Comparing ripping machines to alleviate compaction

CASE STUDY 6

SNAPSHOT

Farmer name: Brett O'Brien
Location: Kyancutta, SA
Farm Size: 4500 ha arable
Enterprise: Cropping and grazing
Average annual rainfall: 300 mm

KEY MESSAGES

- On this site, the 'best' ripping machine is one that works deep enough to give crops access to subsoil moisture.
- With a dry finish, ripping can lead to a yield penalty due to increased crop biomass but lack of moisture for grain fill.
- Machinery performed differently on the siliceous vs calcareous sand.
- Ripped soils often need more nutrition to keep up with improved biomass and higher yield potential.

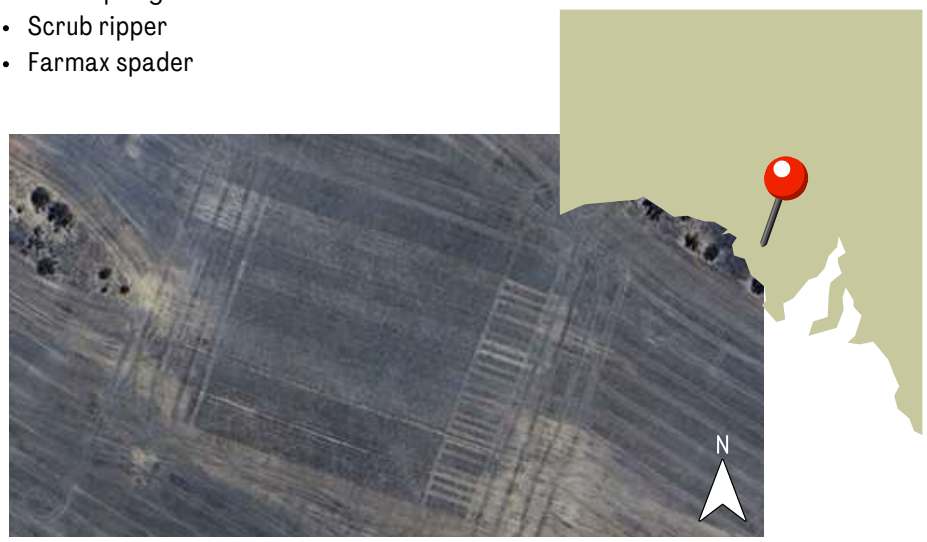
SANDY SOIL CONSTRAINTS

Water repellence | Compaction | Low water use/ water left behind | Low fertility

Area of land affected (ha): 1000 | Area of land affected (%): 25

Trialled

- Lienert deep ripper
- Plozza plough
- Scrub ripper
- Farmax spader



INTRODUCTION

Brett O'Brien has been farming his 4,500 ha farm at Kyancutta since 2000. Low productivity sandy soils cover approximately one quarter of the farm and are predominantly sand hills.

In an average to good year, the sand hills yield 50% less than other soil types.

Water repellence is the major issue, but the sands are also compacted, have low fertility, and low water use, i.e. water left behind at the end of the season.

In the past, Brett grew rye on the sand hills which was used for grazing. He has been ripping using a modified scrub ripper that works 500 mm deep. This has improved productivity on the mid-slope by 1–2 t/ha, but not on the top of the sand hills. The improvement means Brett can now grow wheat on the whole paddock rather than rye, which was not very economical. "It was only a stop gap to stop drift," said Brett.

Brett has also tried delving and spading, saying, "when we delve and spade, we can get an extra 2 t/ha by treating compaction, wettability and improving soil fertility."

With access to multiple pieces of machinery, Brett wanted to know which machine strikes the best balance between economics and a decent ripping job to treat water repellence and compaction.

THE TRIAL

The trial tested which machine does the best ripping job on two different soil types:

1. Siliceous sand: A non-calcareous sandy topsoil with a bleached A2 horizon, overlying loamy sand layer from 15-30 cm depth and a clayey sand subsoil from 30 cm depth.
2. Grey calcareous sand: A grey calcareous loamy sand topsoil with clay and carbonate content increasing with depth.

The trial tested four machines with the aim of both alleviating compaction and treating moderate water repellence:

1. Lienert delver + spader - works to 500 mm depth.
2. Plozza plough – set up to mix to 200 mm depth.
3. Scrub ripper – works to approximately 400 mm depth.
4. Farmax spader – mixes the top 300 mm of soil.

Brett owns all four machines compared in the trial. By participating in the trial, he hoped to identify the most economical way to rip the soil, alleviate compaction and help crop roots access deeper soil moisture and to bring up clay to treat water repellence.

The trial was established on 20 March 2023, as large, replicated plots 15 m x 100 m in size (Figure 1).

Figure 1. Soil surface after treatment with the various machines

RESULTS

Siliceous sand

The various rippers did not improve soil compaction (Figure 2). Further measurements are required to investigate.

The Plozza plough gave the highest yield increase (0.5 t/ha) over the control, followed by the delver + spader (0.25 t/ha). The spader and scrub ripper did not improve yield above the control (Figure 4). The high disturbance with spading might have led to increased water loss.

Overall, the treatments had little impact on soil compaction on the siliceous sand. The dry year may have caused a biomass penalty, where higher growth through the season was not translated to grain fill.

Calcareous sand

All rippers reduced compaction to roughly their working depth; the Plozza plow to 200 mm, the spader to 350 mm depth, the "Scrub ripper" to 400 mm, and the delver + spader to 500 mm (Figure 3).

RESULTS cont...

Generally, deeper disturbance worked better on this soil type. The delver + spader combination giving the highest yield boost above the control (+ 0.97 t/ha), followed by the spader (+0.38 t/ha). The Plozza plough was not able to remove the compaction between 200-300 mm, potentially restricting water extraction by the crop. Despite working to 500 mm depth, the Scrub ripper did not improve yield.

The variable results across the two soil types and between machinery indicate there is still much to understand about ameliorating sandy soils, such as why:

- Deeper disturbance worked better on the calcareous sand.
- The treatments had no impact on compaction on the siliceous sand.
- The Plozza plough led to best yield improvements on the siliceous sand, despite working shallower than the spader.

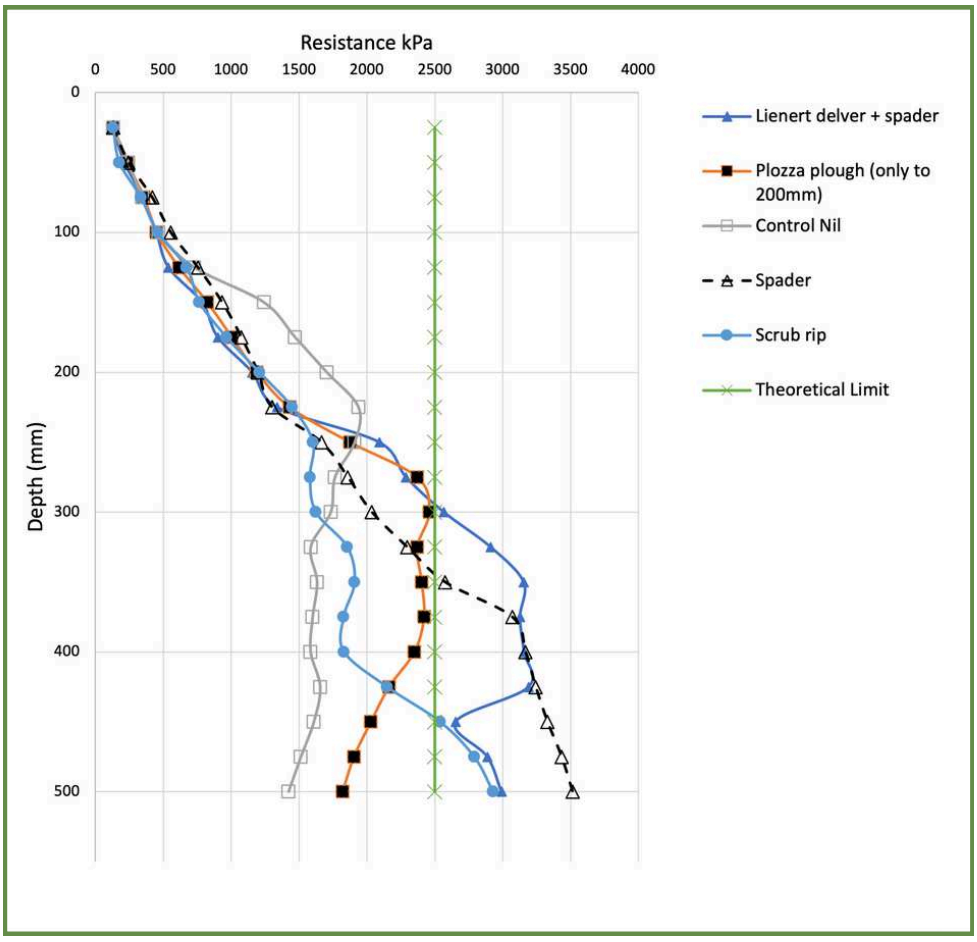


Figure 2. Penetrometer resistance (kPa) measured in siliceous sand in December 2023

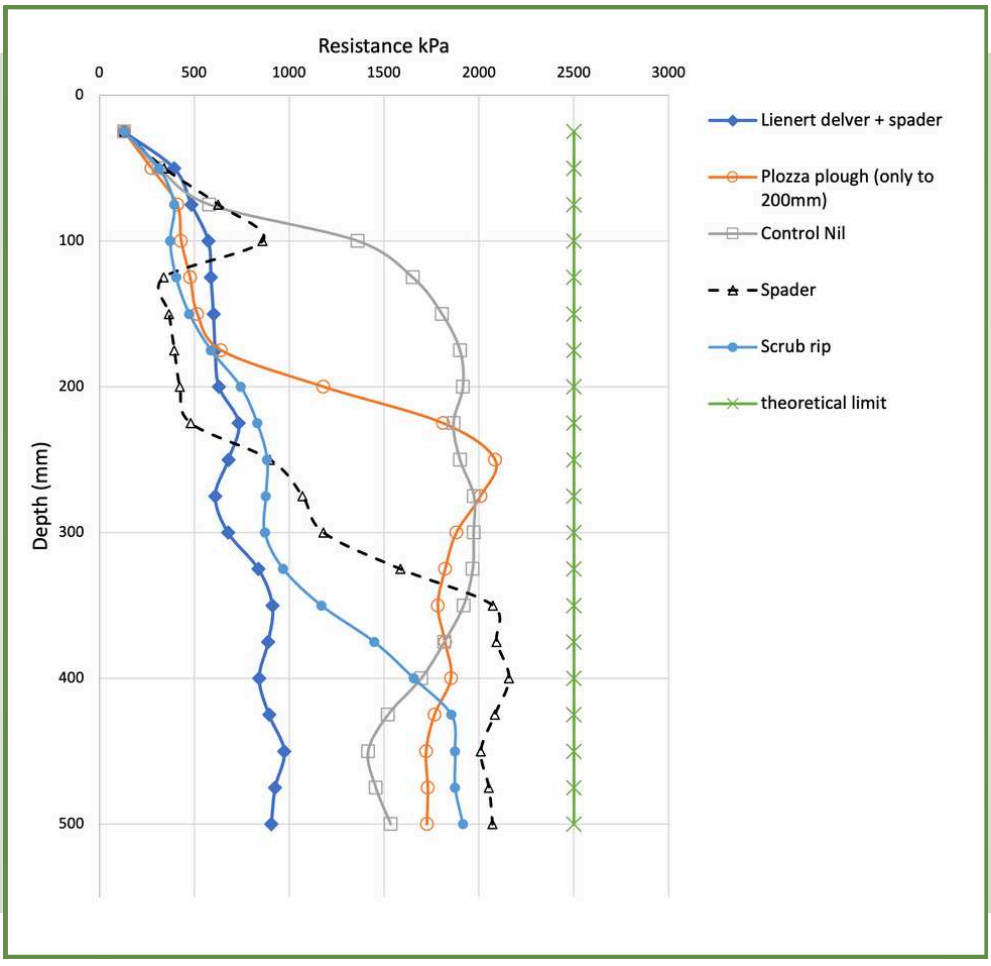


Figure 3. Penetrometer resistance on the calcareous soil in December 2023

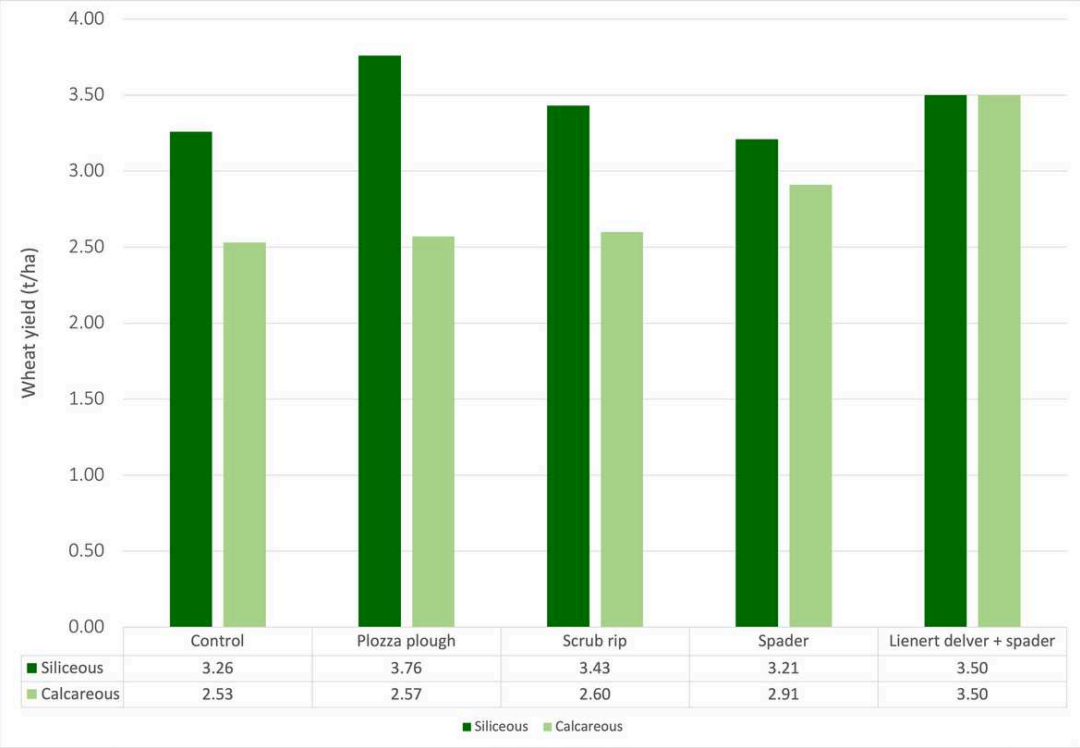


Figure 4. 2023 wheat yield results in the siliceous sand and calcareous sand

NEXT STEPS

Based on the results, Brett would like to test the Plozza plough further down the hill on the slightly heavier, water repellent, low fertility soils. He would also like to continue delving and spading, as it improves the water repellence and nutrition, and provides a positive yield boost.

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RESOURCES

Agriknow: https://www.agriknow.com.au/trial/38

PROJECT INFORMATION

Trial run by SARDI Minnipa Agricultural Centre staff, Amanda Cook, Josh Telfer and Brett Masters (formerly SARDI). Many thanks to Brett O'Brien for hosting the trial.

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