Affect of improving soil **organic matter** with compost on **broad-acre** crop production.

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Introduction

The Farm Compost Demonstration project is the largest compost trial in Australia. It was established by the Southern Metropolitan Regional Council (SMRC), supported by the State Government, as a means of generating interest in the use of compost in commercial farming.

Today, most agricultural businesses in Western Australia are using synthetic fertilisers to feed nutrients into their crops. Compost can be thought of as a source of nutrients, however, it also offers the potential of long term solutions for sustainable soil management which fertilisers alone are unable to achieve.

20 broad-acre farms were to be selected in 2004 to participate over a two year period as part of a program to develop the market for compost made from household waste.

As a result, this project will contribute strongly to the creation of demand for the use of MSW (municipal solid waste) derived compost and create a greater degree of confidence for the development of future waste composting plants in WA.

Twenty farms were chosen from a group of farmers that expressed an interest in being involved in the project. They were chosen primarily on several basic issues including, distance from Perth, crops grown, soil type, paddock accessibility and the farmers ability to spread compost (either through contractors or their own equipment). Most properties were within 100-150km of Perth although two farms were ~200km from Perth in the Williams-Darkan region.

This report is focussed on the results from these farms which grew cereal (including lupin) crops during the winter of 2004.

Broad-acre Results 2004

On each property selected, 1ha plots (100m x 100m) were established and the SMRC compost was broadcast at two nominal rates – 10t/ha and 20t/ha (wet weight). These rates were chosen as they were the lowest rates where positive results had previously been achieved in cereal crops. A range of crops have been part of the project including – wheat, barley, lupins, canola and oats.

The actual rates of compost used were determined by using either load cells, if contractors were equipped with them, or measuring the bulk density of the compost and then applying the appropriate calculated volume to the treated areas. Final rates of compost applied did vary between properties.

A minimum of 30m was left between the treated plots and this was used as the control area along with the remainder of the paddock.

Each farm was monitored for soil and crop performance including initial soil analysis, mid-crop soil moisture, plant tissue analysis, plant growth (dry weight, tiller count), yield and grain quality.

Crops were sown within the farmers seeding program in autumn 2004 and all treatments had the farmers' normal fertilizer rates.

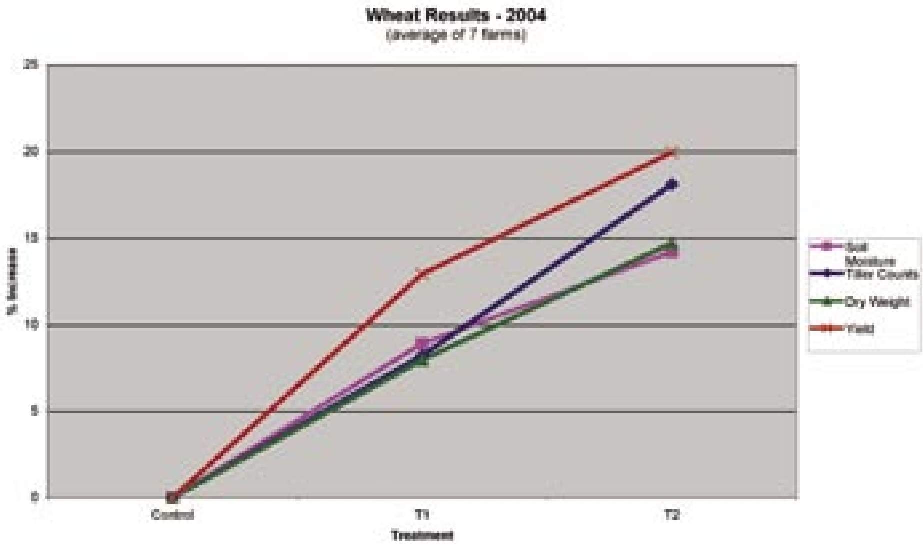
Germination of crops were consistent between treatments and there were no adverse affect on crop germination observed at any of the farm sites (see photograph below).

Figure 1: Recently germinated wheat Muresk College - 2004

This project was established to demonstrate the practical benefits of using compost in existing farming systems and not as a definitive scientific trial, however all sampling and analysis of trials was conducted to comply with scientific principles.

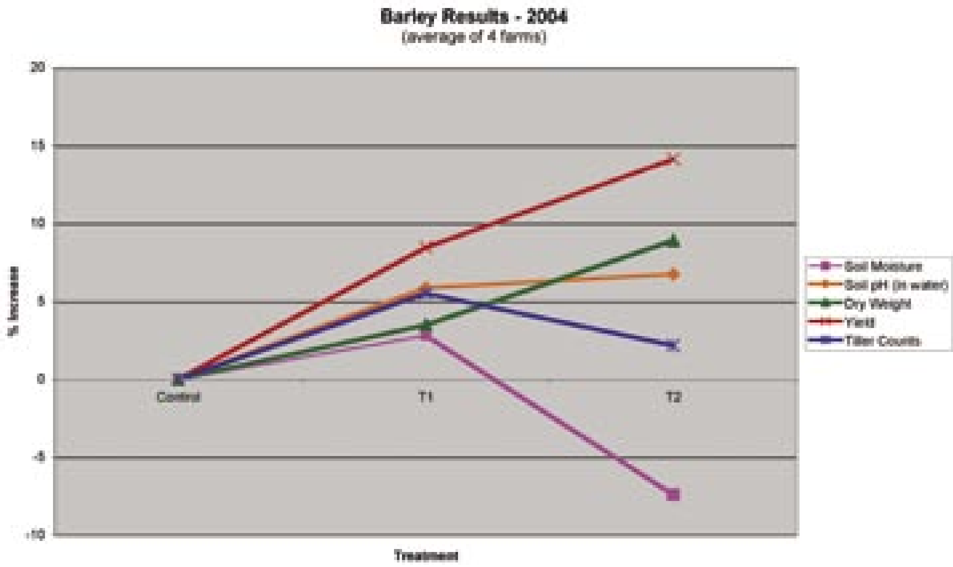
The results in figure 2 show that average wheat yields have improved by an impressive 20% in the 20 tonne treatment and 13% in the 10 tonne treatment. On an individual farm level yield increases were up by an amazing 39% above the control at the higher rate of compost addition. Other results (of the seven properties) for wheat production, show consistent almost linear improvements in soil moisture, plant dry weight and tiller numbers with the application of compost.

Figure 2: Affect of compost application on wheat production



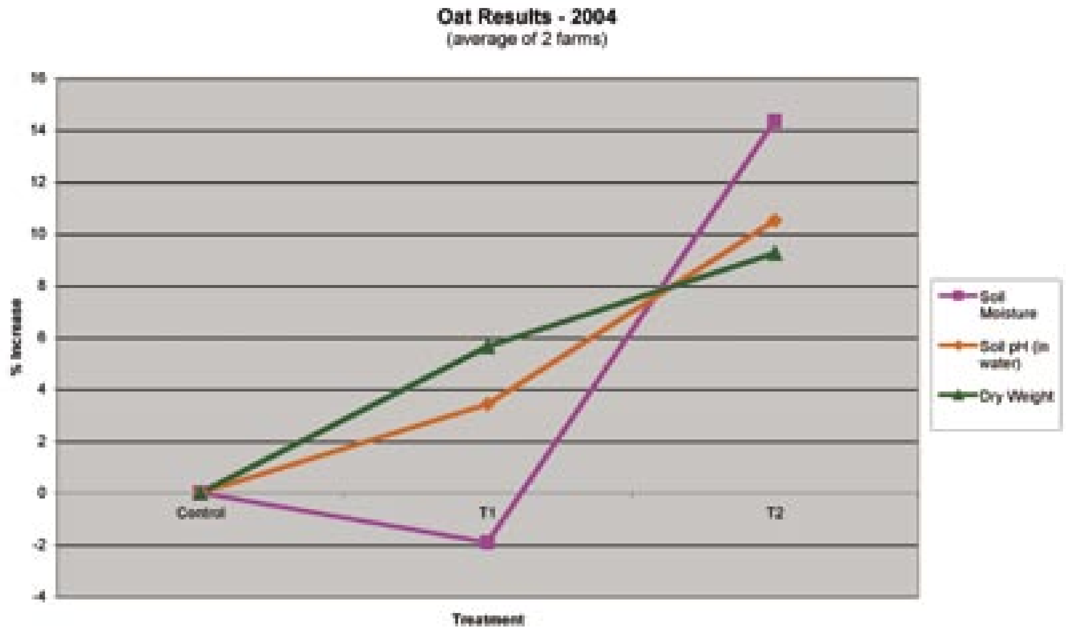
Barley results, whilst not as impressive as wheat, did show consistent improvements in yield and dry weight with less consistency in tillering and soil moisture improvements.

Figure 3: Affect of compost application on barley production and soil.



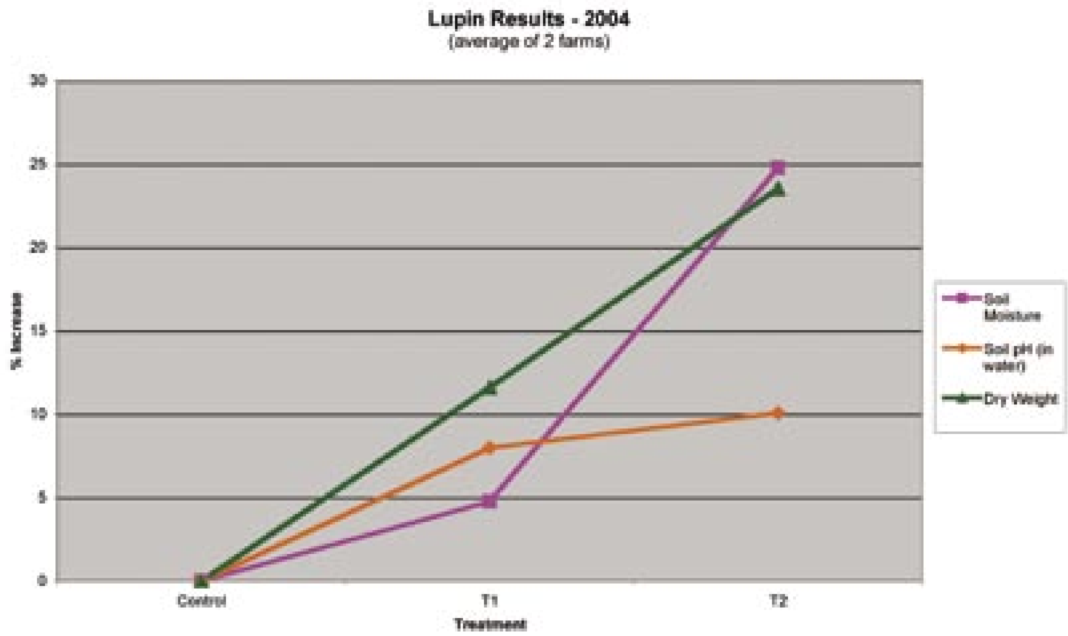
Both oat crops grown in 2004 were cut for hay. Results in figure 4 below show a nearly 10% increase in dry weight production at the 20t compost rate and similar soil improvements to those achieved in other broad-acre crops.

Figure 4: Affect of compost application on oat production.



Lupin crops grown in 2004 suffered from severe growing conditions; one farm was very dry, the second had a wind storm after compost application but before seeding. Despite this nearly 25% improvements in lupin growth (dry weight) and soil moisture were measured in the 20t compost rate compared to the control.

Figure 5: Affect of compost application on lupin production.



Significantly, the use of SMRC compost on broad-acre farms was shown to improve soils by increasing soil buffering capacity (pH) and moisture holding. Compost is also a source of plant nutrients and organic matter which will improve soil fertilizer retention and boost the pool of nutrients. The broad reaching benefits of adding compost to soil make it difficult to isolate which of the components of the compost led to the improvements.

Based on horticultural experience, not all nutrients in the compost are immediately available to the crop. Paulin (personal communication) suggests the Department of Agriculture trial work shows that approximately 40% of the phosphorus is available (similar availability to superphosphate) and results elsewhere show 20% of nitrogen is available in the first season. They also found potassium was at least as available as fertiliser sources and may improve the efficiency of potassium utilisation by 20 % during the life of the crops.

The amount of nutrients added to the soil in compost has varied greatly (see Appendix 2), due to the fact that some properties received compost batches from early production runs that had relatively low nutrient levels.

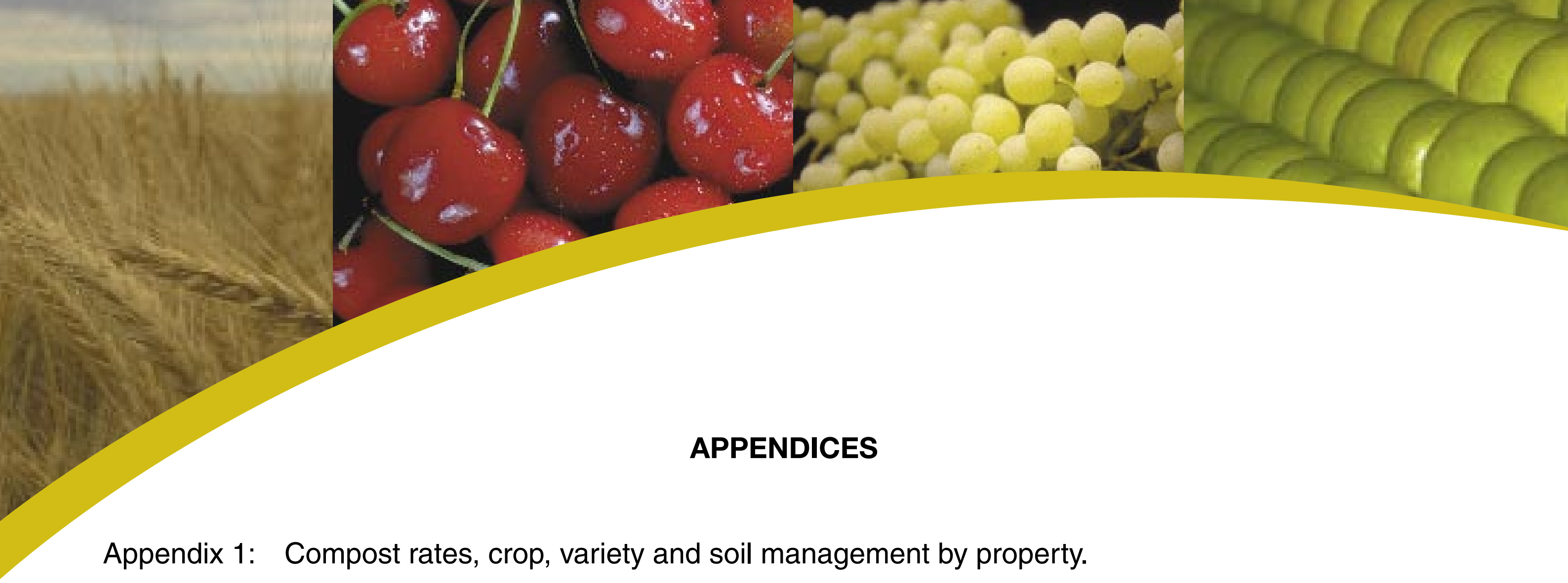
It is noteworthy that one Wongan Hills property received compost with relatively low level of nutrients but also achieved the highest increase in yield. This suggests that the improvements in soil moisture, or other biological factors not measured, were the major contributing factor for the improvements in broad-acre crop growth, including dry weights and tiller numbers at flowering, and yield.

The addition of SMRC compost to agricultural soils is proving to be an effective way to boost a soils ability to retain nutrients and water, improve soil chemical characteristics and increase soil nutrient content. An increase in any one of these soil characteristics can and has led to improvements in crop performance.

2005 Program

The 2005 broad-acre program has commenced and initial indications show that there are significant residual effects from the compost applied during 2004. The economics for broad-acre applications will rely on:

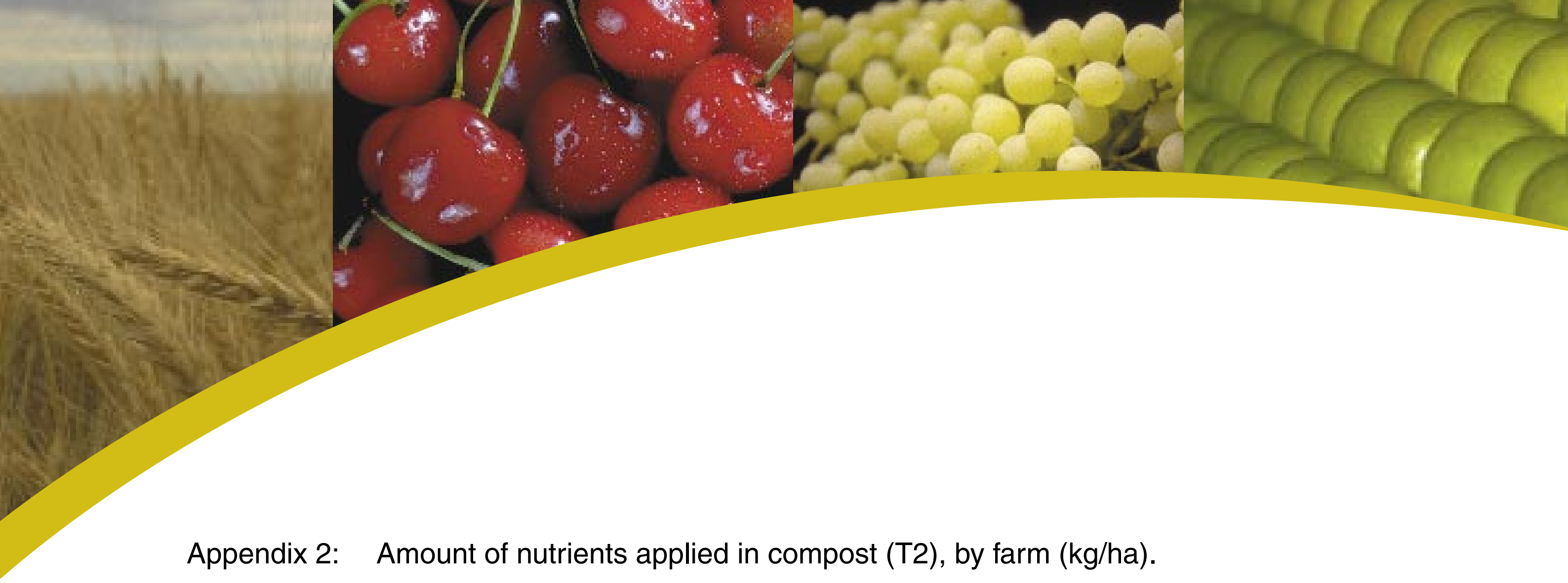
- Reducing the annual applications to 3t/ha (from 10-20t/ha)
- Reducing the annual applications to 100-200kg/ha by pelletising the compost
- Achieving 2-3 years of residual effect of the higher usage rates (10-20t/ha)



APPENDICES

Appendix 1: Compost rates, crop, variety and soil management by property.

Location	Site #	Soil Type	Crop Type – Variety	Compost Rate – T1 t/ha	Compost Rate – T2 t/ha	Stubble Retained	Cultivation
Beverley	BE01	Red sandy loam	Oats Carrollup	9.6	19.4	Yes	Disc cultivation
Beverley	BE09	Gravelly sand	Lupin Belara	10	20	Burnt	Full cut
Bolgart	BN03	Brown sandy loam	Wheat Calingiri	9.9	19.9	Grazed Canola Stubble	No
Brookton	BE05	Gravelly sand	Wheat Brookton	13	26	Yes	Full cut
Brookton	BE08	Grey sand	Wheat Calingiri	10	20	Yes	No
Brookton	BS03	Gravelly sand	Barley Harring-ton	10.4	20.7	Out of pasture	Full cut
Darkan	BS01	Sand over clay	Barley	10	20	Out of pasture	No
Gingin	BN02	Grey Sand	Lupin Tanjil	10	20	Out of pasture	No
Northam	BE03	Sand to red gravely sand	Wheat Calingiri	10	20	Burnt	Yes
Northam	BE10	Red sandy loam	Wheat Calingiri	10	20	Burnt	No
Pingelly	BS06	Red loam	Oats Dalyup	10	20	Yes	Combine with harrow
Wandering	BS05	Gravelly loam	Barley Gairdner	12	24	Out of pasture	Harrows
Williams	BS02	Red loam	Barley	12	24	Cultivated pasture	Yes
Wongan Hills	BN04	Grey sandy loam	Wheat Carnamah	8.5	17	No	No
York	BE07	Grey-brown sand	Wheat Carnamah	10.4	20.9	Yes	Full cut



Appendix 2: Amount of nutrients applied in compost (T2), by farm (kg/ha).

Property	Nitrogen	Phosphorus	Potassium	Organic Matter
Beverley BE01	181.1	24.4	81.5	3,269
Beverley BE09	184.8	25.2	84.0	3,370
Bolgart BN03	183.9	25.1	83.6	3,353
Brookton BS03	248.4	31.0	83.8	3,726
Brookton BE05	14.8	15.0	43.9	3,900
Brookton BE08	12.8	12.8	35.2	4,896
Darkan BS01	12.8	12.8	35.2	4,896
Gingin BN02	176	20.8	62.4	4,869
Northam BE03	240	30	81	3,596
Northam BE10	204.4	21.9	73.0	4,442
Pingelly BS06	12.8	12.8	35.2	4896
Wandering BS05	245.3	26.3	87.6	5,331
Williams BS02	192.7	22.8	64.8	3,223
Wongan Hills BN04	10.9	10.9	29.9	4,162

References:

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Acknowledgements:

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Individual situations vary considerably and farmers should seek advice from their own advisors prior to implementing programs based on this information.

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Check the websites for updates.