

Case study: Post fire soil conservation demonstration



Area burned near Lameroo. Enhanced Landsat imagery from 29 November 2015

Background

On 25 November 2015 a fire burned approximately 1700 ha of cropping land near Lameroo in South Australia's Murray Mallee. The extreme wind and temperatures on the day helped to drive the fire, burning stubble, unharvested crops and roadside vegetation. The fire left the soil surface bare and susceptible to wind erosion over the summer months. By January 2016 the light sandy soils were reportedly drifting whereas heavier soils such as loams and sandy clays were more resistant to wind erosion. Natural Resources SA Murray-Darling Basin teamed up with local landholders to establish demonstration sites highlighting options available to tackle post fire soil recovery. The application of manure to the soil surface and delving subsoil clay featured in the demonstrations.



Burnt area above has drifted, showing lighter subsoil and covering crop stubble lines. On the right the remaining stubble on the un-burnt area is becoming covered by the loose sand.



Sandy topsoil drifting and accumulating against the fence following the fire event



Method

In 2016 a paddock scale demonstration was established to show the value of two commonly employed post fire soil erosion control methods:

1. Spreading piggery manure across the soil surface.
2. Deep ripping the soil to bring clay clods to the surface.

Soil samples were taken from both the ripping and spreading demonstration sites. Soil samples were tested to determine the suitability of the subsoil clay for potential deep ripping. Soil tests also helped to identify potential impacts the fire may have had on the topsoil nutrient ratios.

Spreading piggery manure

- Eco-shelter piggery manure was spread at 5-6t/ha.
- The paddock was dry sown in early May.
- The fire affected paddock was sown to oats for hay as a precaution against any potential weed seeds being introduced through the manure application.
- Rivets within the soil surface that formed as a result of localised erosion were evened out using a land plane and re-sown on the 10 July.
- Following crop establishment (approximately three weeks after germination) the planed areas were rolled again 'just to flatten it off' (Gary Flohr, landholder and farmer).
- The crop was fertilized with 90kg/ha urea to help compensate for lost nutrients following the fire event.



Piggery manure applied at 5-6 tonnes/ha (left), control site of 0 manure/ha (right). Some heavy clumping in the piggery manure, this texture is used to help weigh down the sandy topsoil.



Manure applied across bare soil using a spreader. Some issues with fine particles lost in the wind, larger manure clods (fresh manure) are preferable for stabilising the soil surface.

Subsoil delving

- Care was taken while delving to avoid deep sand as this increases erosion potential.
- Delving depth was modified according to depth of clay beneath sandy topsoil.
- Shallow set clay poses the risk of bringing too much heavy clay to the surface, shallow delving was applied in these instances.
- Large clay clods originally utilised to hold sandy topsoil were broken down throughout the cropping season.
- Barley was planted to the deep ripping site.



Delved subsoil clay acting to catch drifting sand in the furrows. The clay peds break into smaller sizes as the season's activities progress.

The results

Surface manure application

The surface manure application performed a key role in weighing down the topsoil and disturbing the surface wind enough to protect the topsoil from high levels of erosion. Some surface rivets formed as a result of localised soil movement however these problem patches were easily managed by the landholder. Most of the soil was stabilised, allowing the farmer to transition smoothly into sowing and the following cropping schedule.

“It was a compromise between the cost of the manure and getting enough manure to perform the key function of holding the soil in place. Some were talking 10-12 tonnes/hectare but 5-6 tonnes/ha was enough. We needed just enough solids to make some roughage and slow down the wind speed” (Gary Flohr, Landholder and farmer).

Soil testing identified both the 'fire affected' and 'non-affected' sites were low in nitrates, organic carbon(OC) and PBI, while the fire affected site had lower total S and OC. The pig manure applied to the fire affected site had high OC (33%), N (40mg/kg) and S (0.6%); providing supplementary nutrition to offset the loss of nutrients as a result of the fire and lost from mineralization during summer.

Subsoil Delving

Topsoil erosion was localised and the site was capable of establishing a barley crop for the 2016 cropping season. Mid-season photo point monitoring showed a healthy crop had established and entered tillering growth stage. The demonstration site was able to support deep ripping due to the nature of the clay subsoil. The slightly alkaline subsoil pH and slightly raised Boron levels would not affect crop performance once diluted through mixing with the topsoil; if pH and Boron levels were significant then delving would not be advised.

Conclusion

The demonstration sites for both the subsoil delving and surface manure application allowed the establishment of healthy crops for the 2016 cropping season. Both actions succeeded in disturbing the wind at the soils surface, preventing the dramatic movement of topsoil. The demonstration was able to highlight options for landholders seeking to conserve their topsoil following a fire event. While deep ripping allowed the landholder to utilise the clay resource already available in the subsoil, it is critical this clay is tested to prevent pH, sodicity or toxicity issues which may be present. Manure spreading provided the double benefit of soil protection following the fire and additional nutrition.

“I would do it again; ‘If you can’t find clay then this (surface application of manure) is a great option’ Gary Flohr, landholder and farmer.

Location: Lameroo, South Australia

Region: South Australian Murray-Darling Basin

Industry: Dryland grain growing

Issue: Demonstrate the value of delving subsoil clay and the surface application of manure as post fire soil erosion control options suitable to the Mallee environment

Outcomes: The project aimed to demonstrate the value of employing soil conservation techniques to stabilize topsoil following a paddock fire. Post fire soil conservation techniques such as manure spreading and clay delving help to prevent soil erosion. As the key components of crop growth and development are concentrated within the topsoil (organic carbon, mineral nutrients and soil biology); the loss of this resource would have serious and long lasting environmental and economic effects.

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