Deep ripping sandy soils on the upper Eyre Peninsula

CASE STUDY 9

SNAPSHOT

Farmer name: Nigel Oswald
Location: Mt Damper, SA
Farm Size: 5000 ha
Enterprise: Cropping
Average annual rainfall: 310 mm, 263 mm (2022 GSR)

KEY MESSAGES

- After soil amelioration, additional nutrition is needed to support higher yield potential and nutrient removal.

SANDY SOIL CONSTRAINTS

Water repellence | Compaction | Low fertility

Area of land affected (ha): 250 | Area of land affected (%): 5

Trialled

- Spading (300 mm)
- Deep rip + inclusion plates (450 mm)
- Deep rip + inclusion plates (450 mm) + spading (300 mm)
- Deep rip + inclusion plates (450 mm) + nutrition

INTRODUCTION

Water repellence, compaction and low fertility are key concerns on sandy soils that cover approximately 5% of Nigel Oswald's property at Mt Damper, South Australia. Soils vary across the farm, ranging from red loamy soils to grey soils and white siliceous sand.

In wet years there isn't much of a difference in yield, but in dry years, there's up to a 50% reduction in yield (1 t/ha), primarily due to water repellence. Nigel says, "with the rainfall in 2022, water repellence wasn't an issue. But in lower rainfall years, incorporated clay will hold the moisture much better."

In the past Nigel has tried delving to bring up clay to treat water repellence and weeds. In the early 2000's, he built a delver from an old stump ripper and used it on a different block to treat water repellence and control brome grass. Nigel says, "It controlled the brome grass well by burying the brome grass seed."

Since then, Nigel has delved about 200 ha bringing up clay from 40-80 cm depth, using a roller to break up clay lumps then working the clay in with a cultivator. For the first few years following amelioration the paddock surface was still uneven with clay lumps present. However, by the third year the yield response increased to 75-80%, but has since dropped back to about 60%. Better brome grass control also contributed to the yield boost in the first few years after amelioration.

The water repellence largely subsided for 10-15 years, but over time it has gradually returned. Nigel thinks this is because the delver worked on 1 m spacings and after years of working the soil the water repellent sand has moved from the inter-row back into the row.

THE TRIAL

The trial was established in 2019 as part of the GRDC Sandy Soils Impacts validation project. The site has been monitored annually since then to gauge long-term impacts. Treatments were selected to deal with multiple soil constraints including water repellence, high soil strength and low fertility, and included:

1. Control
2. Spading to 300 mm
3. Deep ripping with inclusion plates to 450 mm
4. Deep ripping with inclusion plates to 450 mm + spading to 300 mm
5. Deep ripping with inclusion plates to 450 mm + nutrition

In 2022 additional nutrients were applied to meet the nutrient needs of potential production increases from addressing constraints over the previous 3-year period.

Crops were wheat (2019, 2020), barley (2021), Butler$^{\Phi}$peas (2022), wheat (2023).

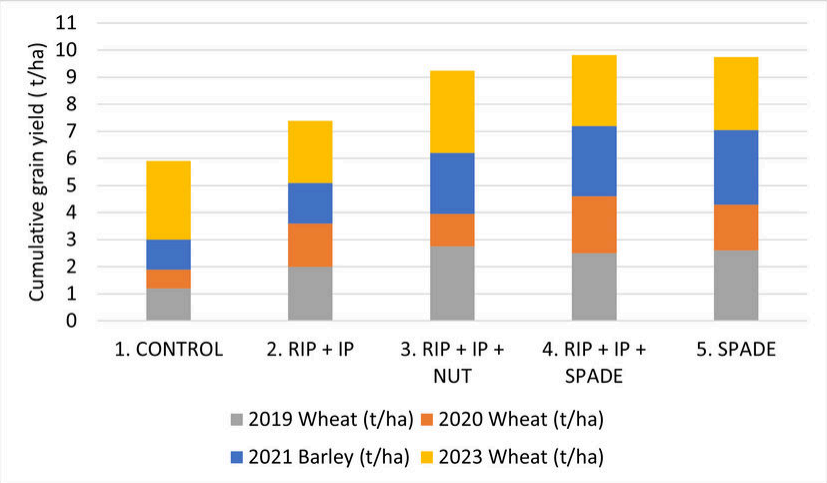

Figure 1. Cumulative grain yield from 2019-2021 and 2023. Pea yield data from 2022 not included. IP = inclusion plates, NUT = Nutrition

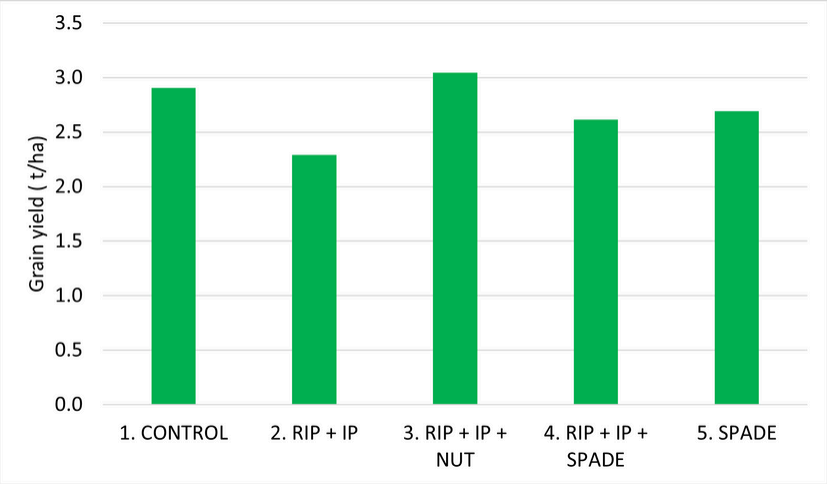

Figure 2. 2023 wheat yield.

RESULTS

From 2019 – 2022, treatments that included spading (+/- rip with inclusion plates) increased biomass compared to the control (Figure 1). These spring biomass responses carried over to increased yields, except for the pea crop in 2022.

Small differences were documented throughout each trial year:

- In 2020 (wheat), spading and ripping with inclusion plates (Treatment 4) resulted in more crop biomass and yield.
- In 2021 (barley), both spading treatments (Treatments 4 and 5) had the highest yields, followed by ripping + nutrition.
- In 2022 (peas) there were no differences in establishment, NDVI values or grain yield. Data not presented.

The results varied in 2023, where the control yielded well, only surpassed by the treatment with additional nutrients (Treatment 3, Figure 2). This indicates that after soil amelioration, additional nutrition is needed to support higher yield potential and nutrient removal.

Nigel says, “For the last few years the deep ripping and spading has probably had the better results [compared to the other treatments]. 2022 was a bit different because we had double the normal rainfall that year. It was hard to see the difference between the treatments. But in years with average or lower than average rainfall you can see differences.”

TREATMENTS

Treatments that mix the soil well to 30 cm i.e. spader vs inclusion plates gave better results. This may be due to improved uniform mixing and decompaction of the top 30 cm achieved by rotary spading, in comparison to deep ripping. The two treatments that included spading provided the highest cumulative grain yield after three years, providing more than 4 t/ha of additional grain (Figure 2).

In 2023, dry spring conditions proved challenging with a number of the treatments performing worse than the control for wheat grain yield. This may be partly due to the season with lack of spring moisture limiting grain filling, due to higher biomass and earlier crop maturity.

Only ripping with inclusion plates and additional nutrients (Treatment 3) yielded higher than the control. This may indicate the need for additional nutrient applications following amelioration, to properly account for additional nutrient removal due to previous higher biomass and grain yields.

"It shows the importance of crop nutrition over time," says Josh Telfer, SARDI Soils Senior Research Officer. "The biggest take home is that after a few years of higher nutrient removal than the control, the fertility of these strips could be dropping. In a dry year, this is detrimental to yield. For example, compare deep ripping with and without nutrition. The treatments with nutrition yielded much better than ripping alone."

> **"There are lots of different tools and it's a matter of finding the right ones."**

NEXT STEPS

Nigel plans on going back to the paddocks that were first delved 20 years ago, with a ripper and spader, to bring up more clay and incorporate it well. He will do this on a 45-degree angle compared to last time. He is also considering ripping and spading, and because of the trial, is looking more closely at post-amelioration nutrition.

Nigel says, "the clay is already up a bit higher from delving. The ripper would bring it up further and the spader would mix it in. When we first delved 20 years ago it was not a common practice and deep ripping and spading weren't being used in the area. Now there are lots of tools used to get a similar result."

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RESOURCES

AgriKnow: https://www.agriknow.com.au/trial/40
Soil Hub: https://soilhub.com.au/mt-damper-south-australia/

PROJECT INFORMATION

This trial was originally set up as part of the GRDC Sands Impacts project.
Trial run by SARDI Minnipa Agricultural Centre staff, Amanda Cook, Josh Telfer and Brett Masters (formerly SARDI).
Many thanks to Nigel Oswald for hosting the trial.

Building drought resilience by scaling out farming practices that will enhance the productive capacity of sandy soil landscapes.
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