IMPROVED GRAZING PRODUCTION ON NON-WETTING SANDS

COMPOST RATE CASE STUDY

This case study explores how compost application affects soil fertility and biomass production after clay spreading.

AT A GLANCE

Challenges

Sandy soils are naturally low in organic carbon and are deficient in most essential plant nutrients.

Opportunities

Clay spreading can overcome multiple sandy soil constraints, but the process is very disruptive. It's important to support the soil to quickly recover its chemical, physical and biological function.

I knew this paddock would be low in nutrients and organic matter after clay spreading. I was keen to explore different ways to supply these, while also supporting soil microbes. This trial lets us test compost application rates and measure changes in soil biology and feed production over time.

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BACKGROUND

A 15ha pasture paddock at Western Flat, SA, was selected to demonstrate strategies to restore soil function following clay application and incorporation. The paddock is characterised by jumbled dunes with deep sandy soils (Image 1) and sporadic heavier flats.

Soil sampling in 2021 confirmed the sand dunes to be severely water repellent and deficient in phosphorus and potassium, with organic carbon below 1%. It has low capacity for nutrient retention throughout (cation exchange capacity <1.0 cmol/kg below 10cm), but did not have high soil strength.

Clay spreading is common practice to alleviate water repellence and 250 t/ha of clay material was applied across the paddock in early 2022, before being incorporated with a disc plough in autumn (Image 2).

A survey with local farmers in 2021 showed 65% were interested in testing multispecies pastures and over 70% wanted to see organic amendments demonstrated in their environment.

In May 2022, compost treatments were applied on plots 1.1 ha in size to boost biological function and nutrient supply using a custom blended compost.

Four different compost rates are tested against a fertiliser control (Image 3).

The paddock was sown to a multispecies pasture on 15 May and will be monitored annually until 2025.

Image 1. Soil profile from the deep sand dune prior to clay and compost being applied.

TREATMENT DETAILS

1) Custom Fertiliser: a blend of mono-ammonium phosphate, sulfate of potash, copper and molybdenum ($1873/t ex Naracoorte; GST Incl.) was spread at 160 kg/ha to supply 11N, 24P, 20K, 9S, 1Cu and 0.04Mo kg/ha ($299 + $41/ha spreading cost).

2) Custom Compost: an organically certified humic compost was supplied locally from Mulbarton Compost at Padthaway at a cost of $174/t (GST Incl.) delivered and spread. 29 kg of Guano, an organic phosphorus fertiliser (12.6% P), was blended into each tonne of compost prior to application. Nutrient supply (kg/ha) for each compost rate (t/ha) is shown below.

Rate t/ha	N	P	K	S	Ca
1	11	3.6	10	1.6	44
2	22	7.2	20	3.3	88
4	44	14.4	40	6.6	176
8	88	29	80	13.2	352

Image 2. Aggregates of clay mixed into sand.

Image credit: Google Earth

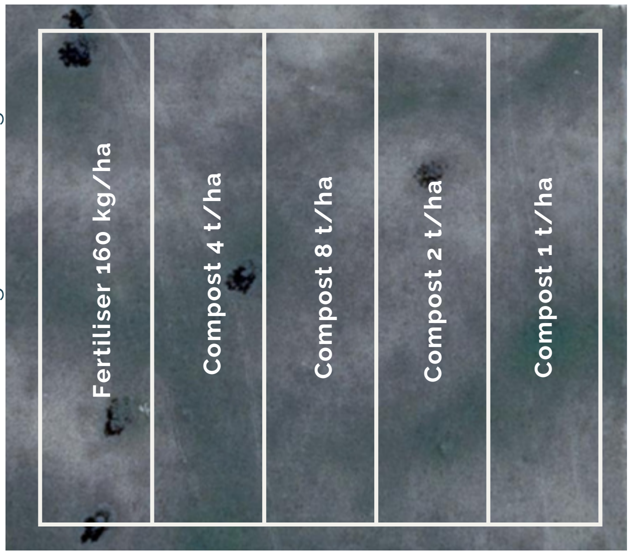


Image 3. Trial map (5 treatments x 1.1ha).

1 t/ha

2 t/ha

4 t/ha

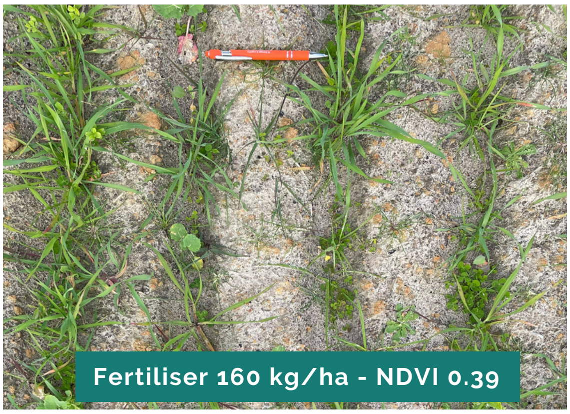
8 t/ha

Sowing details: A mixed species pasture was sown on 15 May, comprised of Balansa, Arrowleaf and Rose clovers, Paraggio medic, vetch, Blast ryegrass, Saia oats, ryecorn, and tillage radish at a rate of 69 kg/ha ($108/ha).

The seed was sown with 130 kg/ha of SMS Guano (12% P) after being treated with a fluid bio-stimulant comprised of compost extract, worm extract, seaweed powder, milk powder, molasses, humic powder, fish hydolysate, wood vinegar, mycorrhizal fungi and N fixing bacteria. The brew was applied to the seed through an auger and allowed to dry prior to planting. The paddock was sown following the hill contours to encourage water infiltration and reduce rill erosion.

Measurements: Normalised difference vegetation index was measured with a Trimble Greenseeker by recording 5 transects across the dune crest in each plot on 19 July (7 weeks post emergent, see Images on right) and by recording 12 measures on 1 September where dry matter cuts were also collected.

Dry matter was assessed on 1 September by harvesting all aboveground biomass from 12 x 0.25m2 quadrats in each treatment and on 1 November by harvesting 12 x 0.5m2 quadrats. Subsamples were retained for moisture and quality assessment.



Fertiliser 160 kg/ha - NDVI 0.39

Compost 1 t/ha - NDVI 0.30

Compost 8 t/ha - NDVI 0.28

YEAR 1 RESULTS

Normalised difference vegetation index (NDVI) results showed enhanced growth in the Fertiliser treatment in July. By September, the 2 and 8 t/ha compost treatments were as good as or better than the Fertiliser treatment, as confirmed by dry matter yield (Table 1).

Table 1. 2022 plant production measures: Normalised difference vegetation index (NDVI) in July and September; dry matter yield (DM t/ha) in September, prior to grazing; DM in November, following recovery from grazing; dry matter digestibility (DMD); crude protein (CP); metabolisable energy (ME). Treatments with the same letter are not significantly different.

Treatment	NDVI July	NDVI Sept	DM t/ha September	DM t/ha November	DMD %	CP %	ME MJ/kg
Fertiliser 160 kg/ha	0.39 a	0.69 b	0.67 a	2.77 a	58.7	12.7	8.5
Compost 1/ha	0.30 b	0.60 c	0.38 b	2.04 c	60.1	11.7	8.7
Compost 2 t/ha	0.28 b	0.77 a	0.55 a	2.59 ab	59.6	13.2	8.6
Compost 4 t/ha	0.29 b	0.60 c	0.40 b	2.42 b	60.6	13.6	8.8
Compost 8 t/ha	0.28 b	0.72 ab	0.57 a	2.48 ab	56.9	16.1	8.2
LSD (p=0.05)	0.042	0.046	0.14	0.34	-	-	-

YEAR 1 RESULTS

Winter pasture growth was slow in 2022, owing to continuous cool and cloudy conditions, hence less than a ton of **dry matter** (DM) had grown by September (Table 1). The paddock was grazed in mid September and recovered well through a relatively cool and wet spring.

The Fertiliser, 2 t/ha and 8 t/ha Compost treatments have been the best and most consistent performing, producing >0.55 and >2.45 t/ha DM in September and November respectively.

These higher yielding treatments had lower dry matter digestibility than the 1 and 4 t/ha Compost rates, but crude protein was considerably higher in the 8 t/ha treatment (data not replicated).

Pasture composition and maturity showed some differences between treatments, with the Compost treatments supporting greater legume composition that was still actively growing in November (see Images on right); the Fertiliser treatment was beginning to senesce.


Fertiliser - 2.77 t DM/ha


Compost 2 t/ha - 2.59 t DM/ha


Compost 8 t/ha - 2.48 t DM/ha

WHERE TO NEXT?

The paddock will be sown to an either an annual or perennial fodder crop in 2023; monitoring of soil physical, chemical and biological fertility and pasture yields will continue.

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