Deep Ripping, 'Deeper' Deep Ripping and Water Use Efficiency

81MIG16

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Organisation: Mingenew Irwin Group

Growers: Cosgrove, Blake, Brindal, Preston

Locations: Irwin and Mingenew

SECTION A. SOIL TEST SUMMARY

Table 1. Soil Test results – Cosgrove, Gravelly Sand

DEPTH	N	P	K	S	pH ($CaCl_2$)	OC%
0-10cm	11	22	41	2.3	5.6	0.95
10-20cm	4	18	24	2.3	4.6	0.60
20-30cm	6	11	25	3.7	4.9	0.23
30-40cm	4	18	27	3.2	4.8	0.11
40-50cm	4	13	38	6.6	4.7	0.07
50-80cm	5	2	52	10.5	5.4	0.06
PAWC	NI					

*PAWC difficult to confirm at this site due to level of gravel in the sample

Table 2. Soil Test results – Blake 1, White Sand

DEPTH	N	P	K	S	pH ($CaCl_2$)	OC%
0-10cm	2	11	25	1.8	5.6	0.44
10-20cm	<1	11	17	1.5	5.0	0.19
20-30cm	<1	15	17	1.1	4.5	0.14
30-40cm	<1	20	16	1.2	4.5	0.11
40-50cm	<1	26	20	1.5	4.3	0.06
50-80cm	<1	8	25	4	4.5	0.05
PAWC	102mm					

Table 3. Soil Test results – Brindal, Sand over Gravel

DEPTH	N	P	K	S	pH ($CaCl_2$)	OC%
0-10cm	5	2	48	12.8	6.0	0.05
10-20cm	5	2	32	10.7	6.0	0.05
20-30cm	9	15	32	7.7	6.1	0.93
30-40cm	3	12	23	3.0	5.5	0.45
40-50cm	1	18	20	1.7	4.8	0.3
50-80cm	4	22	20	15.0	5.1	0.15
PAWC	102mm					

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Table 4. Soil Test results – Preston, Yellow Sand

DEPTH	N	P	K	S	pH ($CaCl_2$)	OC%
0-10cm	11	22	41	2.3	5.6	0.95
10-20cm	4	18	24	2.3	4.6	0.60
20-30cm	6	11	25	3.7	4.9	0.23
30-40cm	4	18	27	3.2	4.8	0.11
40-50cm	4	13	38	6.6	4.7	0.07
50-80cm	5	1	52	10.5	5.5	0.05
PAWC	130mm					

SECTION B. GROWER PADDOCK SUMMARY

GSR (Mar-Sept):
Cosgrove: 445mm Blake: 400mm Brindal: 430mm Preston: 356mm

Table 1. Paddock History:

YEAR	COSGROVE	BLAKE 1	BLAKE 2 (LUDLOW)	BRINDAL	PRESTON
2015	1.4t/ha RR Canola	1.54t/ha Lupins	Fallow	1.8t/ha Canola	2.4t/ha Lupins
2014	2.9t/ha Wheat	Wheat	Wheat	Wheat	3.2t/ha Barley
2013	1.2t/ha Lupins	Lupins	Lupins	Lupins	2.8t/ha Wheat
2012	3.4t/ha Wheat	Wheat	Wheat	Wheat	2.6t/ha Lupins

Trial Size: Large scale demonstration
Sowing Date: Cosgrove 19th May, Blake 22nd May, Brindal 10th May, Preston 25th May
Sowing Rate: Cosgrove 55kg/ha, Blake 90kg/ha, Brindal 80kg/ha, Preston 100kg/ha
Sowing Machinery: Grower machinery
Variety: Cosgrove: Mace, Blake: Wyalkatchem, Brindal: Trojan, Preston: Cobra

Table 2. Ripper used and depth:

YEAR	COSGROVE	BLAKE 1	BRINDAL	PRESTON
Standard Ripper	350mm	350mm	350 -400mm	400mm
Terraland	350mm (shallow due to gravel)		550mm	600mm
Tilco		550		650mm

Standard deep ripper that is capable of working to depths of 300-380mm
Bednar Terraland: With a working width of 6m the Terraland TO removes the hand pan to a depth of 550mm or more in lighter soils, it is made by Bednar Farm Machinery.
Tilco deep ripper: Ripping to depths of 700mm with a high working pressure of up to 2500psi, made by Nufab Equipment.

PADDOCK INPUTS

Table 3. Fertiliser

YEAR	COSGROVE	BLAKE 1	BRINDAL	PRESTON
Pre seeding fert	80kg/ha Amsul	45kg/ha MOP		50kg/ha Amsul
At seeding fert	60kg/ha MAP + 20kg/ha MOP	90kg/ha K-Till extra plus	100kg/ha K-Till Extra plus	80kg/ha MAPSZC 25kg/ha MOP
Post Em fert	140kg/ha Urea	80kg/ha NS51 75L/ha Flexi N	180kg/ha Urea	60kg/ha Urea
Total N Units applied	82	63	93	47

SECTION C. TISSUE TEST SUMMARY, LATE TILLERING

Table 1. Cosgrove Tissue Test Data

DEPTH	TOTAL N %	P %	K %	S %
Nil	1.04	0.19	1.47	0.10
Ausplow	0.95	0.16	1.45	0.10
Terraland	1.04	0.18	1.56	0.10

Table 2. Blake Tissue Test Data

DEPTH	TOTAL N %	P %	K %	S %
Nil	1.94	0.41	2.06	0.20
Ausplow	2.20	0.40	2.01	0.20
Tilco	2.28	0.41	2.28	0.21

Table 3. Brindal Tissue Test Data

DEPTH	TOTAL N %	P %	K %	S %
Nil	0.90	0.17	0.82	0.09
Ausplow	0.81	0.14	0.81	0.08
Terraland	0.86	0.12	1.07	0.10

Table 4. Preston Tissue Test Data

DEPTH	TOTAL N %	P %	K %	S %
Nil	1.25	0.17	1.24	0.13
Terraland	1.56	0.19	1.73	0.20
Tilco	1.61	0.23	1.87	0.18

WHY DO THE TRIAL?

Sub-soil compaction caused primarily by the movement of heavy machinery is having a negative effect on grain yield and quality across the Geraldton Port Zone (as well as all others in WA). Compaction limits plant root growth effectively reducing plant available water capacity (PAWC) which in turn limits yield potential.

Sandy textured soils are the worst affected soils and it is on these soils that compaction frequently goes hand in hand with sub-soil acidity – effectively compounding the problem.

In a time where it seems climate change sees significant dry spells occurring at least once in the vast majority of seasons, it is more important than ever for crop roots to be able to explore the soil profile to the fullest possible extent.

In short the profitability of crop growing is dependent on making the most of what rainfall a grower is fortunate enough to receive and PAWC is critical to this. This applies to all rainfall zones.

Growers in the region report that some soils on their property continue to underperform despite their fertiliser and system management strategy matching the remainder of their soils. The introduction of extra deep rippers to the region (650 – 700mm) has shown encouraging results, prompting growers to question current strategies and investigate the rippers as options for soil improvement.

The aim of the research is to identify any differences in yield that are a result of deep and extra deep ripping.

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SECTION D. COMPACTION SUMMARY

- Each site was tested in July with a penetrometer for compaction.
- The Cosgrove site was unable to be assessed due to gravel at the surface.
- 1 pass refers to the site having been driven over by the tractor (spraying/fert etc)
- Anything over 3MPa is under servere compaction.

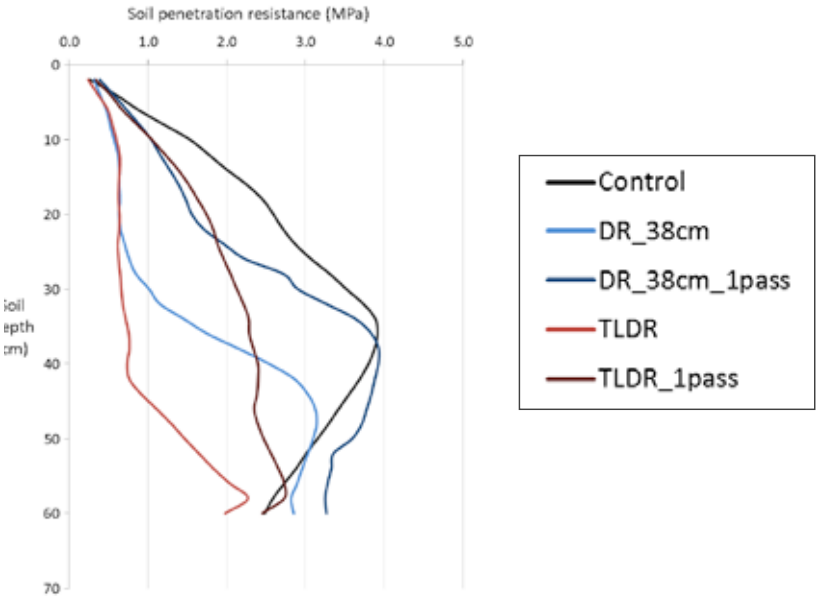

Figure 1. Blake compaction assessment

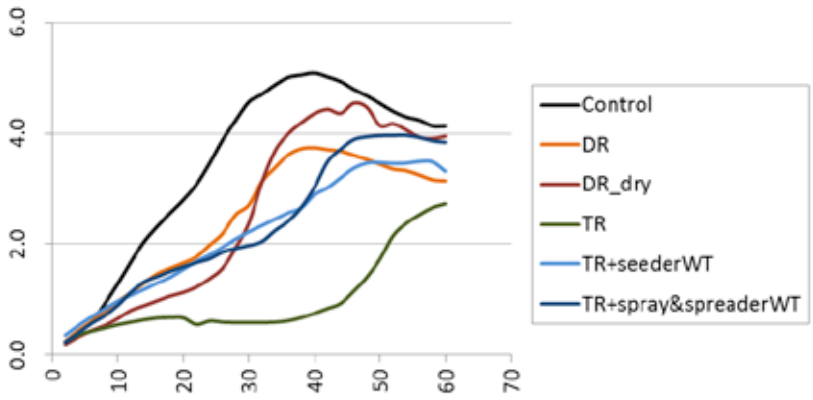

Figure 2. Brindal compaction assessment

- At this site some of the ripping was done dry and then the remainder was completed once the profile was wet. The +seeder, and +sprayer measurements have been taken where the wheels of these machines have driven over the soil ripped with the Terraland machine. These wheel tracks have induced servere compaction under 400mm and highlights the impact of wheel tracks and why growers are encouraged to reduce their wheel tracks after ripping.

KEY MESSAGES:

- It is difficult to assess deep ripping comparisons during the first season due to the challenge of achieving even plant establishment in a soft seed bed. MIG is keen to continue monitoring these sites in 2017 to assess their future performance.
- Final yield results from the Brindal site have not been included due to large variation in the results related to establishment challenges.
- Yield response to ripping is variable depending on seasonal conditions and the interaction with different soil type properties. Other soil constraints may be also be present and impact on yield.Both the Blake and Cosgrove sites had acidity issues at depth.
- There was an increasing response to ripping depth with a decline in rainfall at the sites (about 100mm variation across sites).
- Choosing the right tillage machine to help alleviate soil constraints specific to your farm will help provide the best return on investment

SECTION E. RESULTS

Table 1. Cosgrove Harvest results

TILLAGE TREATMENT	YIELD t/ha	PROTEIN %	WEIGHT kg/hl	SCREENINGS %	TREATMENT COST $/ha	RETURNS $/ha	RETURNS MINUS TREATMENT COST $/ha
Bednar Terraland (350mm)	2.44	9.83	74.84	2.81	45	ASW1 $570	$465
Standard Ripping with Tramline (350mm)	2.36	9.63	76.91	3.14	45	ASW1 $520	$475
Standard Ripping no Tramline	2.38	10.53	76.42	3.05	45	APW1$569	$524
Nil Ripping	2.21	9.63	76.74	1.85	0	ASW1$487	$487
P Value	0.646	0.078	0.513				
Lsd 5%	NS	NS	NS				
CV%	11.3	4.9	2.7				

- The Standard ripping no Tramline treatment was graded APW due to the higher Protein % than the other treatments, there was no significant difference in protein so the higher returns $/ha figure should be treated with caution. Note: Increased protein in tramlines has been observed previously by Paul Blackwell, DAFWA.
- The Bednar Terraland only ripped to 350mm at this site due to gravel content so the treatment cost is less than at the other sites.
- Soil pH was low at this site at depth so in a season where moisture was not limiting, acidity may be more of an issue than compaction.

Table 2. Blake Harvest results

TILLAGE TREATMENT	YIELD t/ha	TREATMENT COST $/ha	RETURNS $/ha	RETURNS MINUS TREATMENT $/ha
Nil (Site 1)	3.29	0	APW $786	$786
Standard Ripper (Site 1) 350mm	3.46	45	APW $827	$782
Tilco (Site 1) 550mm	3.42	75	APW $817	$772
Nil (Site 2)	2.38	0	APW1 $569	$569
Standard Ripper(Site 2)	2.76	45	APW1 $659	$614
Tilco (Site 2)	2.87	75	APW1 $686	$611

Site 2 was weaker white sand than site 1. Site 1 analysis shows that acidity is also an issue at this site. Wheat on these soil types would typically be chasing moisture later in the season but due to the soft season this was not the case in 2016. This needs to be monitored over other seasons to assess if the yield response to deeper ripping is there otherwise ripping shallow may be the more economic option.

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Table 3. Preston Harvest results

TILLAGE TREATMENT	YIELD t/ha	TREATMENT COST $/ha	RETURNS $/ha	RETURNS MINUS TREATMENT $/ha
Standard Ripping 350mm	3.16	45	AH1 $834	$789
Tilco 600mm	3.46	75	AH1 $913	$838
Bednar Terraland 650mm	3.83	75	AH1 $1011	$936
Nil	3.26	0	AH1 $861	$861

Price Notes: All prices net delivered Geraldton and GST Exclusive
Quality data was unavailable at time of printing for the Preston and Blake sites

The Preston site has had a good response to deeper ripping (no benefit to shallow ripping). The better yield with the terralanda may be due to the extra mixing of the top 30cm the terralanda helps with. The soil test results show slightly better K levels at depth indicating this is a loamier yellow sand that has been mixed with the topsoil increasing clay content and increasing the nutrition of the soil. This may have also helped reduce non-wetting and mixed up that acidic layer at 20cm and introduced some more subsoil constraints.

Moisture may have been more limiting at this site as it had nearly 100mm less rainfall than the Cosgrove site and the observation is a greater response to deep ripping.

COMMENTS:

- Each strip was ripped at a width of 2 header fronts for the full length of the paddock. All paddocks were sown to wheat.
- Rainfall decreased by nearly 100mm from the Cosgrove site in the south to the Preston site in the north.
- All sites still had remaining water in the soil profile at harvest.
- Repetitive strips where harvested the length of the paddock
- In general, the results were very mixed. Every site recorded a yield response to ripping but this did not always equate to $/ha. The Preston site showed the greatest response to the "Deeper" Deep ripping while the Blake and Cosgrove sites responded to both the standard ripping depth and the "Deeper" ripping. There are higher costs associated with "Deeper" ripping and these impact on final returns thus it is recommended growers test the depth of soil compaction in their paddock in the winter season prior to planned ripping when soils are moist. Soil testing to the depth of planned ripping is also recommended to ensure growers are aware of soil pH and any toxicity (eg Aluminium) that may exist at depth below the hardpan.

Season 2016, excluding the frost events, was a reasonably 'soft' season with high rainfall and moderate temperatures during the critical wheat growth stages. It is expected that responses to deep ripping will be more evident in a 'tough' season thus it is important that more monitoring of these trials continues before growers can reach a high level of confidence in their decision to adopt the practice of 'deeper' ripping.

ACKNOWLEDGEMENTS:

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