CWFS Chairman, Pete Stuckey's farm, "Homesworth". Pete is a mixed farmer running sheep and cattle along with cereals and pulses. He also grows Monola with a $90/tonne premium over canola. Pete explained his fencing system that was developed within his family and its ease of construction. We saw the devastating aftermath of a thunderstorm that went through a few years ago and destroyed all Pete's sheds and blew the roof of his house. Pete spoke of how the storm even blew the neighbours header backwards and caved in his windscreen with hail, while the guy was still inside. Pete had some of his ewe hoggets in the yard for us to inspect in the race. Tom Kirk (Pete's classer) talked about what qualities he looked at when classing his client's sheep. We enjoyed a curry for lunch in the shearing shed, provided by Condobolin High School students as part of their home economics class catering accreditation.

Back onto the bus we hopped with a full stomach to travel a few hours down the road towards Rankin Springs with an afternoon tea stop at the Weethale Pub. At Rankin Springs Michael Pfitzner showed us a canola trial on his farm with burnt vs standing vs mulched vs worked treatments as part of the CWFS component of the GRDC funded Stubble Initiative. Michael also showed us a "sowing wheat light and early" trial that James Hunt from CSIRO was carrying out on his farm. Next to the trial was a great paddock of vetch that Michael explained he would brown manure in the coming week. Michael also explained his journey into Controlled Traffic Farming. He explained how by using satellite imagery he could see the effects of previous year's wheel tracks in the crop. He spoke about economics of CTF vs conventional and explained his estimated gross margin losses from wheel tracks, with savings of around $400,000 over 7000 acres. We then had the chance to inspect how Michael's machinery had been modified to suit a controlled traffic system while the BBQ got fired up.

The following morning we departed Goolgowi to begin our journey home. We had a bonus stop at the Hay road traffic checking station where one of the officers explained to the group how a shaker machine worked and how a truck's brakes, suspension and wheel bearings were tested. Our last stop before getting home was at the Woolshed Brewery at Murtho where we had a tour of the brewing facility followed by a tasting to wash down a large self-cooked BBQ lunch whilst overlooking the picturesque Murray River. The long journey home allowed for some great discussion and evaluation of the fantastic trip. All participants enjoyed the trip away discovering and learning about farming in another part of the world.

We would like to thank the GRDC for making this trip possible. A huge thank you to the Mallee Sustainable Farming and Central West Farming Systems groups and their staff for organising the site visits and the wonderful hospitality.

Participants
Joe Koch, Matt McCallum, Ian Keller, Matt Nottle, Kerry Modystach, Todd Carey, Ashley Ayles, Lauchy Williams, Toby Fisher, Kym Fromm, Gilmore Catford, Andrew Catford, Jonno Mudge, Neil Lange, Russel Foulis, Stephen Danze, Brad Dennis, and Matt Dennis.

UNFS Eastern Low Rainfall Zone Bus Trip - The Evaluation

On the last leg of the bus tour, the participants were asked to review the success and outcomes of the bus trip. Below is a summary of their responses:

Top 5 highlights

1. Central West Farming Systems Long Term Rotation and Tillage Trial with the wheat on wheat demonstration. All were amazed at the fact that they had grown it for 16 years straight. They found this incredibly intriguing as it goes against everything that farmers get told to do.
2. Controlled Traffic Farming (CTF) appealed to many, with a lot of the respondents keen to try and either begin changing their systems to incorporate this system down the track, or some, willing to incorporate it straight away into their operations.
3. The sheer scale of Kiagarthur Station. They were incredulous at the size of operations.
4. Wedgetail wheat was mentioned by at least half of the attendees as a major highlight.
5. The 'Weed It' Greenseeker technology was a big hit.

Feedback

The resounding feedback regarding the experience was that they were too pressed for time at each place. They understood that they needed to keep the planned schedule to see everything, but next time would like more flexibility to stay and absorb more at places that they were really intrigued with. They also wanted to see more of the machinery behind the systems, not just the systems.

Application of ideas gleaned from the trip

There were many attendees discussing the implementation of CTF into their systems, how they would do this, straight away, or begin working on their systems to incorporate it down the track. A limiting factor for many was the need to invest in gps systems to make this cropping system work efficiently and most would have to incorporate this into their future financial budgets.

Many of the attendees intended to try some on farm trials with wheat on wheat, time of sowing, and seeding rates.

Wedgetail wheat and its characteristics were obviously well received by the growers who attended this trip. Many wanted to look further into the "winter wheat's" that can be sown very early

From this experience, what work would you like to see the UNFS do?

Most would like to see some long term crop rotation trials established in the Booleroo area. They want them set up across whole paddocks with varying soils. All attendees want to see seeding rates worked on in these long term trials, time of sowing, wheat on wheat, and wheat varieties.

Controlled Traffic Farming (CTF) demonstrations, trials and information sessions were another farming system that the attendees would like to see the UNFS work on. Some would also like to extend their knowledge of gps and precision agriculture (PA) systems, especially the next level systems such as weedseeker technology. An information session on PA, use of gps in the farming system, how to implement, and utilize some of the technologies, including CTF, with machinery to visually see these systems.

Another Bus Tour?

All attendees noted that they would, in-fact, attend another tour. All commented that they gleaned so much from going on this one that they would absolutely go on another.

Ideas of the west coast of the Eyre Peninsula or even across to WA were put down. These locations were by far the majority.

Other ideas noted though were to see some of the processing side of things, such as abattoirs, ship loading, milling plants, and making fuel from canola.

Most were in two minds about the time away though. The realized that they couldn't see all that they wanted in the allocated time of 5 days, but most thought 5 was too many to be away from their operations, and maybe shaving off a day or 2 would make them more inclined to go next time.

All attendees appreciated the GRDC funding for this activity and felt that it was an appropriate activity to fund. Getting farmers out of their comfort zones to see other ways and systems was noted to be an extremely appropriate activity.

It was noted that one of the roles of the GRDC was to extend development in farming practices, what a great way to do that by providing funding to a cross section of farmers from across the region to travel interstate and see some different systems and techniques, many that they can in-fact embrace on their own farms. They bring these fresh ideas home and begin integrating them. This encourages surrounding growers to ask questions. The bus trip attendees become the catalyst for change and improvements in farming practices.

UNFS Membership List 2014

Title	First Name	Last Name	Partners Name	Town
Mr	Garry	Arbon	Janet	Booleroo Centre
Mr	Peter	Baker	Tarynn	Clare
Mr	Peter	Barrie		via Orroroo
Mr	Andy	Bates		Streaky Bay
Mr	Braden	Battersby	Michael	Wilmington
Mr	Michael	Battersby	Braden	Wilmington
Mr	Colin	Becker	Colin	Caltowie
Mr	William	Bennett	Henry	Orroroo
Mr	Henry	Bennett	William	Orroroo
Mr	Dustin	Berryman		Booleroo Centre
Mr	Shaun	Borgas		Booleroo Centre
Mr	Don	Bottrall	Heather	Jamestown
Mrs	Anne	Brown		Wirrabara
Mr	Gerard	Burt	Dawn	Hawker
Mr	Andrew	Byerlee		Orroroo
Mrs	Emily	Byerlee		Orroroo
Mr	Malcolm	Byerlee		Orroroo
Mr	Neil	Byerlee		Orroroo
Mr	John	Carey	Nicole	Booleroo Centre
Mr	Todd	Carey	John	Wilmington
Mr	Gilmore	Catford	Michele & Andrew	Orroroo
Mr	Grant	Chapman	Margaret	Orroroo
Mrs	Margaret	Chapman	Grant	Orroroo
Mr	Tyson	Christophersen		Murray Town
Mr	Barry	Clapp	Norma	Peterborough
Mr	Scott	Clark	Jaimie	Jamestown
Mr	David	Clarke		Booleroo Centre
Mr	Ian	Clarke		Booleroo Centre
Mr	Peter	Cockburn		Wirrabarra
Mr	Ben	Crawford	Beck	Georgetown
Mr	Bruce	Crawford	Jan	Georgetown
Mr	Trevor	Crawford	Christine	Jamestown
Mr	Chris	Crouch		Wandearah
Mr	Graeme	Crouch	Cathy	Wandearah
Mr	Robert	Dennis	Michellle	Port Germein
Mr	Damien	Ellery		Orroroo
Mr	Ian	Ellery	Sue	Orroroo
Mr	Toby	Fisher		Murray Town
Mr	Ben	Foulis		Orroroo
Mr	Bentley	Foulis	Michelle	Willowe
Mr	Dion	Foulis		Orroroo
Mr	Matt	Foulis		Booleroo Centre
Mr	Noel	Foulis	Susan	Orroroo
Mr	Douglas	Frances		Quorn
Mr	Kym	Fromm		Orroroo

Title	First Name	Last Name	Partners Name	Town
Mr	Caleb	Girdham		Melrose
Mr	Phil	Green		Booleroo Centre
Mr	Brendan	Groves	Meridee	Booleroo Centre
Mr	Rebecca	Gum	Trevor	Orroroo
Mr	Trevor	Gum	Rebecca	Orroroo
Mr	Daniel	Henderson		Caltowie
Mr	David	Henderson	Joy	Caltowie
Mr	Joy	Henderson	David	Caltowie
Mr	David	Hombsch	Rebecca	Booleroo Centre
Mr	Darren	Hughes		Orroroo
Mr	Niel	Innes		Booleroo Centre
Mr	Tony	Jarvis	Jane Crawford	Booleroo Centre
Mr	Ben	Jefferson		Jamestown
Mr	Brendon	Johns	Denise	Port Pirie
Mr	Leighton	Johns		Port Pirie
Mr	Philip	Johns		Port Pirie
Mr	Steven	Johns		Port Pirie
Mrs	Jacqui	Jones	Paul	Melrose
Mr	Paul	Jones	Jacqui	Melrose
Mr	Bart	Joyce		Wanderah West
Mr	Mick	Kerin		Crystal Brook
Mr	Andrew	Kitto	Nathan May	Gladstone
Mr	Jamie	Koch	Jody	Maitland
Mr	Jess	Koch		Booleroo Centre
Mr	Joe	Koch		Booleroo Centre
Mr	Robert	Koch	Joyleen	Georgetown
Mr	Jim	Kuerschner	Gaye	Orroroo
Mr	Tom	Kuerschner	Jim	Orroroo
Mr	Sam	Kuerschner	Jim	Orroroo
Mr	David	Kumnick	Katrina	Booleroo Centre
Mr	Robert	Lang		Minualara
Mr	Neil	Lange	Judy	Laura
Mr	Brian	Leue		Port Pirie
Mr	Kevin	Lock		Booleroo entre
Mr	Mark	Ludgate		Peterborough
Mr	Martin	Luke		Willowie via Orroroo
Mr	Nathan	May	Andrew Kitto	Gladstone
Mr	Andrew	McCallum	Melissa	Booleroo Centre
Mr	Ian	McCallum	Joan	Booleroo Centre
Mr	Matt	McCallum	Matt, Ross, Heidi	Laura
Mr	Richard	McCallum	Michelle	Booleroo Centre
Mr	Allan	Michael	Helen	Quorn
Mr	Robert	Mills	Lachlan Williams	Booleroo Centre
Mr	Kerry	Modystach	Gill	Wilmington
Mrs	Gill (Gillian)	Leppanon/Modystach	Kerry	Wilmington
Mr	Tony	Moten		Pekina
Mr	Barry	Mudge	Kristina	Port Germein

Title	First Name	Last Name	Partners Name	Town
Mr	Ian	Mudge	Henry	Port Pirie
Mr	Ben	Noll	Leela	Wilmington
Mr	Leela	Noll	Ben	Wilmington
Mr	Trevor	Noll	Henrica	Wilmington
Mr	Matthew	Nottle		Booleroo Centre
Mr	Len	Nutt	Carolyn	Orroroo
Mr	Morgan	Nutt		Orroroo
Mr	Brodie	O'Dea		Orroroo
Mr	Kevin	O'Dea		Orroroo
Mr	Todd	Orrock	Brooke	Murray Town
Mr	Nicholas	Piggott		Booleroo Centre
Mr	Tom	Reddaway	Lisa	Orroroo
Mr	Michael	Redden		Orroroo
Mr	Patrick	Redden		Clare
Mr	Mark	Reichstein		Appila
Mr	Michael	Richards		Crystal Brook
Mr	Steve	Richmond		Jamestown
Mr	Ben	Ritchie		Booleroo Centre
Mrs	Bronwyn	Ritchie	Kevin	Booleroo Centre
Mr	Kevin	Ritchie	Bronwyn	Booleroo Centre
Mr	Ian	Rodgers	Pam	Quorn
Mr	Paul	Rodgers		Quorn
Mr	Wayne	Roocke	Emma McSporran	Booleroo Centre
Mr	Andrew	Sargent		Crystal Brook
Mr	Malcolm	Sargent	Janet	Crystal Brook
Mr	Alex	Schwark	Gavin	Booleroo Centre
Mr	Gavin	Schwark	Alex	Booleroo Centre
Mr	Graham	Stokes	Inge	Quorn
Mr	Brian	Tiller	Diane	Via Port Pirie
Mr	Damien	Tiller	Amy	Port Pirie
Mrs	Diane	Tiller	Brian	Via Port Pirie
Mr	Heath	Tiller		Via Port Pirie
Mr	Ken	Walter	Denise	Melrose
Mr	Andrew	Weckert	Patsy/Tom	Brinkworth
Mrs	Patsy	Weckert	Andrew/Tom	Brinkworth
Mr	Tom	Weckert	Patsy/Andrew	Brinkworth
Mr	Lachlan	Williams	Robert Mills	
Mr	Jamie	Wilson		Maaclesfield
Mr	Wayne,	Young	Louise & Samuel	Port Pirie
Mr	Andrew	Zanker		Laura
Mr	Eric	Zanker	Raelene	Booleroo Centre
Mr	Graham	Zanker		Laura
Mr	Michael	Zwar		Laura