

Compost in citrus - can it make a difference??

Soil amendments, including composted green waste, are making a difference in many agricultural and horticultural operations - including the citrus industry. Recent research conducted at SARDI (Dr Peter Crisp and Greg Baker) and the University of South Australia (Dr Sarah Wheeler) has highlighted several key benefits of using compost in citrus production.

Compost and yield

Applying compost can have substantial yield benefits. SARDI trials in Navel oranges in Loxton, SA demonstrated that yield can increase by 60% when compost is applied. A range of soil amendments were applied at varying rates and yield was measured over two seasons (Table1).

Table 1: The average percentage increase in Navel orange fruit yield recorded for five soil amendment treatments in 2007 and 2008 (compared to the untreated control).

Treatment	Navel Oranges -Loxton North	
	% increase in yield compared to no treatment	
	2007	2008
Animal manure 40 m ³ ha ⁻¹	5.0	28.8
Grape marc 200 m ³ ha ⁻¹	25.5	51.2
Compost 40 m ³ ha ⁻¹	11.7	16.8
Compost 120 m ³ ha ⁻¹	16.9	43.4
Compost 200 m ³ ha ⁻¹	25.7	62.9

Increased yield was achieved through increases in fruit size as well as fruit density - on average, fruit increased by 5-7mm. This gives growers about an extra \$100 per tonne (\$4,000/ha) on fruit for high value markets. A similar study in Valencia oranges achieved similar if not slightly better results.

Yield benefits of soil amendments last well beyond the first year and monitoring is continuing to evaluate the persistence of increased yield after the initial application.

Increases in fruit size and density are consistently achieved with compost.

Compost and pest management

One of the major pests in citrus production, particularly in the Riverland and Sunraysia region is Kelly's citrus thrips (KCT), *Pezothrips kellyanus*.

KCT feed on developing fruit causing damage which often reduces fruit quality and in some cases can make fruit unsaleable. The most common method to control KCT is application of organophosphate insecticides but KCT are developing insecticide resistance. These insecticides can also kill beneficial insects within the orchard, disrupting integrated pest management programs (IPM).

Predatory mites have been identified as a biological control agent of KCT pupae in the soil and, when these mites are in high numbers, KCT emergence from the soil can be reduced by more than 50%.

SARDI research has found that predatory mite numbers increase, and KCT emergence from the soil decreases, when composted green waste is applied to citrus.

In the first year of compost application, KCT adult emergence was reduced by 50%. In the second year after application, KCT emergence had reduced by 90% compared to trees without compost. This reduction represents a significant contribution to KCT management and prevention of fruit damage.

Composted green waste can significantly reduce KCT emergence for at least 2 years.

Not all composted materials are created equal when it comes to KCT control. Composted grape marc and composted dairy waste both increased the numbers of arthropods (insects and allied forms like mites and spiders) found in the soil, but there was no significant reduction in KCT emergence.

Composted green waste applied to citrus can play an important role in IPM program of KCT.

Compost and water conservation

Applying composted green waste to citrus trees can also significantly increase moisture levels in the soil.

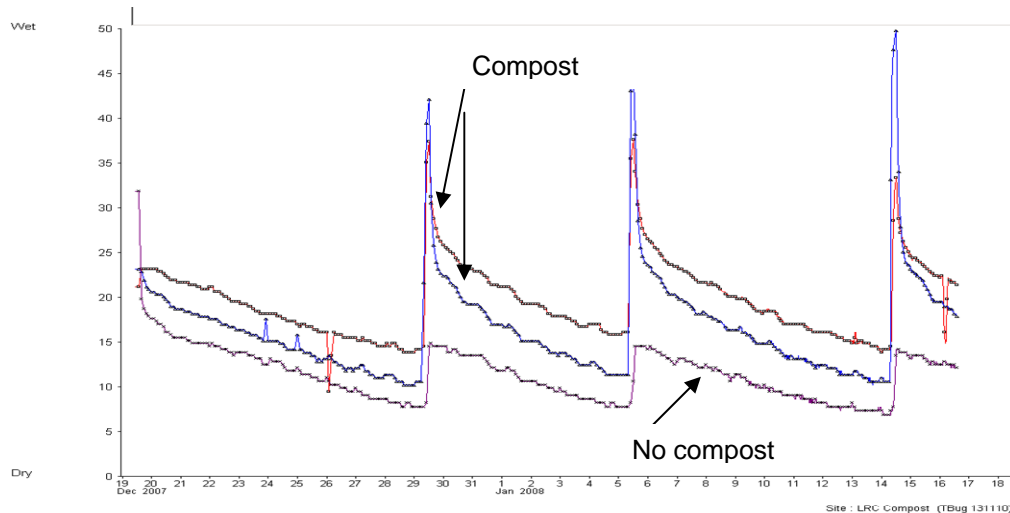


Fig 1: Sample data of soil moisture at a depth of 10-15 cm under Valencia trees at Loxton Research Centre (SA) from control trees without soil amendments or trees treated with $200 \text{ m}^3\text{ha}^{-1}$ composted green waste.

Applying soil amendments can increase soil moisture levels in the top 25 cm of the soil - this can reduce the demand for irrigation without impacting on yield or tree health. Soil moisture monitoring is still underway at Loxton (SA) with sensors added at different soil depths for more detailed measurements of the effect of amendments. Stay tuned for the next round of results!

See the difference.....



Fig 2: Valencia orange trees at Loxton Research Centre, October 2007. Left to right; Untreated control, Grape Marc $200 \text{ m}^3\text{ha}^{-1}$, Compost $200 \text{ m}^3\text{ha}^{-1}$.

Compost and Nutrients

It is well known that compost can supply vital nutrients to the soil after application - particularly nitrogen, phosphorus and potassium.

Compost application can significantly increase the amount of nutrients in your soil.

Soil sampling in citrus orchards highlighted significantly higher nitrogen levels where soil amendments had been applied compared to no application. This increase could be a result of the nitrogen present in the soil amendments, reduced leaching of nitrogen through the soil profile or increased microbial activity in the soil (through bacteria that fix nitrogen). More research is needed to determine the exact cause of the increased nitrogen levels. Regardless of the nitrogen source, the good news is that application of soil amendments could reduce the need for fertiliser applications such as urea, saving significant amounts of time and money.

Soil carbon plays a vital role in soil health and fertility. Increasing soil carbon levels helps to improve root and plant growth and leads to healthier, more productive plants. Soil amendments provide a great source of soil carbon and can add up to 44 tonnes of carbon per hectare when applied at 200 m³ha⁻¹. SARDI trials in citrus have also demonstrated that composted green waste can increase soil carbon beyond the level that can be explained just by the carbon content of compost. Composted green waste added to citrus trees at 200 m³ha⁻¹ provided around 40 t/ha but after 28 months soil carbon levels had increased to 100 t/ha. This means that carbon is being stored or accumulated in the soil. An increase in stored carbon may also provide additional commercial opportunities (as well as improved plant growth) for individual growers and the citrus industry if carbon trading is introduced and this type of carbon storage is included.

Getting bang for your buck - cost benefit analysis

Application of soil amendments in citrus orchards can be expensive, even though it may only need to be applied every 3 - 5 years. This initial investment can be a barrier for many growers, but rigorous cost-benefit analyses have shown it is well worthwhile (Table 2).

All amendments used in SARDI citrus trials (composted green waste, grape marc, animal manure) showed a positive return on the initial investment. Benefits varied between sites, for example the 120 m³ ha⁻¹ composted green waste application returned the lowest benefit of 1.9 (\$1.90 for every \$1.00 spent) on Valencia oranges at Loxton Research Centre, but the same treatment returned a 2.81 benefit in Washington navel oranges at Loxton North.

An application of 40 m³ ha⁻¹ of composted green waste in Loxton North gave the highest benefit at 5.38. This means that for every dollar invested around \$5.00 is returned to the grower!!

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Growers can expect between \$1.90 and ~\$5.40 for every dollar they invest in compost.

Table 2: Benefit Cost Ratios of Trial Applications for Navel Citrus at Loxton North

	Benefit Cost Ratio	Net Profit value/5 years/ha \$
<i>Compost 40</i>	5.38	16,471
<i>Compost 120</i>	2.81	18,270
<i>Compost 200</i>	3.16	22,180
<i>Mark 200</i>	3.11	18,461
<i>Animal 40</i>	4.24	13,347

Low applications of animal manure and composted green waste gave the largest financial returns but high levels of compost resulted in greater overall farm and environmental benefits - including improved soil and water quality, leaf and fruit quality and decreased thrips presence.

The benefit cost figures in Table 2 are a conservative estimate as they do not include the potential water savings associated with compost use, reduction in thrips presence and associated chemical control savings or improvements in fruit quality. When all of these factors are taken into consideration compost applied at 200m³ ha⁻¹ is the most sustainable option with the highest overall net benefits.

For more information please contact your State Compost Industry Development Officer or:

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References

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