DEEP RIPPING ON PULSES: A FIRST YEAR RESPONSE

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TAKE HOME MESSAGES

- Deep ripping increased chickpea yields by 0.3t/ha. This yield increase covered the cost of deep ripping in the first season.
- Deep ripping did not increase or decrease lentil yields.
- Further research is needed to understand why there was a yield response in chickpeas but not in lentils.

BACKGROUND

Pulses are an established rotation in most broadacre cropping systems across the Wimmera and Mallee. Pulses are beneficial break crops and allow farmers to spread financial risks across multiple commodities. As many growers now have sound agronomic knowledge regarding growing pulses, attention is turning to exploring other techniques to further increase pulse yields.

Previous research has shown that pulses; chickpeas, lentils and peas, have seen large increases in yield from deep ripping (Moodie, Saunders and Ucgul 2020). However, this work was conducted on deep sands in the northern Mallee. Deep ripping is now of increasing interest in the northern Wimmera (Telopea Downs to Rainbow) on sand-over-clay (duplex) soil types. This trial is investigating if the same yield increases in pulse crops due to deep ripping on deep sands can be replicated on duplex soil types.

AIM

To validate the effects of deep ripping on pulse crops on sand-over-clay soil types in the northern Wimmera.

PADDOCK DETAILS

Location:	Netherby
Crop year rainfall (Nov-Oct):	345mm
GSR (Apr-Oct):	241mm
Soil type:	Sand over red clay
Paddock history:	19 – Vetch hay cut

TRIAL DETAILS

Crop type/s:	Hallmark XT lentils, Genesis™ 090 chickpeas
Target plant density:	Lentils – 120 plants/m^2, Chickpeas – 35 plants/m^2
Seeding equipment:	Knife points, press wheels, 30cm row spacing
Sowing date:	25 May 2020
Replicates:	Four
Harvest date:	10 December 2020
Trial average yield:	Lentils – 1.6t/ha, Chickpeas – 1.7t/ha

TRIAL INPUTS

Soil amelioration: Deep ripped 2 April to ~30cm

Trial managed as per best practice for pests, weeds and disease.

METHOD

The site was ripped in early April with a tyne depth of 65cm and a tyne spacing of 30cm. A randomised compete block trial was sown on 25 May. Establishment counts post rolling, NDVI and visual root assessments were conducted. Penetrometer measurements were taken in October in moist soil to measure soil compaction. Plots were taken to grain harvest and subsequent grain assessed for quality.

RESULTS AND INTERPRETATION

Effect of deep ripping on compaction levels

Deep ripping removed a hard compaction layer that was present at 15cm. However, the deep ripping was not as deep as expected given the tyne depth, only reducing compaction to 25-30cm (Figure 1). There is another band of compaction at 40-50cm, which was not changed by the deep ripping as it was beyond the reach of the tyne. Despite the ripper having a tyne depth of 65cm, the working depth is approximately 30cm due to kickback and tractor power. It is important for growers to consider the working depth of their ripper when deciding if compaction can be alleviated through deep ripping. Penetrometer resistance above 1,500 kPa indicates that root growth is beginning to be restricted, with roots becoming severely restricted at greater than 2,500kPa (Hunt and Gilkes 1992). This indicates that plant roots will struggle to grow through the soil, with roots in the not ripped treatments being restricted from ~10cm, whereas in the ripped treatment roots would be able to grow unimpeded to ~30cm. This increase in rooting depth would be expected to allow the ripped treatment greater access to moisture and nutrition than the not ripped treatment.

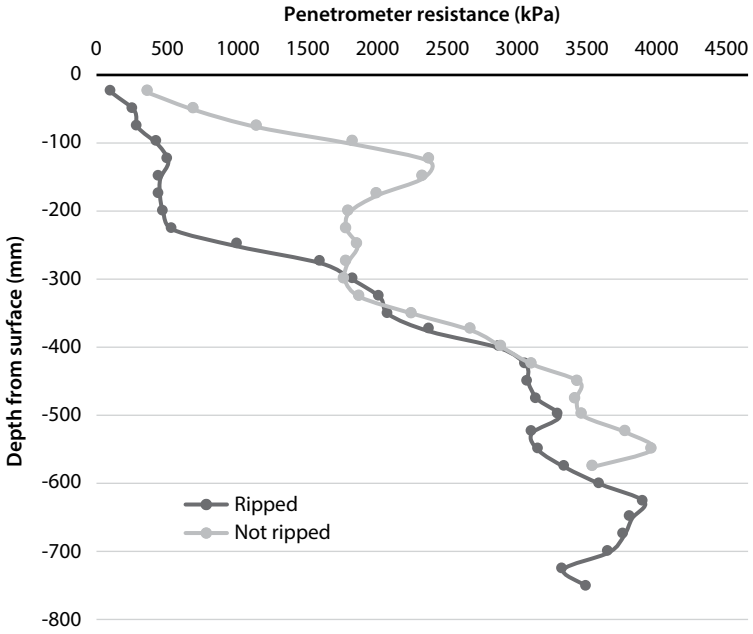

Figure 1. Average penetrometer resistance (four replicates) measured in moist soil in October across ripped and not ripped treatments.

Root growth response to deep ripping

Root assessments showed a visual difference in root growth between the not ripped and ripped treatments in both lentils and chickpeas (Figure 2, Figure 3), likely due to the breaking up of the compaction layer at 15cm.

Figure 2. Differences in root growth between not ripped (L) and ripped (R) treatments in chickpeas 2/9/2020. 40cm ruler for scale.

Figure 3. Differences in root growth between not ripped (L) and ripped (R) treatments in lentils 2/9/2020. 40cm ruler for scale.

NDVI response to deep ripping

There were significant differences in NDVI between the ripped and not ripped chickpeas at both 10 September (p=0.007, LSD=0.014, CV=3.8%) and 13 October (p=0.026, LSD=0.013, CV=2.3%). This indicates the ripped chickpeas had higher ground cover and/or were greener than the not ripped chickpeas.

Despite the differences in root growth between the ripped and not ripped lentils, there were no significant differences in NDVI at either time of measurement.

Yield response to deep ripping

In chickpeas, the ripped treatment significantly increased yields by 17%, from 1.5t/ha to 1.8t/ha (p<0.0001, LSD=0.064t/ha, CV=5.4%).

There were no significant differences between deep ripped and not ripped treatments in lentils. This was supported by the lack of differences in NDVI. Further investigation is needed to determine why this result occurred, as other field trials have seen an increase in lentil yields from deep ripping.

COMMERCIAL PRACTICE AND ON-FARM PROFITABILITY

Before deciding to deep rip a paddock it is vital to ensure the soil constraint can be ameliorated using deep ripping. Deep ripping only alleviates soil compaction, not any other soil constraint. To determine if this is the case in your paddock, it is recommended to conduct a soil test to ensure low nutrient levels, salt, low clay content or toxicities are not present. If these constraints were present, deep ripping may bring them to the surface making the problem worse. A further consideration is that deep ripping only works if the compacted layer is at a depth that can be broken up by the tynes, which will differ between rippers. To determine this, use a penetrometer or a shovel to measure the depth of the compacted layer. It is recommended that if the compacted layer is at the correct depth, deep rip test strips prior – at least one season prior – to deep ripping the whole paddock.

Choosing to deep rip prior to a pulse rotation, especially chickpeas and faba beans, may be a good fit, as they are able to establish better from a deeper sowing depth. Furthermore, pulse crops are often rolled post sowing, which would flatten out ridges and clods created from the deep ripping, making the paddock more manageable. Rolling and future paddock trafficking needs to be done carefully to ensure that soil is not recompacted.

Sowing a pulse crop following deep ripping does have some negatives that also need to be considered. The risk of herbicide damage is increased following deep ripping due to loose soil, variable seeding depth and a lack of organic matter for the herbicide to bind to. Weed control in pulses is already difficult and deep ripping can make it more so. Growing a pulse following deep ripping also increases the risk of erosion of the loosened soil post harvest, compared to crop types that leave more stubble behind, such as cereals.

While these results need to be interpreted with caution as the mechanism that led to the yield increase seen in chickpeas is not yet determined; deep ripping increased income by $168/ha which would cover the cost of deep ripping in the first season. The potential for further yield increases in subsequent seasons presents deep ripping as a significant opportunity for growers to increase returns on suitable soil types.

This trial will run for a further three seasons to investigate the longevity of the deep ripping response and how different crop types respond to deep ripping.

REFERENCES

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