FINAL TECHNICAL REPORT

Project Title:

Compost extracts impacts on soil carbon and microbial activity and crop yield

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1 Project Background

Farming takes up half of the world's habitable land, accounts for 10% of our annual greenhouse gas (GHG) emissions and can have severe long-term implications for biodiversity, ecosystem services, and food security. However, the potential to convert agricultural land into carbon sinks is considerable. Globally, soil organic matter contains nearly 4 times as much carbon as either the atmosphere or terrestrial vegetation.

There are many benefits of building more carbon into our soils through techniques called regenerative farming – whether it's cutting concentrations of CO2 in the atmosphere, boosting food security, creating resilience against changing weather patterns or halting biodiversity loss. Regenerative agriculture is helping farmers to redesign the farming system to work together with nature, instead of against it.

One of the first steps in improving soil health and to increase soil organic matter and carbon, which is central to regenerative agriculture, is to shift away from synthetic fertilisers across to natural fertilisers. By using natural fertilisers the soil biome is enhanced which increases soil organic carbon and builds new soil. Humate levels increase, improving the soil's ability to absorb and hold water, reducing the toxic effect of residual amounts of herbicides and retaining more nutrients.

Typical natural fertilizers include mineral sources, all animal waste including meat processing, manure, slurry, and guano, plant based fertilizers, such as compost, and biosolids.

This project is the first step in the greater process of shifting to regenerative agriculture. It will examine the ability and help develop the strategy for grain growers to transition from synthetic fertilisers to natural fertilisers while maintaining production and profitability.

2 Project Objectives

The key objective of the project is to reduce barriers to adoption of natural fertiliser inputs in broadacre farming through a trial demonstrating a proposed 'transitional' methodology of conventional to biological fertilisers at time of seeding. This will be completed by examining the impacts on soil microbial activity, organic carbon and yield plus the requirement for herbicide/pesticide application through the application of different compost extracts, synthetic fertilisers and a combination of both.

The key outcome that is being explored through this project 'can we transition from conventional agriculture to regenerative practices using biological inputs while still maintaining a productive farm enterprise?'

Set up an agricultural multi-plot trial in order to:

- Provide technical knowledge in how to transition to Regen Ag practices using '30% rule' with Compost Extract as the biological component.
- Provide quantitative evidence of Regen Ag practices being successful within low rainfall zones.

Run a field day to review:

- Application techniques and results
- Advice for transitioning, and
- Seek input on next steps and future trials of Regen Ag inputs.

Look at the changes to production outcomes from variation to nutrient inputs including:

- Changes to soil microbes,
- Organic carbon levels
- Requirements for herbicide/pesticides application

Questions to address from trial:

1. Which product / combination produces best yield?
2. Which product / combination produces best profit?
3. Which product / combination produces best soil / plant health?

3 Methodology

The first hypothesis of the trial is to test if fertiliser usage can be transitioned across from conventional synthetic fertilisers to the use of biological inputs while maintaining a farming operation of similar productivity.

The hypothesis was tested in a replicated trial in West Broomehill by growing a Scepter wheat crop treated with the following fertiliser regimes:

- Best practice conventional fertiliser
- High rates of conventional fertiliser
- Low rates of conventional fertiliser
- Three types of biological inputs each at 2 different rates
- Combination of conventional fertilisers at high and low rates with 30% of the biological inputs.

The methodology was comprised of 15 treatments over 3 replications which were developed to test the hypothesis as outlined in Table 1.

The trial was sown on the 7th of June 2021 to Scepter wheat at a sowing rate of 91.2kg/Ha. Herbicide, Insecticide and Fungicides were applied within best district practices and the crop was kept weed and pathogen free. Due to the very wet conditions experienced in 2021 and the late sowing there were periods of water logging experienced through the eastern end of the plots. For this reason some on the plots were reduced by 2 meters to be 8 meters long.

The three types of biological inputs are detailed below:

Biological input 1: Liquid Wormcasting (Natural Soil Conditioner)

Liquid worm castings are a natural product made from worm castings. A single controlled feed source is utilised that allows for constant growth of the worms as well as a consistent nutrient content in the worm castings, which is then liquefied. The worm casting liquid can be applied directly (recommended in very poor-quality soils with no bacterial life) or diluted in a ratio of up to 1:5. The recommended application rate is between 20L and 40L per hectare, depending on soil condition and density of the crop.

Biological input 2: Verigrow

Verigrow is an innovative all-purpose fertiliser and soil improver made using 100% Australian low-grade wool. Wool is a sustainable and rich source of amino acids (more than 75% of wool is made of amino acids). Verigrow contains an organic (from amino acids) and an inorganic source of nitrogen (12% w/v total N). The inorganic nitrogen provides an immediate source of nitrogen while the organic nitrogen provides a slow release and longer lasting effect. The recommended application rate is 10L/Ha

Biological input 3: Nutri-Tech Solutions

The Nutri-Tech solutions biological input is comprised of four products which include Gyp-Life Organic plus NTS Fulvic Acid Powder plus Tri-Kelp plus Nuri-Life BAM. The products combine innovative technology with proven biological essentials to maximise productivity, crop quality and profitability.

Soil Testing:

The second hypothesis being tested in the project is to test that by applying biological inputs with and without synthetic fertilisers that there will an improvement in organic carbon levels and improvements in soil microbes. A further hypothesis being explored is that any improvement in organic carbon and soil microbes may translate into a reduction in the need for herbicides and/or pesticides as the plants health is improved and the natural defences are able resist damage from insects and overcome weeds.

The methodology to test this hypothesis is being completed by conducting a detailed baseline soil test across the trial site before the crop and treatments are implemented and then retesting the individual plots for each of the treatments to assess any changes in the soil parameters. The soil parameters being tested are:

1) pH (h20)

2) Microbial Biomass C (MBC) (mg/kg)

    Microbial biomass carbon is a measure of the carbon (C) contained within the living component of soil organic matter (i.e. bacteria and fungi). Microbes decompose soil organic matter releasing carbon dioxide and plant available nutrients.

3) Microbial Biomass N (MBN) (mg/kg)

    The microbial biomass consists mostly of bacteria and fungi, which decompose crop residues and organic matter in soil. This process releases nutrients, such as nitrogen (N), into the soil that are available for plant uptake. About half the microbial biomass is located in the surface 10 cm of a soil profile and most of the nutrient release also occurs here. Generally, up to 5% of the total organic carbon and N in soil is in the microbial biomass. When microorganisms die, these nutrients are released in forms that can be taken up by plants. The microbial biomass can be a significant source of N, and in Western Australia can hold 20 – 60 kg N/ha.

4) % Total Nitrogen

5) % Total Carbon

6) Dissolved Organic Carbon (microgram/gram soil)

Dissolved organic carbon (DOC) is the fraction of organic carbon operationally defined as that which can pass through a filter with a pore size typically between 0.22 and 0.7 micrometers. The fraction remaining on the filter is called particulate organic carbon (POC).

Reps: 3 **Plots: 1.8 by 12 meters**

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	Appl Date	Appl Description	Treatments Summary	Rep 1	2	3
1	Agstra Extra	100	kg/ha	A	7/06/2021	banded at seeding	Control normal conventional farming fert inputs	101	214	303
	NKS21	70	kg/ha	C	14/07/2021	4 - 5 leaf				
	Flexi-N	40	L/ha	D	3/08/2021	mid tillering				
2	Agstra Extra	140	kg/ha	A	7/06/2021	banded at seeding	High inputs conventional	102	210	309
	NKS21	100	kg/ha	C	14/07/2021	4 - 5 leaf				
	Flexi-N	40	L/ha	D	3/08/2021	mid tillering				
	Flexi-N	30	L/ha	E	23/08/2021	late tillering				
3	Agstra Extra	60	kg/ha	A	7/06/2021	banded at seeding	Low inputs conventional	103	202	310
	Urea	50	kg/ha	C	14/07/2021	4 - 5 leaf				
4	Liquid Wormcasting	20	L/ha	B	7/06/2021	liquid IF at seeding	Compost extract 1 rate 1	104	207	311
5	Liquid Wormcasting	40	L/ha	B	7/06/2021	liquid IF at seeding	Compost extract 1 rate 2	105	211	301
6	Verigrow	10	L/ha	B	7/06/2021	liquid IF at seeding	Compost extract 2 rate 1	106	205	315
7	Verigrow	20	L/ha	B	7/06/2021	liquid IF at seeding	Compost extract 2 rate 2	107	204	314
8	Gyp-Life Organic	3	L/ha	B	7/06/2021	liquid IF at seeding	Compost extract 3 rate 1	108	201	308
	NTS Fulvic Acid Powder	100	g/ha	B	7/06/2021	liquid IF at seeding				
	Tri-Kelp	100	g/ha	B	7/06/2021	liquid IF at seeding				
	Nuri-Life BAM	2	L/ha	B	7/06/2021	liquid IF at seeding				
9	Gyp-Life Organic	5	L/ha	B	7/06/2021	liquid IF at seeding	Compost extract 3 rate 2	109	208	304
	NTS Fulvic Acid Powder	200	g/ha	B	7/06/2021	liquid IF at seeding				
	Tri-Kelp	200	g/ha	B	7/06/2021	liquid IF at seeding				
	Nuri-Life BAM	3	L/ha	B	7/06/2021	liquid IF at seeding				
10	Agstra Extra	140	kg/ha	A	7/06/2021	banded at seeding	High input conventional +30% compost extract 1	110	215	312
	Liquid Wormcasting	6	L/ha	B	7/06/2021	liquid IF at seeding				
	NKS21	100	kg/ha	C	14/07/2021	4 - 5 leaf				
	Flexi-N	40	L/ha	D	3/08/2021	mid tillering				
	Flexi-N	30	L/ha	E	23/08/2021	late tillering				
11	Agstra Extra	60	kg/ha	A	7/06/2021	banded at seeding	Low input conventional + 30% compost extract 1	111	209	307
	Liquid Wormcasting	6	L/ha	B	7/06/2021	liquid IF at seeding				
	Urea	50	kg/ha	C	14/07/2021	4 - 5 leaf				
12	Agstra Extra	140	kg/ha	A	7/06/2021	banded at seeding	High input conventional + 30 % compost extract 2	112	203	313
	Verigrow	3	L/ha	B	7/06/2021	liquid IF at seeding				
	NKS21	100	kg/ha	C	14/07/2021	4 - 5 leaf				
	Flexi-N	40	L/ha	D	3/08/2021	mid tillering				
	Flexi-N	30	L/ha	E	23/08/2021	late tillering				
13	Agstra Extra	60	kg/ha	A	7/06/2021	banded at seeding	Low input conventional + 30% compost extract 2	113	212	302
	Verigrow	3	L/ha	B	7/06/2021	liquid IF at seeding				
	Urea	50	kg/ha	C	14/07/2021	4 - 5 leaf				
14	Agstra Extra	140	kg/ha	A	7/06/2021	banded at seeding	High input conventional + 30% compost extract 3	114	206	305
	Gyp-Life Organic	0.9	L/ha	B	7/06/2021	liquid IF at seeding				
	NTS Fulvic Acid Powder	30	g/ha	B	7/06/2021	liquid IF at seeding				
	Tri-Kelp	30	g/ha	B	7/06/2021	liquid IF at seeding				
	Nuri-Life BAM	0.6	L/ha	B	7/06/2021	liquid IF at seeding				
	NKS21	100	kg/ha	C	14/07/2021	4 - 5 leaf				
	Flexi-N	40	L/ha	D	3/08/2021	mid tillering				
	Flexi-N	30	L/ha	E	23/08/2021	late tillering				
15	Agstra Extra	60	kg/ha	A	7/06/2021	banded at seeding	Low input conventional + 30% compost extract 3	115	213	306
	Gyp-Life Organic	0.9	L/ha	B	7/06/2021	liquid IF at seeding				
	NTS Fulvic Acid Powder	30	g/ha	B	7/06/2021	liquid IF at seeding				
	Tri-Kelp	30	g/ha	B	7/06/2021	liquid IF at seeding				
	Nuri-Life BAM	0.6	L/ha	B	7/06/2021	liquid IF at seeding				
	Urea	50	kg/ha	C	14/07/2021	4 - 5 leaf				

Table 1: Summary of trial treatments

3 Results

The pre-trial soil tests are outlined in Table 2 and Table 3. The soil samples for the soil nutrient analysis were taken on the 16th of April 2021 and the soil samples for the soil health and organic matter were taken on the 27th of April 2021 as detailed in Table 3.

Organic Carbon levels are very good in the top 10cm across the trial site averaging 3.04%. Microbial Biomass Carbon is however low in relation to the OC averaging 140.0 mg/kg indicating the microbiological activity that is attainable in the soil is well below potential.

		Site 1			Site 2			Site 3		
	Lattitude	33.78065496			33.78065496			33.78065		
	Longitude	117.7561865			117.7561865			117.7562		
	Depth	0 - 10	10 - 20	20 - 30	0 - 10	10 - 20	20 - 30	0 - 10	10 - 20	20 - 30
Colour		DKGR	GR	GR	BRBK	GR	GR	BR	DKBR	DKBR
Gravel	%	0	0	0	0	0	0	5	5 - 10	0
Texture		2.5	2.5	3	2.5	3	3.5	2	2.5	2.5
Ammonium Nitrogen	mg/kg	3	2	2	3	2	2	3	< 1	2
Nitrate Nitrogen	mg/kg	34	6	7	40	6	5	46	4	3
Phosphorus Colwell	mg/kg	33	5	7	65	6	5	80	36	14
Potassium Colwell mg/kg	mg/kg	200	135	155	180	338	146	125	63	69
Sulfur	mg/kg	23	11.9	9.3	27.1	5.4	21.9	43.2	10.5	12.5
Organic Carbon	%	2.97	0.93	0.85	3.41	1.09	0.6	2.75	1.1	0.59
Conductivity	dS/m	0.146	0.072	0.115	0.195	0.092	0.158	0.241	0.056	0.124
pH Level	(CaCl2)	5.2	5.8	6.3	5	6.1	5.6	4.9	4.5	4.6
DTPA Copper	mg/kg	2.26	3.05	3.19	2.09	2.4	2.37	1.23	1.07	1.52
DTPA Iron	mg/kg	102.3	47.5	39.2	211.8	50.1	90	207.3	246.4	133.9
DTPA Manganese	mg/kg	5.74	5.64	4.05	7.05	5.37	1.53	4.8	3.33	7.72
DTPA Zinc	mg/kg	2.52	0.49	0.63	4.95	0.47	0.54	4.33	1.37	0.55
PBI		58.5	65.6	75.2	78.9	72.8	65.3	76.3	79.4	62.7

Table 2: Pre-trial soil nutrient analysis results.

	Site A	Site B	Site C
pH(H2O)	5.2	5.0	4.9
Moisture %	6.3	7.7	6.4
Microbial biomass C (MBC) (mg/kg)	124.6	212.9	82.6
Microbial biomass N (MBN) (mg/kg)	82.5	140.9	54.6
%Total N	0.3	0.3	0.2
%Total C	4.0	3.3	3.0
Dissolved Organic C (microgram/g soil)	100.6	74.6	93.3

Table 3: Pre-trial soil health and organic matter results.

The post-trial soil samples were taken on the 10th of February 2022. Samples were taken from each individual plot and then combined before being sent away for testing. The soil health and organic matter results for each of the treatments are outlined below in Table 4.

There was very limited change across the treatments for % total N and % total C. There was, however, a considerable increase in Microbial Biomass C (MBC) and in Microbial Biomass N (MBN) between the baseline soil tests and the post-trial/treatment soil test results. The average MBC increased from 140 to 903 and the average MBN increased from 93 to 597. These results were an average across all plots and not related to any individual treatment.

Plot	N [%]	C [%]	MBC (mg/kg)	MBN (mg/kg)
T1 control normal conventional farming fert inputs	0.247	3.45	1062.6	703.2
T2 high inputs conventional	0.236	3.26	866.0	573.1
T3 low inputs conventional	0.193	2.59	816.8	540.5
T4 compost extract 1 rate 1	0.226	2.87	1078.3	713.6
T5 compost extract 1 rate 2	0.216	2.90	808.5	535.1
T6 compost extract 2 rate 1	0.249	3.32	676.7	447.8
T7 compost extract 2 rate 2	0.213	3.06	775.0	512.8
T8 compost extract 3 rate 1	0.284	4.30	1179.0	780.2
T9 compost extract 3 rate 2	0.242	3.32	1287.0	851.7
T10 low input conventional + 30% compost extract 1	0.199	2.80	889.6	588.7
T11 high input conventional + 30% compost extract 1	0.217	3.17	798.6	528.5
T12 low input conventional + 30 % compost extract 2	0.230	3.18	707.4	468.1
T13 high input conventional + 30% compost extract 2	0.268	3.81	961.8	636.5
T14 low input conventional + 30% compost extract 3	0.254	3.75	944.3	624.9
T15 high input conventional + 30% compost extract 3	0.243	3.41	692.1	458.0

Table 4: Post trial soil health and organic matter results.

Plant counts and NDVI readings were taken on the 30th of July. There was no significant difference between any on the treatments. Plant counts were all in line with industry best practice to achieve full yield potential (Figure 1).

The NDVI readings (Figure 2) taken at the 7 week stage of the crop mirrors very closely to the final yield figure.

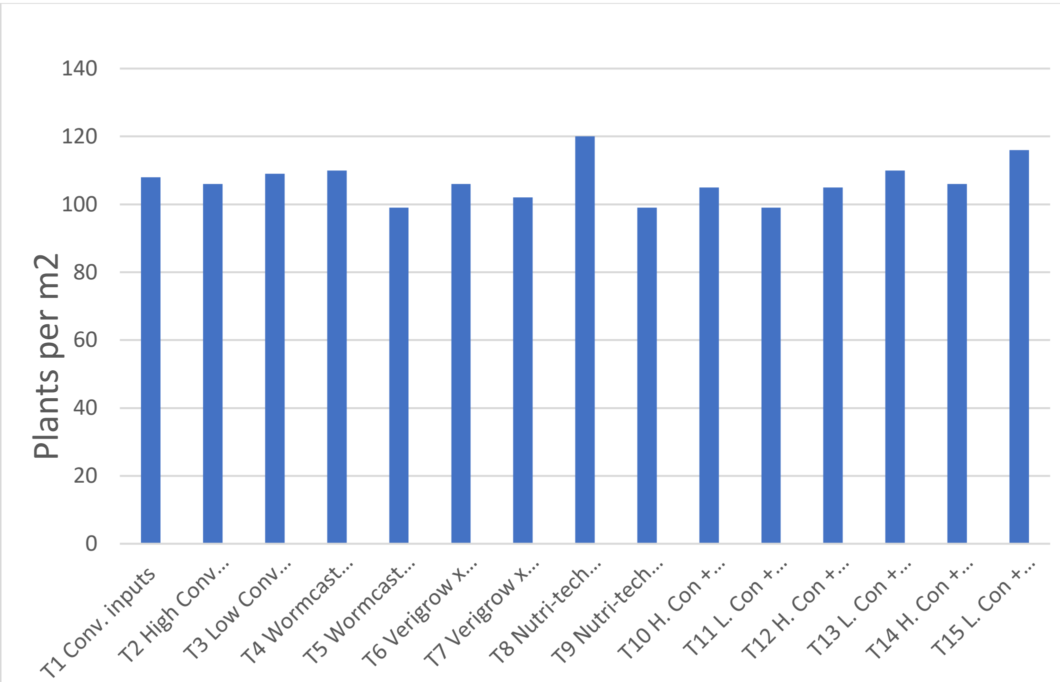

Figure 1: Landcare trial plant numbers per square meter (P=NSD)

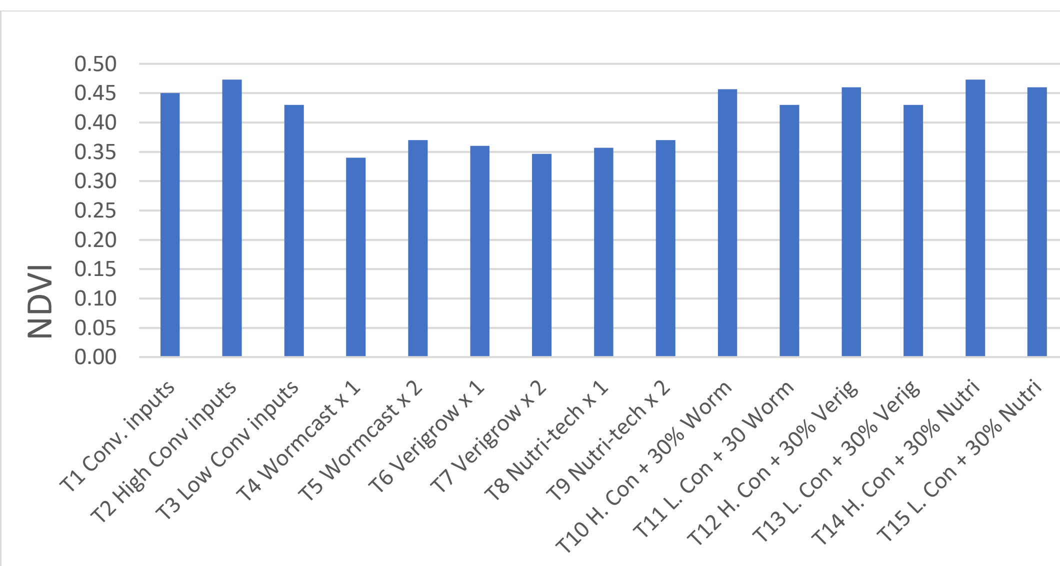

Figure 2: Landcare trial NDVI readings at 30 July 2021(P=NSD)

The trial was harvested on the 21st of December 2021. Figure 3 outlines the average yields across the different treatments. The High Inputs Conventional had the highest yield at 7.58 MT/Ha closely followed by the High Input Conventional + 30% Compost Extract at 7.33 MT/Ha.

The three straight biological inputs treatments, both high and low (treatments 4 – 9) all yielded very similarly between 4.51 – 5.10 MT/Ha and considerably below the conventional input treatments. There didn't appear to be any production benefit in combining the biological inputs with the conventional fertiliser and shown in treatments 10 to 15.

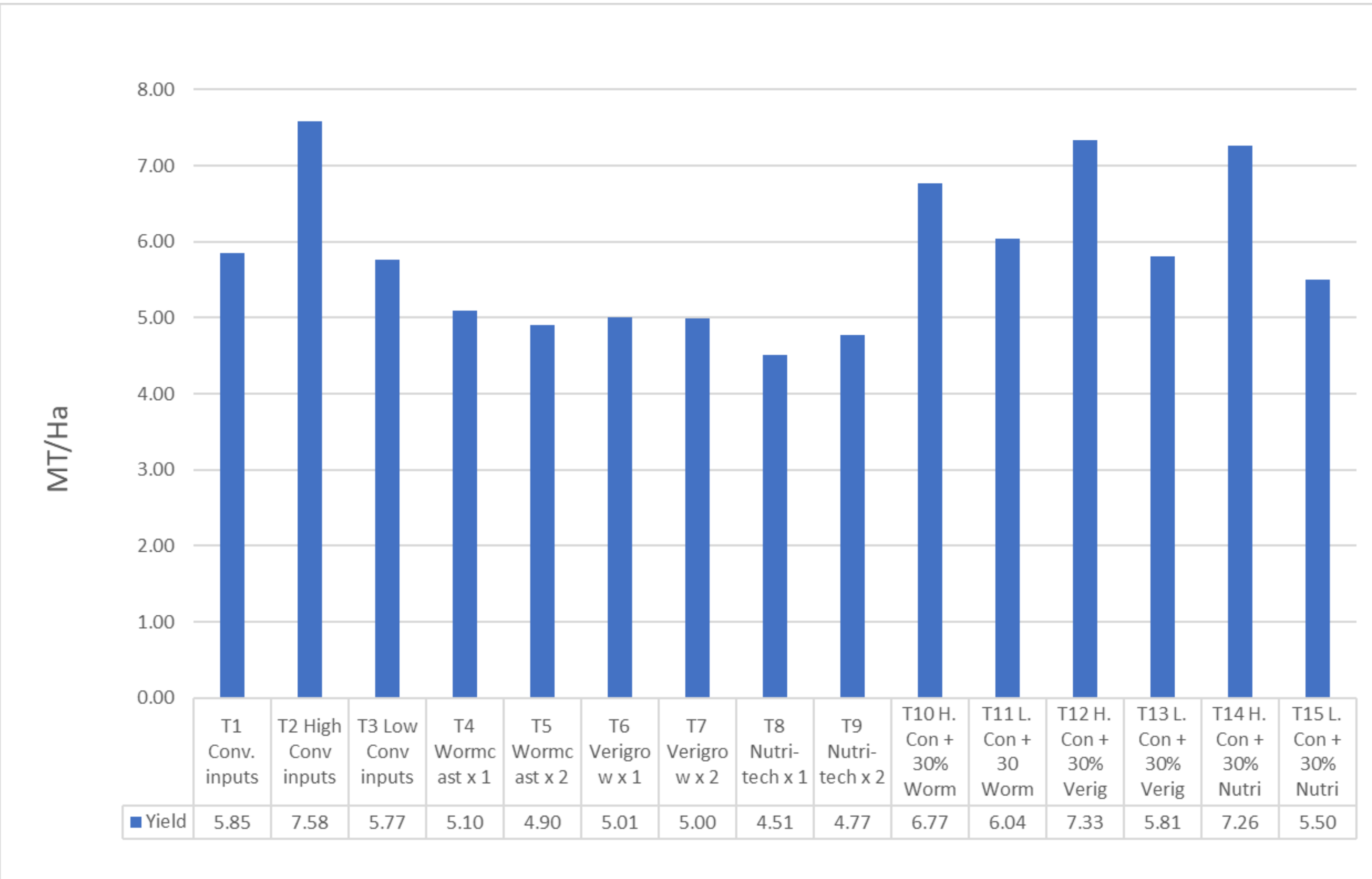

Figure 3: Landcare trial harvest yield data (P=NSD)

Benefit Cost Analysis

The benefit cost analysis was determined by calculating the net change in farm gate return. The baseline farm gate return was represented by treatment 1 or normal farm fertiliser inputs and was calculated by multiplying the yield by the farmgate price of APW1 less the cost of the fertiliser. It was assumed all other inputs were equal across each treatment.

Each treatments total farmgate return was the calculated less the cost of the fertiliser and compared to the control or treatment 1. Figure 4 shows the difference in net return compared to treatment one and the cost of each treatment.

As expected the highest yielding treatment (T2) was the best returning treatment. There was a cost of shifting away from the conventional fertiliser to the biological inputs as seen with the negative change in farm gate return across treatments 4 to 9, despite the considerable reduction in cost/Ha. The best returning treatments were all associated with the high conventional input regime.

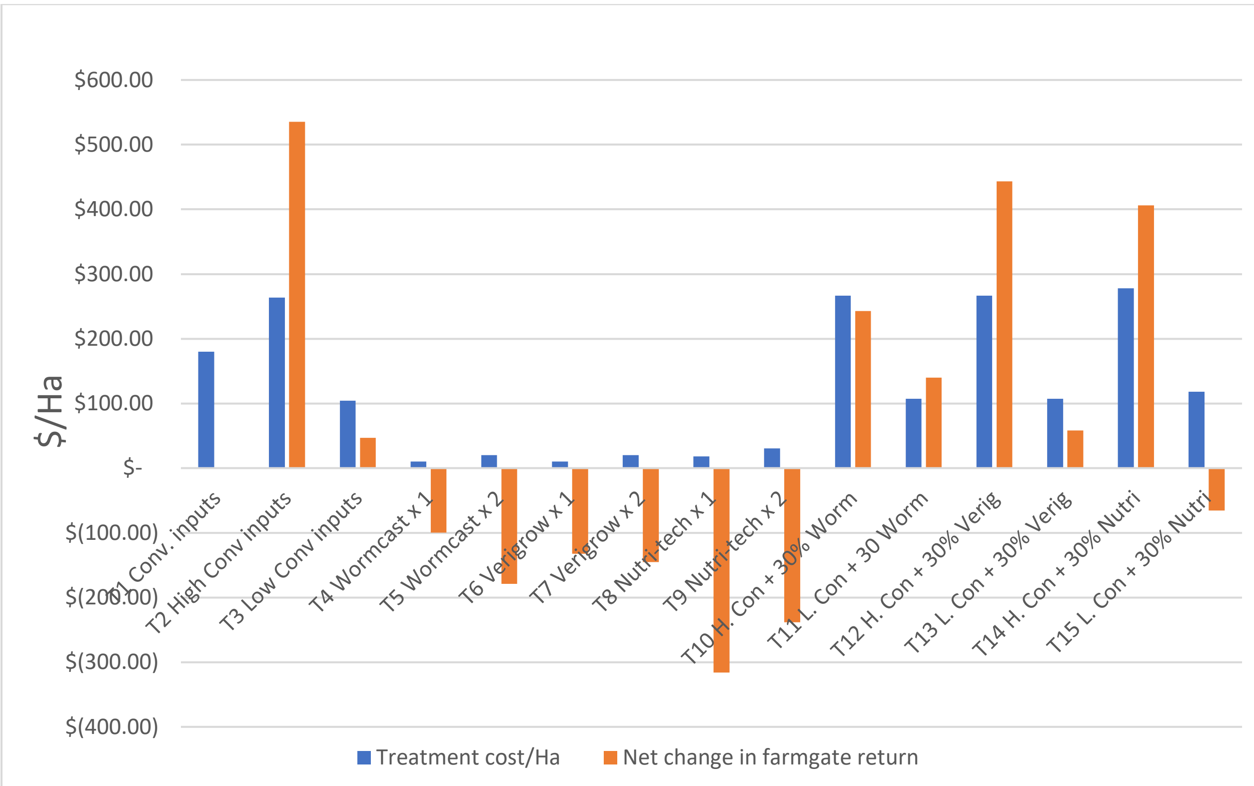

Figure 4 – Landcare trial benefit cost analysis

4 Discussion

The key outcomes of this project is to reduce barriers to adoption of natural fertiliser inputs in broadacre farming and to demonstrate a transitional methodology to producers to shift away from conventional fertilisers over to biological inputs. This is to be achieved by examining the impacts of the conventional and biological treatments on soil microbial activity, organic carbon and yield.

The primary driver for most producers decision making process is yield and gross margin. The yield and net farm gate return results in this project have demonstrated that there is a considerable reduction in yield and drop in farm gate returns if the transitioning from conventional fertilisers to biological inputs is assessed over a one-year period as is the case in this project.

The product or combination of products which produced the highest yield is the high conventional input treatment. This treatment also produced the best net farm gate return or profit. The product that produced the lowest yield and net farm gate return was the Nutri-tech solutions product at rate 1. The three products producing the worst net change in farm gate returns were the three biological fertilisers at both application rates.

For producers to transition across to using biological inputs for crop production the products will need to demonstrate their ability to produce equivalent yielding crops as conventional fertilisers and return similar profits.

While this project does not supported the hypothesis that 'we can transition from conventional agriculture to regenerative practices using biological inputs while still maintaining a productive farm enterprise', there have been some important outcomes generated from the trial.

1) Changing organic matter levels and soil microbial activity takes considerable time. To see a meaningful change takes up to 4 – 5 years. For a trial to demonstrate the ability of natural fertilisers to perform as well as conventional fertilisers the trial needs to be run over several seasons to allow the potential improvement in soil health to occur and translate into production.
2) For producers to transition to biological fertilisers the impact on their production and profit through the transition process needs to be well understood. It is expected that to generate the benefits of the biological fertilisers within the soil microbiology and, in turn, production, that there will be a drop in production while the soil is changing. This trial has helped define what can happen during the early stages of transitioning.
3) There is a requirement for a more detailed scientific explanation to be developed to enable producers to understand how spraying a worm extract, a wool extract or a kelp product can deliver the required nutrients to a wheat crop expected to yield 7 ton/Ha.
4) The trial was unable to address the questions which product / combination produces the best soil / plant health. This was primarily due to the results from the before and after soil tests. Both Microbial Biomass C (MBC) and in Microbial Biomass N (MBN) increased 6-fold on average across the trial area between the testing periods without any relationship to the treatments.

5 Conclusion

For producers to make the decision on whether to change from conventional fertiliser to biological fertilisers from this trials' results alone the uptake would be very low due to the considerable fall in net farm gate returns generated by the biological fertilisers.

The project's key aim was to answer the question 'can we transition from conventional agriculture to regenerative practices using biological inputs while still maintaining a productive farm enterprise?' The answer from this trial's outcomes is *no*!

However, it is important to understand the results before placing weight on them in making a decision. A fall in production is expected when transitioning between conventional to biological fertilisers and this trial has demonstrated:

- The potential fall in production and farmgate returns that can be experienced in year 1 (-$100 - $300/Ha).
- Any transition process needs to be managed well to ensure a smooth change over.
- The reasons and desired outcomes and expectation for the transition need to be clearly understood before beginning the change.

The next steps and future trials of Regen Ag inputs will be very important in influencing the uptake of biological fertilisers. The key step in future trials is to complete the trials over several seasons to better understand the long term impacts and production potential of biological fertilisers. Any change in soil health will take years and not months. The degradation of WA's soils organic matter has taken decades - not a few years.

The second important next step is to develop a better knowledge of how the biological fertilisers will improve soil health, what are the key levels of microbial biomass required and what yields are actually achievable. One ton of wheat seed removes 23 kg of nitrogen, if the target yield is 6-ton/Ha then the crop will require 138 units of N plus what is required to produce the plant.

20L of worm castings puts out between 34 - 750 grams/Ha of N. To grow a 6-ton/Ha wheat crop a further 137 units of nitrogen is required by the crop. Can a soil stimulated with microbiology generate enough plant available N to grow a crop with the equivalent gross margins.

If Regen Ag and biological fertilisers are to transition into mainstream agriculture these questions will need to be answered. The outcome of these questions will be key to driving long-term change.

6 Appendix

Soil Test Results – 16 April 2021

75584
Southern Dirt Incorporated

		UIS21024	UIS21025	UIS21026	UIS21027	UIS21028	UIS21029	UIS21030	UIS21031	UIS21032
Lab No		UIS21024	UIS21025	UIS21026	UIS21027	UIS21028	UIS21029	UIS21030	UIS21031	UIS21032
Name		D	I	F	A	C	E	H	G	B
Code		Site c scott newbey	Site c scott newbey	Site c scott newbey	Site c scott newbey	Site c scott newbey	Site c scott newbey	Site c scott newbey	Site c scott newbey	Site c scott newbey
Sampled Date		16/04/2021	16/04/2021	16/04/2021	16/04/2021	16/04/2021	16/04/2021	16/04/2021	16/04/2021	16/04/2021
Barcode		SOILB0042729	SOILB0061034	SOILB0061035	SOILB0042719	SOILB0061037	SOILB0042741	SOILB0061043	SOILB0042727	SOILB0042723
Depth		0-10	20-30	20-30	0-10	20-30	10-20	10-20	0-10	10-20
Latitude		-33.7806549612196	-33.7806549612196	-33.7806549612196	-33.7806549612196	-33.7806549612196	-33.7806549612196	-33.7806549612196	-33.7806549612196	-33.7806549612196
Longitude		117.756186537445	117.756186537445	117.756186537445	117.756186537445	117.756186537445	117.756186537445	117.756186537445	117.756186537445	117.756186537445
Colour		BRBK	DKBR	GR	DKGR	GR	GR	DKBR	BR	GR
Gravel	%	0	0	0	0	0	0	5-10	5	0
Texture		2.0	2.5	3.5	2.5	3.0	3.0	2.5	2.0	2.5
Ammonium Nitrogen	mg/kg	3	2	2	3	2	2	< 1	3	2
Nitrate Nitrogen	mg/kg	40	3	5	34	7	6	4	46	6
Phosphorus Colwell	mg/kg	65	14	5	33	7	6	36	80	5
Potassium Colwell	mg/kg	180	69	146	200	155	338	63	125	135
Sulfur	mg/kg	27.1	12.5	21.9	23.0	9.3	5.4	10.5	43.2	11.9
Organic Carbon	%	3.41	0.59	0.60	2.97	0.85	1.09	1.10	2.75	0.93
Conductivity	dS/m	0.195	0.124	0.158	0.146	0.115	0.092	0.056	0.241	0.072
pH Level (CaCl2)		5.0	4.6	5.6	5.2	6.3	6.1	4.5	4.9	5.8
pH Level (H2O)		5.9	6.2	7.1	6.2	7.3	7.5	6.1	5.7	7.3
DTPA Copper	mg/kg	2.09	1.52	2.37	2.26	3.19	2.40	1.07	1.23	3.05
DTPA Iron	mg/kg	211.80	133.90	90.00	102.30	39.20	50.10	246.40	207.30	47.50
DTPA Manganese	mg/kg	7.05	1.72	1.53	5.74	4.05	5.37	3.33	4.80	5.64
DTPA Zinc	mg/kg	4.95	0.55	0.54	2.52	0.63	0.47	1.37	4.33	0.49

Lab No		UIS21024	UIS21025	UIS21026	UIS21027	UIS21028	UIS21029	UIS21030	UIS21031	UIS21032
Exc. Aluminium	meq/100g	0.150	0.320	0.130	0.120	0.150	0.200	0.410	0.180	0.160
Exc. Calcium	meq/100g	9.05	2.72	5.00	10.07	8.73	10.20	3.33	5.92	6.17
Exc. Magnesium	meq/100g	2.75	3.48	7.53	3.41	7.29	8.07	1.55	1.57	5.03
Exc. Potassium	meq/100g	0.39	0.16	0.35	0.40	0.39	0.74	0.12	0.22	0.26
Exc. Sodium	meq/100g	1.02	1.43	2.66	0.83	1.50	1.74	0.66	1.01	0.98
Boron Hot CaCl2	mg/kg	1.28	1.01	2.30	1.73	4.14	2.10	0.69	1.06	2.67
PBI		78.9	62.7	65.3	58.5	75.2	72.8	79.4	76.3	65.6