Finding Efficiencies in Deep Ripping

Better results for every dollar spent transforming Mallee sands

The Challenge

Reducing soil amelioration costs while improving efficiency is critical for farmers managing challenging Mallee sands, where non-wetting soils and compaction often limit productivity.

This collaborative NGN project, through the Grains Research and Development Corporation (GRDC), was led by Mallee Sustainable Farming (MSF) in partnership with the University of South Australia's Agricultural Machinery Research and Design Team (AMRDC), Frontier Farming Systems, and grower Mick Farley.

As a key part of the project, a 2024 trial near Copeville, South Australia, evaluated various deep ripping setups to determine their efficiency and cost-effectiveness. The findings provide actionable insights into balancing soil productivity improvements with economic savings, offering farmers guidance for addressing soil constraints in their own paddocks.

Tackling the Problem

Trials over two years were designed to evaluate how different ripping depths, tine setups, and operating speeds could optimise soil loosening efficiency and reduce costs for farmers.

In 2023, Uni SA Research Engineers conducted a machinery performance evaluation, testing a variety of ripper tine types, operating depths, speeds, and configurations, including spading at Walpeup and Parrakie.

Soil strength was characterised, and draft requirements were measured to quantify tractor power needs, fuel use, and labour costs.

In 2024, a paddock-scale site was established by Frontier Farming Systems at Copeville, building on the findings from the first phase.

Treatments were selected based on efficiency data and their suitability to address the sandy soil constraints specific to the paddock. Soil and crop responses were carefully monitored, focusing on changes in soil properties, the mixing of ameliorants, and the removal of physical barriers.

The goal was to identify the most cost-effective solution—optimised ripping that delivers improved yields while minimising expenses.

The sandy soil profile at the Copeville site with a non-wetting surface layer.

Addressing Key Soil Constraints with Deep Ripping

Mallee soils present unique challenges that require targeted solutions.

One of the primary issues is soil compaction, which restricts root growth and limits the ability of plants to access moisture and nutrients. In addition, many areas experience non-wetting soils, where surface layers repel water, exacerbating poor germination and uneven crop establishment.

The trial sought to evaluate deep ripping techniques tailored to common constraints of Mallee sands. Each ripping method was designed to maximise soil loosening and address non-wetting issues while remaining cost-effective.

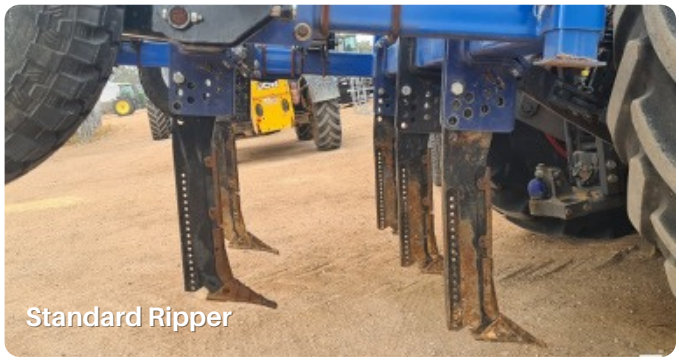
This approach enabled farmers to compare various machinery setups and assess their impact on crop performance, paving the way for more informed decision-making.

Comparing Different Ripping Combinations

The trial involved five deep ripping treatments, each tailored to address specific soil constraints, alongside an untreated control plot.

The treatments included:

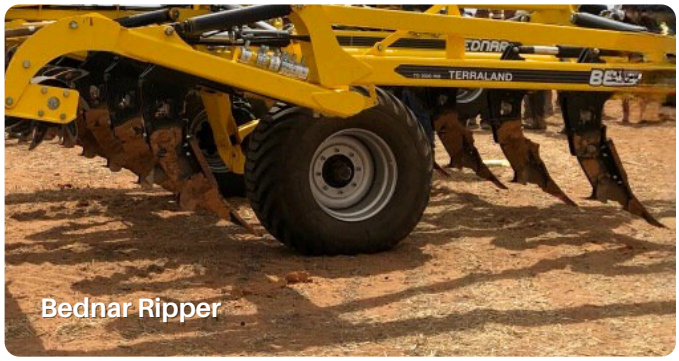
- **Standard Ripping**: A common approach in the region, using straight shank tines that provide minimal surface mixing.
- **Maximum Loosening Ripping:** Featuring high-capacity wings to significantly loosen soil between tine rows.
- **High Efficiency Ripping:** Utilising wider tine spacing with shallow leading tines to reduce power requirements while achieving similar loosening effects.
- **Inclusion Ripping:** Incorporating passive inclusion plates to bury surface soil to a depth of 500 mm, mixing non-wetting layers with deeper soil.
- **Bednar Ripping:** The farmer's machine, designed for intermediate mixing and loosening, with a working depth of 450 mm.


Standard Ripper


Maximum Loosening


High Efficiency


Passive Inclusion



Bednar Ripper

Where were the Greatest Gains?

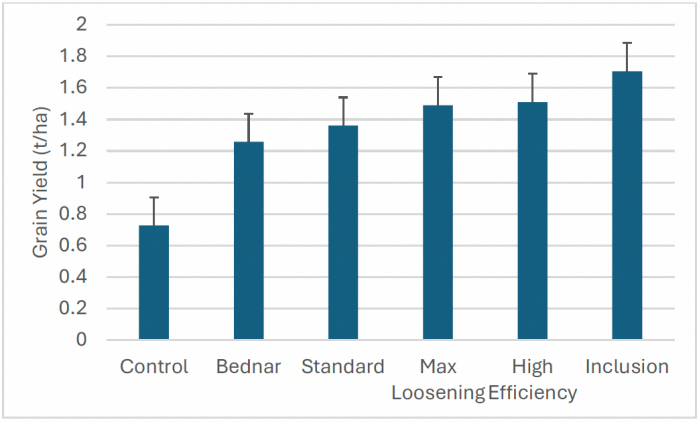
- All deep ripping treatments improved barley establishment and grain yield compared to the control (0.7 t/ha).
- Inclusion ripping yielded 1.7 t/ha, significantly higher than all other treatments.
- Maximum loosening and high-efficiency ripping also improved yields and produced higher yields, but were not significantly different from standard ripping.

The economic benefit of deep ripping was calculated using a partial gross margin for the four deep ripping treatments designed in collaboration with the AMRDC. See table below.

The partial gross margin was calculated using the following parameters:

- Additional revenue generated in the deep ripping treatments relative to the control.
- Fuel costs measured during the implementation of these treatments.
- Labor costs to undertake deep ripping treatments.
- Machinery investment costs.

This analysis further underscored the value of these treatments. While inclusion ripping incurred higher implementation costs due to additional fuel, labour, and equipment, it delivered double the gross margin compared to standard ripping. This demonstrates that strategic investments in soil amelioration provide significant long-term benefits for growers.



Above - Graph of grain yield for each ripping treatment.

The results also highlighted the importance of site-specific management. Maximum loosening ripping proved highly effective on areas with deeper compaction, while high efficiency ripping was more economical for areas with moderate constraints.

Research Agronomist, Michael Moodie emphasised the economic and practical benefits of different approaches stating, "Inclusion ripping is ideal where you need to address both compaction and non-wetting. For less severe constraints, high efficiency ripping can offer similar benefits with reduced costs."

Michael Moodie discussing treatments at the spring Field Day.

Economics of Treatments - Partial gross margin

Treatment	Yield Benefit t/ha	Additional Revenue $/ha	Fuel Cost $/ha	Labour Cost $/ha	Machinary Cost $/ha	Partial Gross Margin $/ha
Standard Ripping	0.63	148	20	15	47	66
Maximum Loosening	0.76	178	25	15	56	82
High-Efficiency Ripping	0.78	183	22	15	37	109
Inclusion Ripping	0.98	230	30	15	62	123

The Grower Perspective

Mick Farley's Journey

Comparing Different Ripping Treatments

For Mick Farley, a grower farming near Copeville, the decision to trial deep ripping stemmed from years of frustration managing sandy soils prone to both compaction and non-wetting.

Mick's paddock included a mix of soil types, some of which consistently underperformed despite best efforts. Reflecting on the trial season, Mick noted the trial provided useful observations into how different ripping setups could improve productivity while saving money.

"*This sand here—it's always been tricky. We get good emergence on it when it's partially wet, but the minute it's dry, it struggles. The trial helped us see how ripping could change that dynamic, even in a tough season",* explains Mick.

Mick dry sowed Maximus barley in early May 2024, and received growing season rainfall of just over 100 mm—less than half of the historical average. While the paddock had retained good summer moisture, the delayed break left him frustrated as staggered germination exacerbated variability across the site.

Observing the trial treatments, Mick found the ripped plots showed more uniform growth and stronger plants in the early stages, even in compacted zones.

Evaluating Ripping Options

One of Mick's key takeaways was the importance of targeting soil constraints based on their specific impacts.

The trial treatments revealed significant variability in how each approach addressed compaction and non-wetting. Mick observed that inclusion ripping, which mixed non-wetting layers with deeper soils, provided the most consistent results.

Mick commented, *"Inclusion ripping really stood out—especially in those areas where the sand is non-wetting. It gave the crop a better chance to use the fertiliser effectively and get even germination."*

However, Mick also recognised that inclusion ripping might not be necessary across the entire paddock. For areas with moderate compaction and fewer non-wetting issues, high-efficiency ripping delivered strong results at a lower cost.

From Trial to Implementation

As Mick looks to implement ripping on a broader scale, he's weighing practical considerations to maximise returns. Key factors include matching the ripping strategy to soil type, managing weed pressure, and timing the operation to align with rotations.

Lentils, planned for the following year, emerged as a strong candidate for ripped soils due to their deep rooting ability and high-value returns.

Mick commented, *"The more we've grown lentils, the more confident we are in getting them up early, even on sand. Ripping opens up those opportunities to push deeper into moisture and establish stronger crops."*

While encouraged by the results, Mick remains mindful of the challenges ripping can pose. Residual herbicides, ground cover, and cost management are all factors he plans to monitor closely. Discussions with researchers reinforced the importance of trialing new approaches incrementally.

"It's all about balancing risk. We'll rip some areas, leave others, and watch how it plays out over a few seasons. The data from this trial gives me confidence to make those calls."

Mick's experience underscores the value of combining practical on-farm knowledge with research insights. By targeting the most constrained areas first and using data to guide decisions, he's paving the way for more resilient cropping systems.

Are Lentils and Option After Ripping?

At the spring Field Day, Chris Davey, Weed Smart Extension Officer SA/ VIC, shared expert insights into integrating deep ripping with crop management practices, particularly for high-value rotations involving crops like lentils.

A key takeaway from his presentation was the dual role of soil amelioration in enhancing crop performance and supporting effective weed control strategies.

"Lentils thrive when compaction is managed effectively," Chris explained.

"Ripping creates an environment where roots can grow deeper, accessing more nutrition and moisture. Establishing a healthier lentil crop leads to better weed competition, so it becomes a win-win for growers through increased lentil yields and less weeds."

Chris also stressed the importance of pairing soil amelioration with appropriate herbicide strategies to mitigate risks.

For lentils, pre-emergent herbicides like triazines and Reflex can effectively manage broadleaf weeds, but these types of products come with greater risk when used in conjunction with soil amelioration. Due to the solubility of these herbicides, applying them to bare soils, often created by more aggressive amelioration techniques, such as spading, leads to a lot greater crop effect as the structure of the soil has been changed so much.

"Managing herbicides effectively is crucial," Chris noted. *"If you're ripping before planting lentils, ensure there's sufficient ground cover to prevent herbicide movement and maintain soil structure. It may be a consideration to not apply a pre-emergent herbicide to the lentils after soil amelioration, just to ensure that establishment is optimised, with minimal crop effect. This, however, places a greater pressure on the post-emergent herbicide options".*

When planning lentil crops, preserving surface cover is essential. Standard deep ripping offers a practical option to improve subsoil conditions without exposing the surface as much as mixing tines, making it a better choice for minimising erosion risks and herbicide crop effects - an important factor to consider when comparing different amelioration methods.

Early & Deeper Sowing with Lentils

MSF's Research Manager, Dr. Penny Roberts, emphasised the benefits of early and deeper sowing of lentils in ripped soils, highlighting how these practices can take advantage of moist subsoil conditions. By accessing stored moisture, lentils can establish faster and create a strong foundation for the season ahead.

Penny also acknowledged that managing trafficability and maintaining consistent depth control can be challenging after ripping, which may impact some crops. However, lentils are tolerant for being sown earlier and deeper, making them a resilient option in post-ripping rotations where ground cover is adequate.

Additionally, Penny noted that lentils' indeterminate flowering may help to mitigate frost risk. Even if frost affects early flowers, lentils can continue to produce pods under favourable conditions later in the season, reducing potential yield losses.

"Sowing lentils early and deeper helps them tap into moisture reserves, ensuring strong establishment, and their ability to keep flowering makes them a reliable choice even in tough seasons," Penny said.

By integrating these strategies, farmers can capitalise on the benefits of ripping while mitigating seasonal risks and supporting long-term productivity.

A Cost-Conscious Approach for Mallee Farmers

This trial demonstrated that optimising deep ripping practices can significantly reduce costs while improving outcomes.

For farmers like Mick Farley, focusing on targeted ripping, efficient depth selection, and appropriate tine setups offers a way to address soil constraints while minimising operating expenses.

While deep ripping can deliver long-lasting benefits, its effects may diminish over time, requiring re-ripping. Choosing cost-effective treatments and aligning amelioration strategies with paddock conditions and crop rotations enables Mallee farmers to boost productivity and profitability.

Useful Resources

Research Summary: (2024) Optimising Soil Amelioration in Typical Mallee Soils, Michael Moodie - Frontier Farming Systems. Insert link

GRDC Factsheet: (2025). Deep Ripping Efficiency Considerations Part 1 – Coming soon. Insert link

GRDC Factsheet: Ripping Technology (2022). Technology considerations for cost-effective subsoil loosening.

Acknowledgments

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