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Longevity of deep ripping on deep white sands in a CTF system

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Key messages

- Rip to below your compacted layer
- Ripping to 60cm reduced soil strength, and this effect continued into the second year after ripping
- Wheat yield response to the 60cm rip treatment paid for deep ripping in the first year
- It is important to understand potential yield benefits of ripping before you rip

Aim

To establish the long-term value of deep ripping on compacted deep south-coast sands. It investigated the longevity of the ripping benefit in a fully controlled traffic system (CTF).

Background

Compaction of deep sands can be alleviated by deep ripping but it is not fully known how long the ripping effect lasts in south coast soils. Shallow ripping (≤40cm) has limited improvements to soil strength and grain yield in previous trials so ripping to below the depth of compaction is essential. There are questions remaining about how long the ripping effect lasts in a CTF system and when to repeat the deep ripping. A trial at East Gibson investigated the longevity of deep ripping benefits on deep sands in a CTF paddock.

Method

Trial treatments were ripped with an Agroplow in March 2018 with treatment depths outlined in Table 1. Plots were 1.7km long and 9.14m wide. Scepter wheat was grown in 2018, GT-53 canola in 2019 and Flinders barley in 2020. The soil profile at the site is white sand over gravel and clay at 30–90cm depth.

Table 1. Deep ripping treatments at East Gibson trial in 2018 and 2021

Treatment	2018	2021
1	Nil	-
2	40cm	-
3	40cm	60cm
4	60cm	-

In-season data collection included establishment counts at crop emergence in 2019 and 2020 in each plot along a transect. Penetrometer readings were taken across the same transect in August 2018, September 2019 and August 2020. Harvest yield data was collected from the grower and interpreted using SMS software.

Results

Yield and plant establishment results

Results from yield mapping in 2018 show that ripping to 60cm significantly increased wheat yields by 0.8t/ha when compared to both 40cm and nil ripped plots (Figure 1). There was no difference in grain yield between plots ripped to 40cm and the nil rip plots with an average grain yield for both of 4.3t/ha (Figure 1). Average grain yield of plots ripped to 60cm was 5.1t/ha. The ripping cost of about $100/ha was well covered by extra grain, worth about $160 in the first year (assuming a price of $330/t for wheat).

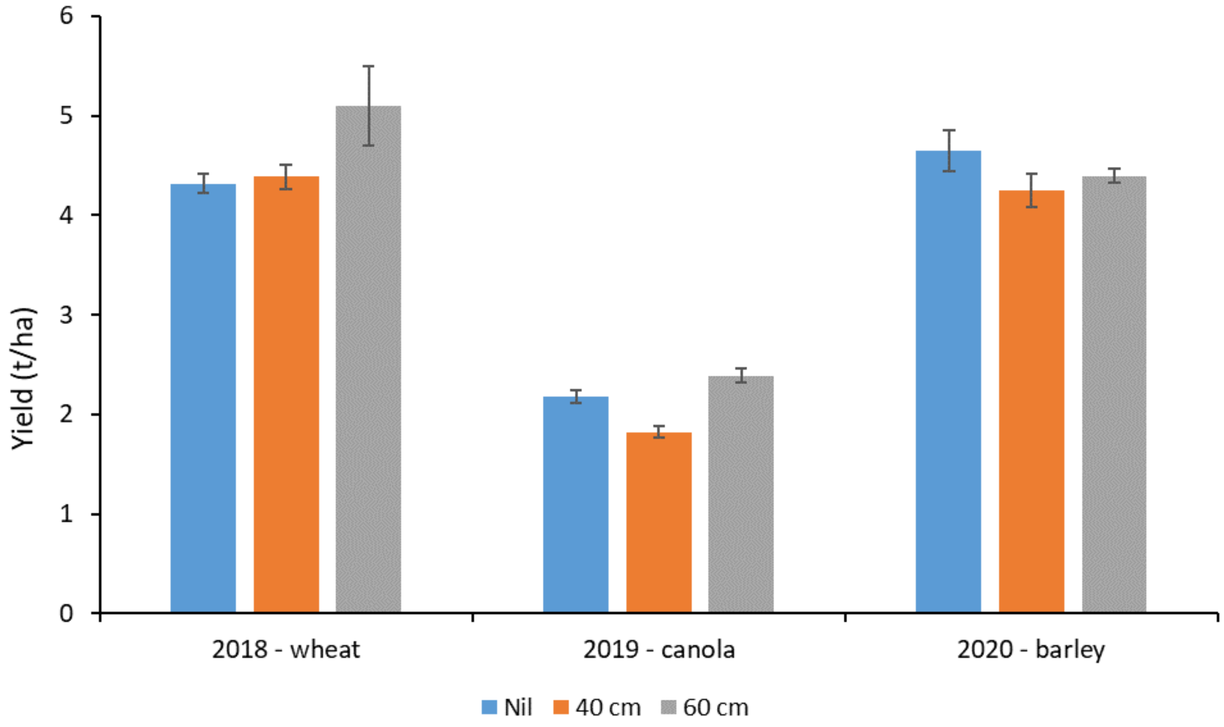

Figure 1- Average grain yield of Scepter wheat sown in 2018, GT-53 canola sown in 2019 and Flinders barley sown in 2020, from each ripping depth treatment. Error bars show standard error.

There was no difference in establishment between ripping treatments in both 2019 and 2020. In 2019 when the site was sown to GT-53 canola there was no significant grain yield differences between the treatments with an average site yield of 2.1t/ha (Figure 1). A potential yield of 2.5t/ha was calculated at this site for canola using a modified French and Schultz method; therefore all treatments are near potential yield for the 2019 season regardless of deep ripping treatments. The 2020 yield results, when sown to barley, also indicate no difference in grain yield between treatments with an average yield of 4.4t/ha (Figure 1). Potential yield of 3.2t/ha was calculated for the 2020 season; actual yield well exceeded this estimation, about one third greater than predicted yield.

Soil strength results

Penetrometer results from each of the three years of this trial indicate that there has been a sustained reduction in soil strength when ripped to 60cm (Figure 2). In the first year after ripping, penetrometer results initially indicated that there was only a reduction in soil strength when ripped to 60cm (Figure 2a). There was no difference between soil strength in the nil rip and the 40cm deep ripped plots. These results indicated that severe soil compaction that constrains root penetration, of 2.5MPa, occurs at 40cm depth, hence the 40cm deep rip treatment was not deep enough to shatter this layer of compaction. It is therefore important to understand the depth of compaction before deep ripping to ensure the constraint is addressed.

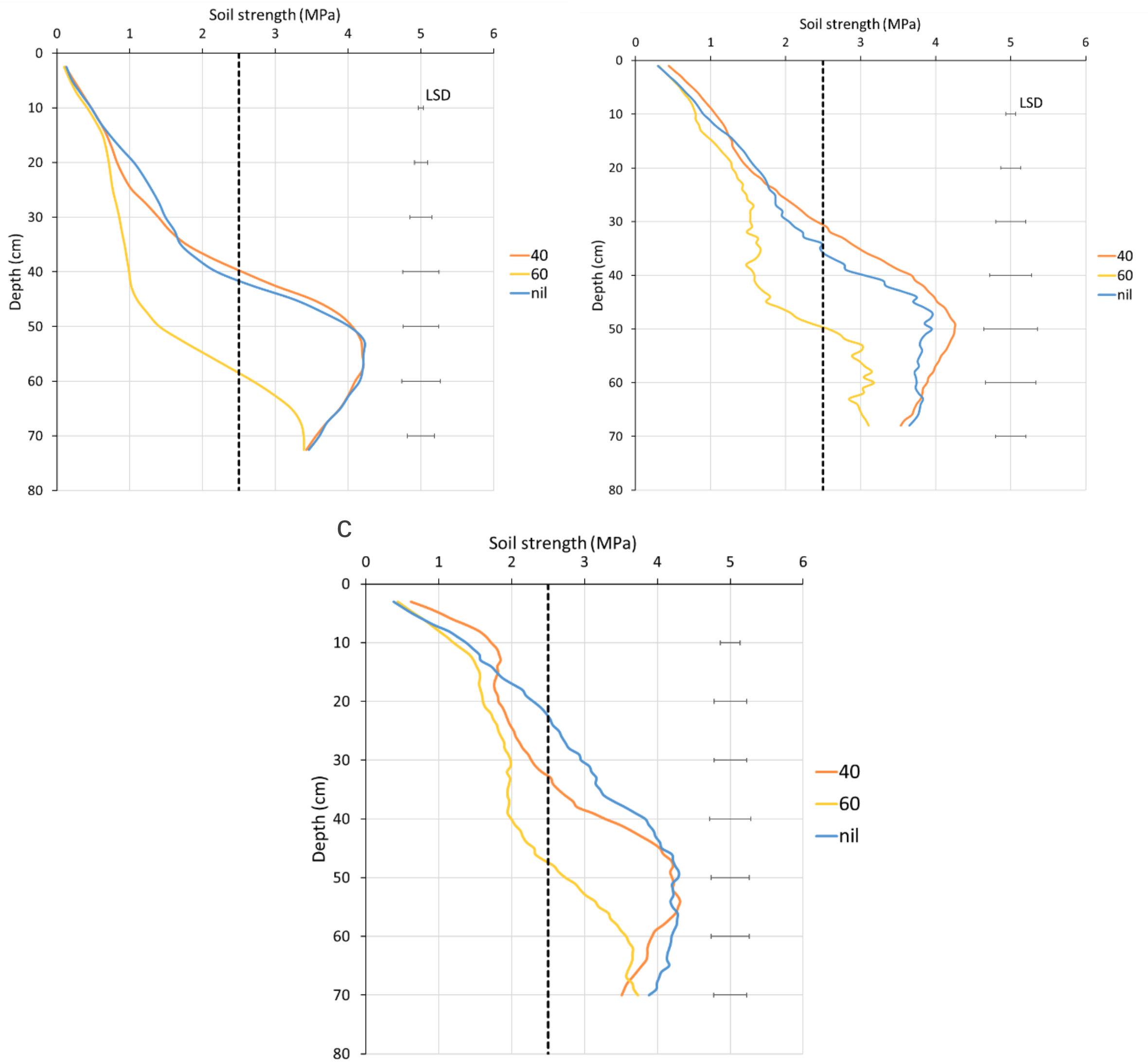

Figure 2 – Soil strength profiles from penetrometer readings taken in August 2018 (a), September 2019 (b) and August 2020 (c). The dotted line at 2.5MPa highlights severe compaction. LSDs are for soil strength at 10cm intervals down the profile at P≤0.05.

The 2019 penetrometer results indicate that while there is a sustained reduction in soil compaction in the 60cm plots there are signs that natural re-compaction is occurring. There is no longer a significant difference in soil strength among treatments below 55–60cm depth (Figure 2b). This same trend is shown in results from the 2020 penetrometer readings where, although there was a sustained reduction in soil strength, there is some indication that natural re-compaction is still occurring at depth (Figure 2c).

Conclusion

Results from this three-year study indicate that deep ripping to a depth of 60cm is economically worthwhile on deep white sands in the Esperance port zone as the ripping paid for itself in the first year. Although there was a sustained reduction in soil strength in the second and third years after ripping, despite natural re-compaction at depth, this was not reflected in yield, with no change across treatments in canola yield in 2019 and barley yield in 2020.

This trial has shown that it is important to understand how deep the compaction layer is to ensure ripping depth will alleviate the problem. To be sure of target ripping depth, take penetrometer readings prior to deep ripping to find the compaction layer of the soil.

Yield potential calculations showed that actual yields are exceeding modelled yield outputs. This indicates that there are factors not accounted for in the equation that are increasing the water use efficiency of crops, be it genetic advances in new varieties that increase yield potential or soil amelioration (i.e. deep ripping, liming, clay spreading).

Acknowledgments

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