Coomandook Agriculture Bureau Sticky Beak Tour

Wednesday 15th September 2021

9.00am - 5.00pm

Light lunch & refreshments provided
Followed by BBQ tea

REGISTRATIONS for catering & COVID planning;
text on 0427 750 050
Register by Friday 10th of Sept

What will you see and hear?

National Variety Trial

Monitoring using telemetry - weather, ground water, soil moisture, soil salinity

GRDC Sandy Soil and Soil Amelioration Projects

GM Crop Trial—Malinong

Commodus Clear Field Barley

IMPROVING GRAZING PRODUCTION ON NON WETTING SANDS

Improving feedbase & grazing production by addressing soil chemical, physical and biological Constraints

- Soil Pit discussion with Dr Mel Fraser
- Soil limitations identified
- What soil amendment techniques do you want to try out to grow more feed?
- Soil acidity in the Coorong District

Agricultural Bureau of South Australia Inc.
PATHWAY TO IMPROVEMENT

Australian Government | National Landcare Program

LANDSCAPE SOUTH AUSTRALIA MURRAYLANDS AND RIVERLAND

COORONG DISTRICT COUNCIL

Coorong Tatiara Local Action Plan

This project is supported by the Murraylands and Riverland Landscape Board through funding from the Australian Government's National Landcare Program and landscape levies

mla MEAT & LIVESTOCK AUSTRALIA

Coomandook Ag Bureau - Sticky Beak Tour Wednesday 15th September 2021				9.00am – Finish over BBQ tea		
Stop	**Item**	**Speaker**	**Organisation**	**Location**	**Time**	**Page**
1	**MEETING POINT** *Car Pool to Sites* Coomandook Uniting Church Hall	Bryan Peter Tracey Strugnell	Coomy Ag Bureau Coorong Tatiara LAP	3223 Dukes Highway COOMANDOOK	**9am**	
2	**National Variety Trial Site** 'Green Hills' Bluey Roberts	Brendan Kupke	SARDI	Old Dukes Highway North of Gypsum Road COOMANDOOK	**9.20am** – *10.15am*	3
3	**Telemetry for weather, ground water, soil moisture, soil salinity** Mick Patterson 'Roby Downs'	Felicity Turner	Coorong Tatiara Local Action Plan	Corner Old Dukes Highway & Goodale Road COOMANDOOK	**10.30am** – *11.00am*	5
	MORNING TEA					
4	**Improving Grazing Production on Non Wetting Sands – MLA PROJECT** Soil pit, limitations identified vs soil amendment techniques **GRDC Soil Amelioration Project**	Dr Mel Fraser Dr Jack Desbiolles	PIRSA Rural Solutions University of SA	Tim Freak 'Booderoo' 572 Flowery Plains Road COOMANDOOK	**11.15am – 12.45pm**	13
	LUNCH				**12.45pm –** *1.30pm*	
5	**Return visit to GRDC Sandy Soils Site at Eckerts**	Dr Mel Fraser Matt Howell Dr Jack Desbiolles	PIRSA Rural Solutions Coorong Platinum Ag University of SA	Eckert's 'Mentara Park' Malinong Road South MALINONG	**2.00pm** – *3.00pm*	13
	AFTERNOON TEA					
6	**GM Crop Trial**	Matt Howell	Coorong Platinum Ag	Malinong Hall Paddock	**3.15pm – 4.15pm**	
7	**Commodus Clear Field Barley Demo**	Matt Howell	Coorong Platinum Ag	Malinong Hall Paddock	**4.30pm – 5.00pm**	
	BBQ TEA & FINISH AT MALINONG HALL		Coorong Platinum Ag Team	Malinong Hall	**EVALUATION via QR CODE PLEASE**	24

BMaA21COOK5 – Cooke Plains Barley

Brendan Kupke – Research Officer - SARDI

Sown 10th June 2021

	Range 1	Range 2	Range 3
Row 0	**Buffer**	**Buffer**	**Buffer**
Row 1	AGTB0043	Commander	AGTB0321
Row 2	Minotaur	Spartacus CL	Commodus CL
Row 3	IGB1922	IGB1923	Maximus CL
Row 4	AGTB0201	AGTB0325	Beast
Row 5	IGB20074	Laperouse	Alestar
Row 6	Rosalind	SCA21-Y001	IGB20073
Row 7	Leabrook	La Trobe	SA12072
Row 8	IGB1944	Compass	Buff
Row 9	SCA21-Y002	Scope CL	Cyclops
Row 10	RGT Planet	Fathom	Compass
Row 11	Buff	Commodus CL	SCA21-Y002
Row 12	Scope CL	RGT Planet	IGB20074
Row 13	IGB20073	Cyclops	Fathom
Row 14	AGTB0325	IGB1922	Rosalind
Row 15	SCA21-Y001	Beast	IGB1923
Row 16	Maximus CL	Leabrook	Minotaur
Row 17	SA12072	AGTB0321	IGB1944
Row 18	Alestar	AGTB0201	Commander
Row 19	Spartacus CL	AGTB0043	Laperouse
Row 20	La Trobe	Buff	Spartacus CL
Row 21	Compass	Alestar	IGB1922
Row 22	Cyclops	Rosalind	La Trobe
Row 23	IGB1923	SA12072	AGTB0201
Row 24	AGTB0321	Minotaur	SCA21-Y001
Row 25	Laperouse	IGB20073	Leabrook
Row 26	Beast	IGB1944	Scope CL
Row 27	Commodus CL	IGB20074	AGTB0325
Row 28	Commander	Maximus CL	RGT Planet
Row 29	Fathom	SCA21-Y002	AGTB0043
Row 30	**Buffer**	**Buffer**	**Buffer**

NEW FOR 2021

Commodus CL is an imidazolinone (IMI) tolerant barley released in 2021 by InterGrain (tested as IGB1908). It is closely related to Compassⓟ being similar agronomically with the addition of IMI tolerance. Suited to the low-medium rainfall environments, Commodus CLⓟ has a similar headloss and lodging risk to Compassⓟ. Commodus CLⓟ has been accepted for Barley Australia malt accreditation, commencing Stage 1 accreditation in 2021 with the earliest possible accreditation decision expected in 2023. Seed is available through InterGrain Seedclub members. EPR $4.25 ex GST.

Cyclops is a new variety released by AGT in spring 2021, with seed available for the 2022 season. It is a quick maturing variety with a speed similar to Spartacus CLⓟ and is suited to a range of environments. It has an erect Hindmarshⓟ plant type and therefore less susceptible to lodging. Cyclops has been accepted for Barley Australia malt accreditation with the earliest possible accreditation decision expected in 2023. Seed available through AGT Affiliates.

Minotaur is a new variety released by AGT in spring 2021, with seed available for the 2022 season. It is a quick maturing variety more similar to RGT Planetⓟ and best suited to medium-high rainfall environments. Minotaur has been accepted for Barley Australia malt accreditation with the earliest possible accreditation decision expected in 2023. Seed available through AGT Affiliates.

FELICITY TURNER - COORONG TATIARA LOCAL ACTION PLAN
SPEAKING AT MICK PATTERSONS WEATHER STATION

USE OF REMOTE MONITORING SYSTEMS

to improve knowledge and decision making around dryland salinity management

REPORT PREPARED BY FELICITY TURNER FOR THE COORONG TATIARA LAP

Key Points:

- **Be aware of which process is causing dryland salinity in your patch, as this will need to be factored in when making management decisions**
- **The use of real time data has improved land manager confidence in the management of dryland salinity**

Background

After decades of successful management and drier years, regional dryland salinity is slowly increasing across the Coorong District Council region with large areas believed to be at risk of becoming saline in the coming years.

Since 2016, the Coorong Tatiara Local Action Plan (CTLAP) has been conducting work on new and historic saline sites to remediate these areas, and reduce the total area of degradation caused by dryland salinity. Where successful, remediation and recharge reduction has provided groundcover and reduced the amount of soil erosion occurring on these areas. Programs undertaken by the Coorong Tatiara Local Action Plan have provided opportunities to explore what is and isn't working in the management of local dryland salinity management systems. As part of this work, several observations have been made by farmers around the conditions that appear to improve results when remediating soils. In particular, the 'flushing effect' required by natural rainfall events and the importance of groundcover in these systems.

Fig 1. Shane Oster, Alpha Group Consulting installing automated weather station and probe at Elephant Lake, 2020

PROJECT DETAILS

Project ID: nbn00001

Funding Body

This project was funded through Landcare Australia by a NBN Co Sustainable Agriculture Landcare Grant

Project Duration

2020-21

Site Locations

Coomandook, Meningie East, Mount Charles

The opportunity arose to utilise automated monitoring equipment to test these observations by using automated monitoring equipment to measure the depth of the water table, soil moisture levels, soil salinity levels and environmental conditions in real time at three monitoring sites across the Coorong and Tatiara District Council regions. This data is updated via automated telemetry every 15 minutes and both real time and historical data can be viewed utilising the internet. These sites have been selected as they are viewed as 'transient' saline sites.

Initial findings from the information being generated suggest that there are two very different dryland salinity processes that are occurring across the region (even within relatively close proximity of each other). It is hoped that additional funding can be sourced to expand monitoring sites and continue the interpretation of this data into the future allowing farmers to make more informed decisions when managing saline areas (particularly those that are transient and scald one year, but may be back into production in the following year).

It is hoped that this technology can be expanded to the mitigation phase; improving our understanding of crop and pasture water use in the landscape and how much rainfall is effectively used compared with what travels through the profile and recharges into the groundwater system.

Interpreting soil moisture probe data

- ### Summed graphs

The summed graphs provide information around the total amount of water in the profile at any point in time. Where soil moisture probes have been in for several years (>5) e.g. soil moisture probe at Pine Hill[1] (Figure 2), we have built up an understanding around the "wettest point" – as close to full capacity as has been observed and the "driest point" observed – beyond which the crop or pasture can't extract any additional moisture. The difference between the wettest point and driest point is the maximum amount of water available to the plant within the observed depth (in this case 90 cms). This maximum amount of water should be thought of as % full as opposed to absolute numbers.

Figure 2. Summed soil moisture data at Pine Hill (2016)

- **Stacked graphs**

The stacked graphs provide information around where in the profile the soil water is located. Understanding how deep into the profile water moves after a rainfall event, at what depth plants are accessing moisture from and where the moisture is stored are all useful pieces of information that provide a lot more value when compared to the stacked graphs (and total amount of soil water available) alone.

The stacked graphs also can provide useful information around where the water is coming from; is it coming from rainfall events or the water table, is the water table rising or falling and knowing the potential impact that has on your system with regards to root growth can also aid in more informed decisions being made.

Figure 3 shows a summed graph from the Mount Charles site where it can be seen that a rainfall event in late May has pushed the soil moisture down to 20cms, with the next major rainfall event on the 16th June pushing the moisture down to 30cms.

Crop extraction at a certain depth will be represented by diurnal stepping (where the sensor drops during the day while the crop is extracting moisture and then flattens at night).

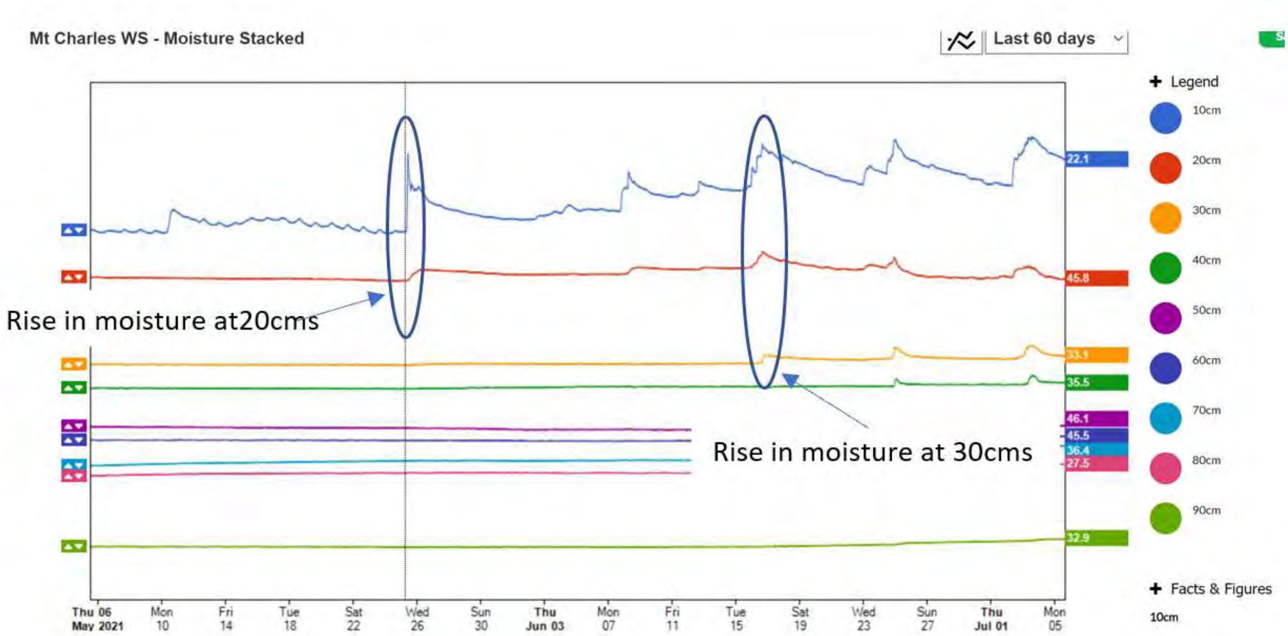


Figure 3. Stacked soil moisture at Mount Charles (June 2021)

What processes are we observing at sites across the Coorong and Tatiara District?

The equipment was installed in September and October 2021. Therefore we have limited data available with a full season at all of the observation sites yet to be collected. However given this small time-frame, we are seeing some really interesting data being generated.

There appears to be two very distinct processes occurring – possibly related to the location of the sites in the landscape, but the initial findings have already Improved knowledge around the different processes and therefore what mitigation strategies may be best put in place for each of these sites.

Rising water table

Mount Charles and Elephant Lake both appear to be sites that are impacted directly by a rising water table that brings groundwater closer to the surface with the potential for soil inundation and waterlogging to occur. The water table then recedes later in the season leaving some of the dissolved salts from the saline groundwater behind. This process can be seen in Figure 4 where the observation site at Elephant Lake shows the increase in the water table in mid-June and a subsequent filling of the soil profile from the bottom up. The black line represents the water table depth and as it rises from -1.4m below surface depth to -0.7 below surface depth, the soil moisture also increases at depth with the soil moisture levels increasing up the profile through the wetting front. This process has been referred to as rising water table. A similar pattern appears to be emerging at Mount Charles (although not yet as pronounced) where the water table has just started to rise in June 2021. This will continue to be monitored to ensure that the correct process is identified at this site.

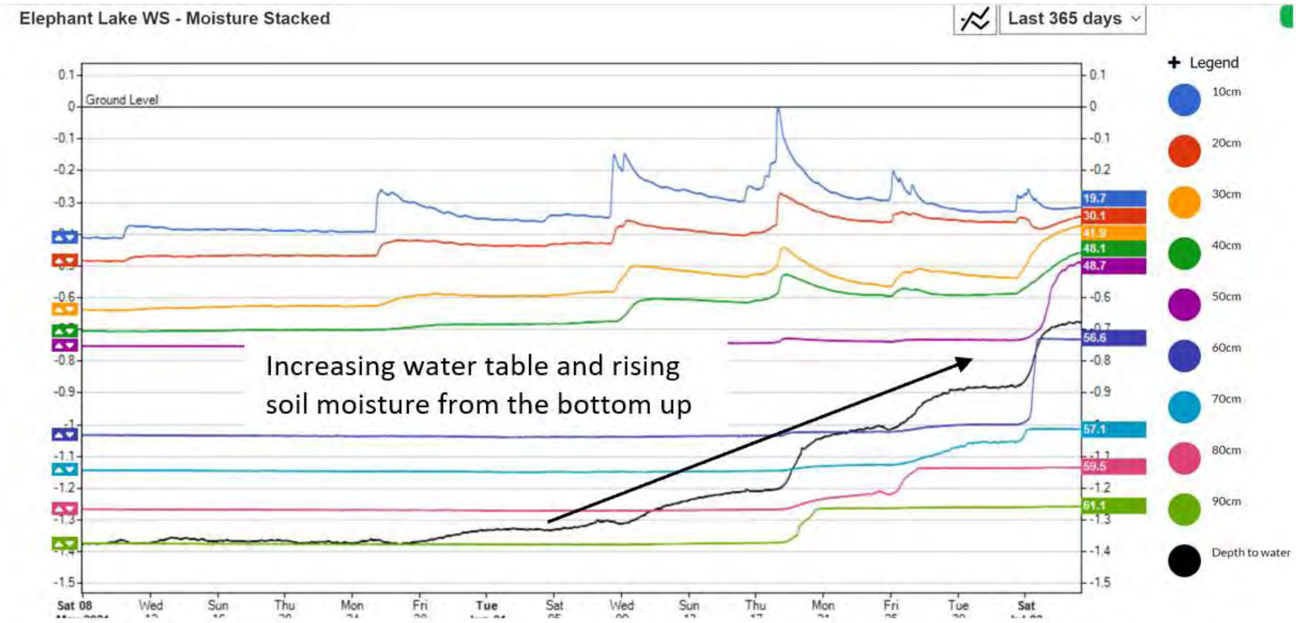


Figure 4. Stacked soil moisture and water table data, Elephant Lake (June 2021)

Wicking effect

Coomandook has a very different process occurring with the water table appearing to be relatively stable throughout the season (although this is only an initial finding that will continue to be monitored). The salinity at this site appears to be driven by warm conditions over summer and wicking of the soil moisture up through the profile (in the event of no rainfall or rising water table events). This is shown in Figure 5 and is referred to as the Wicking Effect (a similar process to wax or oil moving up a candle wick). As the water rises to the surface, it brings with it salts that are deposited as the profile dries out. As more data is collated, it will be interrogated against climatic conditions, and the overall processes will become better understood. The depth that the soil water is rising from is quite surprising, but after installation the site may have been bared out slightly at the surface with the disturbance from the probe placement. As groundcover is re-established at this site, it is hoped that the wicking effect will not be as pronounced.

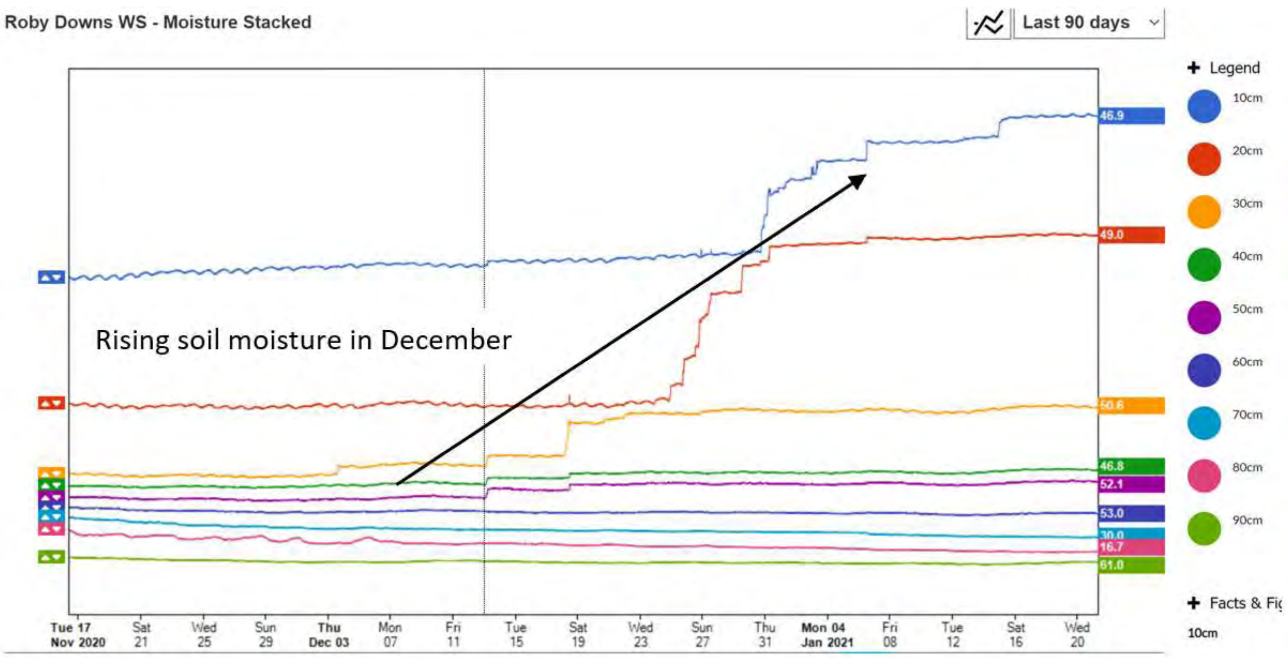


Figure 5. Stacked soil moisture graph, Commandook (December 202)

Environmental data

Additional data being collected includes rainfall, wind speed and direction, air temperature, soil temperature and relative humidity as well as other environmental derivatives (Figure 6). It is hoped that as more data is collected some of these indicators like soil or air temperature may be linked to the wicking of water through the soil allowing the data to be transferrable across to other locations.

Figure 6. Environmental data being collected at Mt.Charles

Dashboard of implications for management

Initial findings suggest that knowing the cause of salinity (waterlogging or wicking) has the potential to have implications on the way that the site is remediated and managed. More work is required on understanding how widespread each of the different processes (wicking or waterlogging) are, and if the different processes operate within a local catchment area or if it depends on the location of the site in the landscape.

If groundwater is rising from below the ground, then ensuring groundcover is established early before the area becomes too wet will assist in establishing and maintaining groundcover and potentially reducing the area that becomes scalded. It may also be beneficial to minimise stock numbers over the period that the water table is high to reduce pugging, damage to groundcover and soil structure.

Conversely, those areas that experience wicking will need water to flush down through the profile to reduce the salt concentration prior to establishment. At these sites, knowing that the water table is at depth, there may be the opportunity to look at ripping to assist in providing a passage for the salts to flush through, however once this has occurred, maintaining groundcover to reduce wicking and evapotranspiration over summer will be critical.

The depth from which the groundwater is wicking over summer was also surprising, as it rose over 1m on what is a loamy soil. Further investigation may be required to determine the maximum height that the water will rise to on these soils and explore what is happening on sites that are more slightly elevated in the landscape to see if the process changes.

As the data continues to be collected, it is hoped that in consultation with farmers and the Saltland Redemption Project Working Group, that more recommendations around management options utilising this technology will be made.

Conclusion

From the data that has been generated since the projects inception (September 2020) there appears to be some really interesting relationships between soil moisture, soil salinity through the profile and its relationship with the groundwater with some sites (Elephant Lake) having strong correlations, and another (Coomandook) appearing to have little or no relationship with the groundwater levels.

As more data is collected, it is hoped that the environmental data (in particular temperature - both ambient and soil, and rainfall) may provide additional insight into how these factors impact on the movement of water and salts through the profile. The late start to the season, and moisture only just starting to move through the profile suggest that it will be later in the season that we start to get an indication of the impacts of rainfall etc. on the soil salinity levels.

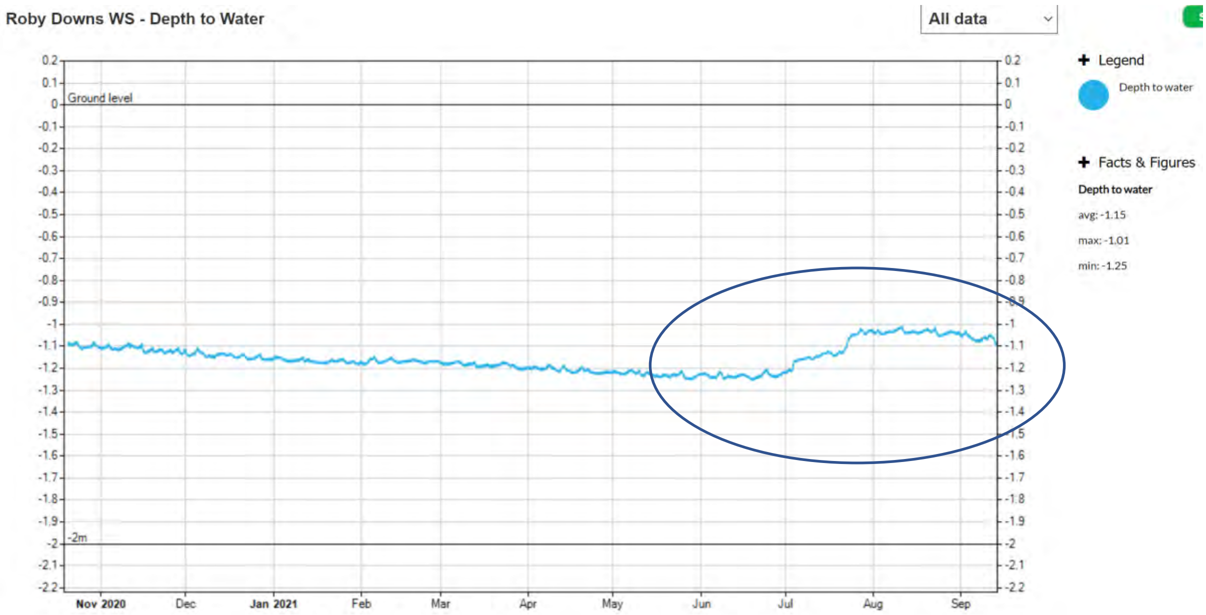
As these relationships become clearer, it is hoped that farmers will utilise the data to make better decisions to reduce the impacts of salinity across the region. Waiting until the salts are observed to have flushed from the topsoil (or alternatively seeing moisture move through the profile) will ensure better germination on transient sites. Knowing when the soil is starting to become waterlogged on those sites where the water table is rising will ensure that groundcover is maintained at those times so that scalding doesn't occur.

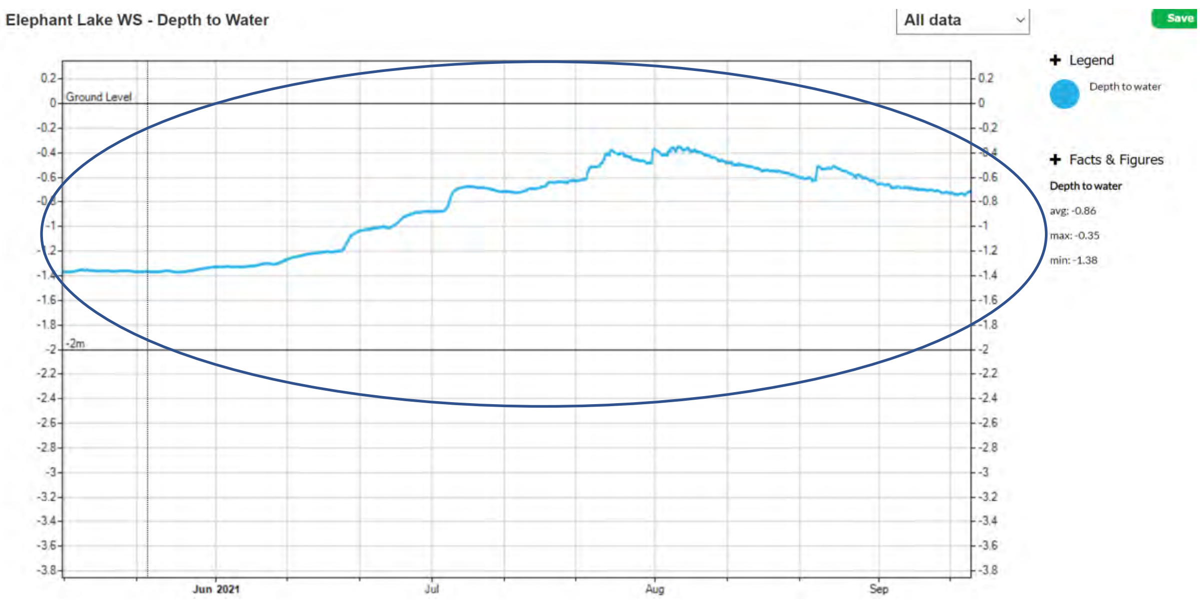
References

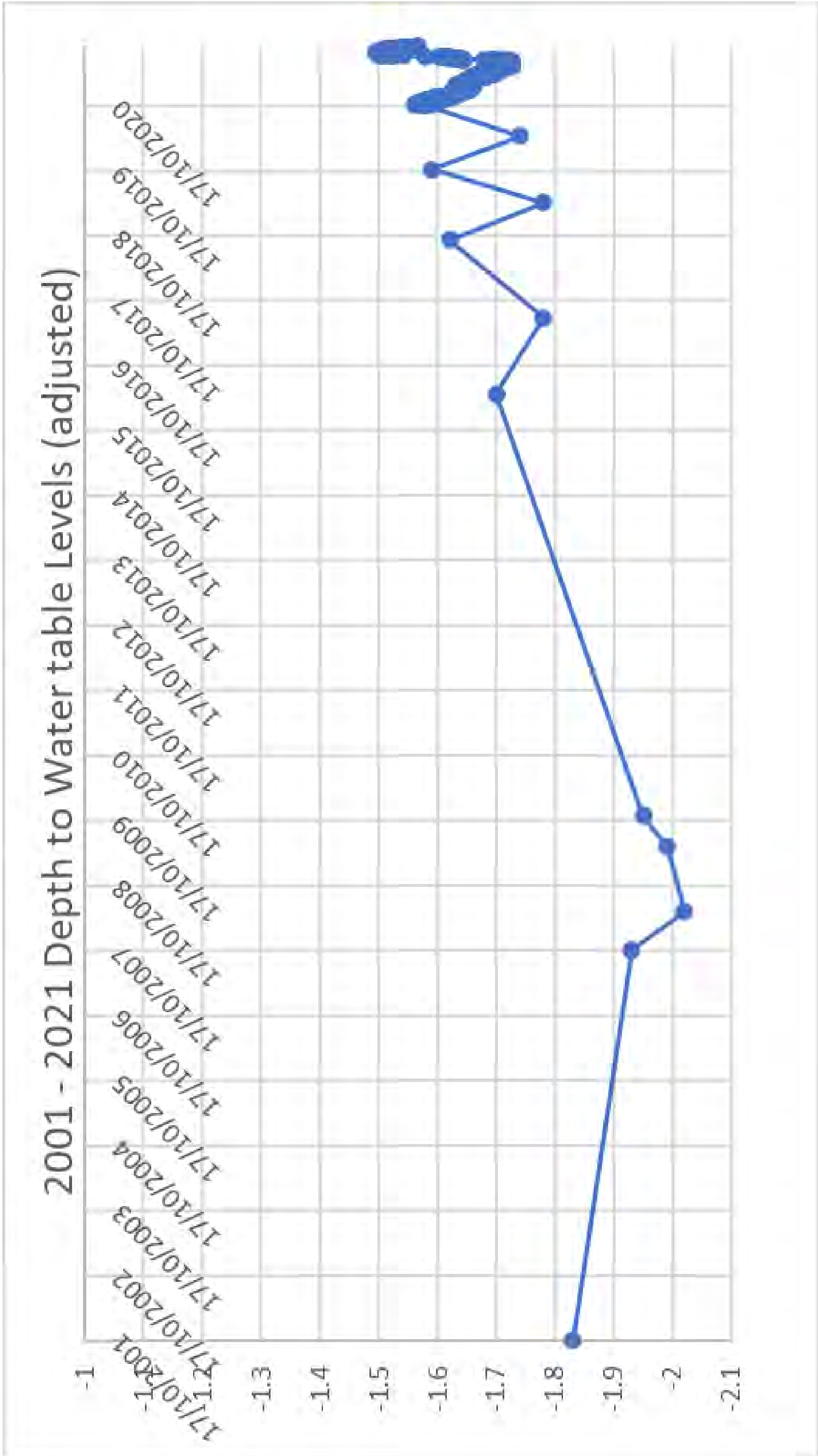
[1] F.Turner, MacKillop Farm Mangement Group, 2021. SAGIT MFM_218 "Utilising soil moisture probes in dryland cropping systems"

This project was funded through Landcare Australia by a NBN Co Sustainable Agriculture Landcare Grant and is an initiative of the Meningie East-Field Healthy Soils Group with support from the Coorong and Tatiara District Councils.

Water Table – automated piezometer readings






2001 - 2021 Depth to Water table Levels (adjusted)
-1
-1.1
-1.2
-1.3
-1.4
-1.5
-1.6
-1.7
-1.8
-1.9
-2
-2.1
17/10/2001
17/10/2002
17/10/2003
17/10/2004
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MEL FRASER - PIRSA RURAL SOLUTIONS & JACKY DESBOILLES SPEAKING AT FREAKS - COOMANDOOK & ECKERTS - MALINONG
MLA & GRDC SANDY SOILS PROJECTS

1. Pasture responses to ameliorating sandy soil constraints at Coomandook

Project: *Improved grazing production on non-wetting sands* is a collaboration between the Coorong Tatiara Local Action Plan and PIRSA through the Coorong District Council, funded by Meat and Livestock Australia (L.FAP.2101; 2020 to 2026).

Sandy soils are a common landscape feature in South Australia, Victoria and Western Australia. Farming on these soils can be challenging due to low water holding capacity, low organic carbon, low nutrient availability, compaction, water repellence and high risk of wind erosion. However, research has demonstrated that improvements in biomass production are possible on these soils when these constraints are overcome.

Building on previous research, **the Improved grazing production on non-wetting sands project** will look at **opportunities to improve the feed base and livestock productivity on sandy soils** by addressing soil chemical, physical and biological constraints.

Three demonstration sites will be established on grazing systems in SA, with a site-specific selection of three to five treatments at each, giving producers a chance to see different interventions in action. New technologies and techniques will be demonstrated in grazing pasture-based systems.

Benefits to producers

This project aims to reduce the overall cost of production per hectare by identifying cost-effective options to produce and convert more feed to increase carrying capacity and livestock production.

The project will give producers an opportunity to look at the effectiveness of different treatments and practices to improve sandy soils, measuring plant growth response, dry matter production and feed nutrition values. It will also test the cost effectiveness of the treatments on sites across the project area.

Project activities

- Three demonstration sites have been identified at Coomandook, Field and Western Flat. Core producers will be regularly involved in the progression of these sites, with a site-specific selection of three to five treatments tested on each.
- Demonstrations on these sites will look at methods of improving the soil, feed base and management to extend the growing season, increase pasture utilisation and optimise fertiliser use.

Progress to date

- The trial site at **Coomandook** [-35.425261 S; 139.754423 E; Image 1] has been mapped using Electromagnetic Induction Sensing (Geonics EM38; Image 2) and elevation (Image 3).
- This information was used to separate the paddock into three production zones: Hilltops, Mid-slopes and Stony flats (red, yellow and green markers respectively in Image 4).
- Soil samples were collected from these three zones for chemical assessment (APAL) and physical condition was measured using a Rimik digital recording cone penetrometer.

Results from soil sampling show:

- Mild **penetration resistance** (PR <1500 kPa) to 17 cm in Zones 1 and 2, moderate PR to 25 cm and severe PR below 30cm, having a detrimental impact on deeper layer root growth (Figure 1).
- Low to moderate **water repellence** in Zones 1 and 2 and nil in Zone 3.
- Slight **acidity**, and extremely low **OC** in Zones 1 and 2 (Table 1).
- Increasing **OC**, clay content, **cation exchange capacity** and **phosphorus** (Colwell) in Zone 3 (Table 1 and soil images on Pg 3).
- Very **deep infertile sand in Zone 1**, improving in Zone 2 and best in Zone 3, albeit the soil depth is limited in zone 3 to <40cm by calcrete (see soil images on Pg 3).

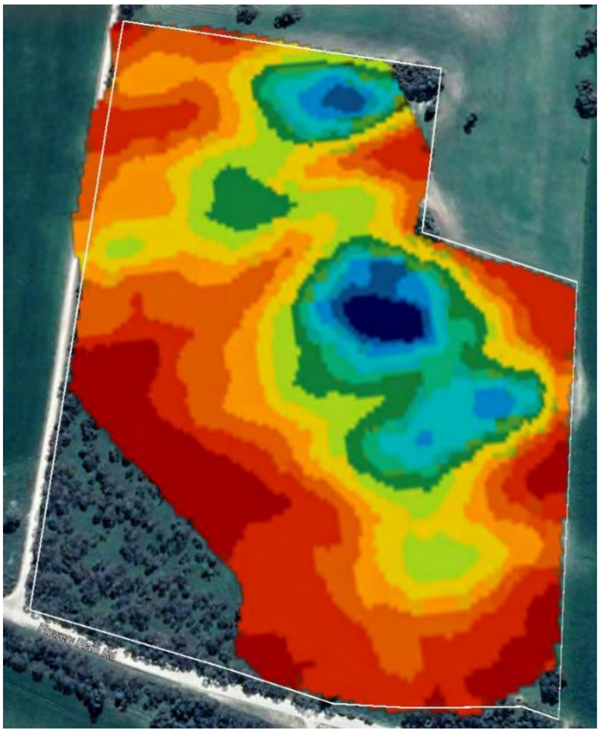
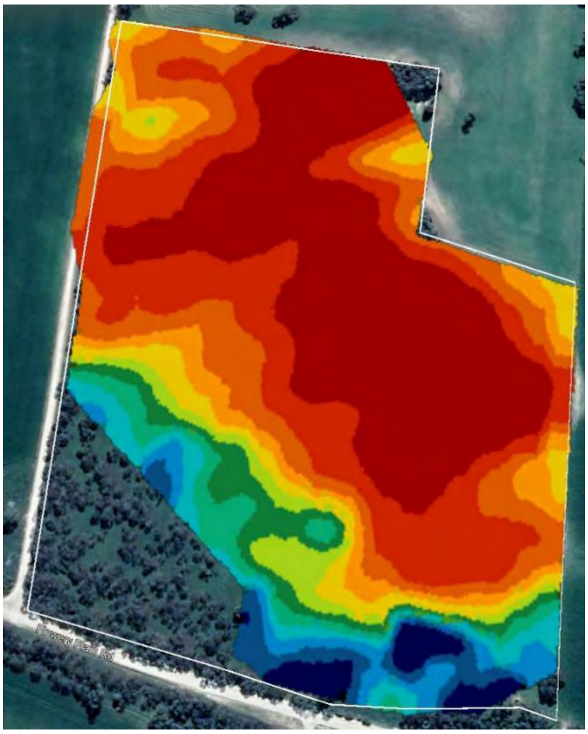


Image 1. Aerial image of the 24ha Demonstration Paddock at Coomandook showing bare soil on the hilltops.

Image 2. Elevation map showing strong correlation between high elevation (blue) with bare soil in Image 1, and low elevation (red) with good ground cover on the stony flats.



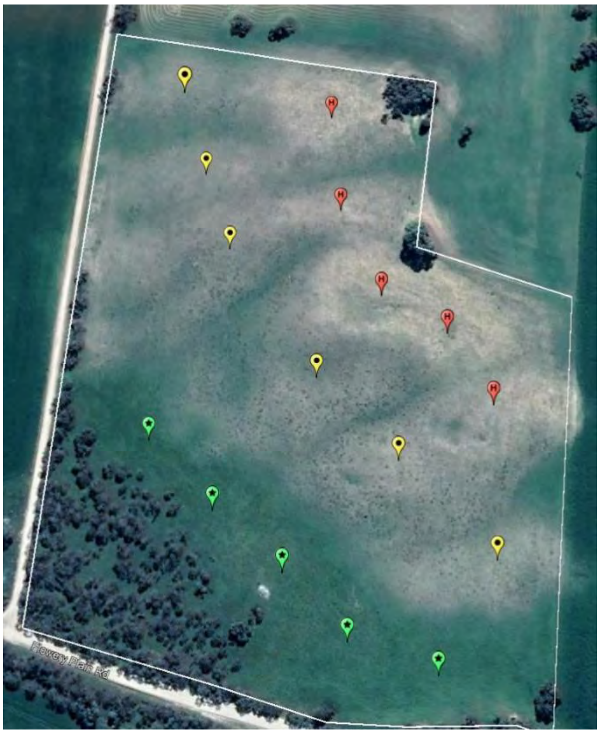
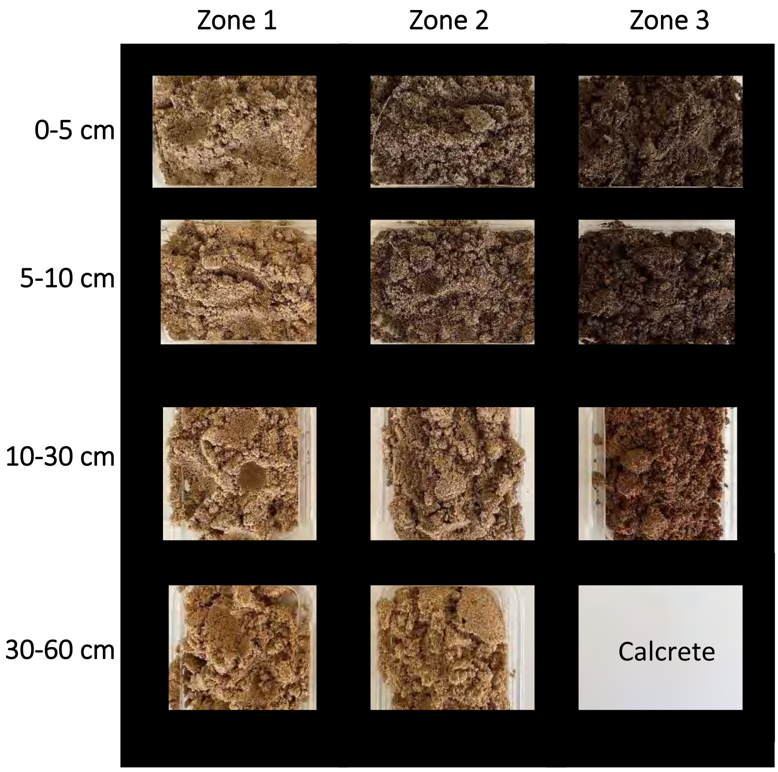


Image 3. Electromagnetic Induction map showing zones of low conductivity (red) on the hilltops and high conductivity (blue/green/yellow) on the stony flats, correlating well with fertility levels (EC, CEC).

Image 4. Three specific zones were selected for sampling: Zone 1 – Hilltops, red markers; Zone 2 – Mid-slopes, yellow markers; and Zone 3 – Stony flats, green markers.



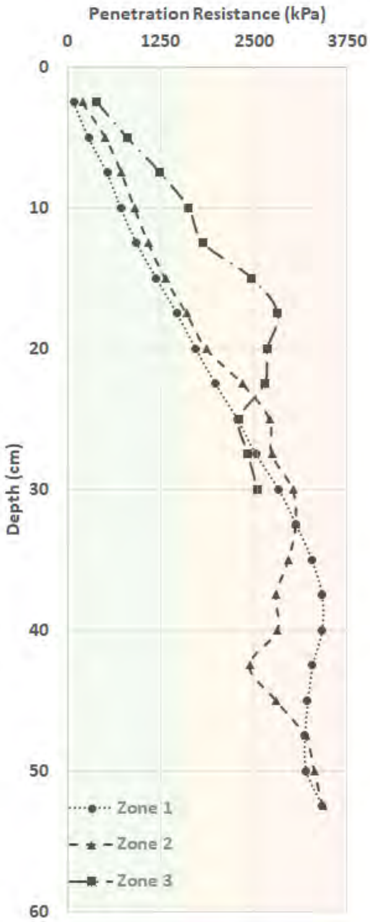


Figure 1. Penetration resistance measured in moist soil in three zones at Coomandook.

Table 1. Soil chemical data for composite samples collected for each of the three zones at Coomandook.

	Depth cm	pH_{Ca}	$EC_{1:5}$ dS/m	OC %	Min. N	Col P mg/kg	S	Exch. K mg/kg	CEC Cmol+/kg
Zone 1	0-10	6.16	0.04	0.32	10.7	22	3.7	48	1.58
	10-30	5.93	0.02	0.16	4	13	<2.5	37	1.32
	30-60	6.23	0.02	-	-	-	-	36	1.12
Zone 2	0-10	6.03	0.06	0.65	14.4	35	7.1	87	3.68
	10-30	6.19	0.03	0.21	4.1	15	4.0	47	1.58
	30-60	6.50	0.02	-	-	-	-	59	1.64
Zone 3	0-10	6.26	0.11	1.01	41	49	6.9	322	7.26
	10-30	7.82	0.17	0.38	5.4	14	7.7	252	23

Amelioration priorities in Zones 1 and 2

- Overcome water repellence
- Boost organic carbon and CEC
- Boost K?
- Reduce compaction in lower depths
- Supply trace elements

2. Crop responses to three deep tillage types on a constrained sand at Malinong

Project: *Increasing production on Sandy Soils in low and medium rainfall areas of the Southern region* is a collaboration between the MFMG, CSIRO, University of SA, PIRSA, Mallee Sustainable Farming Inc., and Trengove Consulting, funded by the GRDC (CSP00203; 2016 to 2023).

What was done?

- Three deep tillage types were used on an acidic, water repellent, compacted, deep sand at Malinong to test their efficacy at overcoming surface and subsoil constraints.
- Lime was applied across the paddock (variable rate 2.3 to 3.5 t/ha) prior to being deep ripped (to 30 cm or 40 cm), inverted (modified one-way plough) or mixed (rotary spader).
- Treatments were applied in plots 18.3m wide and 200m long, replicated x3, including an unmodified control.
- The site was sown to Spartacus CL barley in 2019, 44Y90 CL canola in 2020 and Scepter Wheat in 2021 and managed per best district practise. Crop establishment and grain yield were assessed.

What was the result?

- The degree of topsoil disturbance/mixing can be seen in photos 1 to 5 (Pg 5).
- All deep tillage types reduced penetration resistance (PR) to <2,500 kPa throughout the top 30cm in comparison to the control (Table 2).
- **Ripping to 40cm** was more effective than shallow ripping at overcoming high PR, particularly in the 20 to 30cm zone (on the rip-line) and provided a moderate improvement in repellence and pH (Table 2). Despite some improvement in plant establishment (Figure 2), no grain yield increases have so far been achieved for either ripped treatment (Figure 3 and Table 3).
- **Inverting** the profile made the top 15cm more acidic, but increased pH in the 15-25 cm layer in comparison to all other treatments. Whereas inversion eliminated repellence, the surface soil was very fragile and prone to erosion where the sandy A horizon was deeper than 30cm, negatively impacting crop establishment in the first two seasons (Figure 2). Only small average grain yield gains have been observed, owing to the poor performance of this treatment in replicate 2, where erosion had an ongoing negative impact. When the impact of erosion is omitted, the treatment compares favourably with mixing (Table 3).
- **Mixing** the soil with a rotary spader proved the most successful method to increase pH throughout the top 15cm and eliminated surface water repellence (Table 2), resulting in improved barley and wheat crop establishment (Figure 2) and a cumulative grain yield increase of 0.82 t/ha (Figure 3 and Table 3).
- The high degree of underlying variability across this paddock scale trial rendered increased grain yield differences statistically non-significant.

What does this mean?

- Economic assessment shows mixing to be most effective, returning $1.65 for every $1 spent.
- Harvest data will be collected in 2021 to determine the treatment impacts across three crop types and seasons.

Table 2. Constraints at Malinong include high penetration resistance, very severe water repellence and moderate to severe acidity through the top 30cm (Control) which were treated to varying degrees by tillage.

	Penetration resistance (kPa)					Water repellence	pHCa		
Depth (cm)	10	20	30	40	50	0-5	0-5	5-15	15-25
Control	881	2550	4274	4495	3896	Very Severe	5.22	4.46	4.37
Rip30	350	668	2361	4043	3960	Very severe	5.17	4.59	4.51
Rip40	498	1006	1320	3645	3949	Moderate	5.75	4.57	4.42
Inverted	766	1165	2020	3841	3887	Not repellent	4.71	4.12	5.31
Mixed	774	1414	2263	4072	3731	Not repellent	5.57	4.98	4.28

1. Unmodified Control

2. Rip30 (Ausplow)

3. Rip40 (Ausplow)

4. Inverted (Plozza plow)

5. Mixed (Farmax rotary spader)

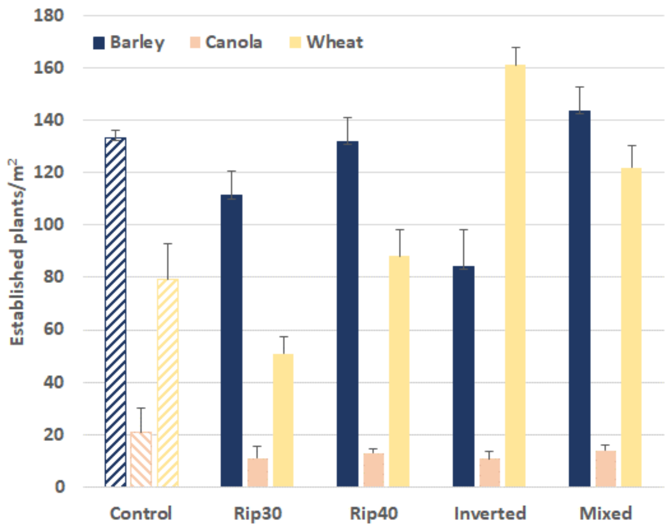


Figure 2. Plant establishment (#/m^2) responses to deep tillage type. Error bars denote the treatment standard error.

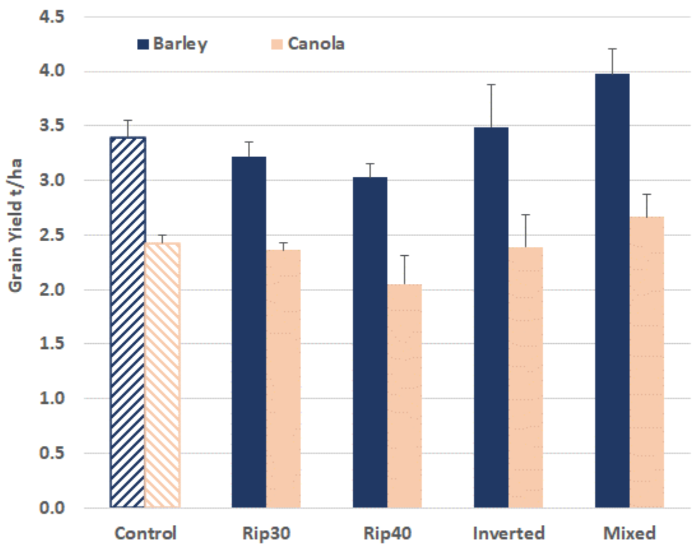


Figure 3. Grain yield (t/ha) responses to deep tillage type in 2019 (GSR 352mm) and 2020 (GSR 380mm; long term average 344mm). Error bars denote the treatment standard error.

Table 3. Cumulative partial gross margin (PGM) for seasons 2019 and 2020. Price assumptions include 5yr average grain prices for barley ($255/t) and canola ($558/t).

	Tillage cost ($/ha)	Cumulative grain yield (t/ha)	Cumulative gross income ($/ha)	Cumulative PGM ($/ha)	ROI (%)
Control	$0	5.82	$ 2,218	$ 2,218	-
Rip30	$50	5.58	$ 2,138	$ 2,088	-130
Rip40	$70	5.08	$ 1,918	$ 1,848	-330
Inverted (+erosion)	$55	5.88	$ 2,224	$ 2,169	10
Inverted (-erosion)	$55	6.56	$ 2,490	$ 2,435	494
Mixed	$170	6.64	$ 2,499	$ 2,329	165

3. Managing sandy soils post-amelioration

Project: *Managing soils post-amelioration in the Upper South East of SA* is a collaboration between the Mackillop Farm Management Group, PIRSA, the University of South Australia and Coorong Tatiara LAP, funded by GRDC (MFM2106-001RLX; June 2021 to January 2025).

Building on previous research, **the Managing soil post-amelioration project** will deliver activities that help **build growers' confidence and address gaps in knowledge relating to the agronomic management of recently ameliorated soils in the upper South East of South Australia**.

The project will include a two-year series of demonstration trials, soil characterisations, pit demonstrations and associated extension activities.

Benefits to producers by March 2024, 25% of grain growers (and their advisors) in the USE with ameliorated sands:

- Will have adopted management techniques that maximise profitability from ameliorated soils and manage risks of poor crop establishment and wind erosion.
- Will have the ability to re-characterise their soils post-amelioration, including water holding capacity, plant available water, texture, changes in nutrient or constraint distribution, and constraint identification.
- Will be managing ameliorated soils to their newly established economic yield potential.

Project activities - Coomandook

Delivered in collaboration with the Uni SA's Agricultural Machinery Research and Design Centre (AMRDC) a small plot replicated trial will be delivered in 2022, alongside paddock scale demonstration strips in 2022 and 2023. These activities will focus on the 1st and 2nd crop challenges following soil amelioration. **Treatments may include:**

- Seeder based strategies that improve seed germination and crop establishment on water-repellent sands or on rough, uneven and/or soft seedbeds following amelioration
- Low risk one-pass 'till and sow' options
- Agronomic packages such crop cultivar choice and in-furrow fertiliser management.

A range of extension activities and educational workshops will also be delivered throughout the project.

What we need - a host!

- Are you planning to do some amelioration this summer/autumn?
- Not sure what set of soil constraints you are dealing with?
- Not sure what treatments to apply and where?
- Not sure how to optimise crop establishment and agronomy in the first year and reduce erosion risk?
- Happy to work alongside the team from Uni SA and SARDI to explore options, build on the local experiences and help validate best-practice?

Then please get in touch:

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Soil acidity and treatment in the Coorong and Tatiara District Council areas

The extent, causes and treatment

KEY POINTS

- Soil acidity is becoming an emerging and significant issue throughout the Coorong and Tatiara District Council areas presenting a major constraint to crop and pasture production.
- Soil acidity can affect sub-surface and sub-soils.
- Soil pH should be tested in paddocks on a regular basis at 5 cm increments to at least 15 cm.
- Soil acidity can be treated with the use of lime and / or soil modifications (such as ripping, delving, spading and clay spreading) provided that the underlying clay has a neutral or alkaline pH.

Figure 1: Testing soil pH at a soil pit field day

Introduction

The Coroong and Tatiara District Council covers a combined area of 1.54 million hectares. It is a productive area of South Australia with a total value of annual agricultural production of about $490 million (ABS, 2015-16).

Soil acidity (low soil pH) is becoming an emerging and significant problem throughout this area particularly on the sandy to sandy loam textured soils. It is a natural process but is accelerated by more productive and intensive farming practices.

When soil pH falls below a pH of 5.5 ($CaCl_2$) the productivity of crops and pastures starts to decline.

The area of the Coorong and Tatiara District Council area, currently acidic or likely to become acidic in the next few years is approximately 334,500 hectares or 35.6% of the agricultural area with an estimated crop and pasture production loss of $5.8 million per year (Figure 2, Table 1).

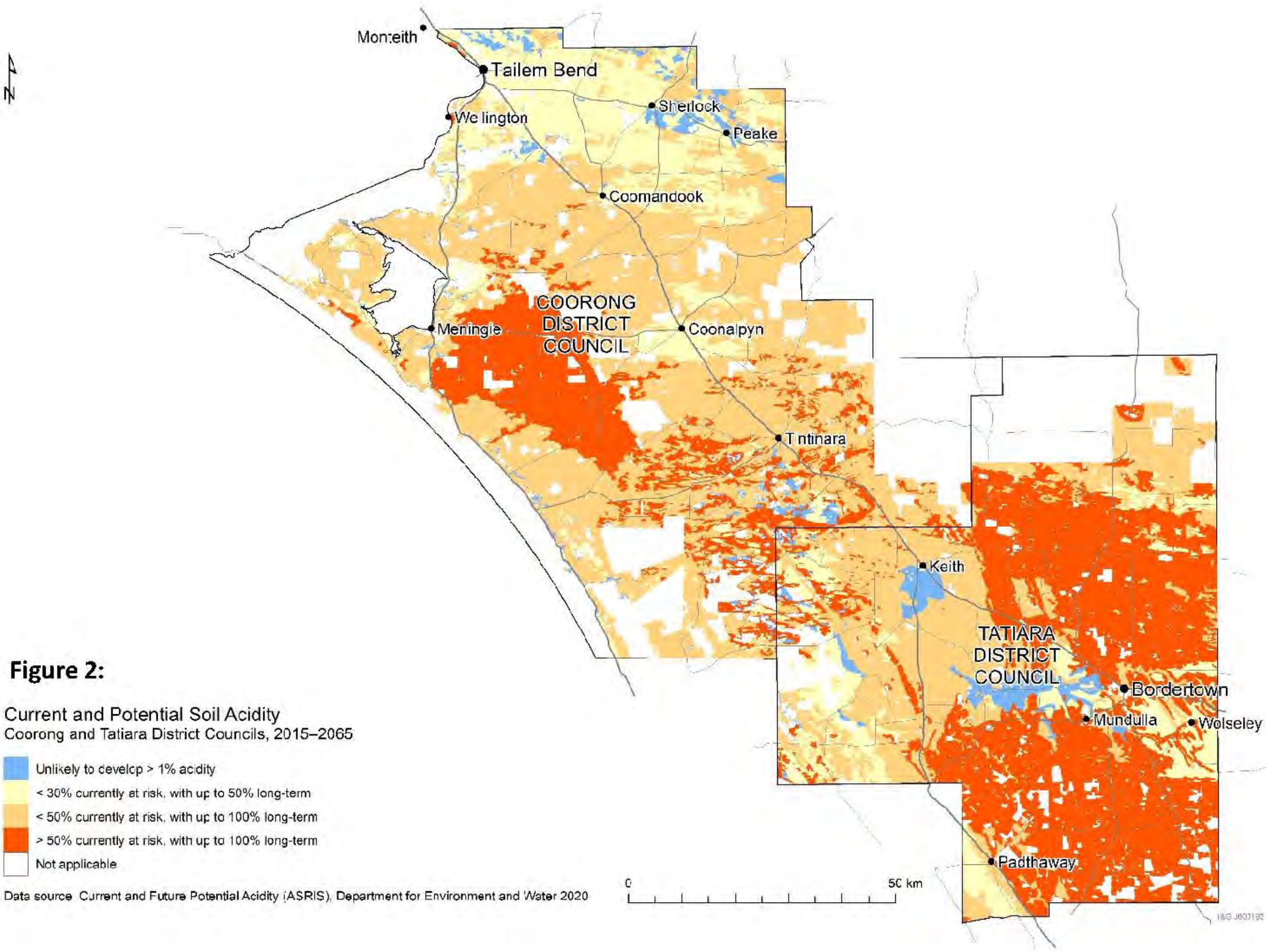


Figure 2:

Current and Potential Soil Acidity
Coorong and Tatiara District Councils, 2015–2065

Data source: Current and Future Potential Acidity (ASRIS), Department for Environment and Water 2020

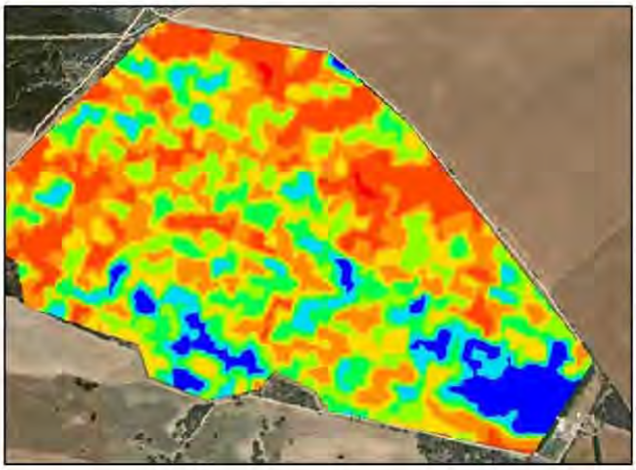
Table 1: Area and total production loss due to soil acidity within each Council area.

	Coorong District		**Tatiara District**		**Total Coorong and Tatiara District**	
Total area	886,084 hectares		652,097 hectares		1.54 million hectares	
Annual agricultural Production (ABS 2015-16)	$247 million		$243 million		$490 million	
	Area impacted (ha)	Total production loss	Area impacted (ha)	Total production loss	Area impacted (ha)	Total production loss
Area currently affected by acidity	117,825	$1.9 million pa	216,690	$3.9 million pa	334,515	$5.8 million pa
Area that will be affected over next few decades	255,448	$3.9 million pa	119,666	$2.2 million pa	375,114	$6.1 million pa
Total	373,273	$5.8 million pa	336,356	$6.1 million pa	709,629	$11.9 million pa

Table 2: Tolerance of crops and pastures to soil acidity (low soil pH)

Very Sensitive	Sensitive	Tolerant	Highly tolerant
Lentils	Canola	Wheat*	Oats
Faba Beans	Phalaris	Sub-clover	Triticale
Chickpeas	Barley	Rye-grass	Lupins
Lucerne	Peas		Couch grass
Annual medics			
Durum wheat			
*Some wheat varieties can be sensitive while others can be tolerant. Wheat varieties that have some tolerance include: Wyalkatchem, Mace and Scepter.			

Figure 7 & 8 shows the correlation between a soil pH map and NDVI map for beans. Where the soil pH is low then the beans are not growing as well.



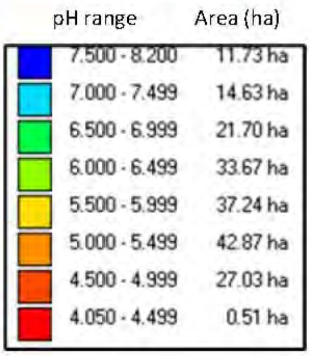


Figure 7

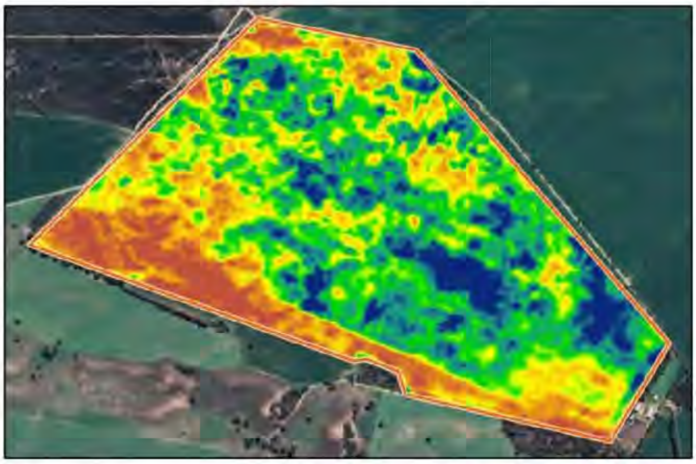


Figure 8

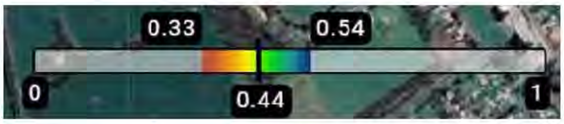


Figure 7: Soil pH Veris® map at Coonalpyn showing a soil pH range from 4.1 to 8.2 ($CaCl_2$).

Figure 8: Showing the NDVI map for beans. Where the soil pH is low – beans are not growing so well (red areas). Dark blue is good growth (Source: Data Farming) August 2020.

Yield penalty

When the soil pH falls below 5.5 ($CaCl_2$) then the yield of crop and pastures starts to decline. Table 3 and 4 show the estimated yield penalty for various crops and pastures with increasing soil acidity.

The data has been sourced from research trials, observations and pH vs yield maps.

Table 3: Estimated yield penalty for various crops with increasing soil acidity

Crop type	Production losses (tonnes per hectare)		
	Soil pH ($CaCl_2$) 5.5 - 5.0	4.9 – 4.51	≤4.5
Wheat (Tolerant)	0	0.2	0.4
Barley	0.2	0.6	1.0
Peas	0.2	0.4	1.0
Lupins	0	0.2	0.4
Beans	0.2	0.6	1.2
Lentils	0.2	0.6	1.2
Hay	0.2	0.4	0.8
Canola	0.2	0.6	1.0
Other (oats / triticale)	0	0.2	0.4

Table 4: Estimated yield penalty for pastures with increasing soil acidity

Crop type	Production losses (tonnes per hectare)		
	Soil pH ($CaCl_2$) 5.5 - 5.0	4.9 – 4.51	≤4.5
Acid sensitive (medic)	0.2	0.6	1.0 – 1.2
Acid tolerant (sub-clover)	0	0.2	0.4

Taking the area from each of the acidic ranges from the soil pH map (Figure 7) and multiplying this by the production losses (Table 3 or 4) and the current commodity price ($/t) will provide an estimate of income lost, which can be quite substantial.

Example of calculating lime rate

Assuming that a paddock with a sandy soil at Coonalpyn had a soil pH of 4.5 ($CaCl_2$) then the cost of the lime from the above sources to raise the soil pH to 5.5 ($CaCl_2$) taking into account the lime quality, freight, distance and spreading costs would vary from $125 to $184/ha.

As lime does not move quickly through the soil, mixing lime within the top-soil with tillage will improve its effectiveness. Lime may take up to two to five years to be fully effective.

Once the top-soil pH has been raised to pH 5.5 ($CaCl_2$) and assuming a rotation of wheat, barley, beans the pay-back period would be in the order 1 to 1.5 years. A maintenance rate of approximately 1 – 2 t/ha tonnes would be required about every 10 years.

Tillage method	Summary	Approx. cost ($/ha)	Approx. payback period (years)	Estimated time the treatment may last (years)
Deep Ripping	Deep Ripping results in minimal incorporation depending on the ripper tynes, however it can bring up some neutral to alkaline clay that can influence surface soil acidity provided that the clay is within 0.6 metres of the surface.	60 - 100	0.6 – 1.0	2-10
Spading	Mixes soil to a maximum working depth of 0.35 -0.4 metres. Can incorporate a range of surface spread amendments (e.g. lime, gypsum, organic matter, sub-soil clay and nutrients).	130	1.2	3-10
Delving and Incorporation	Delving is the use of wide tynes and bringing up neutral to alkaline clay from the lower part of the soil profile to the surface provided that the clay is within 0.6 metres of the surface. Once the clay is brought to the surface it requires incorporation into the surface soil (Figure 10).	300-450	1.9 – 2.3	10+
Clay Spreading and Incorporation	If the clay is too deep in the profile for ripping or delving then clay spreading can be an option. Clay spreading is the removal of sub-soil clay from excavated soil pits, transporting it to the site and spreading it on the soil surface (Figure 11). The total distance from the clay pit must be considered in the total cost per hectare. If the distance is too far, the cost of transporting the clay to the site will prove un-economic. Clay spreading rates can vary from 150 to 250 t/ha with most farmers in the SE now using the higher rates, particularly in the higher rainfall areas. The neutral or alkaline clay on the surface will need to be fully incorporated. The total cost depends on the machinery used, amount of clay applied per hectare, distance from the pits, the amount of over burden of material stockpiled, and incorporation.	500-800	2.5 – 4.0	Up to 20+

Further information

Further information can be obtained from the web-site at: https://acidsoilssa.com.au/

Australian Government | National Landcare Program
COORONG DISTRICT COUNCIL
Tatiara the good country
Coorong Tatiara Local Action Plan
Government of South Australia
Department of Primary Industries and Regions

This project is supported by the Coorong and Tatiara District Councils, through funding from the Australian Government's National Landcare Program.

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