MSF

Group: Mallee Sustainable Farming | Bowhill
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Soil technology and innovation focus

| Improved crop performance through soil amelioration

Background to the project

Sandy soils in the Mallee region present significant challenges for agricultural productivity, including water repellence (non-wetting sand), low fertility, and compaction. These soil constraints limit crop establishment, reduce water infiltration and retention, and limit root growth, restricting biomass, yields and groundcover and increasing risks of wind erosion.

Previous work, funded by the Future Drought Fund and delivered by Mallee Sustainable Farming, has resulted in the development of various soil amelioration techniques to address common constraints in sandy soils. Techniques developed so far include:

- Deep ripping to loosen compaction layers
- Application of organic materials and compost to improve moisture retention and fertility
- Inclusion ripping that actively funnels topsoil (and any organic amendments spread on topsoil) down into the subsoil.

Though a number of farmers across the SA Mallee have adopted deep ripping and the application of organic amendments, inclusion ripping has only been studied in small plot trials in the Younghusband/Bow Hill districts. Questions remain as to what rates of organic amendments should be applied, optimal tine widths for inclusion ripping, and how inclusion ripping compares to conventional deep ripping or the use of organic amendments alone.

Justification for the project

Farmers and agronomists from the Bowhill district identified non-wetting soils, soil infertility and soil compaction as key constraints to production and sustainability, and were keen to refine amelioration practices. Activities were designed to help farmers make well-informed decisions on adopting soil amelioration, leading to improvements in production, soil health, sustainability and the development of farming systems more resilient to climate change.

Project aims

This project aimed to demonstrate inclusion ripping at different ripping widths, with and without the addition of organic amendments at paddock scale, and to compare the results to conventional deep ripping and the addition of organic amendments only.

Inclusion plates attached to ripping tines allow top soil and organic matter to be transferred from the soil surface to deeper in the profile.

Adoption Characteristics

When the project commenced, soil amelioration practices had been adopted by a small group of leading farmers, but uptake remained limited due to uncertainties regarding which soils respond to different ripping practices, duration of effects, and practical challenges such as machinery costs and configuration. Awareness of amelioration techniques was moderate, with current adoption rates estimated to be under 10%. The project has increased awareness and interest. As more farmers engage in peer-to-peer learning and conduct on-farm trials, adoption is expected to rise.

Engagement Strategy

The project engaged with leading local farmers and agronomists. These stakeholders played a central role in facilitating practice adoption. Peer-to-peer learning was encouraged at all sessions, allowing farmers to share experiences informally. Communication was supported through collaboration with local experts, social media outreach, and direct text messaging to promote events. These strategies boosted awareness and participation across the district.

Workshop Activities

Workshops run through the project included technical sessions with soil amelioration experts Dr. Chris McDonough and Dr. Chris Saunders. Seasonal updates were also provided by Barrie Mudge and Professor Peter Hayman, while Dr. Nick Paltridge tested for impacts of ripping on soil carbon stocks, and Penny Roberts discussed trends in plant emergence after soil amelioration. At the conclusion of the project, results were presented on yields achieved after conventional and inclusion ripping, with and without organic amendments.

About the demonstration trials

Mallee Sustainable Farming and UniSA research engineers tested a range of soil amelioration techniques at Younghusband in 2024 to address these issues, including:

- deep ripping (to 40-50 cm) to break compacted/hardened layers
- active inclusion ripping, a method that deep rips and channels topsoil (along with surface additions like chicken manure) down into subsoil slots at 60cm or 120cm intervals
- chicken manure application across treatments to improve moisture retention and fertility.

Active Inclusion Ripping with manure aims to permanently change the soil profile, rather than just breaking hard layers. If shown to be practical and successful, this could potentially eliminate the need for ripping in years to come. Barley was sown into the trial site in early May. The dry season provided an ideal opportunity to assess how these treatments affected crop establishment in water-repellent soils under marginal moisture.

Inclusion ripping on 60cm spacing (left) led to the transfer of topsoil into the subsoil.

Field Demonstration Outcomes

Demonstrations showed that barley crop establishment was significantly better in the inclusion-ripped plots than conventional ripping or untreated controls, likely due to the removal of non-wetting soil from the surface layers. By mid-season, inclusion-ripped plots exhibited more biomass and better ground cover than the other plots. During a mid-season field day, soil pits revealed that topsoil had been incorporated into subsoil in the inclusion-ripped plots. Farmers were impressed by the enhanced crop vigour and biomass of barley in the inclusion-ripped plots.

By the end of the season, ripped and inclusion ripped plots showed slightly higher yields than control plots, likely due to increased root volume and greater access to moisture and nutrients at depth. However, the yield advantage was not as high as expected, probably due to the effects of drought and frost, which disproportionately impacted early, high-biomass crops. Longer-term monitoring will be required to assess effects over multiple seasons. Groundcover will also be tracked in inclusion ripped plots over the long term, with additional biomass expected to result in improved ground cover and reduced erosion risks after ripping. The application of chicken manure only led to very minor improvements in yield in 2024, and it was clear that chicken litter was not necessary for the successful early establishment of barley on inclusion ripped soil.

Key Outcomes and Discoveries

The project has generated extra awareness and interest in soil amelioration and deep ripping/inclusion ripping within the Bowhill farming community, and provided a great platform for discussions on best practice crop establishment and management. Going into 2025, farmers are now better placed to adopt strategic deep tillage to ameliorate sandy soils.

Key Take-Home Messages

- Ripping treatments outperformed control plots by breaking up compacted soil layers.
- Inclusion ripping provided greater benefits incorporating organic matter and redistributing non-wetting soil deeper into the profile.
- These changes resulted in enhanced nutrient availability and improved root development, leading to biomass gains and long-term soil loosening.
- Overall, soil amelioration improved crop performance, lowered long term erosion risk, and aided crops in establishing more quickly.

Germination of barley in the paddock adjacent the demonstration site was patchy in May/June 2024, with some rain in mid-late May then relatively dry conditions until mid-June.

Inclusion ripped areas (left), in which non-wetting topsoil and fertile organic matter was transferred from the surface to the subsoil, showed much earlier crop establishment and crop growth than control areas (right).

Conventionally ripped plots (foreground and right) showed some early germination but were only slightly greener than the control plot (top left).

Project Impacts and Reach

The project impacted approximately 35,000 hectares of farmland and engaged around 100 farmers. Twelve farmers actively participated in the project, supported by agricultural advisers who collectively influence more than 600 farmers across the region.

Conclusion

The Bowhill project set out to build climate resilience by improving soil and crop management on Mallee sands. While current adoption of soil amelioration practices remains relatively low, the project has established a strong platform for broader uptake. By addressing key knowledge gaps, demonstrating practical on-farm benefits, and offering both expert technical support and peer-to-peer learning opportunities, the project has effectively supported farmers in exploring these techniques.

High levels of farmer engagement and encouraging field results suggest the project is well-positioned to support wider adoption of soil amelioration in the coming years. While the final evaluation will shed more light on long-term outcomes, the strong participation to date reflects growing momentum in soil improvement and sustainable farming practices in the region.

Australian Government
Department of Agriculture, Fisheries and Forestry

Future Drought Fund

This project emphasised the value of targeted soil management practices to improve the performance of producing lentils on sandy soils. The opportunity to transform sandy soils from challenging, often low-producing assets into highly productive soils was demonstrated, which will provide further incentives for farmers to manage such soil types better. Through workshops, field trials, and collaborative efforts with agronomists, outcomes from the project will help foster sustainable practices and enhance regional agricultural resilience.