Improving tree and vine growth with compost.

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Background

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, however, can be thought of as a source of nutrients and it also offers the potential of long term solutions for sustainable soil management which fertilisers alone are unable to achieve.

25 horticultural sites were 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.

The twenty five 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 their ability to spread compost (either through contractors or their own equipment). All horticultural properties were within 100-150km of Perth.

This report focuses on results from the horticultural sites in the summer of 2004/05.

Materials and Methods

On each property selected, plots were established and comprehensive tests were conducted to assess nutrient levels, heavy metal and pesticide residue levels in the soil. The size of plots varied but as a minimum were 3 rows of control with three rows of compost treatment (two treatments) on either side of the control rows.

In the treated areas SMRC compost was banded into the tree/vine row at two depths – 2.5cm (20t/ha) and 5.0cm (40t/ha). Final rates of compost applied did vary between properties, see Table 1.

A minimum of 3 rows were left between the treated plots and this was used as the control area.

Each farm monitored for soil and crop performance which included:

a) Soil analysis – initial nutrient, heavy metal & pesticide residue levels, mid-crop including soil moisture, pH, nitrate, ammonium, EC.

b) Plant tissue analysis - mid-crop

c) Plant growth – stem diameter

Sites were tagged at row ends and initial soil tests were conducted prior to application of compost.

Compost was applied in late winter and spring 2004 and all treatments had the farmers' normal fertilizer rates.

The mid-crop and soil measurements were taken at appropriate times for the individual crop species.

All soil and tissue analysis was conducted on a specific "monitoring" row, generally the centre row, in each treatment.

Yields were measured differently in different crops. For example in wine grapes where many crops are thinned for quality reasons bunch weights were recorded and for all other crops yield was measured as total yield per tree or hectare.

Table 1: Crop type, soil type and compost rates by property.

Location	Site #	Soil Type	Crop	Compost Rate T1 t/ha	Compost Rate T2 t/ha
Carabooda	HN10	Gravelly sand	Avocado	13	26
Carmel	HE06	Gravelly loam/clay	Pears	15	30
Dwellingup	HS04	Gravelly loam	Wine grapes	20	40
Dwellingup	HS05	Gravelly loam	Peaches	15	30
Gingin	HN01	Red sand	Wine grapes	66	132
Gingin	HN02	Sand	Wine grapes	20 broadcast	40 broadcast
Gingin	HN03	Grey sand	Citrus	20	40
Gingin	HN04	Brown sandy loam	Table grapes	20	40
Gingin	HN05	Sand	Olives	20	40
Gingin (West)	HN07	Grey Sand	Citrus	10	20
Gingin (West)	HN07B	Grey sand	Citrus	10	20
Harvey	HS01	Sand to red gravely sand	Wine grapes	10	20
Hackett's Gully	HE05	Gravelly loam	Peaches	15	30
Karragullen	HE06	Red sandy loam	Pears	10	20
Jarrahdale	HS07	Red gravelly sand	Nectarines	15	30
Karragullen	HE01	Clay	Apples	15	30
Karragullen	HE02	Sandy loam	Nectarines	15	30
Serpentine	HS02	Gravelly sand	Oranges	10	20
Swan Valley	HN06	Sand	Wine grapes	20	40

Results

Visible differences were noticed between treatments in some crops. The most obvious were leaf colour differences in wine grapes (see figure 1) and root development in olives.

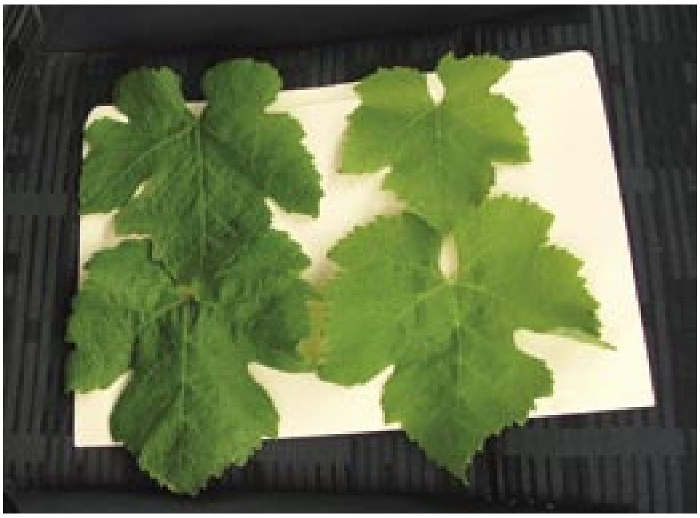


Figure 1. Colour differences between treated wine grapes (T2 on left) & Control on right – 2005

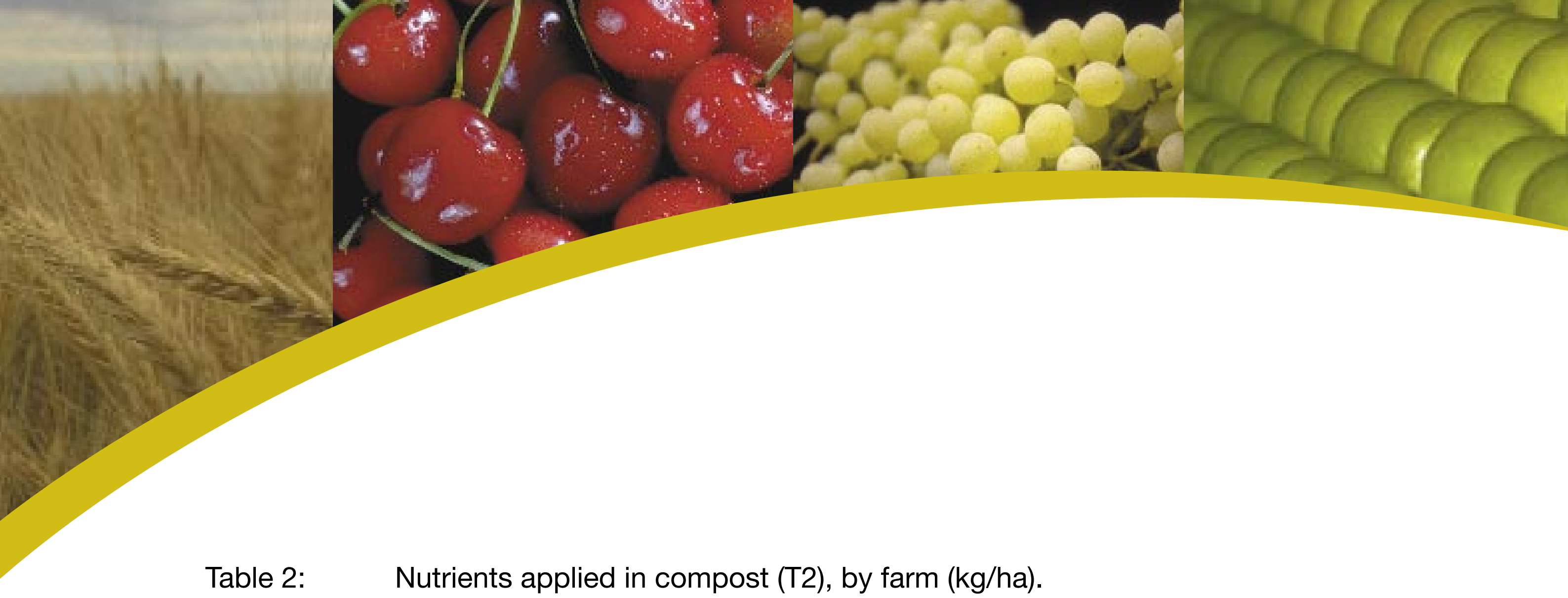
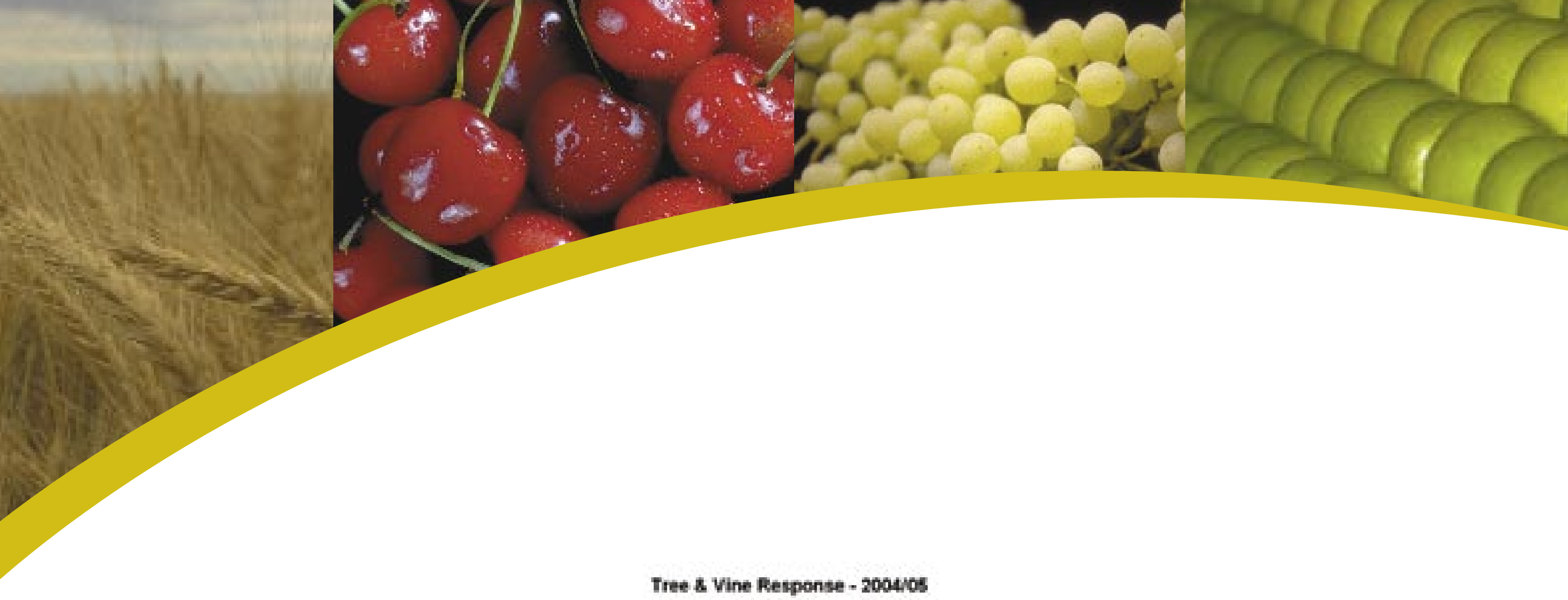
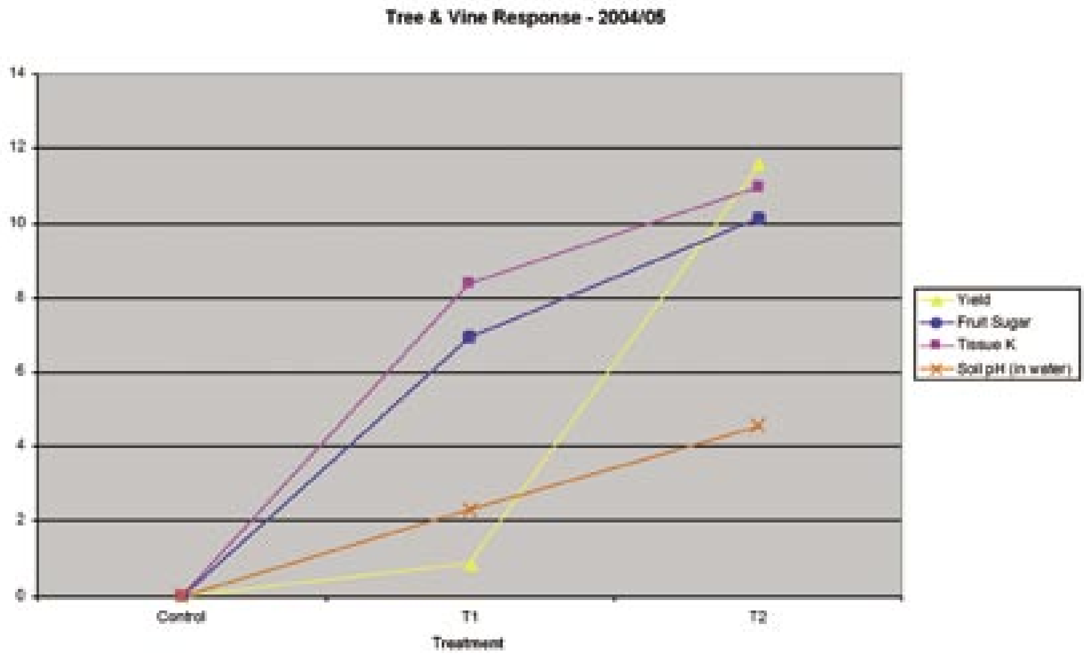


Table 2: Nutrients applied in compost (T2), by farm (kg/ha).

Property	Nitrogen	Phosphorus	Potassium	Organic Matter
Carabooda HN10	187	34	22	12,199
Carmel HE06	324	45	24	17,626
Dwellingup HS04	374	46	43	11,178
Dwellingup HS05	508	65	189	9,657
Gingin HN01	684	114	342	29,567
Gingin HN02	138	26	14	10,037
Gingin HN03	144	46	124	8,960
Gingin HN04	228	58	124	8,617
Gingin HN05	374	32	95	15,129
Gingin (West) HN07	396	55	157	23,657
Gingin (West) B HN07	114	7	5	2,497
Harvey HS01	26	26	7	9,792
Hackett's Gully – HE05	87	26	35	18,360
Jarrahdale HS07	259	56	48	23,501
Karragullen HE01	8	57	21	17,054
Karragullen HE02	187	43	71	7,151
Serpentine HS02	324	45	24	17,626
Swan Valley HN06	461	20	20	7,384



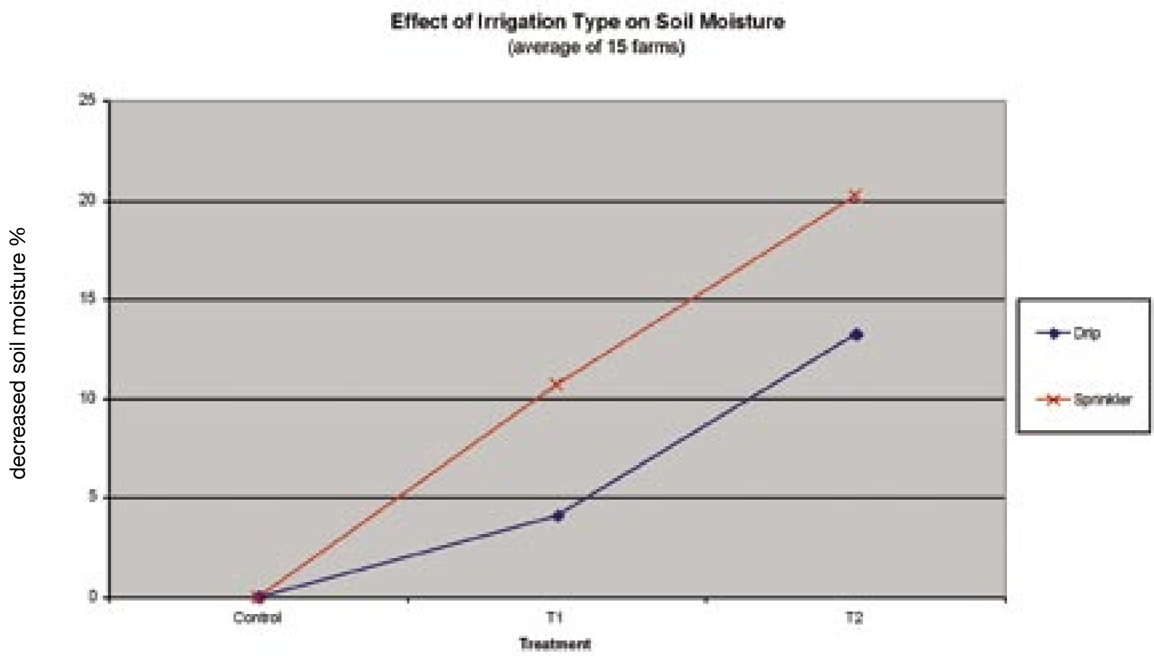


Average fruit sugar levels across a range of crops increased 6.9% under the 25cm compost and 10.1% under the 50cm compost treatment. Individual properties increased sugar levels by up to 5% in apples, 13% in wine grapes and 20% in nectarines.

The mid-season testing showed a consistent improvement of soil pH (measured in water) as compost application rates increased.

Tissue testing also showed increases in potassium levels of 8.4% in T1 and 11% in T2. This result was not repeated with other macro-nutrients tested (N & P).

Yields improved by an average of 11.6% under the 50cm layer and 0.9% for the 25cm treatment.



The average moisture level in the soil underneath the compost layer was increased by 20% in the 50cm mulch layer under sprinklers and 13.3% under drip irrigation when compared to the control. Individual properties however had variable results with some showing declines in soil moisture immediately below the compost layer.

Soil moisture level under drip irrigation was lower than the level under sprinkler irrigation.

Discussion

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 addition of SMRC compost as an input into existing tree and vine crops was shown to improve soils by increasing soil buffering capacity (pH) and moisture holding. This led, in most cases, to improved crop performance. It is difficult to isolate which of the components of the compost led to these improvements because of the broad reaching benefits addition of this type of material to soil can have.

The amount of nutrients added to the soil in compost has varied greatly (see Table 2) due to the varied rate of application and that some properties received compost batches from early production runs that had relatively low nutrient (particularly P & K) levels.

Buckerfield and Webster (2000) showed improved growth and yields by mulching tree and vine crops. This demonstration supported this work although it did find a level of inconsistency within and between properties.

Other than improving soil moisture and nutrient retention, compost is also a source of plant nutrients and organic matter which will boost the pool of nutrients available to the crop. On several properties tree and vine roots could be seen growing actively through the compost layer.

It is noteworthy that several of the properties had relatively low levels of nutrients in the compost but achieved the some of the higher growth and yield results. This suggests that the major impact of the use of compost in this situation has been via the mulching effects.

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.

This may explain the increased potassium levels in the crops and along with the improvements in soil moisture and soil fertility are the major contributing factors for the improvement in crop growth, fruit quality (sugar levels) and yield.

The addition of SMRC compost to horticultural soils is 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 lead to improvements in crop performance.

References:
Buckerfield, JC and Webster, KA; (2000) Composted “Green Organics” for Water Conservation and Weed Control. CSIRO Land & Water

David, SG (2004) Using SMRC Compost In Your Crop, Organic Farming Systems

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

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Check the websites for results from other crops.