Sand and Straw Overcome Growing Dry Saline Patches near Wentworth

SNAPSHOT

Farmer name: Ben Pollard
Location: Wentworth, NSW Mallee
Farm size: 2200 ha cropping land; 30,000 ha sheep station
Enterprise: Continuous cropping and grazing
Rainfall: 200 mm (average annual), 120 mm (GSR)
Cropping program: 75% cereal, 25% pulses

Key messages

- 8-10 cm sand mulch was the most effective treatment to reduce soil salinity and improve crop growth in the dry saline land patch.
- Deep ripping to 50 cm through the sand mulch and into the subsoil gave a slight initial yield benefit.
- Surface straw cover for one season and summer also resulted in substantial salinity reductions in the top 30 cm of soil.
- While seasonal rainfall events temporarily lowered surface soil salinity in untreated patches, the overall salinity levels and detrimental crop impacts remained high.

TREATMENTS

Figure 1. Typical bare saline patches forming after dry periods on clayey soils

INTRODUCTION

Ben Pollard is a sheep farmer who crops just over 2,000 ha of farmland, 40 kilometres west of Wentworth in NSW. The soils on the farm range from deep sands to good fertile loams over clays, interspersed with poor producing marly loams.

Patches of dry saline land affect about 100 ha in total across the property. The bare patches are still small, approximately 'the size of a ute or two', but the surrounding areas of very poor crop growth are about the size of a tennis court (Figure 1). Ben would like to fix them before they get worse and more expensive to rehabilitate. In the low rainfall environment, the patches tend to get bigger and smaller depending on the autumn rainfall (Figure 2).

Historically, no-till farming, stubble retention and managed grazing (stock graze areas for 6 weeks at most), kept the dry saline land patches at bay. However, a series of unfortunate events - the combination of low legume stubble, drought, wind erosion and vermin - caused the patches to bare out and expand.

Ben said, "The dry saline land patches were always there, but they were always covered because we are no-till and keep stubble. But we incorporated legumes as the drought hit, leaving lower stubble cover, and because of the drought the vermin kept tilling up the soil and eating the crops, so the dry saline land became worse."

Lack of rain to dilute the salts and big erosion events made the patches worse.

"The wind and summer keep flogging it and scalding it out," Ben said. "If I can get the cover, even one wheat crop to grow on it, it can help, but because of the wind we couldn't get cover."

THE TRIAL

In March 2022, Ben set out three different treatments (10 m x 50 m):

1. Straw mulch.
2. Sand mulch (~8 cm thick).
3. Ripping into the sand mulch at 50 cm depth and 60 cm spacing.

The mulches aimed to reduce evaporation and capillary rise of salt to the surface. Sand mulch has two additional benefits:

- Being coarse, there is less capillary rise than with a clay. Once rainfall pushes salts deeper into the soil, it's harder for the salts to rise back up through the sand.
- It provides a non-saline environment for the seed to germinate in, as well as ongoing soil cover.

Ripping aimed to help break capillary rise and limit salt rise to the surface, as well as push more sand deeper into the hostile clay. This made channels for crop roots to help them explore more of the soil.

Figure 2. Large saline areas greatly reduced after large autumn rainfall

Figure 3. Demonstration site preparation with both sand and straw (April 2022)

The straw mulch strip was accidentally burned while burning header strips for weed control in 2023, however, this was well after the hot summer/autumn period giving at least one year's worth of cover with the straw.

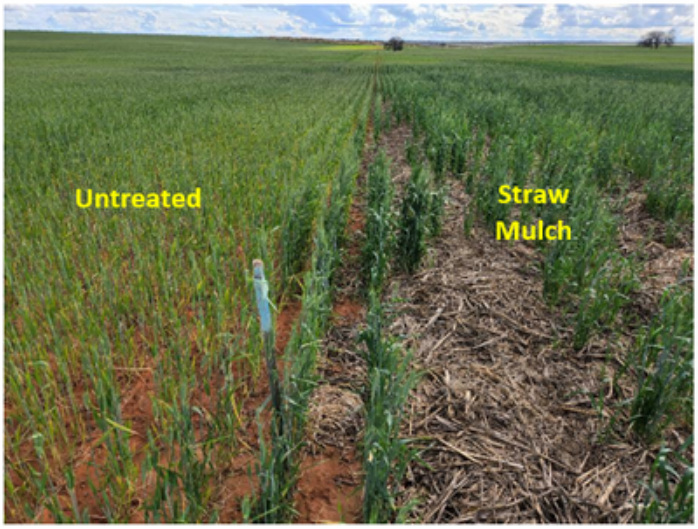

Figure 4. 2022 crop growth between untreated and straw mulch strip

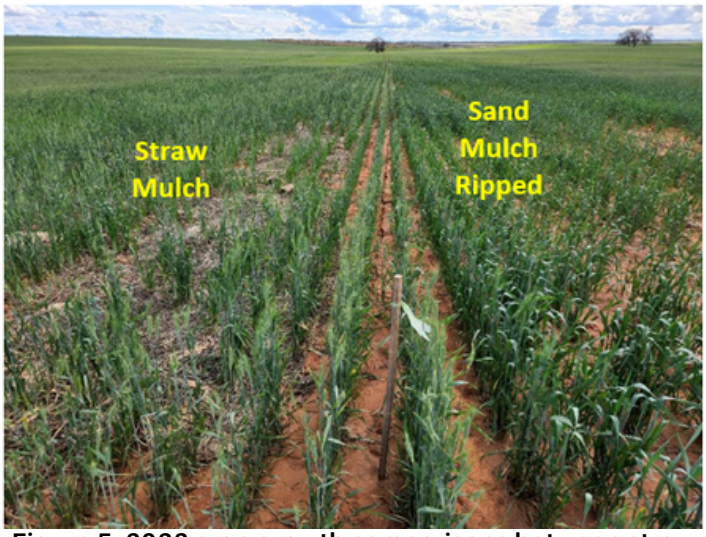

Figure 5. 2022 crop growth comparisons between straw mulch and ripped sand mulch

RESULTS AND RECOMMENDATIONS

There was a substantial reduction soil salinity and improved crop growth where mulch treatments were applied. Initial soil tests were taken in April 2022 after the treatments were applied. Due to 25 mm of rain in March topsoil salinity levels were already low, but there were also improvements in soil salinity from 10-20 cm depth where surface cover was applied (Figure 7). This translated into large yield differences between the worst bare patch areas (from the previous dry 2021 season) and the covered areas (Figure 9).

The wet 2022 season greatly reduced the bare areas and appeared to leach some salts beyond 20 cm going into the 2023 season. However, by February 2024, salinity in the surface layers on the bare soil returned to toxic levels while the treated areas were all reduced to very low, non-toxic salinity levels (Figures 7 and 8).

Figure 6. Late 2022 showing ripped sand remaining greener for longer

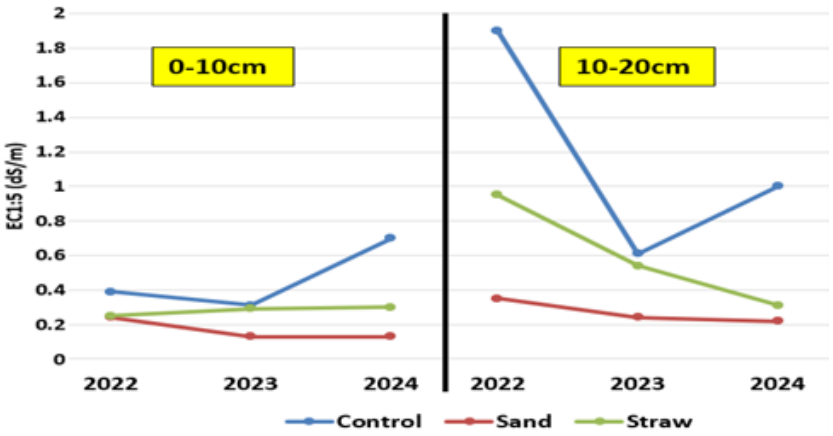

Figure 7. Soil salinity changes with treatments through seasons

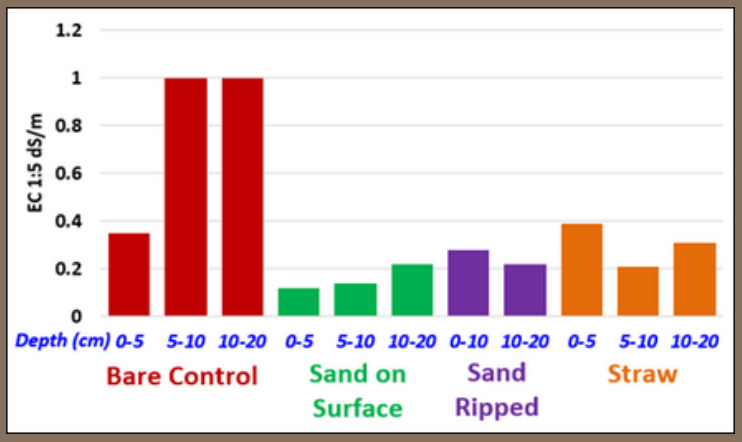

Figure 8. Soil salinity Feb 2024, 22 months after treatments applied

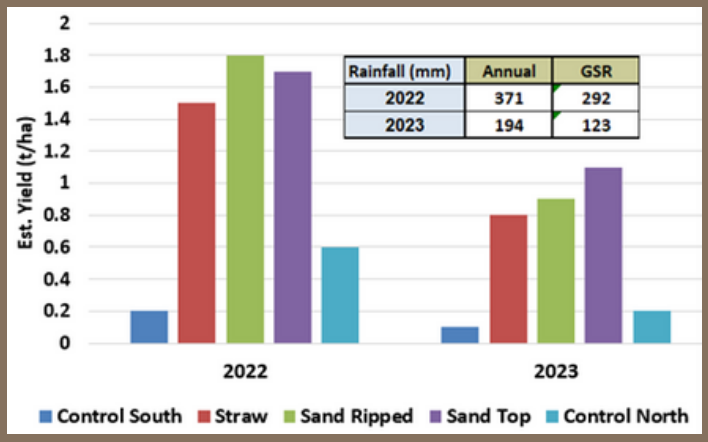

Figure 9. Yield estimates from initial scald patch areas within treatment plots

Sand mulch

Areas with sand mulch grew successful crops of up to 1.8 t/ha in 2022 and 1.1 t/ha in 2023. This was 2 t/ha more than the control over the two years combined (Figure 9).

The advantage of the sand layer over other mulches is that it provides a non-toxic soil layer for the crop to germinate and grow in, which in turn produces crop residues that protect the topsoil from evaporation and salt accumulation. This ongoing crop cover has likely helped limit further capillary rise of moisture and salt from deeper layers, which has begun the long-term rehabilitation process. Salinity in the sand mulch treatment remained low (Figure 9).

While it is a very costly exercise to move and deposit 800-1000 t/ha sand on an area, it becomes more efficient and practical where the source of sand is close, and for farmers that have access to sand moving equipment. Numerous other long-term sand mulch sites have shown it can permanently rehabilitate previously scalded land back into full production, and costs are recovered over a few seasons - even where large areas are treated.

Sand + ripping

Ripping into the sand mulch was an attempt to drop sand into the rip line, giving the crop roots a channel of non-saline sand to grow in. This made some difference in 2022, when this strip appeared to stay greener for slightly longer (Figure 6), producing a slight yield benefit. This impact was not clearly evident in 2023, which may have been due to the changed soil moisture dynamics in the drier season.

When deep ripping this site, great care was taken to avoid bringing sodic clay to the surface as it can be highly detrimental to crop establishment. Although ripping offered a slight benefit, it is evident that the most significant, safe, and enduring improvements, as well as the best return on investment, are achieved through the application of sand mulch.

Straw mulch

Despite only one year's cover from the straw mulch, the mulch was still very effective in reducing salinity enough to grow sufficient cover for ongoing topsoil protection and restoration. The 2023 crop yields were slightly less than the sand treatments, but still well above the comparative control areas (Figures 4, 5 and 9).

FARMER THOUGHTS

Ben thought both sand treatments performed well and could not see much of a difference between the sand mulch and ripped sand strips. The crop with the straw mulch did not perform quite as well, but still looked better than the control.

Ben found that while sand treatments worked the best, spreading the sand was a challenge.
"I got the sand from a sand hill next to a salt lake where the sand has built up over hundreds of years. I only covered about 50 meters by 12 meters and it took 30 truck loads. Then I spread it around with a loader and smoothed it out with a loam leveller bar. It's much more labour intensive than the straw, but it yielded about 0.3t/ha better than the straw."

NEXT STEPS

Ben plans to gradually treat the patches of dry saline land with sand, however, based on the experience with moving the sand for the trial, Ben wants to invest in a loam bucket to do the job. The cost of the bucket will far outweigh the crop value from fixing the patches, but Ben wants the peace of mind of having the scalds covered.

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PROJECT INFO

Trial run by Chris McDonough, Insight Extension for Agriculture.
Thanks to Ben Pollard for hosting the trial.

Building resilience to drought with landscape scale remediation of saline land.
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