

Post Fire Soil Conservation

Demonstration- Broadacre cropping

Location: Lameroo, South Australian

Region: South Australia Murray-Darling Basin

Industry: Dryland grain

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

Delivery: The National Landcare Program, delivered through Natural Resources SA Murray-Darling Basin, supported the major fire affected Lameroo landholders to implement the demonstration site; Primary Industries South Australia were engaged for expert advice and initial soil testing

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 drive the fire which went on to burn stubble, unreaped 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, heavier soils such as the loams and sandy clays provided greater resistance to wind erosion. Natural Resources SA Murray-Darling basin teamed up with local landholders to establish demonstration sites which highlighted the options available to tackle post fire soil recovery. The application of manure to the soil surface and delving subsoil clay were highlighted within the demonstration.



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



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

Figure 1: Area burned near Lameroo. Enhanced Landsat image from 29th November 2015.

Method 1.1 Spreading piggery manure

Method 1.0

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

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

Soil samples were taken from both the clay delving and manure spreading demonstration sites. Test results were required to determine the suitability of the sub soil clay for potential delving. Soil tests also helped highlight potential impact the fire may have had on the topsoil nutrient ratios.

- Eco-shelter piggery manure was spread at 5-6 t/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 introduced through the manure application.
- Rivets within the soil surface which formed as a result of localised erosion were evened out using a land plane and re-sown on 10 July.
- Following crop establishment (approximately three weeks after germination) the planed areas were again rolled "just to flatten it off" (Gary Flohr, landholder and farmer).

- The crop was fertilised with 90 kg/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 aimed to help weigh down the sandy topsoil.



Surface application piggery manure: Crop showing good growth and development at tillering growth stages.

Method 1.2 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.

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. The soil was mostly stabilised and allowed the farmer to transition smoothly into sowing.

“It was a compromise between the cost of the manure and getting enough 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 highlighted both the ‘fire affected’ and ‘non-affected’ sites were low in nitrates, organic carbon (OC) and had a low phosphorus buffering index; while the fire affected site had lower total sulphur and OC. The pig manure applied to the fire affected site had high OC (33%), N (40 mg/kg) and S (0.6%); nutrition provided as manure would have supplemented the loss of nutrients as a result of the fire and those lost over summer mineralisation.

Results. 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, delving would not be advised.

Conclusion

The demonstration sites for both the deep ripping clay and surface manure application allowed the establishment of healthy crops for the 2016 cropping season. Both actions succeeded in disturbing the wind at the soil 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.

