Addressing soil constraints in post amelioration sandy soils

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Introduction:

Soil amelioration has been a significant driver in increasing yields in South Australia's sandy soil regions, particularly the Eyre Peninsula where it has seen rapid adoption due to the substantial economic benefits. The modification of soil profiles through strategic tillage to elevate clay from within the profile or clay spreading has given growers the opportunity to overcome constraints such as water repellence, poor fertility or layers of high soil strength.

Although there are significant benefits from amelioration it is not a risk free process. The rapid adoption, often without proper understanding or ground truthing and soil testing prior to application has resulted in some areas of sandy soils becoming more constrained rather than improved.

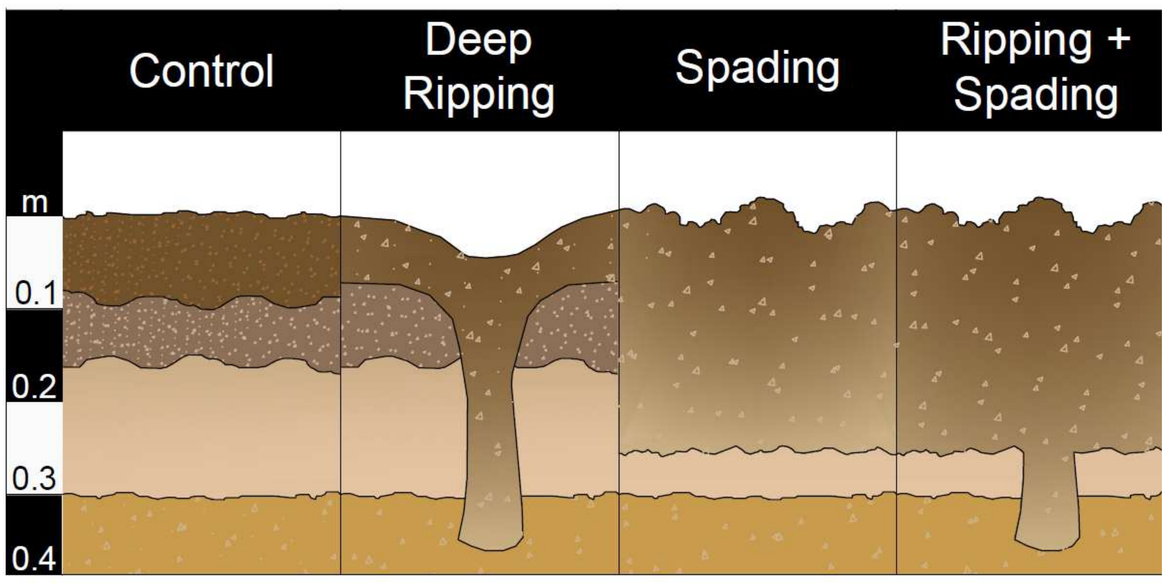
Aim:

The aim of this study was to address the negative effects of poorly executed high rate clay spreading through the usage of current amelioration and incorporation practices.

Methodology:

In 2024 a field trial was established at Wharminda on the Eyre Peninsula, which was replicated in 2025. The site has a historic application of clay spreading at 300 - 400 t/ha, more than double the current recommended application rate for this site. Additionally no incorporation was used following the clay application, resulting in a ~10cm layer of clay blanketing the original profile. Prior to modification the soil type was a brown Sodosol.

The trial design at the site included 3 primary tillage treatments to incorporate the broadcast clay, alongside an unmodified control. These treatments included: deep ripping with passive inclusion, rotary spading and a combination of ripping plus spading. Additionally each tillage treatment was replicated with an application of gypsum, organic matter (mulched lucerne hay) and a combination of both. This was applied at 5 t/ha for each amendment prior to the application of tillage treatments.

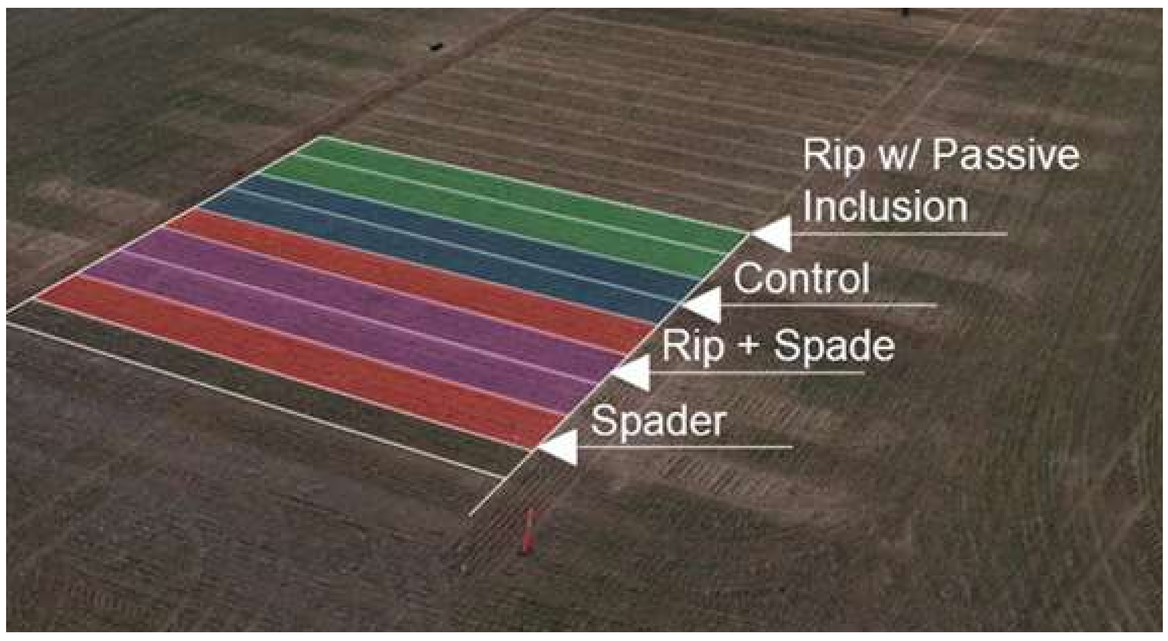


Impact of amelioration processes on soil profile:

Deep ripping with inclusion results in some mixing of the broadcast clay at the surface, whilst also allowing material from higher in the profile to backfill into the channel created by ripping tynes inclusion plates. Additionally it breaks into the hard-setting sodic clay B horizon. allowing deeper penetration of plant roots along the ripping channel.

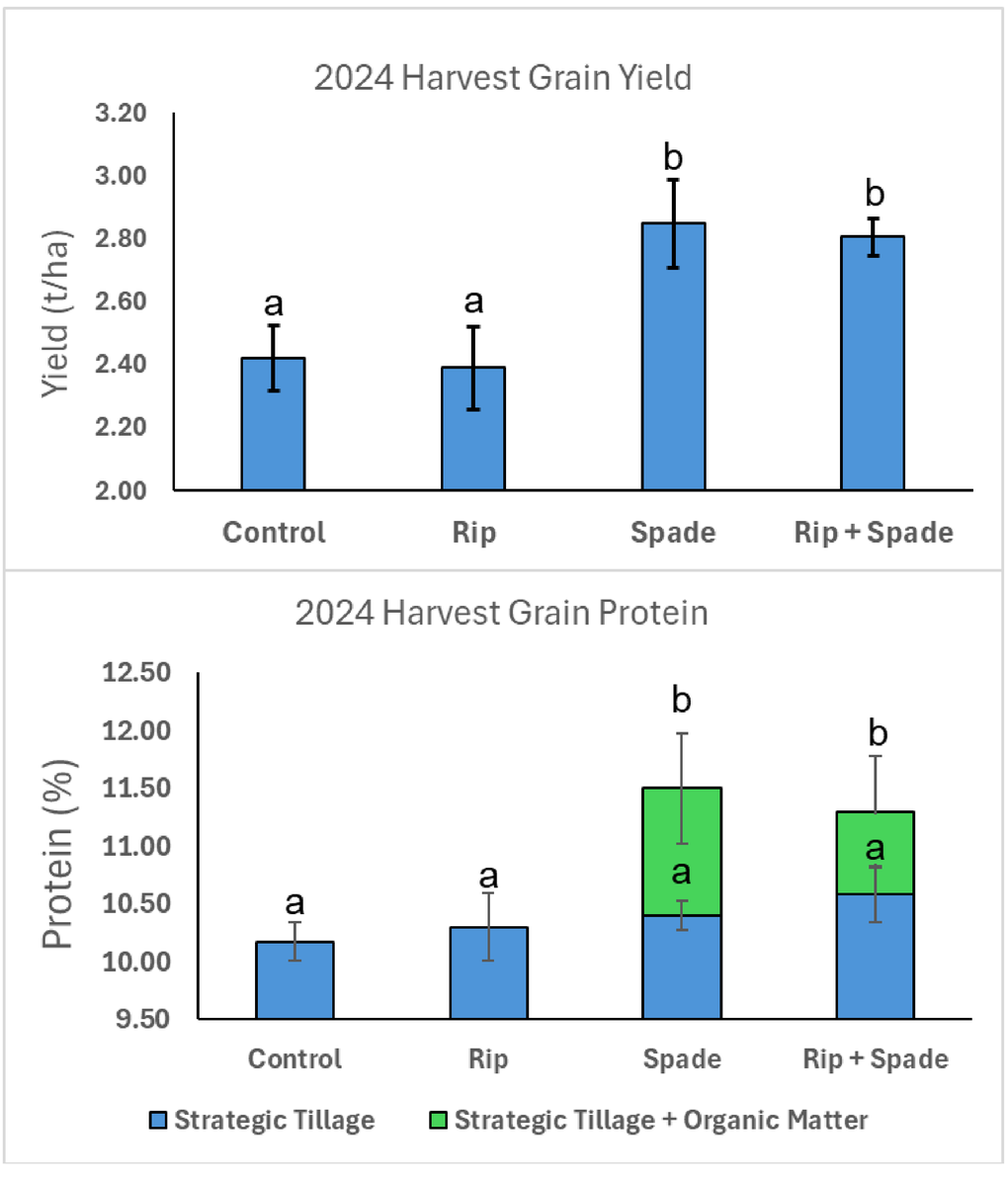
Spading provides a more thorough mixing of broadcast material with the historic A horizons, this was achieved at a depth of 25 - 30cm across the site dependent on the depth to the underlying sodic B horizon.

Ripping + Spading provides the benefits of both ripping with inclusion and spading.



Results:

- Amelioration treatments with spading provided a significant yield increase of 400kg/ha
- The usage of deep ripping provided no significant benefit to yield, however it improved plant access to stored subsoil moisture.
- The addition of organic matter to spading treatments provided an additional small increase to yields of ~100kg/ha but provided significant increases in protein.



Conclusion:

The use of current strategic tillage amelioration techniques was able to achieve a significant yield increase when applied to a heavy clay spread soil, despite the limited rainfall throughout the 2024 season. The 2025 trial aims to monitor the longer-term benefits of the treatments to determine if they persist after the first year of application. Additionally, throughout the season a range of soil physics measurements will be taken, including penetration resistance, infiltration and hydraulic conductivity, to better understand the mechanisms driving the yield increase.

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