
Western Australia
LEGEND
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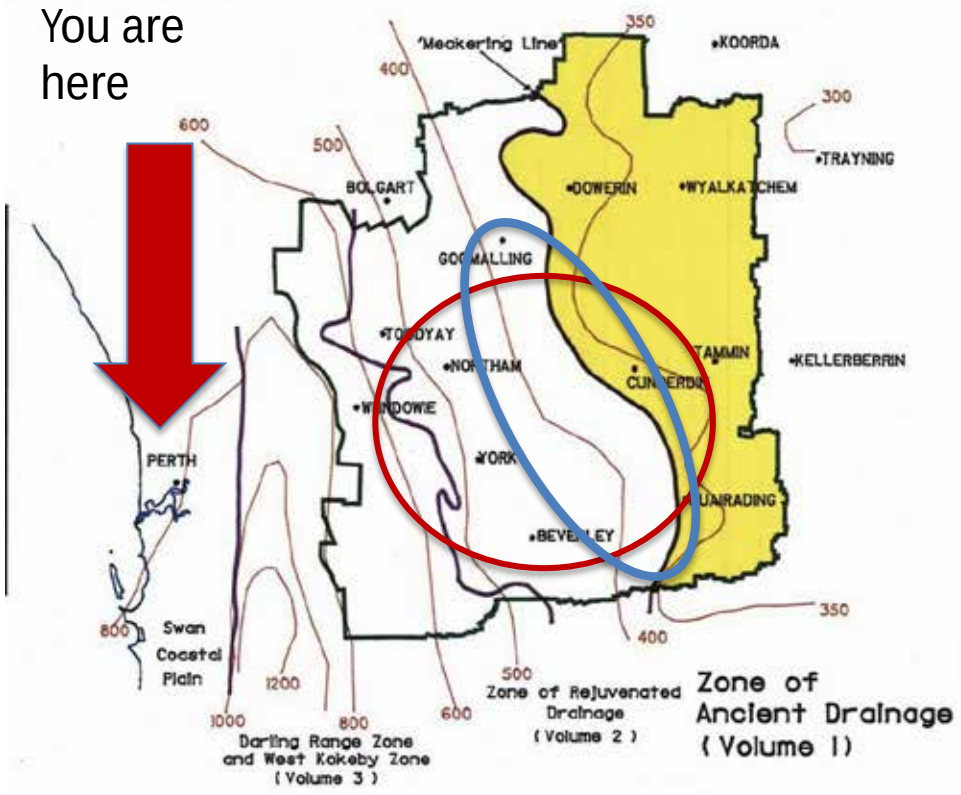
WESTERN
AUSTRALIA
PERTH

My Sandplain Soils



Where I work

My sandplain soils

Location

75-160 kms East of Perth

Plant crops in early April to late May and harvest ripe by end of October (Filling grain September to October)

Rainfall – Annual rainfall 360mm

Distribution of rainfall – 245 mm falls May to September
- 180 mm falls June – August

Temperature Maximums – August 30.3 degrees
- September 34.7 degrees
- October 38.8 degrees

My Sandplain Soils

Zone of Rejuvenated Drainage

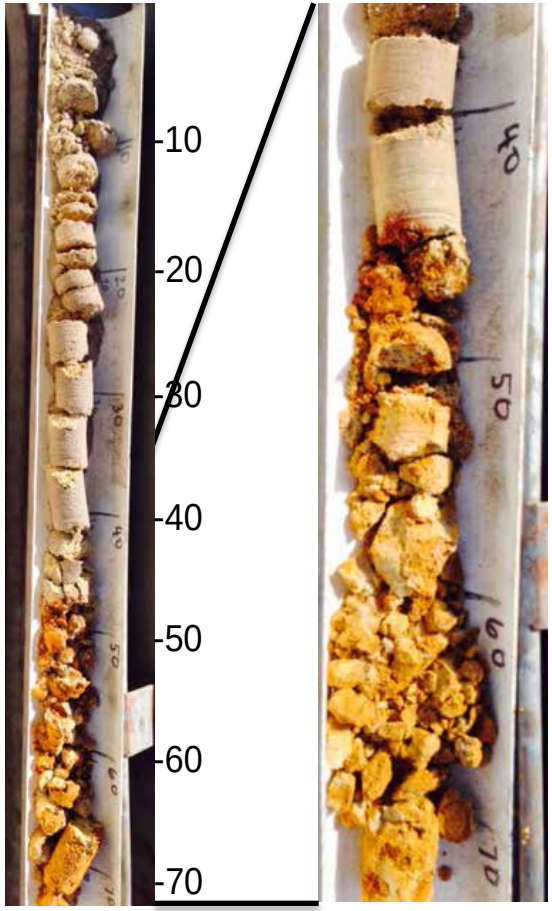
1. Deep pale sand
2. Deep yellow sand
3. Pale sand over gravel/loamy sand
4. Yellow gradational loamy sand
5. Waterlogged sand

Zone of Ancient Drainage

1. All of those sands;plus
2. Deep yellow acid sand
3. Shallow mottled zone

Sands with clay in subsoil

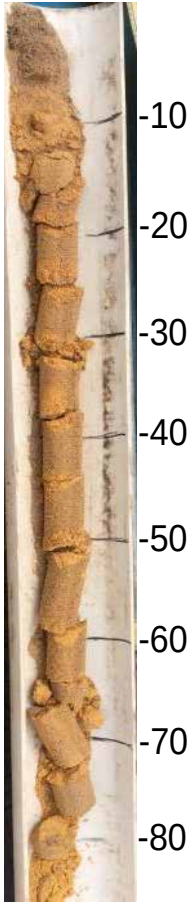
Gravelly pale deep sand



Clay in subsoil

- Moisture holding
- Determining soil properties and function
- Nutrient retention
- Influencing soil structure
- pH buffering
- CEC capacity

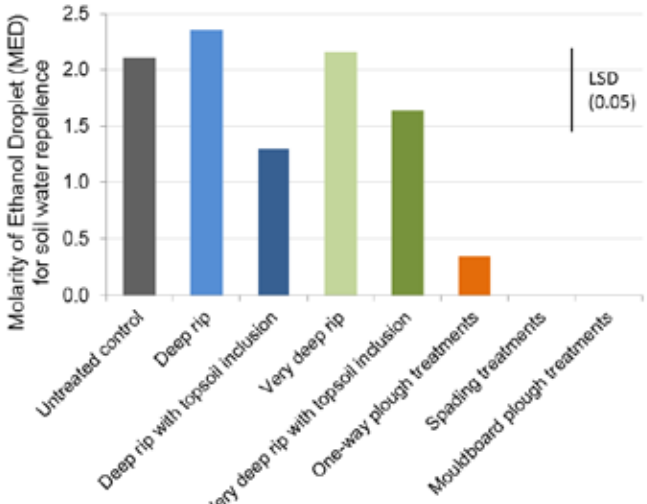
Sands without clay in subsoil



Yellow Deep sand

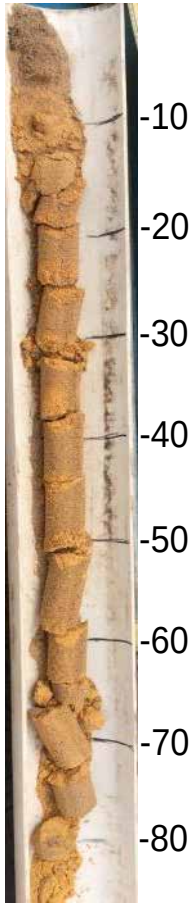
Sands with clay in subsoil

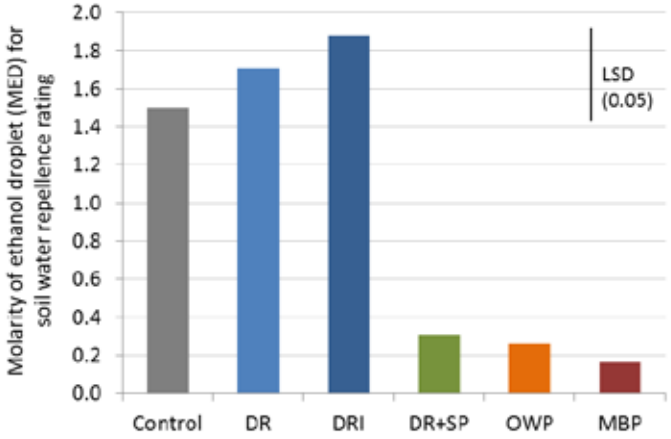
Gravelly pale deep sand



Sands without clay in subsoil

Yellow Deep sand

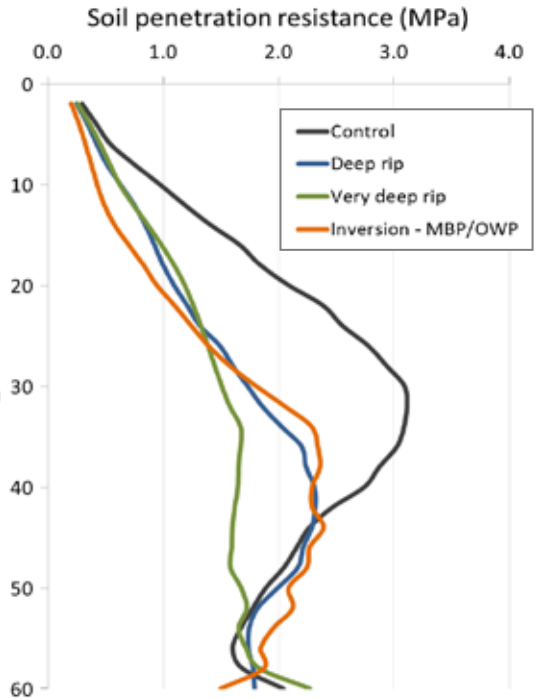


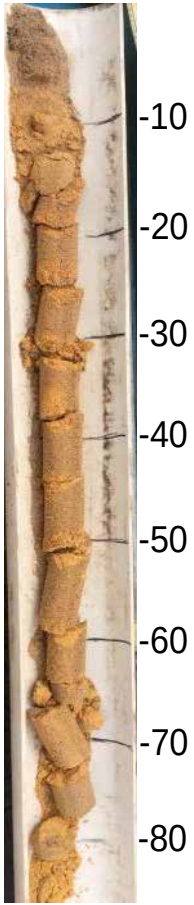


Sands with clay in subsoil

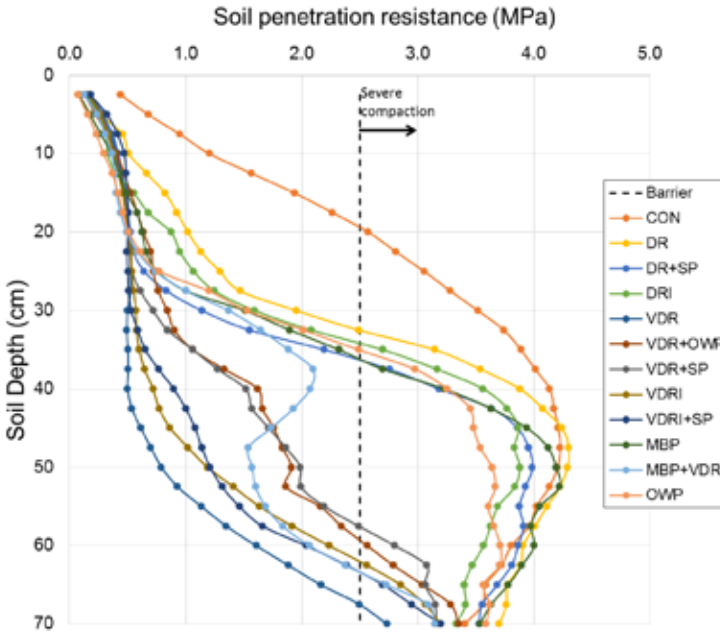
Sands without clay in subsoil

Gravelly pale deep sand



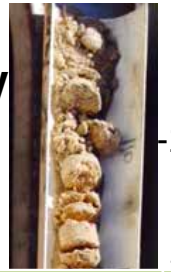


Yellow Deep sand

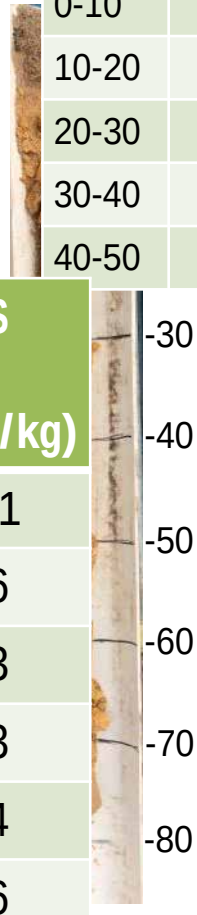


Sands with clay in subsoil

Gravelly pale deep sand



Depth (cm)	Soil pH ($CaCl_2$)	Soil Al (mg/kg)	Col. P (mg/kg)	PBI	Col. K (mg/kg)	OC %
0-10	5.8		21	13	61	0.98
10-20	4.8	1.5	16		42	
20-30	4.3	5.6	16		39	
30-40	4.3	8.0				
40-50	4.3	10.0				



Soil depth (cm)	Soil pH ($CaCl_2$)	Organic Carbon (%)	P (mg/kg)	K (mg/kg)	S (mg/kg)
0-10	5.8	0.8	13	37	11
10-20	5.2	0.6	11	19	6
20-30	4.7	0.3	15	21	3
30-40	4.6	0.2	20	20	3
40-50	4.5	0.2	18	28	4
50-70	5.0	0.1	9	31	6

Sands without clay in subsoil

Yellow
Deep sand

Sand Properties

Both Sands Hydrophobic

Both Sands compact and create physical hardpans to impair root penetration and distribution

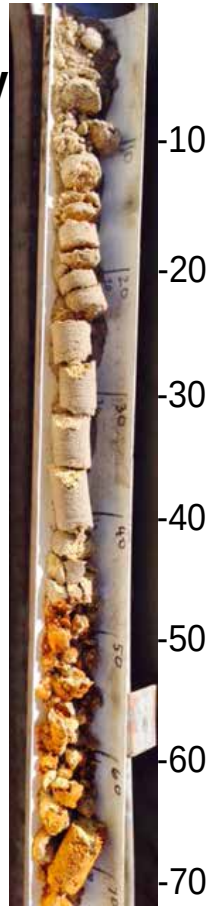
Both Sands have low pH buffering capacity and acidify quickly in the root zone and create chemical hardpans to impair root penetration and distribution or conditions less favourable to nutrient recovery.

Both sands hold little water in the topsoil

BUT They differ dramatically in their ability to support crop production.

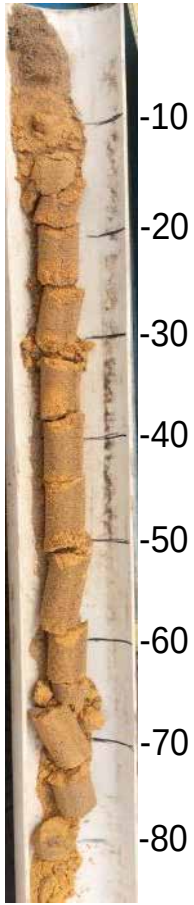
Sands with clay in subsoil

Gravelly pale deep sand



Depth	Clay	Silt	Sand
%	%	%	%
0-10cm	4	1	95
10-20cm	7	1	92
20-30cm	14	1	85
30-40cm	16	2	82
40-50cm	18	2	80
50-70cm	20	2	78
70-90cm	27	4	69

Sands without clay in subsoil



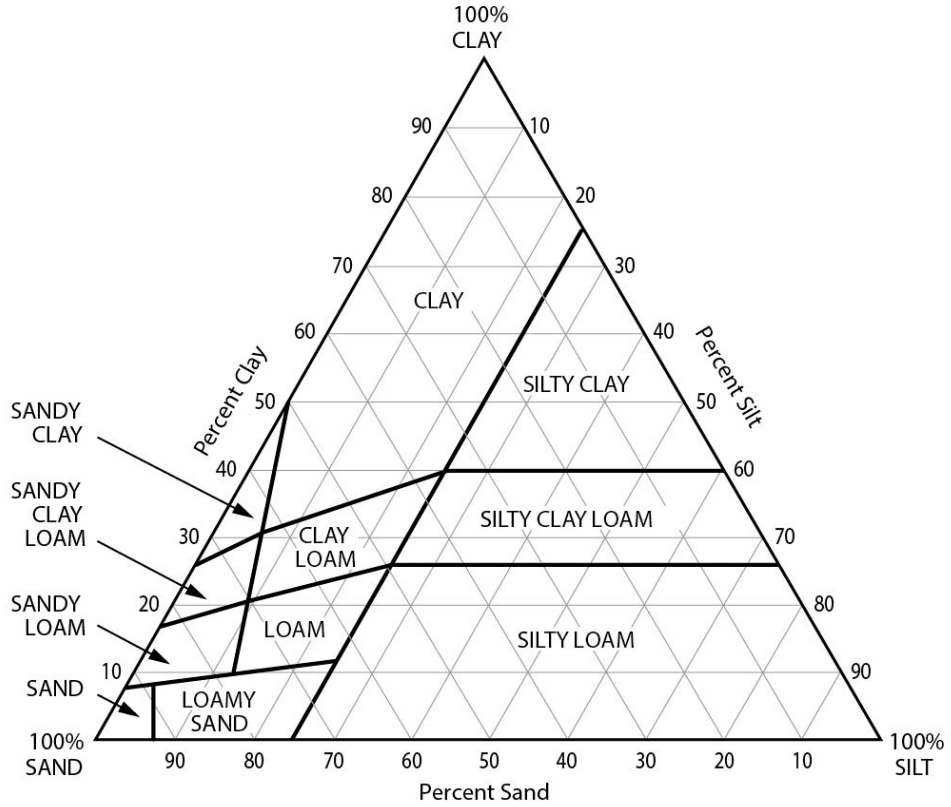
Yellow Deep sand

Depth	Clay	Silt	Sand
%	%	%	%
0-10cm	4	1	95
10-20cm	5	1	94
20-30cm	5	1	94
30-40cm	5	1	94
40-50cm	6	1	94

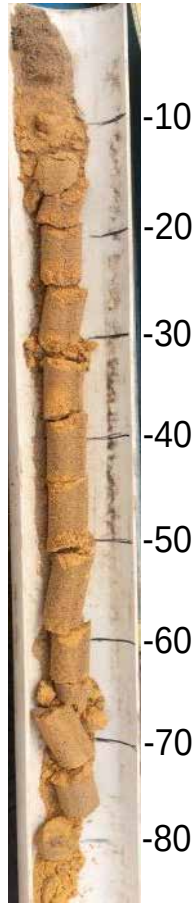
Sands with clay in subsoil

Sands without clay in subsoil

Gravelly pale deep sand

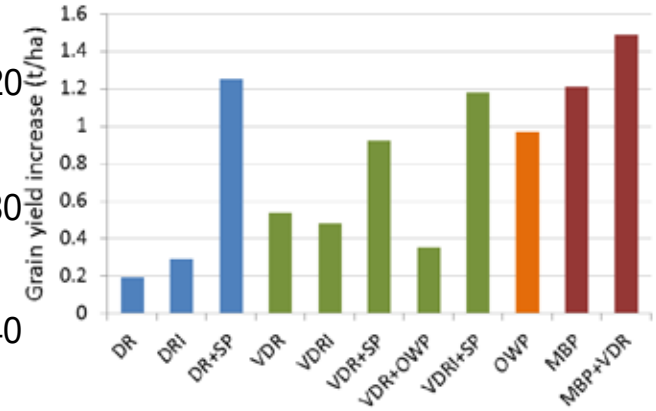


Yellow Deep sand



Sands with clay in subsoil

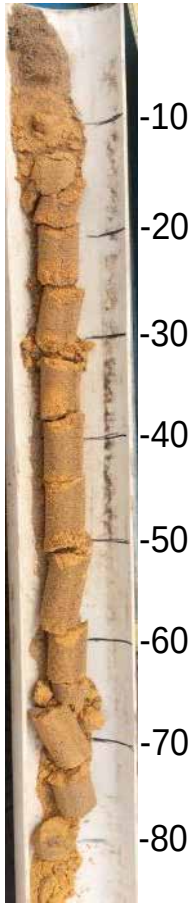
Gravelly pale deep sand

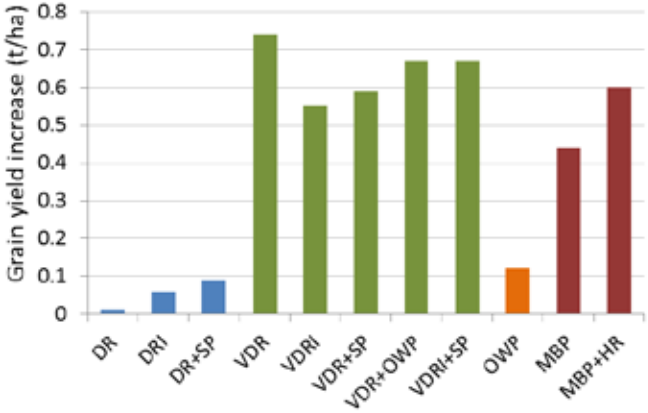


Control grain yield = 3.8 t/ha
LSD 0.05 = 0.7 t/ha

Sands without clay in subsoil

Yellow Deep sand





Control yield = 0.8 t/ha
LSD 0.05 = 0.16 t/ha

SOIL CONSTRAINTS		AMELIORATION OPTION
Subsoil Compaction	Accurately ascertain compaction depth for appropriate ripping depth	Deep Ripping (+CTF)
Subsoil Acidity		Lime +/- incorporation
Compaction + Acidity	Consideration what you can influence: Water infiltration? Water uptake? Water Holding Capacity? Nutrient uptake? What is the topsoil and subsoil resource?	Lime + Ripping with slotting
Water Repellence		Spading/Mouldboard/One-way/Delving/Claying
Repellence + Compaction		
Repellence + Compaction + Acidity		Spading/MBP/One-Way/ Delving/Claying + Ripping
Repellence + Compaction + Acidity and **NO CLAY within 50cm**	Potential Returns	Lime + Spading/MBP/One-Way/Delving/Claying + Ripping

AGRONOMIC CONSTRAINTS: Weeds; Frost; Nutrition; Disease?

Our thanks to:

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

GOVERNMENT OF WESTERN AUSTRALIA
Department of Primary Industries and Regional Development

agVivo
advice for agriculture

living farm

Map IQ
smarter ag mapping

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Rob & Dan Dempster, ‘Adair’ Goomalling

Liz Petersen, DPIRD Perth

Joanne Walker, DPIRD Geraldton

Joel Andrew, MapIQ

1. Deep pale sand

P.P.F. Uc 1.21, Uc 2.12, Uc 1.22, Uc 5.11, Uc 2.21

Phillips series, Eaton series

Horizon

A1 Grey (10YR 5/1) to light grey (10YR 6/1), medium to coarse grained sand.
Single grains, loose surface.
pH = 6.0

A2 White (10YR 8/2) to pale yellow (10YR 8/6), medium to coarse grained sand.
Single grains.
pH = 6.5

B1 White (10YR 8/2) to pale yellow (10YR 8/6), medium to coarse grained sand.
Single grains.
Large ironstone gravel.
pH = 6.5
(Note – this layer is sometimes present)

2. Deep yellow sand

Average quality yellow sand –
'Sandplain pear and banksia country'.

P.P.F. Uc 5.11

Cunderdin series.

Horizon

A1 Brown (10YR 4/3), medium grained sand.
Single grains, loose surface.
pH = 6.5

B1 Yellow (10YR 6/8) medium grained sand.
Single grains.
pH = 7.0

B2 Yellow (10YR 6/8) loamy sand.
Single grains or massive structure.
Earthy fabric.
pH = 7.0
(Note – this layer is sometimes present).

3. Yellow gradational loamy sand

Good quality, yellow, gravelly sandplain 'Tammar country' and other non-gravelly, good quality, yellow sandplain

P.P.F. Dy 5.52, Dy 3.62, Gn 2.61, KS-Uc 4.12

Tamnin series, Ejanding series, Wyola series, Ucarty series.

Horizon

A1 Greyish brown (10YR 4/2) to yellowish brown (10YR 5/8), medium grained sand to clayey sand.
Loose to hardsetting surface.
Single grains to massive structure.
Usually contains small to moderate amounts of ironstone gravel.
pH = 6.0

B1/B2 Yellow (10YR 7/8) to yellowish brown (10YR 5/8) clayey sand grading to a sandy loam or sandy clay loam at depth.
Massive structure, earthy fabric.
May contain red and orange mottles.
Large amounts of ironstone gravel often present.
pH = 6.0

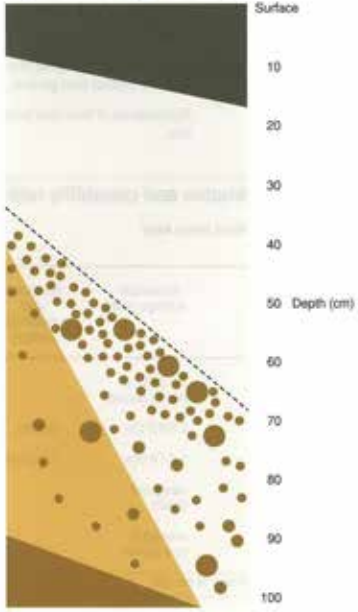
C Mottled zone.
Red, orange and yellow mottled sandy clay loam to sandy clay.
Hardpan.
Little or no ironstone gravel.
pH = 6.5

4. Pale sand over gravel/loamy sand

Pale, sandy surfaced sandplain over gravel and/or loamy sand at about 40 cm.

P.P.F. Gn 2.75, Uc 2.12, Uc 2.21

Kauring series, Mawson series



Horizon

A1 Greyish brown (10YR 5/2) to light grey (10YR 6/1), medium to coarse grained sand.
May contain ironstone gravel.
Single grains, loose surface.
pH = 6.5

A2 Pale (10YR 7/4), medium to coarse grained sand.
Single grains.
May contain ironstone gravel.
pH = 7.0

A3 Pale (10YR 7/4) medium to coarse grained sand.
Single grains.
Large amounts of ironstone gravel.
pH = 7.0

B2 Yellow (10YR 6/8), loamy sand to sandy loam.
Massive structure, earthy fabric.
Large amounts of red and pale mottles.
May contain ironstone gravel.
pH = 7.0

C Mottled zone.
Red, orange and yellow mottled sandy clay loam to sandy clay.
Hardpan.
pH = 6.5

5. Waterlogged sand

Winter waterlogged, pale sand. Found in poorly drained depressions within areas of sandplain.

P.P.F. Dy 5.82, Uc 1.21

Cularing series

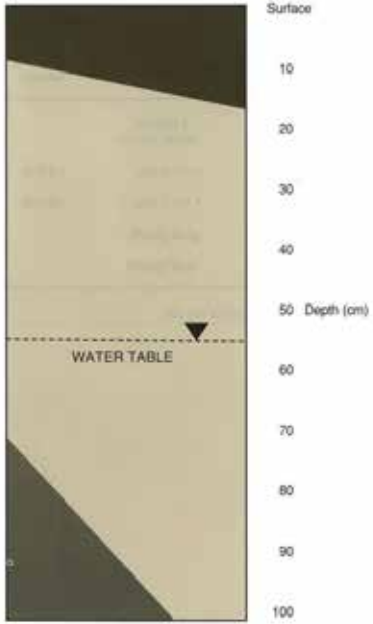
Horizon

A1 Grey (10YR 4/1), medium to coarse grained sand.
Single grains, loose surface.
pH = 6.0

A2 Pale (10YR 7/3), medium to coarse grained sand.
Single grains.
pH = 7.0

B2 Mottled pale (10YR 7/2), yellow (5Y 7/6) and grey (5Y 5/1) sandy clay.
pH = 7.0

(Note – Silcrete often occurs below this soil.
– The watertable may reach the surface in winter and generally remains within 150 cm all year round).



6. Deep yellow acid sand

Poor quality, deep, yellow, acid sandplain.
Found in the east of the Advisory District – 'Wodjil country'

P.P.F. Dy 2.51, Dy 4.51, Gn 2.21, Uc 5.22

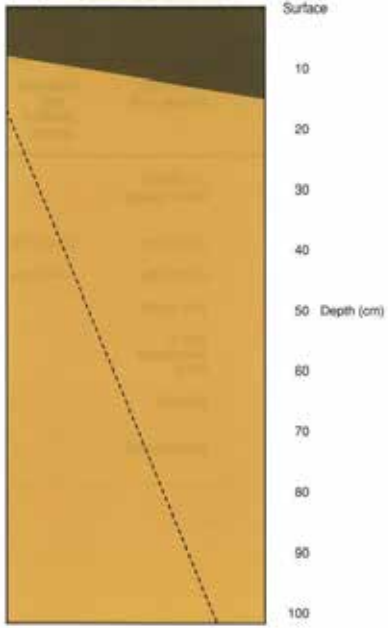
Holleton series

Horizon

A1 Brown (10YR 4/3), sand to loamy sand.
Loose to hardsetting surface.
pH = 5.0 (water)
pH = 4.3 ($CaCl_2$)

B1 Yellow (10YR 6/8), sand to sandy loam.
Single grains to massive structure, often with an earthy fabric.
pH = 4.5 (water)
pH = 3.9 ($CaCl_2$)

B2 Yellow (10YR 6/8), clayey sand to sandy clay loam.
Massive structure, earthy fabric.
pH = 4.0 (water)
pH = 3.7 ($CaCl_2$)



7. Shallow mottled zone

Poor quality, gravelly soils.
Yellow gravelly soils overlying mottled zone at about 15 cm.
– 'Shallow conglomerate or wodjil country'

P.P.F. Uc 5.13

Wyaluteherm series

Horizon

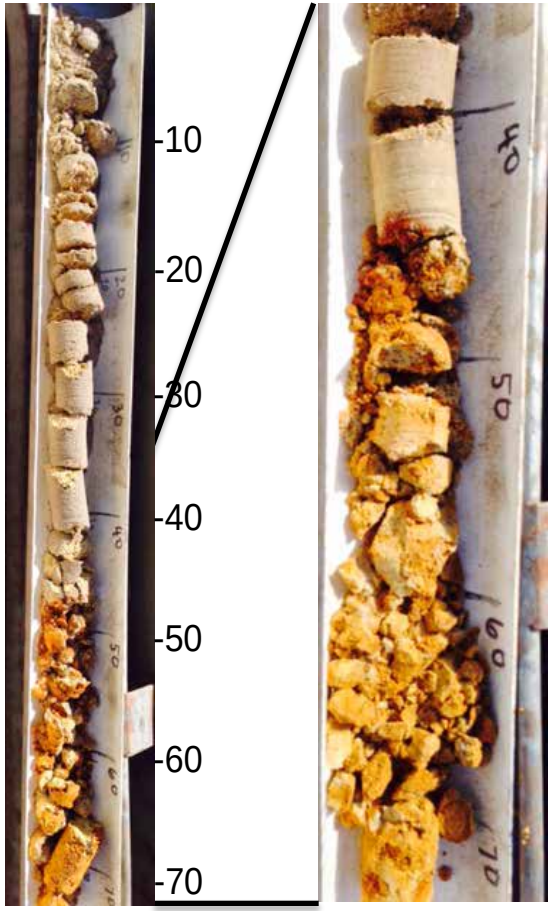
A1 Greyish brown (10YR 4/2) clamy sand.
Massive structure.
Firm to hardsetting surface.
May contain ironstone gravel.
pH = 6.0

A3 Yellow (10YR 7/6) to yellowish brown (10YR 5/8) clayey sand.
Massive structure.
Often contains loose, ironstone gravel.
pH = 5.5

C Mottled zone.
Yellow, red and orange mottled sandy loam to sandy clay loam.
Hardpan.
Little or no ironstone gravel.
pH = 5.5

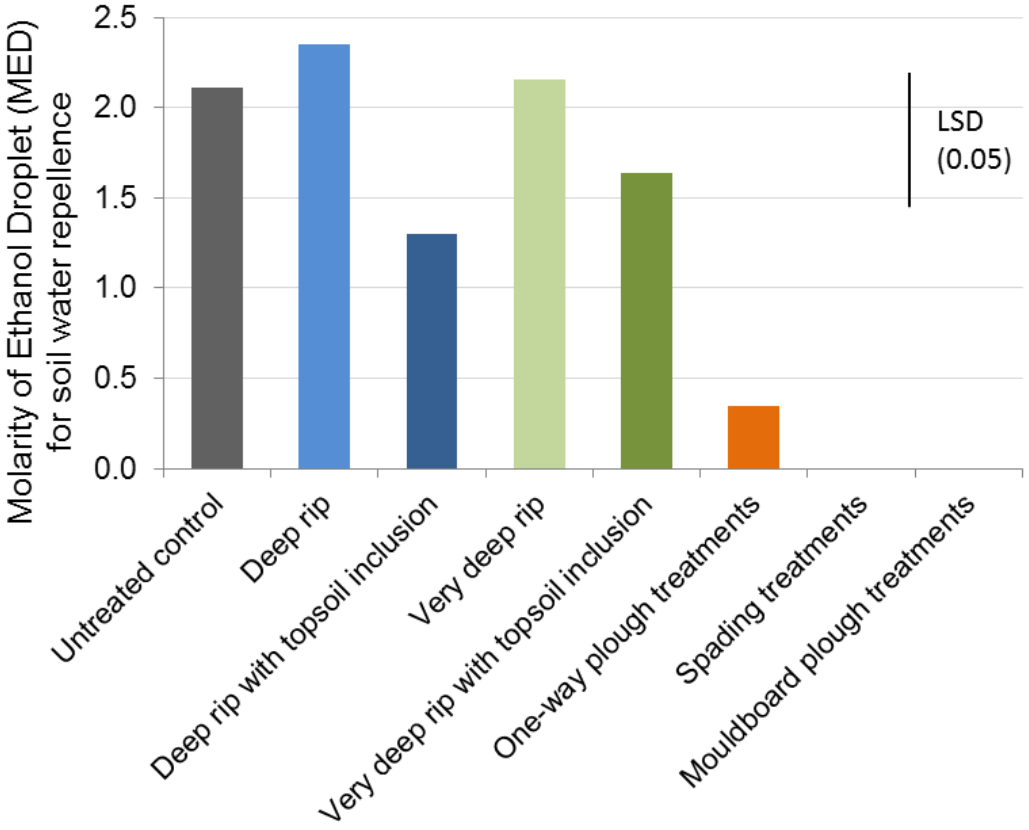
Surface
10
20
30
40
50 Depth (cm)
60
70
80
90
100

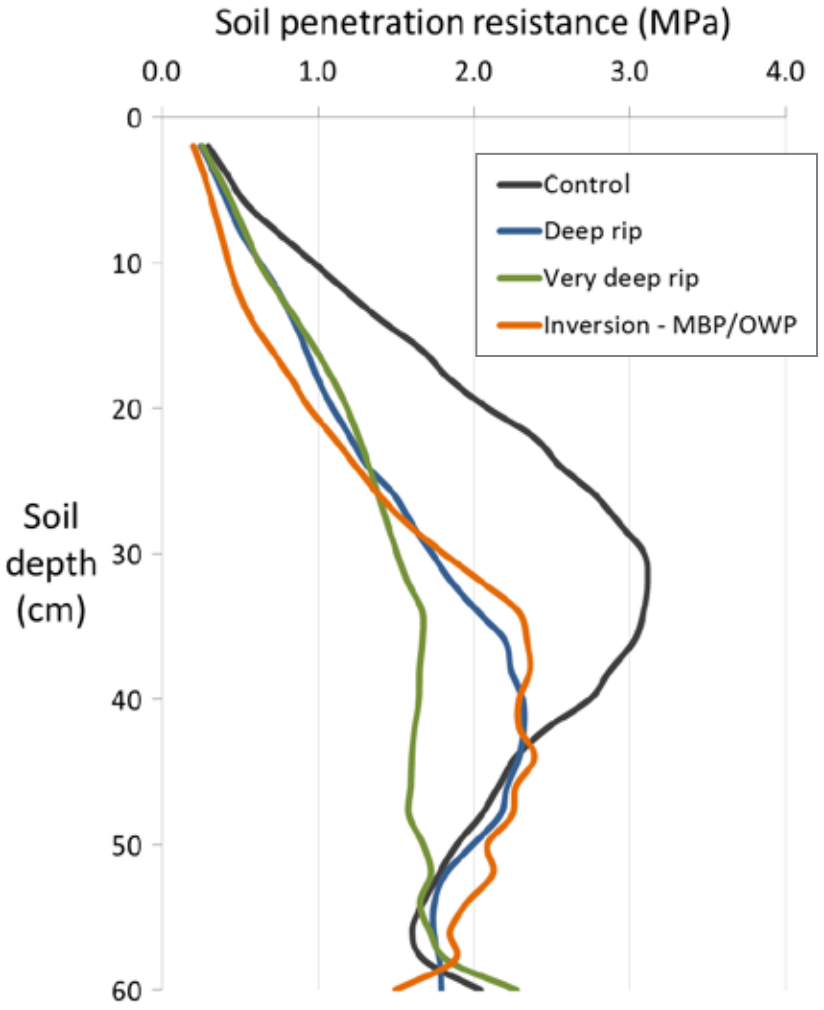
Meckering – Ty and Ray Fulwood



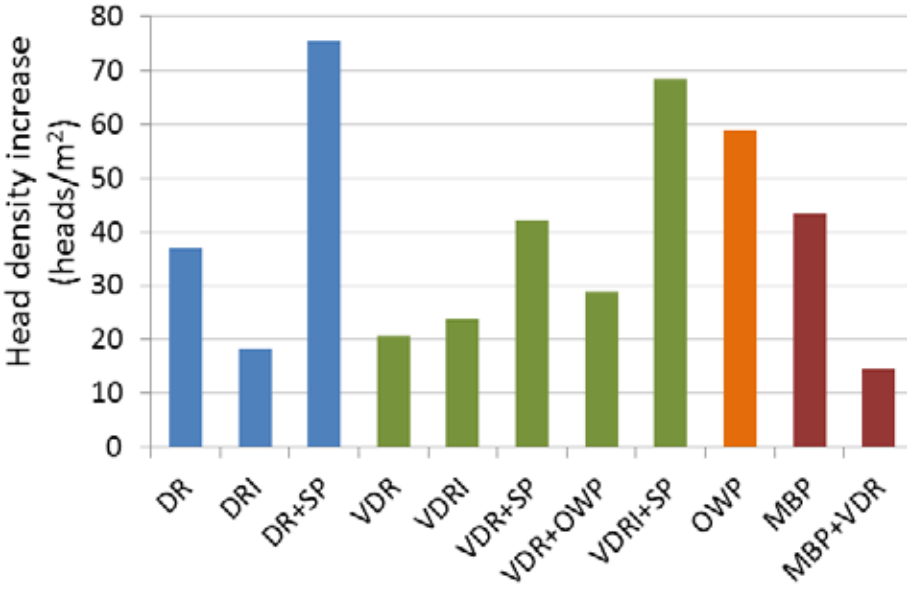
Soil depth (cm)	Soil pH ($CaCl_2$)	Organic Carbon (%)	P (mg/kg)	K (mg/kg)	S (mg/kg)
0-10	5.8	0.8	13	37	11
10-20	5.2	0.6	11	19	6
20-30	4.7	0.3	15	21	3
30-40	4.6	0.2	20	20	3
40-50	4.5	0.2	18	28	4
50-70	5.0	0.1	9	31	6

Meckering – constraints

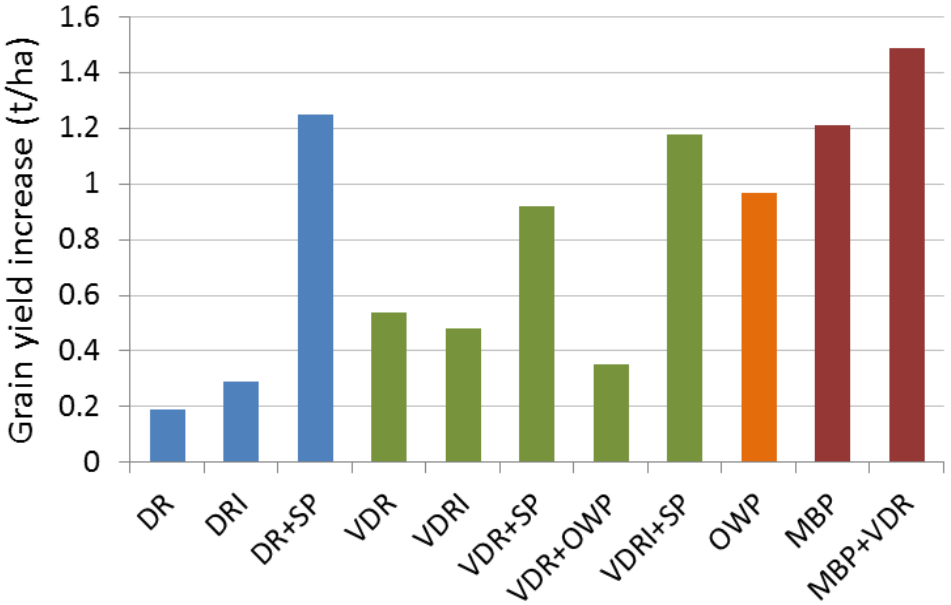




Meckering – head density & grain yield 2017

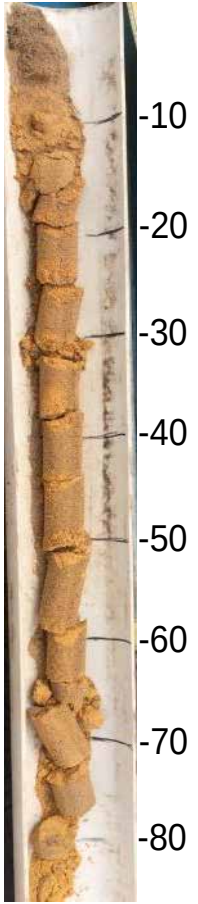


Control head density = 204/m^2
LSD 0.05 = 57/m^2



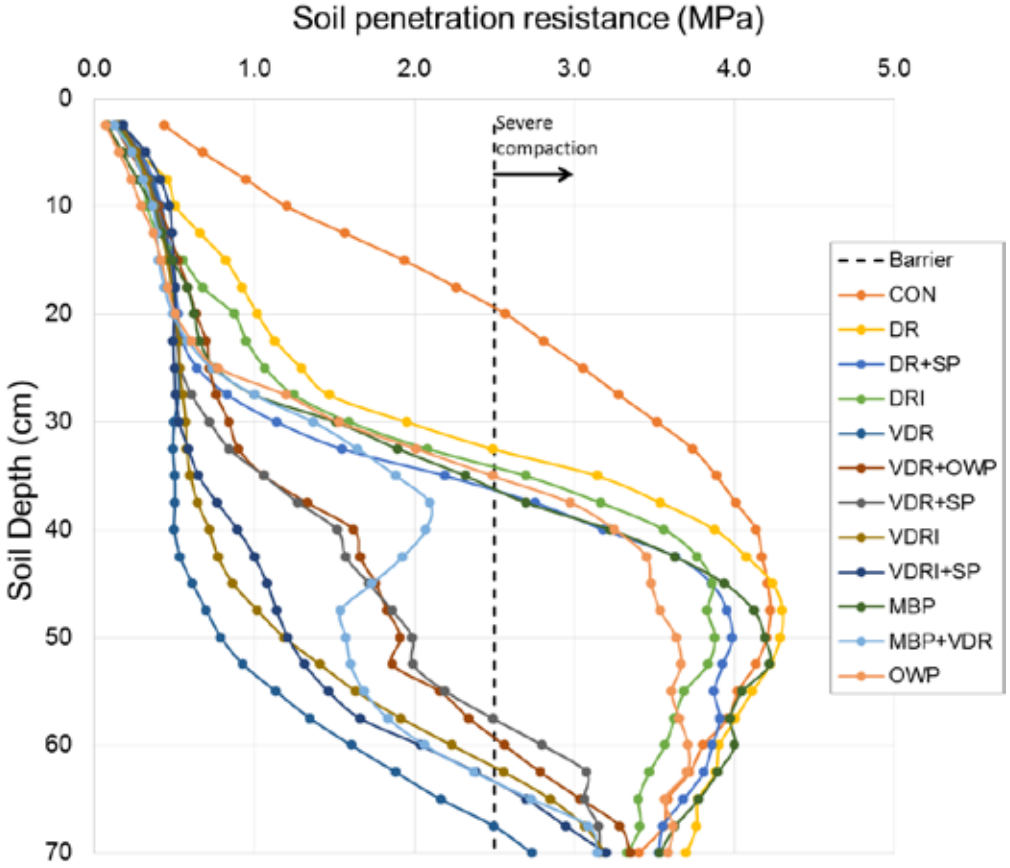
Control grain yield = 3.8 t/ha
LSD 0.05 = 0.7 t/ha

Goomalling – Rob and Daniel Dempster



Yellow
Deep sand

Goomalling - Constraints



Depth (cm)	Soil pH ($CaCl_2$)	Soil Al (mg/kg)	Col. P (mg/kg)	PBI	Col. K (mg/kg)	OC %
0-10	5.8		21	13	61	0.98
10-20	4.8	1.5	16		42	
20-30	4.3	5.6	16		39	
30-40	4.3	8.0				
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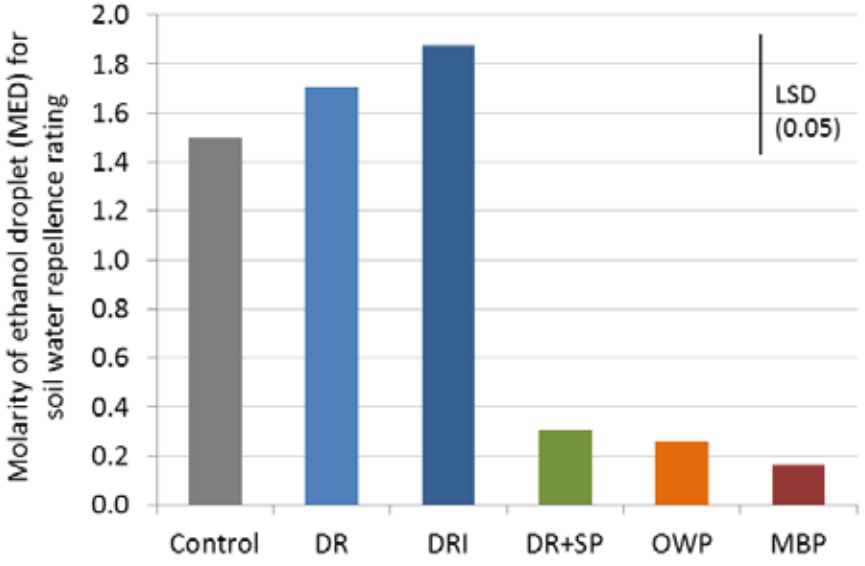
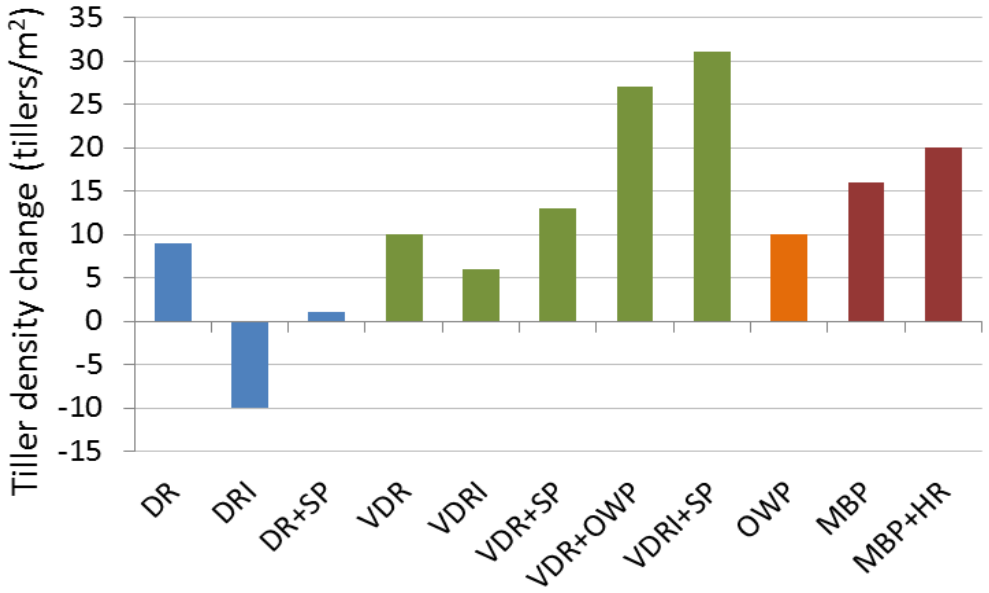
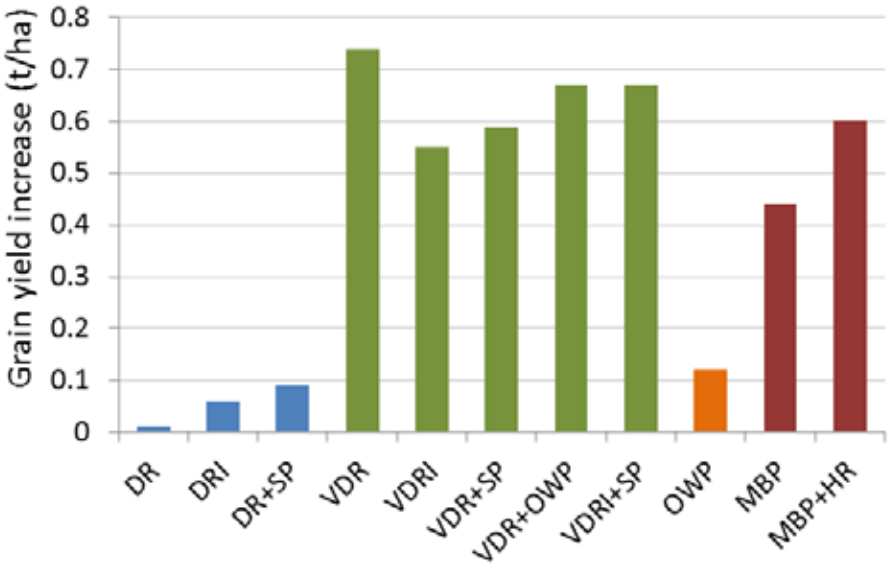


Goomalling – Crop Growth



Control tillers = 49/m^2
LSD 0.05 = 15/m^2

Goomalling – grain yield and returns



Control yield = 0.8 t/ha
LSD 0.05 = 0.16 t/ha

Treatment	Cost ($/ha)	Gross benefit ($/ha)	Net benefit ($/ha)	Years to break-even Sustained	Years to break-even Declining
DR	45	3	-42	>10	>10
DRI	50	14	-36	4	>10
DR+SP	150	21	-129	7	>10
VDR	90	172	82	1	1
VDRI	95	128	33	1	1
VDR+SP	190	137	-53	2	2
VDR+OWP	140	155	15	1	1
VDRI+SP	195	155	-40	2	2
OWP	50	28	-22	2	3
MBP	120	102	-18	2	2
MBP+VDR	200	139	-61	2	2

Assuming ASW1 wheat grade with farm-gate price of $231/t.

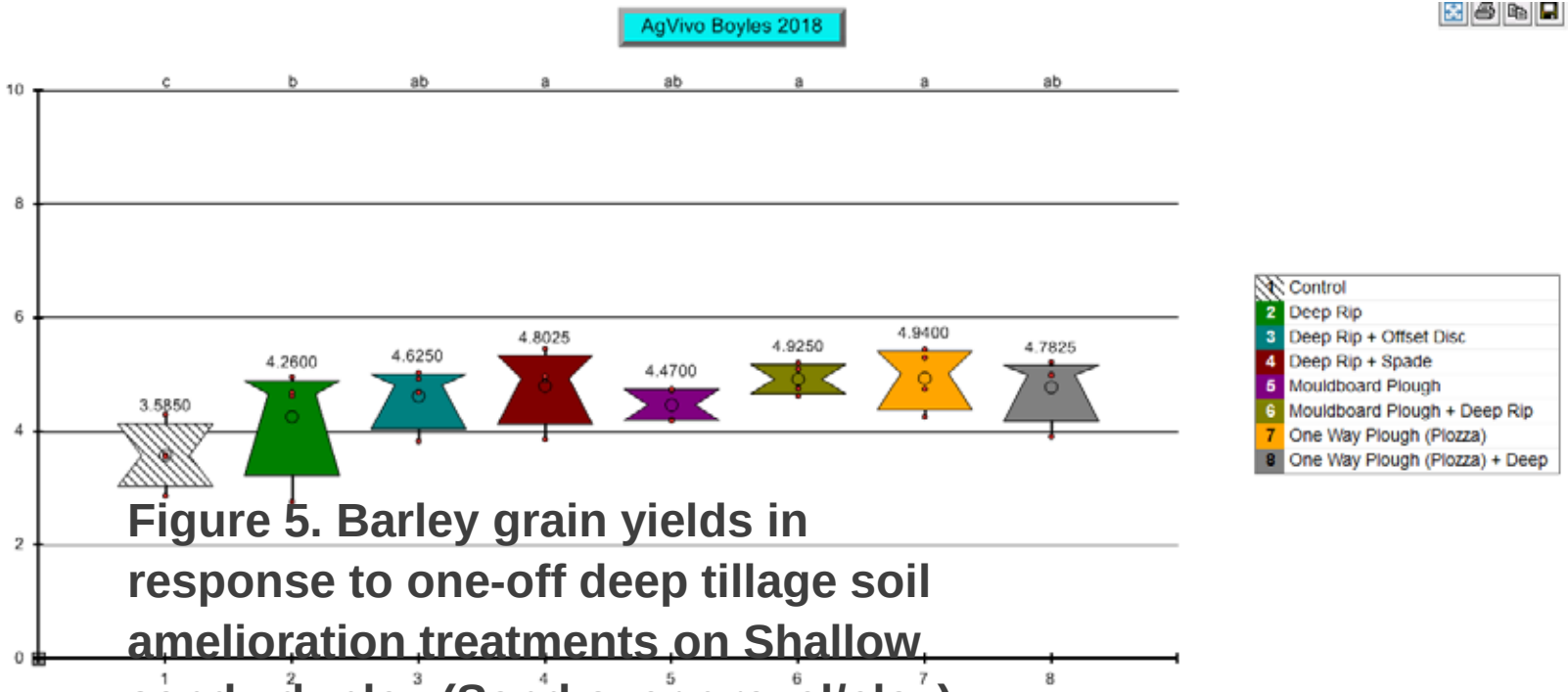


Figure 5. Barley grain yields in response to one-off deep tillage soil amelioration treatments on Shallow sandy duplex (Sand over gravel/clay), York, Western Australia. Bars represent LSD (0.05) of 0.52 t/ha 2018