Sand improvement through manure profiling in the low rainfall northern Mallee

Background

The project was developed with the Lowbank Agricultural Bureau to address issues with poorly performing sandy soils in the Waikerie district and across the northern Mallee.

It builds on the trial work from the New Horizons project that has shown dramatically improved production on sands by incorporating nutrient enriched organic matter at depth.

Organic matter is now readily available and more affordable in the northern Mallee with the rapid expansion of chicken farms in the Swan Reach and Blanchetown areas.

The demonstration at Waikerie aimed to show an economic benefit in using chicken manure and spading to lift production in sandy soils.

The method

In 2015 a farmer scale demonstration was established to compare thirteen different soil and nutrition treatments. Table 1 outlines the treatments

The treatment strips were 15m wide x 400m long passing over two sand dunes and swale to capture the paddock variation.

The paddock was EM38 mapped and deep soil testing was performed in the different soil zones across the trial.

Four soil moisture probes were located within the trial area to measure differences in soil moisture infiltration and crop moisture extraction.

Treatments were applied in early April and the paddock was sown to wheat in late April.

In crop monitoring included measurements for crop establishment, tillers and a crop growth rating.

Yield data from each plot was gathered using yield mapping in the header at harvest. The yield maps were analysed over the EM38 soil zone maps to give accurate comparisons of the treatments on the different soil types.

The results

The soil tests confirmed the sandy soil types in the trial area were extremely low in organic carbon and very infertile. No sub soil constraints were found in the deep sands or mid-slope sands.

Spading resulted in some soil erosion on the tops of the sand hill after 2 severe wind events around seeding time, which was concerning.

The deep ripped manure treatment strip maintained soil cover and was considered to be an easier, cheaper and safer option by farmers, while not producing quite the same growth benefits as spading.

In season crop monitoring revealed double the tiller numbers in the treatments that received chicken manure and spading, with stronger stems and larger heads. This suggests that these treatments had much higher yield potential than was realised in the very poor season finish.

Spading and chicken manure treatments had much improved soil moisture retention and deep root growth. Control areas showed very few roots or moisture extraction below 30cm, while the spaded chicken manure sites recorded improved root growth and moisture extraction to 150cm depth.

Spading consistently increased yields when compared to the surface application of the same nutrition treatment.

Spading in high levels of commercial fertiliser gave an excellent yield response however the benefits of this is not expected to be as long lasting as the chicken manure treatments.

The winery waste mix (flush water from liquid fertiliser manufacturing containing base level trace elements including Zn, Mn, Fe, Mg, Seasol and formbic acid) may have provided a small benefit but was not consistent.

The clay spread treatment at 80t/ha that was also spaded produced a 0.5t/ha increase over the control but the cost of the treatment means it could take approximately 4 years to break even.

Similarly the kitchen sink treatment (clay spreading, 6t/ha chicken manure, spading, high fertiliser input and trace elements) gave an excellent yield increase of 0.9t/ha but is cost prohibitive and would take many years to break even.

The nutrient content of 6t/ha of chicken manure spaded is estimated at around 40kg/ha P and 150kg/ha N, as well as high trace elements. The higher yielding plots with high protein have already removed 50-60kg/ha more N in the first year. While the subsoil benefits are wide ranging, reduction in N over time could well reduce the long-term yield benefits of these treatments.

Below - Yield results and economic return of the different treatments on the deep sand and midslope sand areas.

NB. These costs were based on approx. $30/t chicken manure delivered and $100/ha spading costs. This will vary with transport distance. Larger spading machines that better firm the topsoil can cost up to $170/ha.

Conclusion

The trial has shown that spading chicken manure at rates of 3t/ha and 6t/ha has almost doubled crop yields.

This is due to a combination of breaking deep soil compaction, increasing soil fertility and improving soil moisture holding capacity. This has led to increased crop rooting depth and moisture extraction through spring.

Economic analysis in the first year suggests that chicken manure and spading is affordable and costs recoverable in the short term. It is intended that this trial will continue to be monitored for soil quality and yield over coming years.

Recommendations

It is recommended that the effects of this trial be monitored for several years to investigate the long-term benefits of the treatments. This will give a more accurate assessment of the economic return on investment.

Spading can increase the risk of wind erosion in the paddock. Therefore it is recommended this spading take place as close to sowing as possible.

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	Ave yield t/ha	t/ha increase over control	$/ha value @ $250/t	Estimated cost $/ha	$ GM first year	Years to pay off
Control	1.27	-	0	-	0	-
Clay, spaded, kitchen sink	2.17	0.90	226	650	-424	2.9
Clay + spaded	1.76	0.49	123	400	-277	3.3
Chicken manure 3t/ha + spaded	1.98	0.71	178	200	-22	1.1
Chicken manure 3t/ha	1.47	0.20	49	100	-51	2.1
Chicken manure 6t/ha	1.41	0.14	34	190	-156	5.6
Chicken manure spaded 6t/ha	2.13	0.86	215	290	-75	1.4
Chicken manure 3t/ha + deep ripping	1.59	0.32	80	110	-30	1.4
Winery waste mix surface	1.36	0.09	24	30	-6	1.3
Winery waste mix spaded	1.75	0.48	121	130	-9	1.1
Winery mix + grape marc spaded	1.63	0.36	90	150	-60	1.7
High fertiliser spaded	2.01	0.74	184	190	-6	1.0
High fertiliser	1.61	0.34	85	90	-5	1.1

Yield results and economic return of the different treatments on the deep sand and midslope sand areas

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