GRDC SANDY SOILS IMPACTS PROJECT (CSP00203) VALIDATION TRIALS

BUCKLEBOO FARM IMPROVEMENT GROUP (BIGFIG) DEEP RIPPING TRIAL

This trial is delivered by Eyre Peninsula Agricultural Research Foundation (EPARF) and Buckleboo Farm Improvement Group (BigFIG) as part of GRDC project CSP00203 (Increasing production on sandy soils in low and medium rainfall areas of the Southern Region); a partnership between CSIRO, University of South Australia, SA state government through Primary Industries and Regions SA, Mallee Sustainable Farming Inc, AgGrow Agronomy and Trengove Consulting.

We would like to acknowledge the cooperation of the landholders involved in the trials.

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Buckleboo Site

Location. S -32.8879 E 136.2186

Cooperator. Karinya Ag (Baldock)

BOM weather station 18190; (Buckleboo, Karinya)

Rainfall (mean); 295mm annual, 204 mm April-October

Site Selection

The target soil for this trial is a Buckleboo red sand. Subsurface layers with high soil strength. The hypothesis of this trial is that; Physical ***disturbance beneath the depth of constrained layer is important to maximise yield benefits, and the incorporation of nutrition has greater yield benefits compared to physical amelioration alone***

(Penetrometer resistance >2000 Kpa) constrain the development of crop roots in this soil type in district. Additionally high levels of carbonate and boron in subsoil layers can provide significant chemical constraints to root development.

Physical constraints on this soil type in the districts are thought to occur partly from machinery compaction, but also as a result of soil characteristic such as particle size and cementation of soil particles by iron and other sesquioxides that appear to be present.

Results of the Buckleboo Farm Improvement Group (BigFIG) soil amelioration trial at Napandee (2015-2018) indicated that crop yield responses could be gained on the Buckleboo red sandy soils by deep ripping, and further benefits could be achieved by deep placement of organic matter and/or nutrition.

Several sites in the district were visited on 13th March 2019 with the site on Baldock's property on Rayson Road the best access and most uniform topography. (Figure 1)

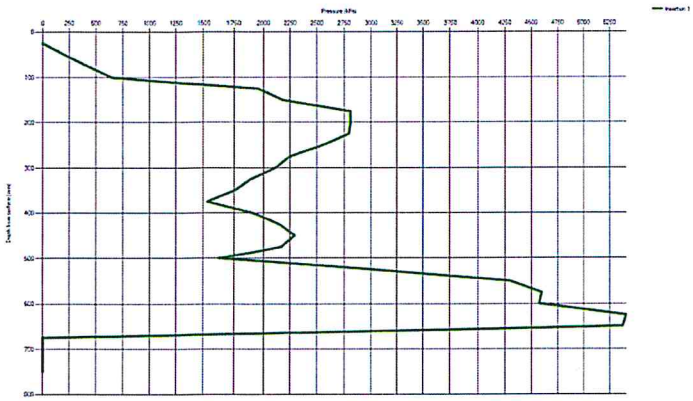
Figure 1. **Location of site within paddock at corner of Whytes, Dog Fence and Rayson's Roads,**

Soil sampling for site characterisation, preseason nutrition and water repellence to a depth of 100 cm was conducted at 10 locations along a transect running east-west across the proposed trial area using a hydraulic drill rig at 10 locations. The soil profile comprises a sandy A horizon with clay and carbonate content increasing at depths below 25 cm (Figure 2).

Soil cores were subsampled by profile layers, with changes in texture and depth to carbonate identified. Composite samples were sent for comprehensive laboratory analysis (Appendix 1)

Soil analysis identified very low organic carbon levels (even for the soil texture) with low cation exchange capacity indication poor inherent fertility in the surface soil layers. N, P, Zn levels were very low in the soil test with S and Cu marginal.

Figure 2. **Soil core taken from site**



At the time of soil characterisation sample the soil profile was very dry in surface layers and in order to take measure penetration resistance three locations were wet up to field capacity. High soil strength (penetrometer resistance in the range 2750 and 3250 kpa) was found at 10-25 cm depth with B horizon clays presenting resistance from 400 mm (Figure 3).

Figure 3. ***Penetrometer resistance at site.***

Ripping treatments (Table 1) were implemented on Monday 1st of April using Buckleboo Farm Improvement Groups 'Paxton' deep ripping plough + inclusion plates ripping to 450 mm. A liquid fertiliser tank allowed deep fertiliser treatments to be placed in a liquid stream behind ripping tynes.

The dry soil made implementation of these treatments difficult and resulted in large soil clods being brought up by the ripper (Figures 4 and 5). The landholder rolled the site following treatment to try and flatten it and firm the soil ahead of seeding.

Figure 4. *BigFIG 'Paxton' plough deep ripper with inclusion plates and liquids cart*
Figure 5. *Large soil clods brought up by ripper*

Table 1. Treatments

Treatment No.	Treatment
C1	Control
T1	Deep rip (300 mm)
T2	Deep rip (450 mm)
T3	Deep ripping (450 mm) + inclusion plates
T4	Deep ripping (450 mm) + inclusion plates + complete fluid fertiliser (budget unconstrained)
T5	Deep ripping (450 mm) + inclusion plates + complete fluid fertiliser (budget limited)
T6	Deep ripping (450 mm) + inclusion plates + Ammonium polyphosphate (APP)

Plots are 18 x 50 m (0.09 ha) per trial layout below (Figure 6);

	Rep 1								Rep 2								Rep 3							
B1	T3	C1	T1	T5	T2	T6	T4	B2	T5	T6	C1	T3	T2	T1	T4	B3	C1	T4	T2	T6	T1	T5	T3	B4

Figure 6. *Trial layout*

The site was sown with to Scepter wheat on 12th May 2019 using Seedhawk seeding bar at 303 mm row spacing. 60 kg ha-1 DAP was applied at seeding with 20 L ha-1 UAN and 5 L ha-1 liquid starter (2.4 N, 10P, 6 Zn, 1 Cu) applied with seed using liquid tank. Post emergent broadleaf herbicides applied with trace elements on 15th June 2019.

Assessments of crop establishment were undertaken on 23rd June 2019 with the crop at 3-4 leaf stage. Germination was relatively even with little variation in seeding depth.

NDVI imagery showed considerable differences in growth between some of the treatments in mid July (Figure 7).

Figure 7. *NDVI imagery for period 20-27th July 2019 (IrriSat accessed 08/08/19)*

Appendix 1. Laboratory soil results

Sample Depth	pH 1:5 water	pH CaCl2	Organic Carbon (W&B)	Field Texture	NO3 N	NH4 N	Colwell P	PBI + Col P	Colwell K	KCl Sulfur (S)	Exch. Ca	Exch. Mg	Ex. K	Ex. Na	ECEC	Ca	Mg	K	Na	Salinity EC1:5	Boron	Iron (Fe)	Manganese (Mn)	Copper (Cu)	Zinc (Zn)
	pH units	pH units	%		mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg	%	%	%	%	dS/m	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
0-10	7.36	6.99	0.55	Sand	13	2.8	40	18	160	21	3.19	0.702	0.264	0.066	4	76	17	6	2	0.176	0.51	12	5.9	0.27	1.4
10-25	8.13	7.54	0.18	Sand	2.7	1	16	17	140	7.1	3.88	0.83	0.295	0.043	5	77	16	6	1	0.1	0.47	6.4	2.1	0.19	0.18
25-45	8.71	8.06	0.12	Sandy loam	1.6	<1	<5	22	220	5.5	8.21	2.54	0.477	0.112	11	72	22	4	1	0.099	0.96	4.8	0.5	0.27	<0.08
45-65	9.2	8.37	0.11	Sandy loam	1.7	<1	<5	111	190	7.8	16.7	4.83	0.517	0.631	23	74	21	2	3	0.133	3.7	4.6	0.3	0.39	<0.08
65-100	9.57	8.44	0.12	Sandy clay loam	1.9	<1	<5	199	290	12	17.5	6.3	0.74	1.77	26	66	24	3	7	0.239	7.2	4.7	0.6	0.54	0.08

Appendix 2. SARDI Deep ripping trial plan – Brian Dzoma

Plot #	buffer	buffer	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	buffer	buffer
Treatment # (tinespacing/Depth			60 (60)	control	30 (80)	60 (20)	30 (60)	60 (80)	30 (20)	30 (40)	control	60 (40)	60 (20)	30 (80)	30 (40)	60 (60)	control	60 (80)	60 (40)	30 (20)	30 (60)	control	30 (40)	60 (80)	60 (20)	60 (60)	60 (40)	30 (60)	control	30 (20)	control	30 (80)		
Rep			1										2										3											

Ripping depth in brackets