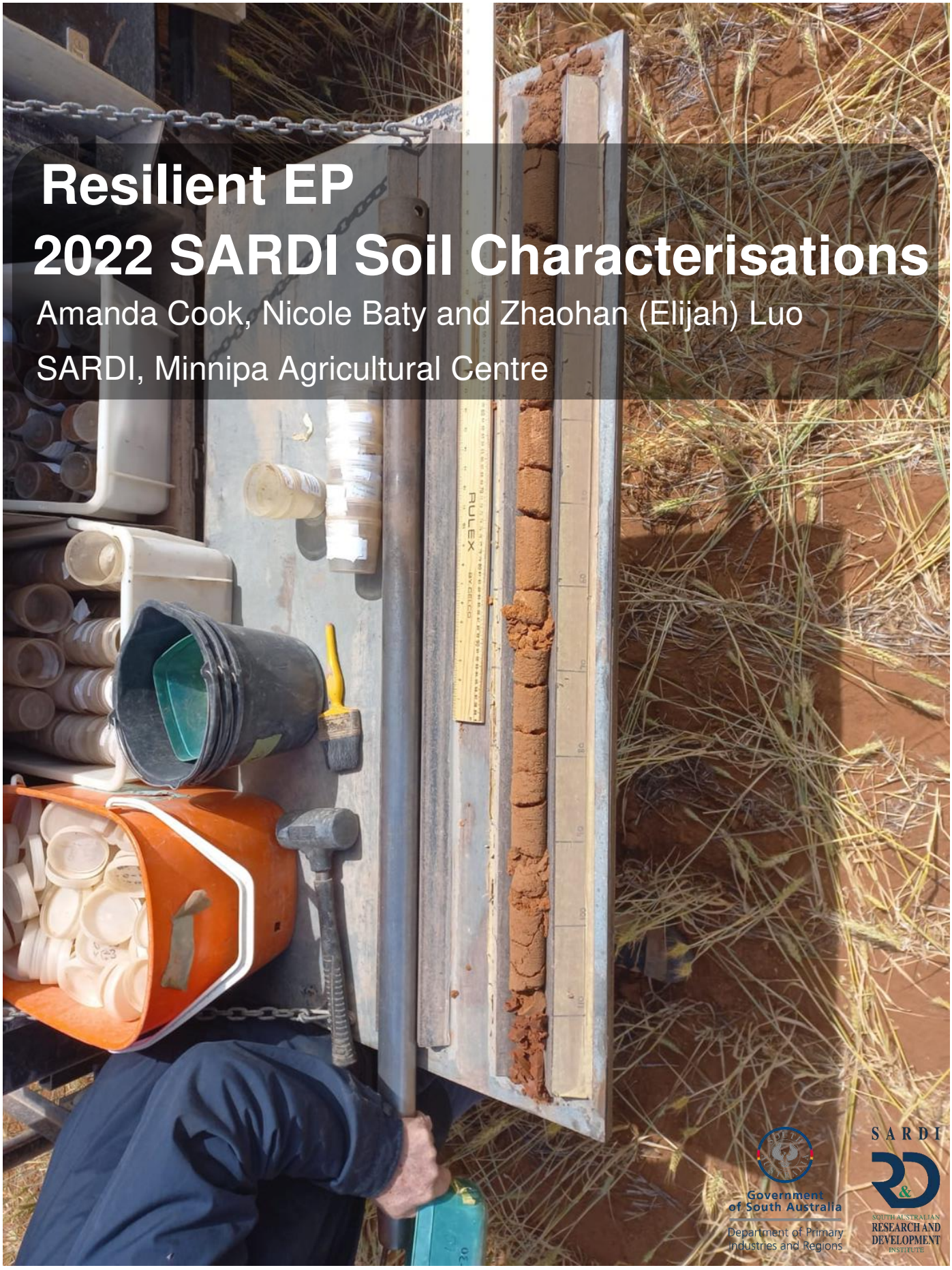
Resilient EP
2022 SARDI Soil Characterisations

Amanda Cook, Nicole Baty and Zhaohan (Elijah) Luo

SARDI, Minnipa Agricultural Centre



Government of South Australia
Department of Primary Industries and Regions

SARDI
South Australian Research and Development Institute

Resilient EP
2022 SARDI Soil Characterisations

Information current as of 1 October 2024

Disclaimer

Department of Primary Industries and Regions and its employees do not warrant or make any representation regarding the use, or results of the use, of the information contained herein as regards to its correctness, accuracy, reliability and currency or otherwise. Department of Primary Industries and Regions and its employees expressly disclaim all liability or responsibility to any person using the information or advice.

All Enquiries

Department of Primary Industries and Regions
Level 14, 25 Grenfell Street
GPO Box 1671, Adelaide SA 5001
T 08 8680 6200 F 08 8680 5020 M 0427 270 154
E amanda.cook@sa.gov.au

Acknowledgements

Thanks to the SARDI Agronomy team, Amanda Cook, Craig Stanley, Ian Richter, Katrina Brands, Kym Zeppel, Marina Mudge, Rebbecca Tomney and Cate Scholz for the field and lab work. Thanks to Therese McBeath (CSIRO), Elijah Luo and Cathy Paterson for reviewing the data and help with the PAWC diagrams.

Delivery Partners

This project is funded by the Australian Government's NLP2 Smart Farming Partnerships program

Australian Government | National Landcare Programme

Delivery Partners

AIR EP | Ag Innovation & Research Eyre Peninsula

CSIRO Regional Connections SquareV EPAG RESEARCH Government of South Australia Primary Industries and Regions SA SARDI RESEARCH AND DEVELOPMENT

Background

Soil characterisations were undertaken by SARDI Minnipa Agricultural Centre staff in 2022 at eleven Eyre Peninsula soil moisture probe sites as contracted through the National Landcare Program Project, Resilient EP, "Creating a new paradigm for resilient and profitable farming on the Eyre Peninsula".

Project Aims

This project aims to ground truth new and emerging technologies including use of data from soil moisture probe and automatic weather station networks, GIS systems (satellite drone and imagery), decision tools being developed by the CSIRO (Grain Cast, C-Crop), and more sophisticated seasonal weather forecasting tools being developed by the BOM, Ag Victoria and SARDI. The project will evaluate a range of on-ground practices based on real time soil moisture and climate data to optimise productivity and reduce financial and soil erosion risk. The project will ensure there are effective linkages between the science and on-ground application though the formation of a regional drivers group (RIG) made up leading farmers and farm advisers.

Soil Characterisations

The full soil characterisations were undertaken by SARDI, Minnipa Agricultural Centre Agronomy team in March 2022 at eleven grower soil moisture probe sites when cropped to cereal. Crop lower limits were taken under rain out shelters in October and November just before crop harvest. Amanda Cook was responsible for undertaking the soil characterisations along with Ian Richter, Craig Stanley, Katrina Brands, Kym Zeppel, Marina Mudge, Rebbecca Tomney and Cate Scholz. The soil characterisations were undertaken following the 'Estimating plant available water capacity', Burk and Dalgliesh protocols, 2013, and 'Field protocols to APSoil characterisations', CSIRO October 2016. On Eyre Peninsula 2022 was a Decile 7-10 season, so crop lower limits were taken again in October and November 2023 to get a more accurate measurement of the amount of soil moisture removed from the soil profile.

Soil measurements taken included:

- Soil chemistry
- Bulk density (BD)
- Drained Upper Limit (DUL) – maximum soil water holding capacity (in-field)
- Crop Lower Limit (CLL) – amount water a cereal crop can remove from the soil profile
- Soil texture and colour
- Rock content
- Photos of soil to depth.

2022 sites which were soil characterised were:

- Buckleboo, Baldock
- Darke Peak, Wake
- Karkoo, Wilksch
- Minnipa, Scholz
- Palkagee (Lock), Glover
- Ungarra (Hinks), Modra
- Ungarra, Phyllis
- Warramboo, Pope
- Yabmanna (Cleve), Beinke
- Yeelanna (Pooh Bear), Wilksch
- Yeltuka, Treloar

The sites were wet up and sampled according to the Burk and Dalgliesh protocols. The 1000 L shuttles were filled with EP mains water weekly and allowed to drain according to soil type. See field logs for individual site details on timing and the amount of water applied.

Soil chemistry samples were collected (away from the wet site) from 3 soil cores to depth which was dried at 40^{o}C for 96 hours then bulked to form a composite sample. The chemistry analysis was undertaken by CSBP, Western Australia. Calcium carbonate content to depth, and Phosphorus Buffering Index and DGT P level to 30 cm depth were also analysed.

Soil Test Methodology

Extracted from APAL Soil Laboratory Methods, valid to 31 December 2022.

Amm. acetate exchangeable cations (Ca, Mg, K, Na)
Rayment and Lyons Method 15D3
Units of measurement mg/kg
Soils are shaken end-over-end for 1 hour in 1M ammonium acetate solution pH 7.0 at a ratio of 1:10. Automated emission spectrometry analysis of soil extracts is performed by ICP-OES. This is APAL's default method for measuring exchangeable cations. Alternative methods are available depending on your soil type, or the nature of the investigation.
Perkin Elmer Avio 500 ICP-OES Spectrometer; PerkinElmer Inc.

Ammonium-N
Units of measurement mg/kg
Soils are shaken end-over-end for 1 hour in 2M KCl at a ratio of 1:10. Automated colorimetric analysis of soil extracts is performed on a Continuous Flow Analyser.
Instrument: Skalar San ++ Continuous Flow Analyser (Skalar Analytical B.V., Breda, Netherlands)

Boron (Hot $CaCl_2$)
Rayment and Lyons Method 12C2
Units of measurement mg/kg
Soils in 0.01M calcium chloride solution at a ratio of 1:2 are heated in a microwave oven to boiling (without shaking). Automated emission spectrometry analysis of soil extracts is performed by ICP-OES.
Instrument: Perkin Elmer Optima 8300 ICP-OES Spectrometer; PerkinElmer Inc.

Colwell Extractable Phosphorus
Rayment and Lyons Method 9B2
Units of measurement mg/kg
Soils are shaken end-over-end for 16 hours in 0.5M sodium bicarbonate pH 8.5 solution at a ratio of 1:100. Automated colorimetric analysis of soil extracts is performed on Continuous Flow Analyser.
Instrument: Skalar San ++ Continuous Flow Analyser (Skalar Analytical B.V., Breda, Netherlands)

Colwell Extractable Potassium
Rayment and Lyons Method 18A1
Units of measurement mg/kg
Soils are shaken end-over-end for 16 hours in 0.5M sodium bicarbonate pH 8.5 solution at a ratio of 1:100. Automated emission spectrometry analysis of soil extracts is performed by ICP-OES. This method is favoured by some agronomists for assessing soil K status. Due to the very high dilution factor imposed by a 1:100 soil:solution ratio, the method is not recommended for soils with low CEC and low K status.
Instrument: Perkin Elmer Optima 8300 ICP-OES Spectrometer; PerkinElmer Inc.

Diffusive Gradient Thin Film Phosphorus (DGT-P)
Rayment and Lyons Method – Not applicable
Mason S (2012). DGT Commercial Protocol (2) – Deployment and analysis. The University of Adelaide
Units of measurement µg/L
DGT has been developed for the assessment of available P in a wide range of Australian soils. The mode of measurement is by diffusion of available P in the soil toward a P sink (an iron oxide gel) via a membrane which controls movement of P to the sink. Colorimetric analysis of soil extracts is performed on a UV-VIS spectrophotometer. DGT measurement incorporates the initial soil solution P concentration and also the ability of the soil to resupply the soil solution pool in response to the removal of P, mimicking plant phosphorus uptake better in many soils than traditional phosphorus soil test methods.
Instrument: Thermo Spectronic Unicam Helios Delta UV-Vis Spectrophotometer (Thermo Fisher Scientific, Massachusetts, USA).

DTPA Trace Elements (Extractable Cu, Fe, Mn, Zn)
Rayment and Lyons Method 12A1
Units of measurement mg/kg
Soils are shaken end-over-end for 2 hours in 0.005M DTPA, 0.01M $CaCl_2$, 0.10M triethanolamine (TEA) solution at a ratio of 1:2. Automated emission spectrometry analysis of soil extracts is performed by ICP-OES.
Instrument: Perkin Elmer Optima 8300 ICP-OES Spectrometer; PerkinElmer Inc.

EC (1:5 Soil / Water Extract), pH Water, pH $CaCl_2$ following pHw
Rayment & Lyons Method 3A1, 4A1, 4B4
Units of measurement pH, dS/m
Soils are shaken end-over-end for 1 hour in deionised water at a ratio of 1:5. Fully automated analysis of soil extracts is performed on a roboticised Skalar pH/EC system. Electrical conductivity is measured with a conductivity cell and multi-mode meter. pH is measured with a pH electrode and the same meter. EC is measured initially, and then pH water. The instrument subsequently adds calcium chloride to achieve 0.01M calcium chloride, stirs and allows an equilibration period before returning to read pH CaCl2.
Instrument: OrionStar A215 meter (Thermo Fisher Scientific, Massachusetts, USA) and Orion 013005MD Conductivity cell (Thermo Fisher Scientific, Massachusetts, USA).

Exchangeable acidity (Al + H)
Rayment and Lyons Method 15G1
Units of measurement cmol/kg
Soils are shaken end-over-end for 1 hour in 1M KCl solution at a ratio of 1:10. Extracts are analysed by automated acid/base titrimetry, in a 2-step titration. Total exchangeable acidity is initially measured by titration of an aliquot with 0.008M sodium hydroxide solution to pH 8.0. An aliquot is simultaneously removed and filtered through a 0.45 µm membrane with glass fibre pre-filter, and then analysed for aluminium by ICP-OES. Analysis by ICP-OES instead of titration removes concerns about the assumption in the cmol/kg result derived from titration that all aluminium present is trivalent. ICP-OES measures and reports aluminium regardless of form or valency. The solution mg/L is converted to cmol/kg. This method is the best available method for assessing the total potential toxic Al in acidic soils. pH alone is not a sufficient indicator, or in many cases not an indicator at all of Al toxicity.
Instrument: Perkin Elmer Optima 8300 ICP-OES Spectrometer; PerkinElmer Inc.
Instrument: Metrohm 855 Robotic Titrosampler (Metrohm AG, Herisau, Switzerland)

Extractable Sulfur (KCl)
Rayment and Lyons Method 10D1
Units of measurement mg/kg
Soils are equilibrated (without shaking) for 3 hours at 40^{o}C in 0.25M potassium chloride solution at a ratio of 4.5:30. Automated emission spectrometry analysis of soil extracts is performed by ICP-OES.
Instrument: Perkin Elmer Optima 8300 ICP-OES Spectrometer; PerkinElmer Inc.

Micro-Pipette Australian Particle Size Analysis
Rayment and Lyons Method - Not applicable
In-house methodology
Units of measurement % and texture class
Soil samples are shaken overnight in a dispersing solution of hexametaphosphate. Once removed, and after a final shake just prior to commencing timing, a fixed aliquot of solution is withdrawn at a set depth from the vessel based on settling velocity of clay particles. This aliquot is dried at 105^{o}C, and weight corrected for the weight of hexametaphosphate salt. This yields the clay fraction. The remaining test solution is filtered through a 20 µm mesh sieve, transferred to a drying vessel and dried at 105^{o}C. This yields the sand fraction. The silt fraction is calculated as 100% - (sand + clay%). R code is used to generate a textural classification from the Australian soil textural triangle. This version of the method reports % sand, silt and clay.

Nitrate-N
Rayment and Lyons Method 7C2a
Units of measurement mg/kg
Soils are shaken end-over-end for 1 hour in 2M KCl at a ratio of 1:10. Automated colorimetric analysis is performed on a Continuous Flow Analyser. The chemistry module utilises vanadium (III) reduction of nitrate to nitrite, and subsequent measurement as nitrite.
Instrument: Skalar San ++ Continuous Flow Analyser (Skalar Analytical B.V., Breda, Netherlands)
Organic Carbon (Walkley and Black)
Rayment and Lyons Method 6A1
Units of measurement %
The Walkley-Black method utilises the reaction of concentrated sulfuric acid and dichromate solution to achieve a temperature catalysed oxidation of organic matter in soils. The chromic ions produced are proportional to the oxidised organic carbon and measured colorimetrically on a UV-VIS spectrophotometer.
Instrument: Thermo Spectronic Unicam Helios Delta UV-Vis Spectrophotometer (Thermo Fisher Scientific, Massachusetts, USA).

Phosphorus Buffering Index - PBI + Col P
Rayment and Lyons Method 9I2b
Units of measurement None
Soils are shaken end-over-end for 17 hours in 100 mg P/L/0.01M calcium chloride equilibrating solution at a ratio of 1:10. Automated emission spectrometry analysis of soil extracts is performed by ICP-OES. The calculation is based on the amount of P sorption by the soil from the 100 mg/L solution, plus the measured Colwell P representing total P sorption.
Instrument: Perkin Elmer Optima 7300 ICP-OES Spectrometer, Perkin Elmer Optima 8300 ICP-OES Spectrometer, Perkin Elmer Avio 500 ICP-OES Spectrometer; PerkinElmer Inc.

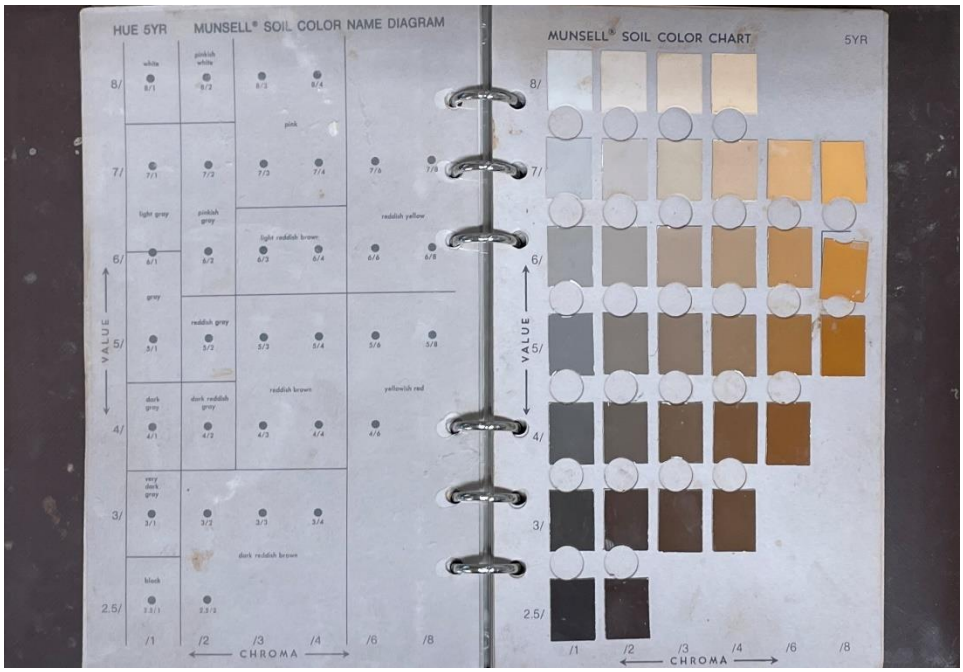
PHYSICAL CLASSIFICATION OF SOILS

Relative Texture Gradings of soil

CATEGORY	GENERAL DESCRIPTION OF DRY STATE	BEHAVIOURS OF MOIST BOLUS
1.0 SAND	Consists almost exclusively of sand grains. Flows easily through the fingers.	Coherence nil to very sight. Cannot be moulded; single grains adhere to fingers.
1.5 SAND/LOAM	Sand particles predominate. Ill-defined crumbs from surface, off which sand is easily rubbed.	Only slightly coherent but very sandy to touch. Will roll out or form a ribbon of about 10-15 mm. Larger sand grains visible to the naked eye.
2.0 LOAM	Heterogeneous. Loam alternates with sand. Not uniform in compactness.	Rather spongy and coherent. Smooth feel with no obvious sandiness. The presence of much organic matter makes the soil feel rather greasy. Sample will form a ribbon of approximately 20-25 mm.
2.5 LOAM/CLAY	Not quite homogeneous powder. Compact-crumbly but not so hard.	Coherent and plastic. Smooth to manipulate, forming a ribbon 45-50 mm.
3.5 VERY HEAVY CLAY	Fine homogeneous powder. Very compact. Forms very hard crumbs.	Very smooth and plastic. Handles like plasticine. Can be moulded and rolled out in a ribbon of 80 mm or more.

MUNSELL SOIL COLOR CHART

The Munsell Soil Color Chart is the most widely used method used for determining soil colours. Soil colour is determined via a visual comparison between the colour chips and air-dried bulk soil samples. In this system, colour is expressed in terms of hue (dominate base colour), value (lightness or darkness) and chroma (intensity of basic hue).



Crop Lower Limit (field)

Crop Lower Limit (CLL) soil samples were collected as crops ripened and before the early November rains. Larger rain out shelters were used to cover a larger crop area in 202**2**. On Eyre Peninsula 2022 was a Decile 7-10 season, so crop lower limits were taken again in October-November 2023 after cereal crops to get more accurate measurements for the amount of soil moisture removed from the soil profile. An accurate CLL after a cereal crops is needed for an accurate calculation of overall Plant Available Water (PAWC) content of the soil profile. Thank you to Therese McBeath CSIRO, for reviewing the data and PAWC graphs.

1. Buckleboo, Baldock

Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Baldock 2022	Buckleboo	-32.974365	136.209964	Sandy loam	120	3000 L	11 days	8 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth - Wheat (cm)	Description
21 Feb	21 Feb 1000 L 21 Feb 1000 L 2 Mar 1000 L	10 March 2022	120	90	Dark red sandy loam from 0-10 cm, dark red clay from 10-120 cm

Site photo with slope, 10th March 2022.

Soil profile, October 2022.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark red	2.5/4 2.5YR	Sandy loam	16.2	75.5	8.3
10-20	Dark red	3.6 2.5YR	Clay	34.6	55.6	9.8
20-30	Dark red	3.6 10R	Clay	34	57	9
30-40	Red	4.6 10R	Clay	32.2	58.2	9.6
40-50	Red	4.6 2.5YR	Clay	36.1	53.1	10.8
50-60	Red	4.6 10R	Clay	38.8	49	12.2
60-80	Red	4.6 2.5YR	Clay	41.3	47.6	11.1
80-100	Red	4.6 2.5YR	Clay	40.7	51.1	8.2
100-120	Dark red	3.6 10R	Clay	39.9	55.6	4.5

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	<1	7.9	11	310	12	0.62	0.2
10-20	<1	11	<5	450	37	0.48	0.48
20-30	<1	11	<5	300	87	0.41	0.76
30-40	<1	9.5	<5	280	150	0.27	1.2
40-50	<1	7.7	<5	300	220	0.25	1.6
50-60	<1	4.8	<5	300	250	0.23	1.8
60-80	<1	3	<5	390	230	0.2	1.9
80-100	<1	3.2	<5	410	260	0.17	2
100-120	<1	3	<5	350	220	0.23	1.5

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	7.89	8.78	51	<0.4	58	1.75	3
10-20	8.37	9.21	109	2.3	14	5.87	8.7
20-30	8.2	9.15	158	10	nd	*7.2*	*17*
30-40	8.31	9.16	150	15	nd	*8.7*	*27*
40-50	8.33	9.1	160	24	nd	*10.9*	*29*
50-60	8.31	9.08	167	29	nd	*11.4*	*27*
60-80	8.41	9.09	161	15	nd	*12.8*	*36*
80-100	7.72	8.17	184	<0.4	nd	*13.8*	*29*
100-120	4.71	5.37	124	<0.4	nd	*11.1*	12

nd – no data

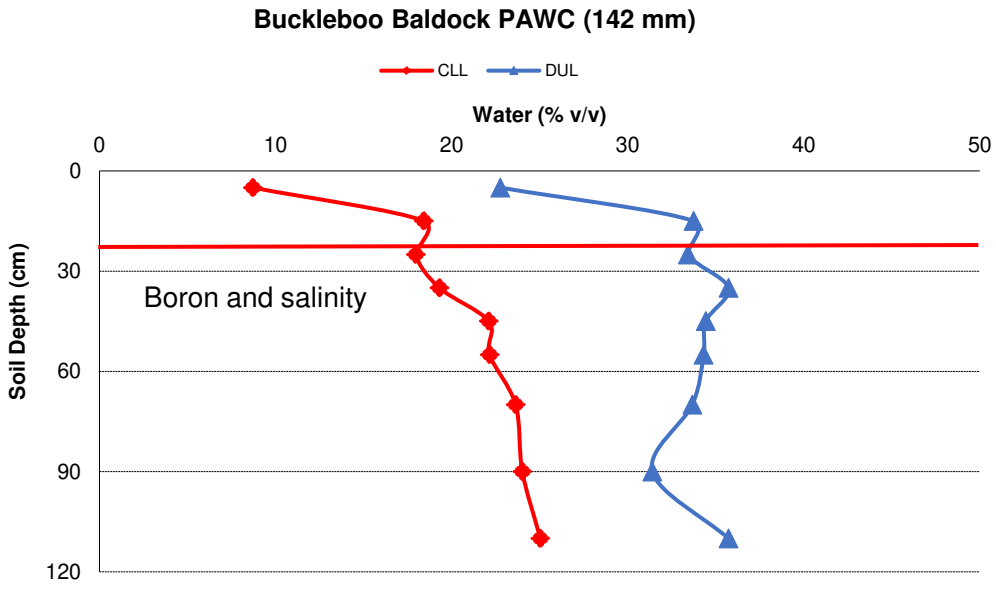
Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.43	4.3	3.9	0.47	<0.02	9.6	3.2	0.835
10-20	0.62	5.4	1.9	0.19	<0.02	24.2	8.51	0.968
20-30	0.99	5.7	1.5	0.11	<0.02	24.1	8.98	0.744
30-40	1.2	3.9	1	0.09	<0.02	22	8.85	0.762
40-50	1.3	3.5	0.9	0.1	<0.02	22.3	8.88	0.772
50-60	1.4	3.5	0.9	<0.08	<0.02	21.7	8.84	0.808
60-80	0.97	1.8	0.4	<0.08	<0.02	21.6	9.59	0.996
80-100	0.69	2.9	<0.3	<0.08	<0.02	10.9	9.4	0.98
100-120	0.83	11	<0.3	0.13	0.5	3.59	7.24	0.702

Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per layer (mm)	Ave PAWC Profile (mm)	Midpoint (cm)
Baldock, T	Buckleboo	0-10	1.47	23	9	14		5.00
Baldock, T	Buckleboo	10-20	1.37	34	18	15		15.00
Baldock, T	Buckleboo	20-30	1.29	33	18	15		25.00
Baldock, T	Buckleboo	30-40	1.32	36	19	16		35.00
Baldock, T	Buckleboo	40-50	1.36	34	22	12	142	45.00
Baldock, T	Buckleboo	50-60	1.34	34	22	12		55.00
Baldock, T	Buckleboo	60-80	1.46	34	24	20		70.00
Baldock, T	Buckleboo	80-100	1.42	31	24	15		90.00
Baldock, T	Buckleboo	100-120	1.36	36	25	21		110.00

PAWC Diagram



2. Darke Peak, Wake
Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Wake 2022	Darke Peak	-33.441673	136.181336	Sandy loam over clay	120	3000 L	14 days	8 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth - Canola (cm)	Description
18 Feb 1000 L	18 Feb 2000 L 2 Mar 1000 L	10 March 2022	100	55	Dark reddish brown sandy loam from 0-10 cm, followed by yellowish red clay loam from 10-20 cm. Dark red to red clay from 20-40 cm. Yellowish red/reddish yellow clay from 40-100 cm.

Site photo with slope, 10 March 2022.


Soil profile, 10 March 2022.


Soil profile, October 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark reddish brown	3.3 2.5YR	Sandy loam	13.5	77.3	9.3
10-20	Yellowish red	4.6 5YR	Clay loam	29.2	59.7	11.1
20-30	Dark red	3.6 2.5YR	Clay	41.1	46.7	12.2
30-40	Red	4.6 5YR	Clay	44.8	40.4	14.8
40-50	Yellowish red	4.6 5YR	Clay	43.9	36.3	19.8
50-60	Yellowish red	5.6 5YR	Clay	43.3	37.4	19.3
60-80	Reddish yellow	6.6 5YR	Clay	42.9	40.1	17
80-100	Yellowish red	5.6 5YR	Clay	42.9	44.3	12.8

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conducti -vity (dS/m)
0-10	1.7	6.2	55	470	9.4	1.43	0.075
10-20	1.2	4.3	20	370	10	0.68	0.21
20-30	<1	4.7	9	270	20	0.13	0.25
30-40	<1	4.1	7	250	41	0.68	0.39
40-50	<1	5.1	7	240	60	0.58	0.63
50-60	<1	4.7	7	280	70	0.44	0.84
60-80	<1	4.2	6	300	65	0.43	1
80-100	<1	4.9	<5	380	100	0.19	0.57

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	5.85	6.71	41	<0.4	258	0.206	1.2
10-20	7.57	8.13	69	1.6	36	0.788	2.4
20-30	8.02	8.67	115	7.4	nd	2.02	4.6
30-40	8.28	9.01	169	15	nd	3.84	7.3
40-50	8.37	9.15	193	26	nd	*5.84*	9.3
50-60	8.38	9.18	195	27	nd	*6.93*	11
60-80	8.46	9.33	189	26	nd	*8.44*	*15*
80-100	8.65	9.91	183	22	nd	*12.5*	*22*

nd – no data

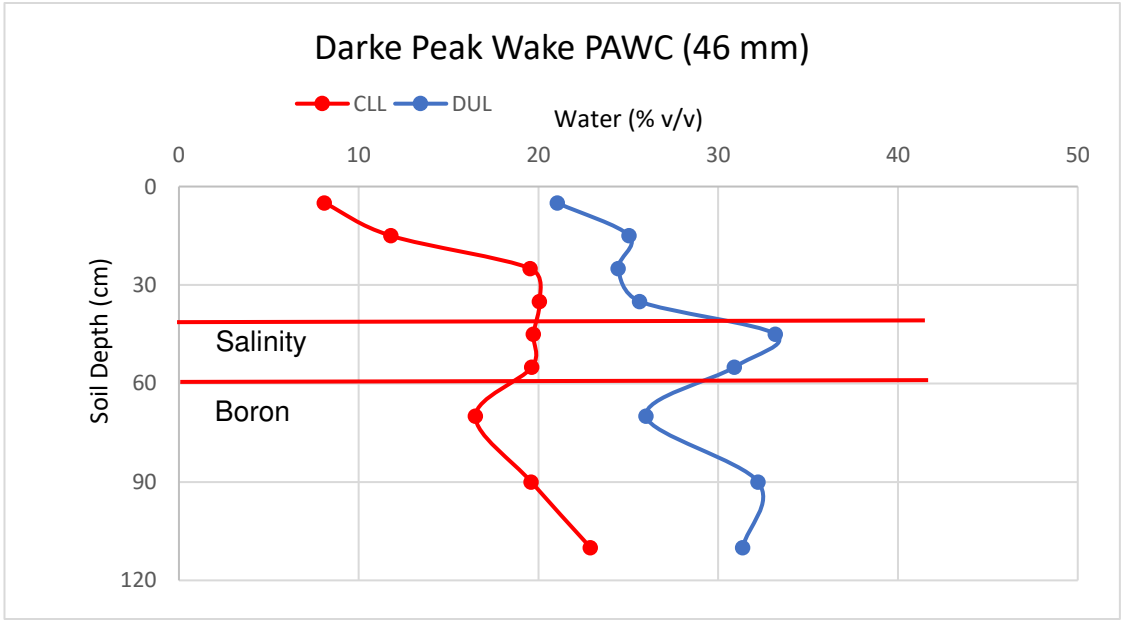
Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.46	21	11	0.59	<0.02	7.24	2.11	1.29
10-20	0.67	12	3.9	0.23	<0.02	22	6.53	1.15
20-30	1.1	10	1.7	0.17	<0.02	27.9	10.4	0.941
30-40	1.7	9.8	2	0.19	<0.02	27.6	12.7	0.822
40-50	2	6.8	1.9	0.15	<0.02	25	13.7	0.812
50-60	2	6.5	1.8	0.21	<0.02	23	13.1	0.846
60-80	1.5	6.4	1.8	0.26	<0.02	21.2	13	0.882
80-100	1	5.8	0.9	0.28	<0.02	19.5	11.9	1.1

Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Wake, B	Darke Peak	0-10	1.48	21	8	6		5.00
Wake, B	Darke Peak	10-20	1.55	25	12	7		15.00
Wake, B	Darke Peak	20-30	1.41	24	20	2		25.00
Wake, B	Darke Peak	30 - 40	1.45	26	20	3		35.00
Wake, B	Darke Peak	40-50	1.35	33	20	7	46	45.00
Wake, B	Darke Peak	50 - 60	1.34	31	20	6		55.00
Wake, B	Darke Peak	60-80	1.28	26	16	5		70.00
Wake, B	Darke Peak	80-100	1.33	32	20	6		90.00
Wake, B	Darke Peak	100-120	1.34	31	23	4		110.00

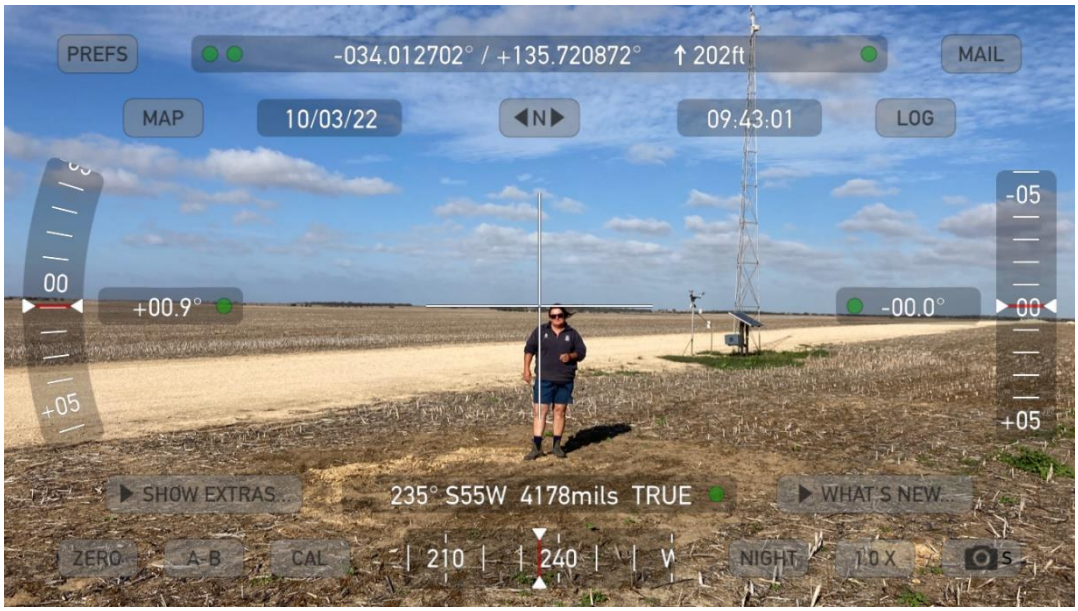
PAWC Diagram



3. Karkoo, Wilksch
Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Wilksch 2022	Karkoo	-34.012702	135.720872	Sand over clay	120	3000 L	13 days	9 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth – Wheat (cm)	Description
17 Feb	17 Feb 1000 L 17 Feb 1000 L 1 Mar 1000 L	10 March 2022	110	75	Very dark greyish sand from 0-10 cm, brown to strong brown sand from 10-40 cm, followed by a layer of yellowish brown sandy loam from 40-50 cm shifting to a yellowish brown sandy clay at 50-60 cm. Brown-yellowish clay from 60-110 cm.



Site photo with slope, 10 March 2022.

Soil profile, 10 March 2022

Soil profile, November 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Very dark greyish brown	3.2 10YR	Sand	4.8	91.9	3.3
10-20	Brown	5.3 10YR	Sand	6.2	91.7	2.1
20-30	Strong brown	5.6 7.5YR	Sand	4.5	94.5	1
30-40	Strong brown	5.6 7.5YR	Sand	2.8	95.4	1.8
40-50	Yellowish brown	5.6 10YR	Sandy clay loam	24.2	73.3	2.5
50-60	Yellowish brown	5.6 10YR	Sandy clay	41.8	55.8	2.4
60-80	Brownish yellow	6.8 10YR	Clay	43.3	48.6	8.1
80-100	Yellowish brown	5.6 10YR	Clay	42.2	47.4	10.5
100-120	Brownish yellow	6.6 10YR	Clay	42.5	48.1	9.4

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	1.4	22	22	310	8.7	1.15	0.14
10-20	<1	7.7	26	260	4.5	0.59	0.093
20-30	<1	5.2	26	160	7.9	0.36	0.075
30-40	1.5	5.2	21	93	7.8	0.22	0.061
40-50	<1	3.5	27	280	11	0.32	0.1
50-60	<1	4.3	12	500	15	0.2	0.24
60-80	<1	6.6	11	500	29	0.24	0.32
80-100	<1	6.2	<5	480	52	0.27	0.38
100-120	<1	9	<5	560	67	0.17	0.5

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	7.53	7.68	18	<0.4	256	0.101	1.1
10-20	7.57	7.71	17	<0.4	171	0.064	0.67
20-30	7.34	7.92	16	<0.4	nd	0.07	0.57
30-40	7.03	7.51	15	<0.4	nd	0.068	0.56
40-50	6.97	7.76	49	<0.4	nd	0.715	0.37
50-60	7.87	8.54	86	0.9	nd	1.77	1.9
60-80	8.14	8.94	135	17	nd	2.35	3.8
80-100	8.23	9.08	153	30	nd	2.65	6.7
100-120	8.31	9.21	140	22	nd	3.75	6.9

nd – no data

Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.44	5	3.2	2.3	<0.02	6.89	0.819	0.704
10-20	0.53	7.5	1.7	1.3	<0.02	4.8	0.458	0.554
20-30	0.49	11	0.8	0.5	<0.02	2.5	0.224	0.245
30-40	0.27	12	0.5	0.3	<0.02	1.63	0.204	0.159
40-50	0.22	26	<0.3	0.11	<0.02	7.08	2.61	0.701
50-60	0.15	15	<0.3	0.12	<0.02	16.2	5.76	1.24
60-80	0.27	11	<0.3	0.12	<0.02	22.6	6.2	1.27
80-100	0.21	6.1	<0.3	0.14	<0.02	22.3	6.18	1.16
100-120	0.21	4.2	<0.3	0.22	<0.02	21.8	7.17	1.49

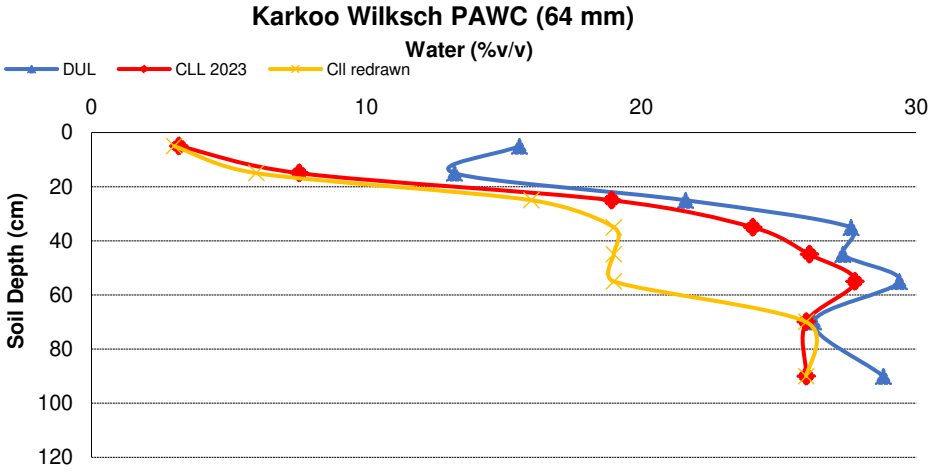
Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave DUL Vol. (%)	Ave CLL Vol. (%)	2022 Ave. PAWC per layer (mm)	2020 & 2023 PAWC per layer (mm)	Ave PAWC Profile (mm)*	Midpoint (cm)
Wilksch, J	Karkoo	0-10	1.39	16	3	12	13	64	5.00
Wilksch, J	Karkoo	10-20	1.64	13	8	6	7		15.00
Wilksch, J	Karkoo	20-30	1.65	22	19	3	6		25.00
Wilksch, J	Karkoo	30-40	1.59	28	24	4	9		35.00
Wilksch, J	Karkoo	40-50	1.48	27	26	1	8		45.00
Wilksch, J	Karkoo	50-60	1.50	29	28	2	10		55.00
Wilksch, J	Karkoo	60-80	1.45	26	26	11	11		70.00
Wilksch, J	Karkoo	80-100	1.38	29	26	6	nd		90.00
Wilksch, J	Karkoo	100-120	1.45	28	23	10	nd		110.00

*Note. The 2020 In crop soil moisture PAWC graph indicates this profile was not close to CLL when sampled in 2023.

PAWC Diagram



*Note. The CLL redraw used the 2020 In crop soil moisture for the CLL as the 2023 canola crop did not draw the soil moisture below 30 cm depth compared to the 2020 cereal.

4. Minnipa, Scholz
Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Scholz 2022	Minnipa	-32.764792	135.158210	Sandy loam	120	3000 L	9 days	13 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth – Wheat (cm)	Description
22 Feb	22 Feb 1000 L 22 Feb 1000 L 2 Mar 1000 L	15 March 2022	120	100	Dark reddish brown sandy loam from 0-10 cm, followed by red sandy loam from 10-30 cm. Yellowish red sandy loam from 30-60 cm, then reddish yellow sandy loam from 8-100 cm to yellowish red loam from 100-120 cm.

Site photo with slope, 15 March 2022.

Soil Profile, October 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark reddish brown	3.2 2.5YR	Sandy loam	9.7	84.3	6
10-20	Red	4.6 2.5YR	Sandy loam	12.2	80	7.8
20-30	Red	4.6 2.5YR	Sandy loam	11.5	82	6.5
30-40	Yellowish red	4.6 5YR	Sandy loam	9.6	84.1	6.3
40-50	Yellowish red	4.6 5YR	Sandy loam	9.2	84.1	6.7
50-60	Yellowish red	5.6 5YR	Sandy loam	9.4	83.5	7.1
60-80	Reddish yellow	6.6 5YR	Sandy loam	10.6	81.2	8.2
80-100	Reddish yellow	6.6 5YR	Sandy loam	12.7	77.7	9.6
100-120	Yellowish red	6.6 5YR	Loam	17.1	71.5	11.5

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	<1	7.2	13	390	4.1	0.71	0.11
10-20	<1	4.6	<5	330	4.4	0.48	0.11
20-30	<1	6.2	<5	280	9.1	0.35	0.12
30-40	<1	7.4	<5	200	9.6	0.31	0.11
40-50	<1	6.8	<5	170	9.1	0.26	0.11
50-60	<1	8.7	<5	160	9.7	0.26	0.12
60-80	<1	6.5	<5	180	11	0.21	0.16
80-100	<1	10	<5	280	15	0.22	0.36
100-120	<1	21	<5	400	24	0.18	0.68

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	8.1	8.82	79	4.1	16	0.056	1.2
10-20	8.13	8.92	114	8.8	<4	0.078	1.4
20-30	8.1	8.74	130	12	nd	0.08	9.9
30-40	8.12	8.79	237	13	nd	0.115	1.5
40-50	8.18	8.86	320	12	nd	0.167	1.4
50-60	8.2	8.87	356	14	nd	0.212	1.5
60-80	8.31	9.17	372	19	nd	0.726	1.8
80-100	8.42	9.62	348	24	nd	2.04	5.4
100-120	8.37	9.83	339	33	nd	5.03	13

nd – no data

Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.22	2.1	2.6	0.32	<0.02	22.2	1.35	0.978
10-20	0.37	2.1	1.7	0.11	<0.02	22.6	1.56	0.81
20-30	0.44	2	1.3	<0.08	<0.02	20.9	1.63	0.558
30-40	0.4	2	1.2	0.11	<0.02	21.3	2.12	0.514
40-50	0.37	1.9	1	0.08	<0.02	21	2.73	0.362
50-60	0.31	1.7	0.9	0.09	<0.02	20.8	3.4	0.367
60-80	0.32	1.8	0.7	<0.08	<0.02	19.5	4.67	0.412
80-100	0.37	1.7	0.5	<0.08	<0.02	18.4	4.92	0.601
100-120	0.54	1.5	0.6	<0.08	<0.02	16.9	5.16	0.987

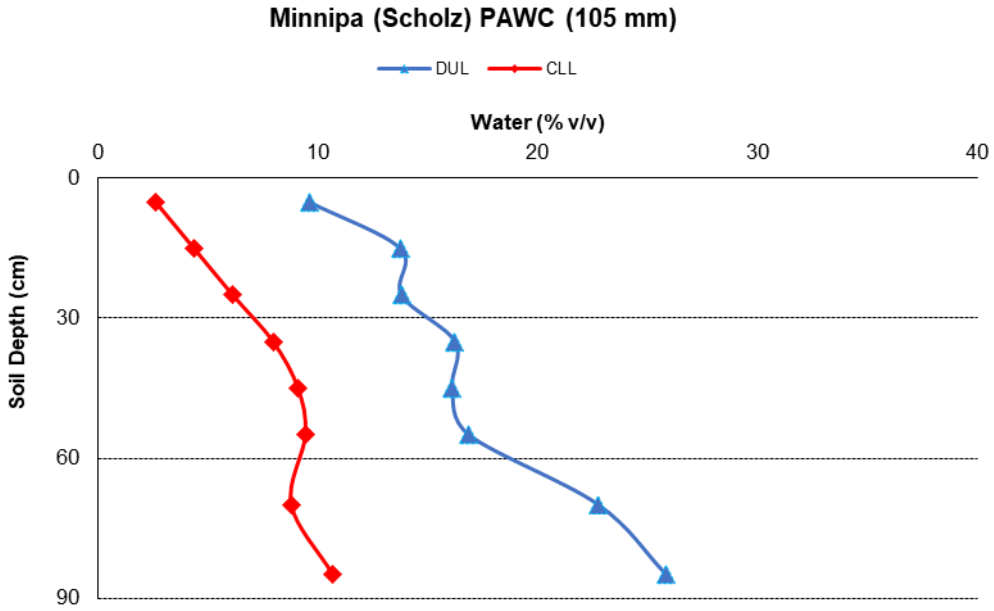
Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Schloz, G&R	Minnipa	0-10	1.49	10	3	7		5.00
Schloz, G&R	Minnipa	10 to 20	1.53	14	4	9		15.00
Schloz, G&R	Minnipa	20-30	1.45	14	6	8		25.00
Schloz, G&R	Minnipa	30-40	1.46	16	8	8		35.00
Schloz, G&R	Minnipa	40-50	1.49	16	9	7	105	45.00
Schloz, G&R	Minnipa	50-60	1.51	17	9	7		55.00
Schloz, G&R	Minnipa	60-80	1.40	23	9	28		70.00
Schloz, G&R	Minnipa	80-100	1.47	26	11	30		85.00
Schloz, G&R	Minnipa	100-120	1.56	25	nd	nd		nd

nd – no data

PAWC Diagram



5. Palkagee, Glover

Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Glover – backhoe used 2022	Palkagee	-33.705606	136.673031	Sand over sandy loam	50	5000 L	22 days	11 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth - Wheat (cm)	Description
18 Feb	18 Feb 1000 L 18 Feb 1000 L 2 Mar 1000 L 4 Mar 1000 L 11 Mar 1000 L	22 March 2022	120 with backhoe	35	0-30 cm dark reddish brown to brown sand, 30-60 cm yellowish brown sandy loam with calcrete sheets and large calcrete rocks, over a pink loamy sand from 60 -120 cm.

Site photo with slope, October 2024.

Soil Profile, 8 October 2022.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark reddish brown	3.2 5YR	Sand	5.4	92.3	2.3
10-20	Brown	4.3 10YR	Sand	4.7	93.9	1.5
20-30	Dark yellowish brown	4.4 10YR	Sand	4.8	91.3	3.9
30-40	Yellowish red	5/6 5YR	Sandy loam	16.4	80.2	3.4
40-50	Strong brown	5/6 7.5YR	Sandy loam	7.6	88.1	4.3
50-60	Reddish yellow	6/6 5YR	Sandy loam	13.2	77.4	9.4
60-80	Pink	7.4 7.5YR	Loamy sand	6.8	86.4	6.8
80-100	Pink	7.4 7.5YR	Loamy sand	3.9	90.3	5.8
100-120	Pink	7.4 7.5YR	Loamy sand	3.6	89.1	7.3

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	1.7	15	38	140	4.8	0.85	0.19
10-20	1.6	25	32	91	7.4	0.74	0.15
20-30	3	21	34	96	7.4	0.61	0.18
30-40	<1	6.6	22	63	9.8	0.41	0.17
40-50	<1	6.9	13	42	14	0.57	0.17
50-60	<1	5.8	6	53	29	0.52	0.2
60-80	<1	4.5	<5	59	19	0.41	0.15
80-100	<1	4.8	<5	86	14	0.25	0.15
100-120	<1	4.8	<5	99	15	0.28	0.19

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	7.3	7.78	36	<0.4	127	0.184	0.56
10-20	6.87	7.31	25	<0.4	177	0.211	0.51
20-30	7.27	7.72	32	1.1	nd	0.223	0.74
30-40	7.94	8.49	92	18	nd	0.437	1.6
40-50	8.21	8.86	148	55	nd	0.377	1.2
50-60	8.19	9.06	197	62	nd	0.748	1.8
60-80	8.34	9.28	374	71	nd	0.558	1.3
80-100	8.26	9.42	839	74	nd	0.562	1.1
100-120	8.26	9.61	825	73	nd	1.08	1.5

nd – no data

Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.17	21	1.6	0.71	<0.02	6.02	1.07	0.249
10-20	0.12	17	1.3	0.54	<0.02	3.72	0.802	0.188
20-30	0.13	19	1	0.42	<0.02	7.16	1.11	0.188
30-40	0.14	15	<0.3	0.16	<0.02	23	2.74	0.172
40-50	0.15	7.3	<0.3	0.15	<0.02	20.8	1.94	0.105
50-60	0.25	3.1	<0.3	0.1	<0.02	21.7	3.56	0.143
60-80	0.16	1.5	<0.3	<0.08	<0.02	21	2.81	0.154
80-100	0.11	<1	<0.3	<0.08	<0.02	20.2	2.24	0.223
100-120	0.13	1	<0.3	<0.08	<0.02	20.4	2.24	0.271

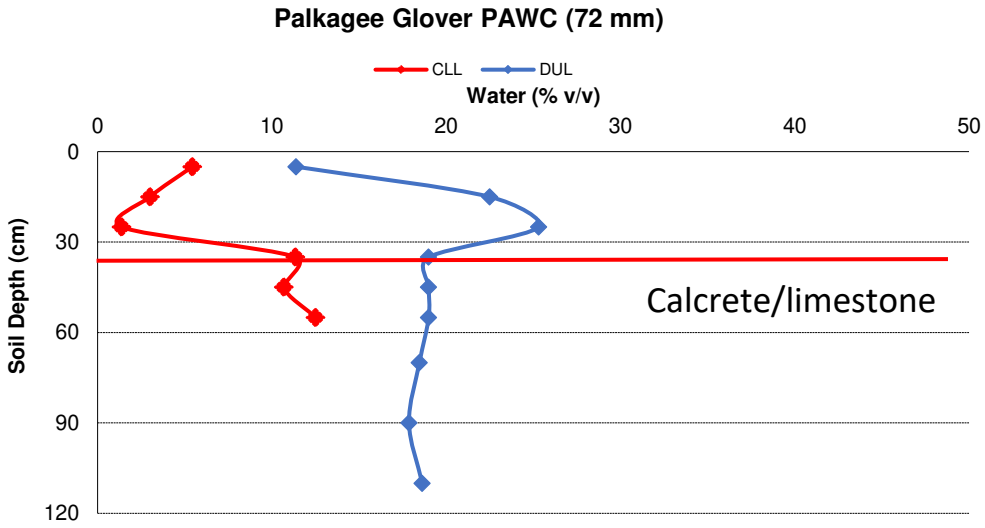
Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Glover, G&M	Palkagee	0-10	1.55	5	5	6	72	5.00
Glover, G&M	Palkagee	10-20	1.57	22	3	19		15.00
Glover, G&M	Palkagee	20-30	1.51	25	1	24		25.00
Glover, G&M	Palkagee	30-40*	1.43	19	11	8		35.00
Glover, G&M	Palkagee	40-50*	1.43	19	11	8		45.00
Glover, G&M	Palkagee	50-60*	1.43	19	13	6		55.00
Glover, G&M	Palkagee	60-80	1.28	18	nd	nd		70.00
Glover, G&M	Palkagee	80-100	1.33	18	nd	nd		90.00
Glover, G&M	Palkagee	100-120	1.37	19	nd	nd		110.00

*High levels of calcrete/limestone in sample so average BD and DUL used. nd – no data

PAWC Diagram



6. Ungarra, Modra
Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Modra 2022	Ungarra	-34.015020	135.969450	Sand over sandy clay loam	120	3000 L	13 days	9 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth - Barley (cm)	Description
17 Feb	17 Feb 1000 L 24 Feb 1000 L 1 Mar 1000 L	10 March 2022	120	40	Dark brown sand from 0-20 cm. Light yellowish brown sand from 20-30 cm, followed by brownish yellow sand from 30-60 cm. Yellowish red sand from 60-80 cm with red sandy clay loam from 80-100 cm and sandy clay from 100-110 cm.

Site photo with slope, 10 March 2022.

Soil profile, October 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark brown	4.2 7.5YR	Sand	3.4	94	2.6
10-20	Dark brown	4.3 7.5YR	Sand	3.2	94.6	2.2
20-30	Light yellowish brown	6.4 10YR	Sand	2.9	96.7	<1
30-40	Brownish yellow	6.6 10YR	Sand	2.8	97	<1
40-50	Brownish yellow	6.6 10YR	Sand	3	95.9	1.1
50-60	Brownish yellow	6.6 10YR	Sand	2.9	96.8	<1
60-80	Yellowish red	5.8 5YR	Sand	2.7	96.3	1
80-100	Red	5.8 2.5 YR	Sandy clay loam	26.5	71.9	1.6
100-120	Red	5.8 2.5 YR	Sandy clay	38.1	60.5	1.4

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	3	20	25	120	4.5	1.11	0.072
10-20	3.2	11	19	60	5.5	0.8	0.12
20-30	2.6	12	17	45	5.1	0.58	0.14
30-40	1.5	8.6	22	45	2.9	0.52	0.045
40-50	1.3	8.1	19	40	3.2	0.36	0.065
50-60	3.7	12	20	48	4	0.44	0.055
60-80	1.2	6	15	54	2.5	0.3	0.056
80-100	<1	4	<5	160	5.8	0.19	0.18
100-120	<1	2.7	<5	230	5	0.17	0.12

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	5.25	5.93	19	<0.4	209	0.044	0.19
10-20	6.66	6.88	21	<0.4	127	<0.035	0.26
20-30	7.13	7.48	10	<0.4	nd	0.037	0.2
30-40	6.59	6.98	14	<0.4	nd	<0.035	0.1
40-50	6.78	7.06	16	<0.4	nd	<0.035	0.25
50-60	6.46	6.78	17	<0.4	nd	<0.035	0.1
60-80	6.69	7.06	17	<0.4	nd	<0.035	<0.1
80-100	7.4	7.76	81	<0.4	nd	0.469	1.1
100-120	7.25	7.79	120	<0.4	nd	0.334	1.7

nd – no data

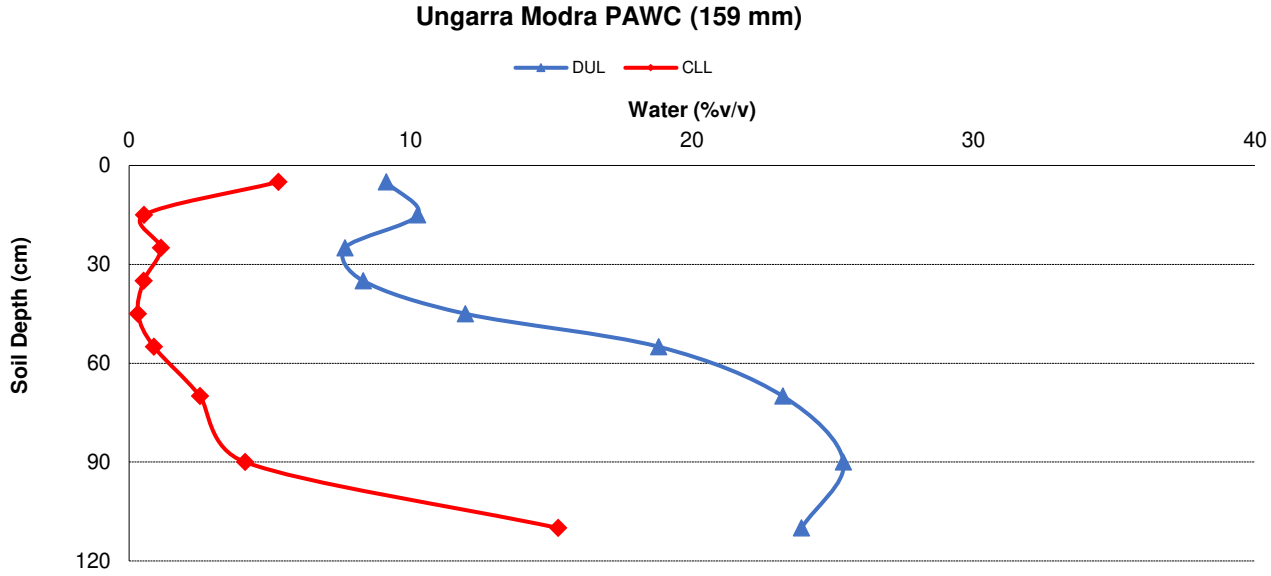
Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.49	30	5	2.4	<0.02	2.32	0.443	0.197
10-20	0.3	26	4.1	1.5	<0.02	3.53	0.621	0.132
20-30	0.34	26	5.3	2.2	<0.02	2.52	0.418	0.086
30-40	0.18	46	3	1.6	<0.02	1.37	0.244	0.07
40-50	0.28	28	3.1	1.7	<0.02	2.26	0.344	0.073
50-60	0.26	27	3	1.3	<0.02	1.59	0.266	0.068
60-80	0.23	21	1.6	0.65	<0.02	1.78	0.402	0.124
80-100	0.17	11	0.4	0.26	<0.02	16.2	3.18	0.454
100-120	0.27	11	<0.3	0.15	<0.02	9.9	4.05	0.604

Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per Layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Modra, J	Ungarra	0-10	1.43	9	5	4	159	5.00
Modra, J	Ungarra	10 to 20	1.49	10	1	10		15.00
Modra, J	Ungarra	20-30	1.55	8	1	7		25.00
Modra, J	Ungarra	30-40	1.54	8	1	8		35.00
Modra, J	Ungarra	40-50	1.56	12	0	12		45.00
Modra, J	Ungarra	50-60	1.57	19	1	18		55.00
Modra, J	Ungarra	60-80	1.64	23	3	41		70.00
Modra, J	Ungarra	80-100	1.58	25	4	43		90.00
Modra, J	Ungarra	100-120	1.65	24	15	17		110.00

PAWC Diagram

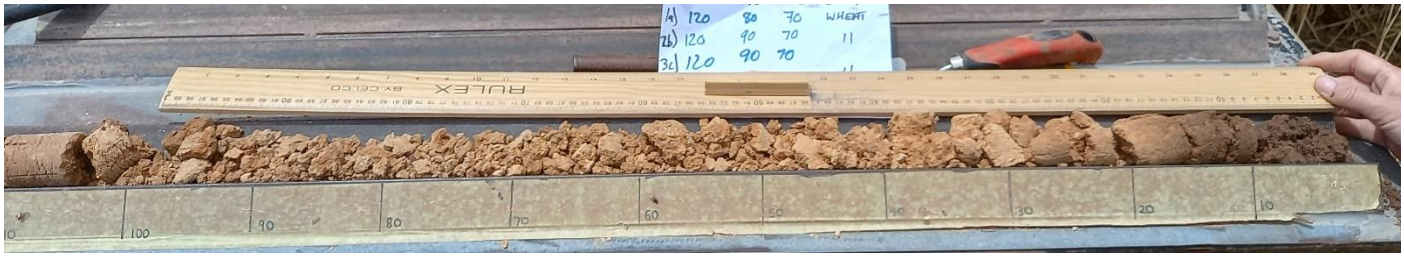


7. Ungarra, Phillis
Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Phillis 2022	Ungarra	-34.197854	136.095559	Clay with calcrete nodules from 40 cm to depth	120	3000 L	13 days	8 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth – Canola (cm)	Description
17 Feb	17 Feb 1000 L 17 Feb 1000 L 1 Mar 1000 L	9 March 2022	120	70	Dark brown clay from 0-30 cm, shifting to reddish brown clay from 30-40 cm, followed by yellowish red clay with calcrete nodules from 40-120 cm.

Site photo with slope, 9 March 2022.



Soil profile, October 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark brown	3.2 7.5YR	Clay	43.3	33.8	22.9
10-20	Dark brown	3.3 7.5YR	Clay	52.8	27.4	19.8
20-30	Dark Brown	4.4 7.5YR	Clay	59.4	25.4	15.2
30-40	Reddish brown	4.4 5YR	Clay	65	21.4	13.7
40-50	Yellowish red	5.6 5YR	Clay	68.6	18.6	12.8
50-60	Yellowish red	5.6 5YR	Clay	70.4	18.5	11.1
60-80	Yellowish red	5.6 5YR	Clay	73.1	14.5	12.4
80-100	Yellowish red	5.6 5YR	Clay	73.6	13.9	12.5
100-120	Yellowish red	5.8 5YR	Clay	73.6	14	12.4

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	<1	13	28	620	6.8	1.43	0.21
10-20	1.1	5.1	<5	520	7.1	0.54	0.36
20-30	<1	5	<5	650	8.9	0.3	0.64
30-40	<1	5.2	<5	740	18	0.26	0.77
40-50	<1	4.9	<5	860	35	0.22	0.65
50-60	<1	4.3	<5	900	60	0.21	1
60-80	<1	3.2	<5	890	130	0.12	1.2
80-100	<1	3.1	<5	870	130	0.13	1.6
100-120	<1	4.3	<5	740	270	0.28	0.72

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	8.06	8.67	248	23	10	1.28	6.3
10-20	8.22	8.38	273	25	<4	4.65	*18*
20-30	8.68	9.51	234	16	nd	*9.2*	*38*
30-40	8.83	9.66	218	12	nd	*13.9*	*56*
40-50	8.86	9.8	206	7.4	nd	*17.9*	*69*
50-60	8.88	9.66	185	6.7	nd	*19.1*	*66*
60-80	8.69	9.36	156	<0.4	nd	*20.9*	*63*
80-100	8.6	9.13	166	<0.4	nd	*21.9*	*53*
100-120	7.21	8	280	<0.4	nd	*20.9*	*32*

nd – no data

Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.45	9.7	2.6	0.74	<0.02	32	9.43	2.07
10-20	0.76	9.9	0.9	0.19	<0.02	26.2	15.1	1.76
20-30	0.73	10	0.5	0.2	<0.02	20.4	19.5	1.85
30-40	0.76	12	<0.3	0.22	<0.02	18.2	20.4	2.25
40-50	0.57	14	0.3	0.56	<0.02	15.5	18.3	2.31
50-60	0.68	15	<0.3	0.31	<0.02	14.9	17.5	2.42
60-80	0.49	11	<0.3	0.24	<0.02	8.43	15.8	2.37
80-100	0.55	10	<0.3	0.14	<0.02	5.67	16.8	2.41
100-120	0.5	15	<0.3	0.49	<0.02	5.76	13.2	1.89

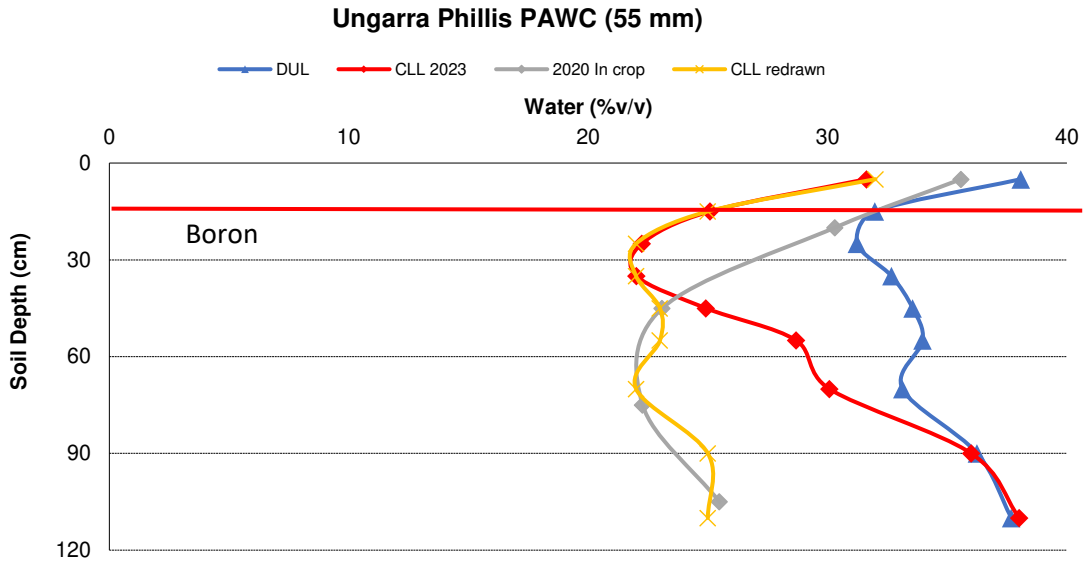
Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	2023 Ave. PAWC per Layer (mm)	2020 & 2023 PAWC per Layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Phillis, J	Ungarra	0-10	1.31	38	32	6	6		5.00
Phillis, J	Ungarra	10-20	1.30	32	25	7	7		15.00
Phillis, J	Ungarra	20-30	1.27	31	22	9	9		25.00
Phillis, J	Ungarra	30 - 40	1.30	33	22	11	11		35.00
Phillis, J	Ungarra	40-50	1.36	34	25	9	11	99*	45.00
Phillis, J	Ungarra	50 - 60	1.36	34	29	5	11		55.00
Phillis, J	Ungarra	60-80	1.30	33	30	6	22		70.00
Phillis, J	Ungarra	80-100	1.38	36	36	1	22		90.00
Phillis, J	Ungarra	100-120	1.40	38	38	1	25		110.00

*Note. 2023 Crop type was canola and the 2020 In crop soil moisture PAWC graph indicates this profile was not at CLL when sampled in 2023, so CLL was redrawn.

PAWC Diagram*

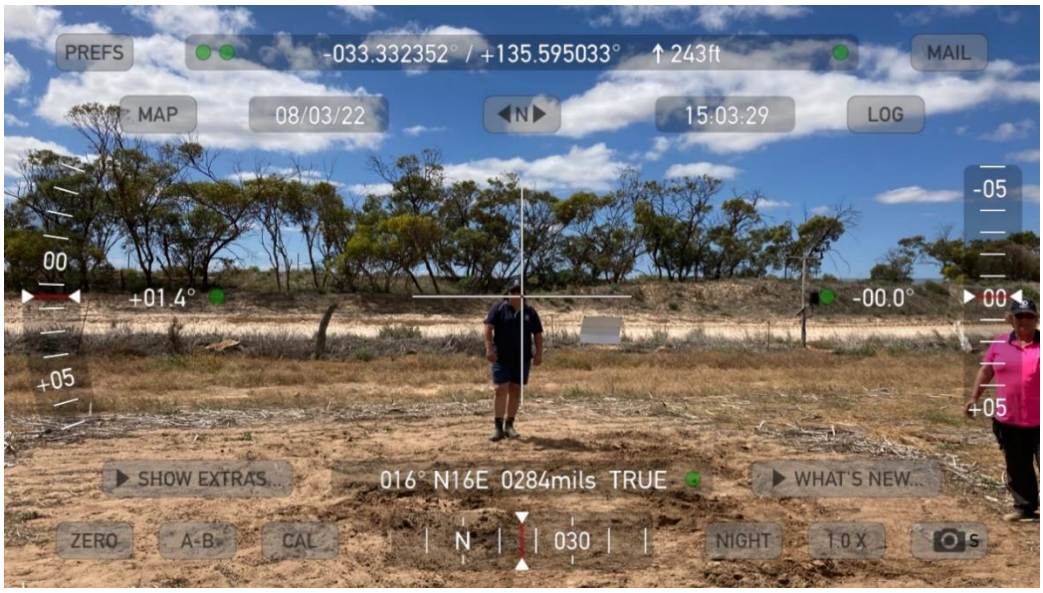


*Note. Crop type in 2023 was canola and the 2020 In crop soil moisture indicates this profile was not at CLL when sampled in 2023, hence the PAWC graph has been redrawn.

8. Warramboo, Pope
Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Pope 2022	Warramboo	-33.332352	135.595033	Sandy Loam with limestone	60	3000 L	13 days	7 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth - Wheat (cm)	Description
17 Feb	17 Feb 2000 L 1 Mar 1000 L	8 March 2022	60	60	Dark reddish brown sand from 0-10 cm, followed by dark yellowish brown sandy loam from 10-20 cm and brown sandy loam from 20-30 cm. A calcrete layer is underneath from 30 cm to depth with some brown sand, sandy loam and sandy clay loam.



Site photo with slope, 8 March 2022.

Soil Profile, October 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark reddish brown	3.2 5YR	Sand	5.6	90.7	3.7
10-20	Dark yellowish Brown	4.4 10YR	Sandy loam	10.1	83	6.9
20-30	Brown	4.3 7.5YR	Sandy loam	10	85.4	4.6
30-40	Dark brown	4.3 7.5YR	Sand	6.5	90.3	3.3
40-50	Brown	4.3 7.5YR	Sandy loam	9	87.9	3.1
50-60	Brown	4.3 7.5YR	Sandy clay loam	20.1	77.1	2.8

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	1	11	24	260	7.8	0.91	0.12
10-20	<1	7.5	15	240	5.6	0.71	0.12
20-30	<1	8.1	10	170	7.2	0.68	0.12
30-40	<1	3.9	10	150	5.5	0.36	0.096
40-50	<1	2.9	8	120	5.7	0.33	0.1
50-60	<1	1.6	<5	230	9.2	0.23	0.14

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	7.86	8.44	30	<0.4	132	0.056	1
10-20	8.01	8.6	55	2.4	30	0.091	1.4
20-30	8.13	8.84	69	4.2	nd	0.143	2.1
30-40	8.19	8.81	37	2.1	nd	0.104	1.1
40-50	8.23	8.9	61	3.4	nd	0.132	1.4
50-60	8.21	8.86	72	1.9	nd	0.539	3.8

nd – no data

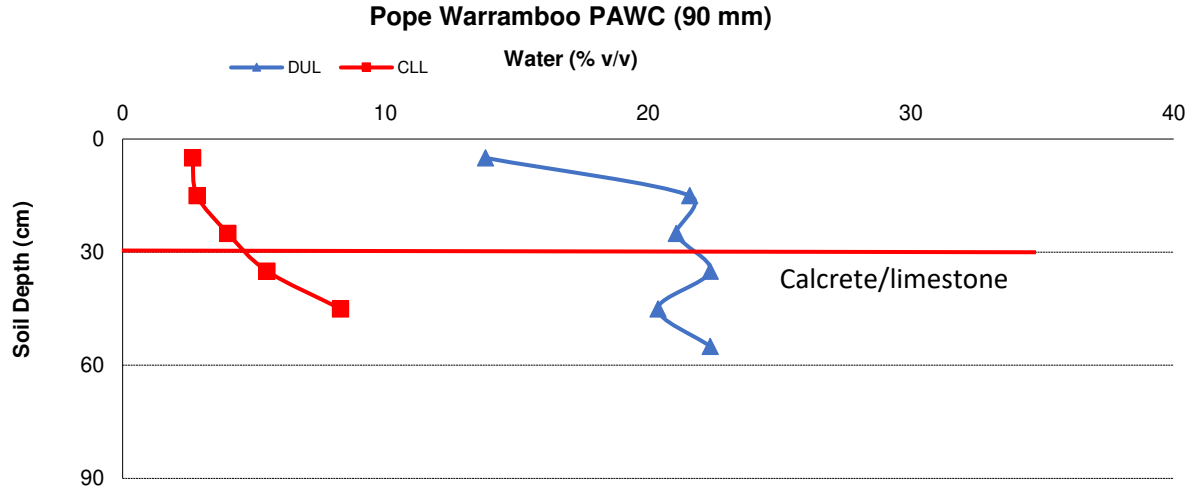
Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.23	3.4	3.1	4.2	<0.02	12.3	1.06	0.615
10-20	0.23	4.9	2.3	1.7	<0.02	21.7	1.55	0.655
20-30	0.38	5.7	1.8	1.8	<0.02	23.8	2.2	0.482
30-40	0.22	4.4	1.1	0.54	<0.02	19.6	1.56	0.351
40-50	0.27	5.9	1.1	0.43	<0.02	20.6	2.43	0.319
50-60	0.23	13	0.4	0.25	<0.02	16	4.5	0.689

Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
RHS (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per Layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Pope, B	Warramboo	0-10	1.42	14	3	11	90	5
Pope, B	Warramboo	10-20	1.52	22	3	19		15
Pope, B	Warramboo	20-30	1.41	21	4	17		25
Pope, B	Warramboo	30-40	1.41	22	5	17		35
Pope, B	Warramboo	40-50	1.41	20	8	12		45
Pope, B	Warramboo	50-60	1.60	22	8	14		55

PAWC Diagram



9. Yabmanna, Beinke

Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Beinke 2022	Yabmanna	-33.554759	135.884089	Sandy loam over clay	50	4000 L	13 days	8 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth – Wheat (cm)	Description
18 Feb	18 Feb 2000 L Feb 22 1000 L 2 Mar 1000 L	10 March 2022	120	60	Dark reddish brown sandy loam from 0-10 cm, transitioning into a loam from 10-20 cm. Dark reddish brown clay loam from 20-30 cm with red/yellow clay from 30 cm to 120 cm.

Site photo with slope, October 2024.

Soil profile, 10 March 2022.

Soil profile, October 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark reddish brown	3.3 2.5YR	Sandy loam	11.4	77.1	11.5
10-20	Dark reddish brown	3.3 2.5YR	Loam	19.5	67.5	13.1
20-30	Dark reddish brown	3.4 2.5YR	Clay loam	29.8	59.3	10.9
30-40	Reddish brown	4.4 2.5YR	Clay	34	56.3	9.7
40-50	Yellowish red	5.6 5YR	Clay	43.8	46.8	9.5
50-60	Reddish yellow	6.6 5YR	Clay	46.3	44.3	9.4
60-80	Yellowish red	5.8 5YR	Clay	42.1	42.4	15.5
80-100	Reddish yellow	5.8 5YR	Clay	42.1	36.9	21
100-120	Yellowish red	5.6 5YR	Clay	41	35.9	23.1

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	1.6	12	34	300	5.8	0.96	0.13
10-20	<1	7.1	16	250	5.9	0.45	0.19
20-30	<1	3.8	8	200	4.7	0.26	0.24
30-40	<1	3.8	<5	200	9.3	0.16	0.37
40-50	<1	3.2	<5	220	18	0.21	0.59
50-60	<1	2.6	<5	250	38	0.24	0.86
60-80	<1	2.6	5	220	68	0.3	1.2
80-100	<1	2.2	<5	210	120	0.25	1.5
100-120	<1	2.7	<5	190	130	0.26	1.4

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	6.6	7.22	46	<0.4	84	0.495	0.95
10-20	7.69	8.36	65	<0.4	30	1.02	1.5
20-30	8.15	9.09	93	1.7	nd	2.69	2.6
30-40	8.37	9.32	111	3.2	nd	4.86	3.6
40-50	8.47	9.38	130	5	nd	8.06	6.7
50-60	8.48	9.3	146	5.8	nd	9.72	8.4
60-80	8.45	9.24	161	21	nd	10.7	7.8
80-100	8.47	9.26	159	41	nd	11.5	6.4
100-120	8.38	9.26	159	52	nd	10.6	5.1

nd – no data

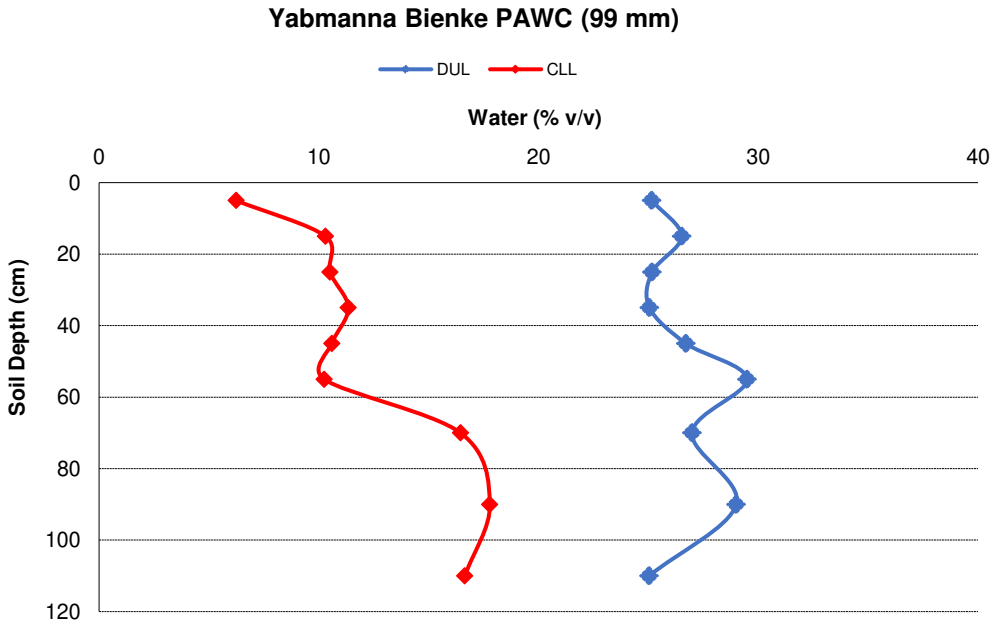
Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.47	14	13	0.44	<0.02	6.7	2.37	0.73
10-20	0.78	8.9	5.4	0.22	<0.02	14.2	3.82	0.619
20-30	0.95	12	2.2	0.18	<0.02	21.3	6.67	0.543
30-40	1.3	11	1.5	0.13	<0.02	21.4	8.5	0.559
40-50	1.6	12	1.3	0.17	<0.02	20.9	11.8	0.744
50-60	1.9	14	1.5	0.15	<0.02	20.8	12.2	0.787
60-80	1.8	9.4	1.7	0.3	<0.02	21.9	10.4	0.718
80-100	1.6	5.6	0.9	0.14	<0.02	20.2	8.97	0.62
100-120	1.3	5.1	1	0.15	<0.02	20.4	7.61	0.53

Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per Layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Beinke, J&K	Yabmanna	0-10	1.35	25	6	19	99	5.00
Beinke, J&K	Yabmanna	10-20	1.32	27	10	16		15.00
Beinke, J&K	Yabmanna	20-30	1.40	25	11	15		25.00
Beinke, J&K	Yabmanna	30-40	1.41	25	11	14		35.00
Beinke, J&K	Yabmanna	40-50	1.44	27	11	16		45.00
Beinke, J&K	Yabmanna	50-60	1.37	29	10	19		55.00
Beinke, J&K	Yabmanna	60-80	1.46	27	16	21		70.00
Beinke, J&K	Yabmanna	80-100	1.59	29	18	23		90.00
Beinke, J&K	Yabmanna	100-120	1.55	25	17	17		110.00

PAWC Diagram



10. Yeelanna (Pooh Bear), Wilksch

Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Wilksch 2022	Yeelanna SW	-34.136661	135.817749	Loamy sand over clay	120	3000 L	13 days	8 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth - Wheat (cm)	Description
17 Feb	17 Feb 1000 L 17 Feb 1000 L 1 Mar 1000 L	9 March 2022	120	70	Brown/yellow/red loam sand from 0-30 cm. Followed by red loamy sand from 30-50 cm with red sandy loam underneath from 50-60 cm. Red clay from 60-120 cm.

Site photo with slope, 11 October 2024.

Soil profile, 9 March 2022.

Soil profile, November 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Very dark red	2.5/2 10R	Loamy sand	6.6	83	10.4
10-20	Brown	5.4 7.5YR	Loamy sand	6.8	83	10.2
20-30	Yellowish red	5.6 5YR	Loamy sand	5.2	86.9	7.9
30-40	Red	4.8 2.5YR	Loamy sand	4.2	88	7.8
40-50	Red	4.8 2.5YR	Loamy sand	4.1	87.2	8.7
50-60	Red	4.8 2.5YR	Sandy loam	14.2	75.8	10
60-80	Red	4.8 2.5YR	Clay	46.4	45.2	8.4
80-100	Red	4.8 2.5YR	Clay	46.6	45.2	8.2
100-120	Red	4.8 2.5YR	Clay	42.1	50.3	7.7

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	1.6	26	75	180	12	1.65	0.15
10-20	1.1	9.3	71	110	84	1.29	0.2
20-30	<1	7	50	72	19	0.75	0.14
30-40	<1	2.8	15	58	17	0.38	0.063
40-50	<1	1.9	7	44	15	0.23	0.063
50-60	<1	2.2	<5	79	17	0.27	0.057
60-80	<1	3.9	<5	110	43	0.25	0.18
80-100	<1	4.5	<5	130	39	0.13	0.12
100-120	<1	4.8	<5	140	27	0.15	0.11

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	7.22	7.82	52	<0.4	233	0.127	0.69
10-20	6.91	7.39	50	<0.4	156	0.124	0.56
20-30	7.33	8.12	48	<0.4	nd	0.097	0.49
30-40	7.38	8.35	43	<0.4	nd	0.075	0.34
40-50	7.37	8.3	33	<0.4	nd	0.085	0.35
50-60	6.46	6.69	43	<0.4	nd	0.235	0.63
60-80	6.7	6.99	139	<0.4	nd	0.701	1.4
80-100	5.58	6.47	102	<0.4	nd	1.16	1.6
100-120	5.7	6.75	75	<0.4	nd	1.28	1.5

nd – no data

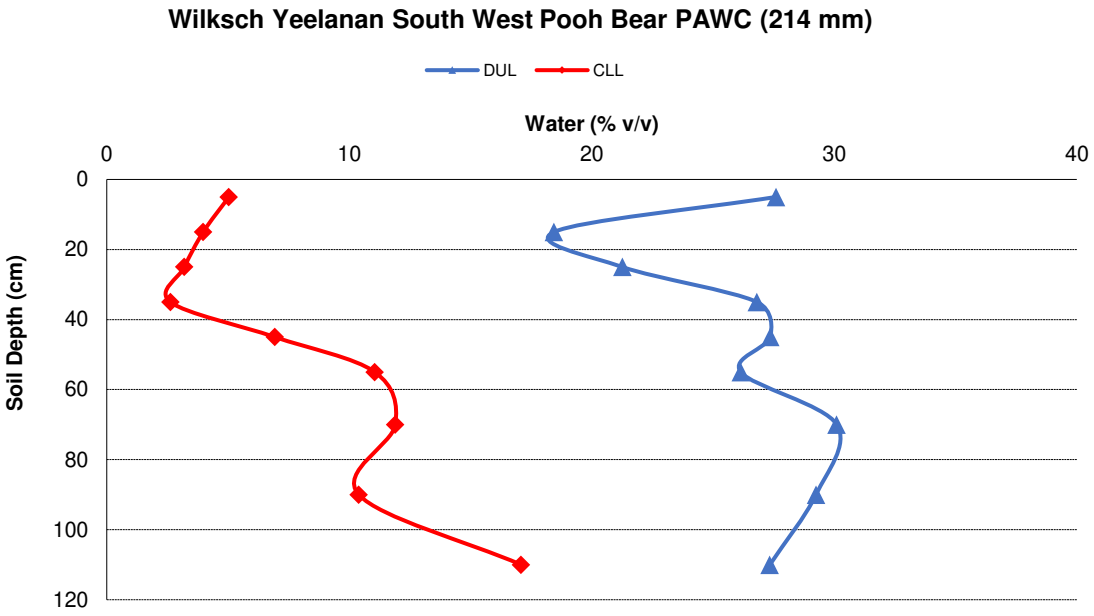
Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.68	26	2.8	2.4	<0.02	9.69	0.818	0.385
10-20	0.65	33	2.2	1.8	<0.02	7.05	0.47	0.233
20-30	0.5	61	1.9	1.1	<0.02	3.29	0.327	0.124
30-40	0.22	31	2.2	1	<0.02	1.91	0.203	0.095
40-50	0.26	17	2.4	0.68	<0.02	1.62	0.229	0.089
50-60	0.22	13	1.7	0.45	<0.02	3.08	0.987	0.15
60-80	0.15	12	<0.3	0.16	<0.02	7.54	3.98	0.271
80-100	0.13	15	<0.3	0.11	<0.02	5.89	5.81	0.332
100-120	0.18	19	<0.3	0.17	<0.02	5.61	6.35	0.355

Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per Layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Wilksch, J	Yeelanna SW	0-10	1.57	28	5	23	214	5.00
Wilksch, J	Yeelanna SW	10 to 20	1.80	18	4	14		15.00
Wilksch, J	Yeelanna SW	20-30	1.85	21	3	18		25.00
Wilksch, J	Yeelanna SW	30-40	1.70	27	3	24		35.00
Wilksch, J	Yeelanna SW	40-50	1.61	27	7	20		45.00
Wilksch, J	Yeelanna SW	50-60	1.63	26	11	30		55.00
Wilksch, J	Yeelanna SW	60-80	1.55	30	12	36		70.00
Wilksch, J	Yeelanna SW	80-100	1.57	29	10	38		90.00
Wilksch, J	Yeelanna SW	100-120	1.58	27	17	10		110.00

PAWC Diagram



11. Yeltuka, Treloar
Field Log

Site/ Farmer	Location	GPS South	GPS East	Soil type	Previous sampling depth (cm)	Amount water applied	Time of watering	Drainage time
Treloar – backhoe used 2022	Yeltuka	-34.155063	135.620676	Sand to sandy clay over clay	120	5000 L	18 days	10 days

Set up date	Water date	Sampling date	Maximum Sampling Depth for BD and CLL (cm)	Root Depth -Wheat (cm)	Description
17 Feb	17 Feb 1000 L 17 Feb 1000 L 1 Mar 1000 L 4 Mar 1000 L 11 Mar 1000 L	21 March 2022	200	70	Dark brown to brown sand from 0-20 cm. Red sandy clay from 20-30 cm. Red-yellowish clay from 30 to 120 cm. Reddish yellow clay loam from 120-160 cm with another strong brown clay layer from 160-200 cm.

Site photo with slope, 11 October 2024.


Soil profile, November 2023.

Soil Chemistry

Depth (cm)	Colour	Colour Code	Texture	Clay (%)	Sand (%)	Silt (%)
0-10	Dark brown	3.3 7.5YR	Sand	3.3	93.8	2.9
10-20	Brown	5.4 7.5YR	Sand	8.1	88.3	3.6
20-30	Red	4.6 2.5YR	Sandy clay	31.7	65.1	3.2
30-40	Red	4.6 2.5 YR	Clay	48.2	47.9	3.9
40-50	Yellowish red	5.6 5YR	Clay	50	41.9	8.2
50-60	Yellowish red	5.6 5YR	Clay	43.4	43.8	12.8
60-80	Reddish yellow	6.6 5YR	Clay	42.2	46.1	11.7
80-100	Reddish yellow	6.6 5YR	Clay	39.4	47.5	13.1
100-120	Reddish yellow	6.6 5YR	Clay	41.9	41.5	16.6
120-140	Reddish yellow	6.6 5YR	Clay loam	35.5	44.9	19.6
140-160	Reddish yellow	6.6 5YR	Clay loam	35.5	45.5	19
160-180	Strong brown	5.6 7.5YR	Clay	48.3	35.1	16.6
180-200	Strong brown	5.6 7.5YR	Clay	53.8	37.4	8.8

Depth (cm)	Ammonium Nitrogen (mg/kg)	Nitrate Nitrogen (mg/kg)	Phosphorus Colwell (mg/kg)	Potassium Colwell (mg/kg)	Sulphur (mg/kg)	Organic Carbon (%)	Conductivity (dS/m)
0-10	2.1	13	17	100	4.5	1.01	0.063
10-20	<1	2.5	23	150	2.6	0.35	0.039
20-30	<1	2.8	17	390	3.4	0.32	0.084
30-40	<1	3.3	11	450	5.2	0.27	0.28
40-50	1	3.5	8	420	5.6	0.24	0.19
50-60	<1	3.3	<5	340	5.5	0.26	0.17
60-80	<1	1.7	<5	420	4.5	0.2	0.19
80-100	<1	1.5	<5	470	5.8	0.22	0.24
100-120	<1	3.4	<5	580	7.4	0.18	0.31
120-140	<1	2.5	<5	260	7	0.25	0.28
140-160	<1	2.1	<5	370	11	0.17	0.32
160-180	<1	3.1	<5	580	17	0.13	0.47
180-200	<1	3.9	<5	670	29	0.07	0.65

Depth (cm)	pH Level ($CaCl_2$)	pH Level (H_2O)	PBI	Calcium Carbonate (%)	DGTP (ug/L)	Exc. Sodium (meq/100g)	Boron Hot $CaCl_2$ (mg/kg)
0-10	5.12	5.94	16	<0.4	109	0.058	0.23
10-20	5.82	6.39	24	<0.4	50	0.079	0.37
20-30	6.66	7.51	71	<0.4	nd	0.438	1.8
30-40	7.48	7.98	117	2.1	nd	0.751	2.3
40-50	7.94	8.6	138	15	nd	0.895	3.2
50-60	8.09	8.9	163	32	nd	0.969	3.3
60-80	8.17	9.14	150	34	nd	1.45	3.3
80-100	8.16	9.29	170	41	nd	2.43	4.1
100-120	8.26	9.49	164	41	nd	3.71	6.2
120-140	8.11	9.45	199	52	nd	3.38	1.3
140-160	8.14	9.52	217	46	nd	4.14	1.8
160-180	8.25	9.46	187	24	nd	6.58	4.4
180-200	8.43	9.22	81	5.6	nd	8.29	9.7

nd – no data

Depth (cm)	DTPA Copper (mg/kg)	DTPA Iron (mg/kg)	DTPA Manganese (mg/kg)	DTPA Zinc (mg/kg)	Exc. Aluminium (meq/100g)	Exc. Calcium (meq/100g)	Exc. Magnesium (meq/100g)	Exc. Potassium (meq/100g)
0-10	0.35	41	2.9	1.2	0.02	2.15	0.336	0.254
10-20	0.25	30	1	0.21	<0.02	1.8	0.518	0.261
20-30	0.16	30	0.8	0.11	<0.02	9.16	3.39	0.98
30-40	0.22	26	0.5	0.18	<0.02	27.5	6.37	1.43
40-50	0.2	13	0.7	0.11	<0.02	29.8	6.96	1.41
50-60	0.24	8	0.5	0.08	<0.02	27.5	6.08	1.1
60-80	0.37	5.2	0.4	0.12	<0.02	25.9	6.64	1.19
80-100	0.25	4.7	0.5	0.1	<0.02	25.6	7.9	1.49
100-120	0.24	4	0.3	0.1	<0.02	23	8.46	1.66
120-140	0.18	4.5	0.5	0.09	<0.02	24.1	5.88	0.787
140-160	0.22	3.8	0.5	0.08	<0.02	22.4	7.34	1.08
160-180	0.37	4.5	0.4	0.14	<0.02	21.5	10.6	1.61
180-200	0.47	5.9	0.4	0.1	<0.02	18.3	12.9	1.96

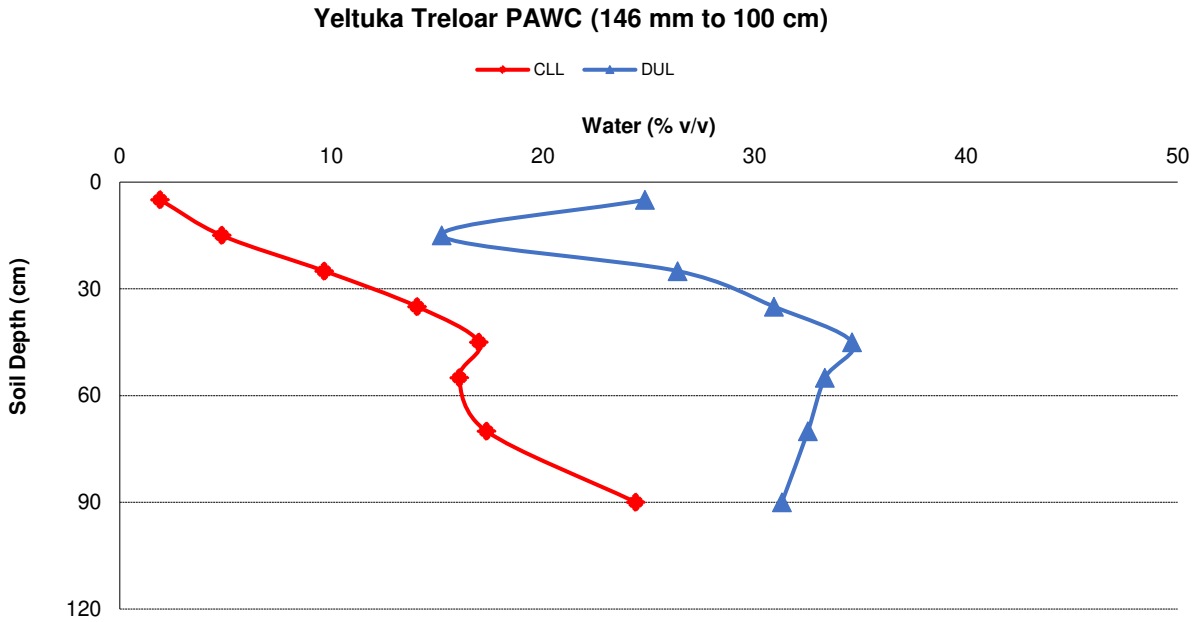
Photo: LHS (bottom tray) 0-10 cm, middle 10-20 cm, top 20-30 cm.
LHS Middle (bottom tray) 30-40 cm, middle 40-50 cm, top 50-60 cm.
RHS Middle (bottom tray) 60-80 cm, middle 80-100 cm, top 100-120 cm
RHS (bottom tray) 120-140 cm, middle 140-160 cm, top 160-180 cm
Far right 180-200 cm.

Bulk Density, DUL, CLL and PAWC

Farmer	Location	Sample Depth (cm)	Ave. Bulk Density (g/cc)	Ave. DUL Vol. (%)	Ave. CLL Vol. (%)	Ave. PAWC per Layer (mm)	Ave. PAWC Profile (mm)	Midpoint (cm)
Treloar, M	Yeltuka	0-10	1.54	25	2	23	146	5
Treloar, M	Yeltuka	10-20	1.66	15	5	10		15
Treloar, M	Yeltuka	20-30	1.51	26	10	17		25
Treloar, M	Yeltuka	30 - 40	1.41	31	14	17		35
Treloar, M	Yeltuka	40-50	1.42	35	17	18		45
Treloar, M	Yeltuka	50 - 60	1.39	33	16	17		55
Treloar, M	Yeltuka	60-80	1.39	33	17	30		70
Treloar, M	Yeltuka	80-100	1.51	31	24	14		90
Treloar, M	Yeltuka	100-120	1.42	31	nd	nd		110
Treloar, M	Yeltuka	120-140	1.41	33	nd	nd		130
Treloar, M	Yeltuka	140-160	1.42	32	nd	nd		150
Treloar, M	Yeltuka	160-180	1.35	34	nd	nd		170
Treloar, M	Yeltuka	180-200	1.58	32	nd	nd		190

nd – no data

PAWC Diagram



This project is funded by the Australian Government's NLP2 Smart Farming Partnerships program

Australian Government | National Landcare Programme

Delivery Partners

AIR EP | Ag Innovation & Research Eyre Peninsula

CSIRO Regional Connections SquareV EPAG RESEARCH Government of South Australia Primary Industries and Regions SA SARDI RESEARCH AND DEVELOPMENT INSTITUTE

Government of South Australia
Department of Primary Industries and Regions

SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE