Clay improves soil recovery after Pinery bushfire

Spreading clay on sandhills protected soils from erosion and improved crop establishment

The problem
The Pinery bushfire devastated 85,000 hectares of cropping land in the Lower North region of South Australia in November 2015. Devoid of any soil surface protection, soils were exposed to catastrophic wind, dust and soil erosion, which had major implications for topsoil loss.
Aware of the risk of erosion, many growers performed tillage soon after the fire, in many cases, using borrowed equipment after their own had been destroyed in the fire.
Tillage roughened the soil surface by bringing up soil ‘clods’, reducing wind speed and soil movement. This practice was relatively successful on heavier soils such as loam and clay, but sands and sandy loam soils continued to drift. Sandhills, a common feature of cropping land in the Lower North, were especially at risk.

The approach
A project to demonstrate the benefits of clay spreading to protect sandy soils, including technical advice and coordinating claying contractors to treat badly eroding areas was funded from the Australian Government’s National Landcare Program along with the Adelaide and Mount Lofty Ranges Natural Resources Management Board and Primary Industries and Regions South Australia (PIRSA).
The project also monitored soil changes following testing of various soil management practices.
Monitoring and spreading sites were located across the fireground including Pinery, Barabba and Stockport, encompassing the areas with the highest levels of sand degradation.
Clay spreading is a technique used to improve the structure and water-holding capacity of deep sandy soils.
Clay is found (ideally within the same paddock), a pit is dug, and the clay is excavated and spread over the paddock before being incorporated into the soil. Clay spreading has not been a common practice in this area, however, it has been used with success in other locations such as the Eyre Peninsula. The anticipated benefits of spreading were two-fold in this project – initially to provide immediate protection from soil erosion during the summer and autumn following the fire, and secondly, to assist in the long-term improvement of soil productivity. Sites were chosen based on the relative risk of soil erosion, with spreading performed at five locations. At most spreading sites suitable clay was identified within the same paddock, which minimised the cost of performing the operation. Monitoring sites were also set up at 50 locations, with nutritional and biological testing performed, including a comparison of burnt and unburnt areas. Over the course of the project, field days were held to demonstrate the methods and benefits involved with clay spreading. Growers were invited to watch the spreading process and local agricultural bureaus visited the sites during the growing season.

The outcomes
Project leader David Woodard said the benefits of clay spreading were seen immediately after spreading was performed.

"Before the treatment, dust blew with any light breeze but after we had spread the clay, it stopped blowing straight away," he said.
"Then when the rains arrived in autumn, there were visible improvements in sand wetting qualities, crop emergence improved and crop establishment was much more consistent."

The effect of clay spreading could not be quantified, because it was not considered appropriate to leave areas untreated, however growers reported that crop establishment and yield was higher than expected. One Barabba landholder commented that he had "never seen a crop like that on that area before" indicating an improvement in crop establishment. "Growers also found the process gave a better finish than they had expected," Mr Woodard said. "Some had expected it would leave a big hole in the paddock from the clay pit, but we were able to demonstrate this wasn’t the case. "We were also able to smooth out old imperfections in the paddock, leaving a smoother surface than before."

In a stroke of luck, the 2016 season featured exceptional growing conditions, leading to record yields in many areas including many fire-affected properties. These favourable conditions resulted in high stubble loads to protect the soils the following year, promoting nitrogen and carbon cycling to restore soil biological health.
Soil monitoring results

Monitoring showed that the loss of nutrients caused by the fire was lower than initially feared. Where growers had maintained good soil health before the fire, losses were minimal.

At a Mallala site, side-by-side burnt and unburnt samples were taken in a loamy soil. Minimal differences were found in organic carbon or Cation Exchange Capacity (CEC), a measure of soil fertility. Similar findings were seen at Long Plains, where samples were taken on a sandhill and flats comparing burnt and unburnt soils. At this site, the sandhill had been spread with feedlot manure after the fire to hold the soil in place.

As a result the burnt sands had 30 per cent higher CEC, 67 per cent more organic carbon and double the potassium of the unburnt sand.

On the Long Plains flats, fertility was similar on burnt and unburnt soils.

A site at Linwood tested the long-term effects of clay spreading, with the sandhill having been spread five years before it was burnt by the fire. There was minimal erosion after the fire, and the clayed area showed 80 per cent higher CEC and improved availability of phosphorus, potassium and nitrogen.

These results demonstrate the benefits of well maintained soil health in improving resilience and the long term benefits of clay spreading.

Sustainable industry support

This project was supported by the Adelaide and Mount Lofty Ranges Natural Resources Management Board through funding from the Australian Government’s National Landcare Program and the NRM levy.

Healthy natural ecosystems and sustainable primary production systems are fundamental to social, environmental and economic well-being.

With more than 50 per cent of the Adelaide and Mount Lofty Ranges region used for primary production, the board will continue to partner with industry to increase sustainability in production systems.

Project linkages

This project followed another Adelaide and Mount Lofty Ranges Natural Resources Management Board and PIRSA project investigating clay delving in 2012.

Clay delving is the partner process to clay spreading and can be performed when there is clay in the subsoil within 30-40 centimetres of the surface.

See case study Clay delving for improving productivity in the Lower North.
For more information

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