COMPOST AUSTRALIA
A Division of the WASTE MANAGEMENT ASSOCIATION OF AUSTRALIA

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22 September 2011

Committee Secretary
Joint Select Committee on Australia's Clean Energy Future Legislation
PO Box 6021
Parliament House
CANBERRA ACT 2600

Dear Sir/Madam,

RE: Inquiry into Australia's Clean Energy Future

Compost Australia, representing the Recycled Organics Industry in Australia, would like to submit three summary documents for consideration by the parliamentary enquiry:

1. The Capability of the Australian Recycled Organics Industry
2. Fact Sheet: Compost Use Mitigates Climate Change
3. 2011 International Symposium: Organic Matter Management & Compost Use in Horticulture – Our Common Responsibility

We submit that the appropriate recycling of organic matter and application to land of quality, fit-for-purpose, recycled organic products have an important role to play in the abatement and sequestration of carbon.

It is crucial that Australia's Clean Energy Future recognise and support the need to lift organic matter management and compost use into mainstream horticultural and agricultural practices. A key first step is to quantify soil carbon sequestration benefits from use of external organic residues as soil amendments. Over 150 leading researchers and practitioners from Australia delivered this and other messages at the 2011 International Symposium.

We recognise that the Federal Government has a number of programs in place (or proposed) that could support organic recycling and increasing soil organic matter, particularly in agricultural soils. Such programs include:

1. National Waste Policy Implementation Plan
2. Caring for Our Country (Sustainable Farm Practices) grants
3. Carbon Farming Initiative – a mechanism for recognition of carbon credits
4. CFI non-Kyoto Carbon Fund – funding to purchase non-Kyoto carbon credits
5. Carbon Farming Futures Fund – filling the research gap, action on the ground and extension and outreach

While these initiatives are a step in the right direction, to date the only form of organic recycling to receive significant Federal Government recognition (for its capacity to address climate change) and financial support has been pyrolysis (producing bio-char). We submit that other forms of organic recycling, and in particular composting, should be fully investigated and valued as part of our clean energy future.

Yours Sincerely,

Peter Wadewitz
Chairman, Compost Australia

organics

Compost Use Mitigates Climate Change

FACT SHEET

It is well documented that preventing organic residues from going to landfill avoids methane emissions, and also preserves organic carbon and nutrients for beneficial use in land management and food production. It is equally well known that on-going use of compost improves physical, chemical and biological soil properties, and delivers a wide range of agronomic and environmental benefits. By supplying both stable and labile organic compounds, as well as plant nutrients and beneficial organisms, the agricultural and horticultural use of compost also supports climate change mitigation on two fronts:

1. **Removal of atmospheric carbon through soil carbon sequestration, achieved directly through storage of compost carbon, and indirectly through enhanced plant growth, which in turn contributes also to increased soil carbon levels;**
2. **Reduction of greenhouse gas (GHG) emissions, e.g. through reduced production and use of chemical fertiliser and pesticides, and through reduced irrigation.**

Preventing Methane Generation

In 2006/07, the Australian Organics Recycling Industry diverted at least 3.7 million tonnes of organic residues from landfill, comprising materials such as garden and food organics, wood & timber, biosolids, sludges, and the like. Diverting these materials from landfill and recycling them prevented the generation of methane equivalent to 4.28 million tonnes CO2-e, which is almost as much as what was recovered from landfill in 2007 (4.5 Mt CO2-e)

In addition, a minimum of 600,000 tonnes of manure and other agricultural residues were composted, which is recognised by the IPCC as superior manure management compared to deep litter or dry storage, let alone pit or liquid storage.

Declining Soil Carbon

The clearing of native land for agricultural use, particularly when it involves soil cultivation, results in considerable decline of soil carbon levels. It is estimated that soil carbon levels in Australia declined 30% to 60% after land clearing for cropping some 60 to 100 years ago. The rate of decline depends primarily on initial soil carbon levels, soil texture (clay content), rainfall and agricultural activities (Fig 1).

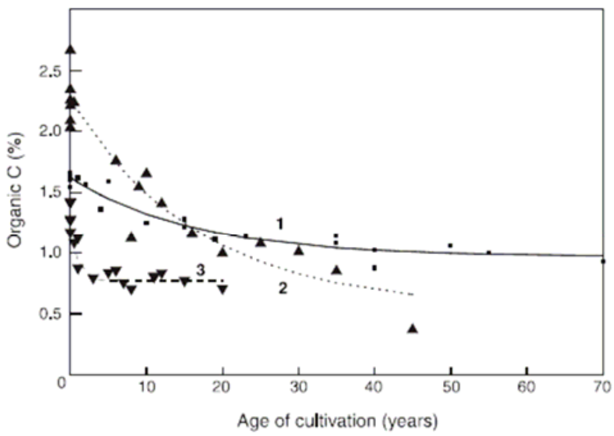

Figure 1 Long-term decline of organic carbon in three soils (top 10 cm) in Southern Queensland (Source: Dalal and Chan, 2001)

However, the decline of soil carbon is not a historic phenomenon – it still is widespread today as many soils have not yet reached new steady state carbon levels, and as agricultural production still intensifies.

Declining Soil Productivity

Soil organic matter (or carbon) levels are closely linked with soil fertility and soil productivity. Hence, declining organic matter results also in diminishing soil fertility, namely in less favourable soil physical characteristics, reduced water storage and availability, and reduced nutrient (N, P, K, trace elements) supply capacity.

Mineralisation of organic matter provides a constant slow-release nutrient source in natural and also agricultural ecosystems. Hence, declining soil carbon also delivered significant benefits: approx. 1,200 kg of N and 100 kg of P per hectare (at soil bulk density of 1.2 t/m^3) were released per one percentage point of carbon lost. Agriculture production benefited from this effect for a long time. However, increasingly unfavourable soil conditions and diminishing soil nutrient supplies due to organic matter decline resulted in growing needs for mineral fertiliser and other external inputs.

Using Compost is the Solution

Using compost has a two-fold benefit, as it is ideal for helping re-build soil fertility and re-plenish soil carbon and nutrient stocks, while at the same time helping mitigate climate change.

Compost contains macro and micro nutrients, a diverse microbial population, stable organic compounds (e.g. humic compounds), and also labile organic matter, which is an important source of food and energy for the soil food web. Hence, compost is not 'naked carbon', but rather 'humus in the making'.

The conversion of compost into humus continues after compost is added to soil. This means that the transformation of organic matter into microbial biomass, energy, CO_2 and stable organic compounds, i.e. humus, continues. Although this mineralisation process reduces the amount of compost carbon that remains in the soil, it also releases nutrients necessary for plant growth. Apart from soil type and agricultural activity, the degree to which compost carbon is converted into CO_2 depends on the type and age (maturity) of compost used, as well as on environmental conditions, primarily temperature and moisture. Research has shown for example that 17% of the total organic carbon added with garden and food organics compost was converted into CO_2 during a one-year period. This means that 83% of all carbon added with compost was still in the soil after one year.

Compost Use Sequesters Carbon

Many trials in Australia and overseas have demonstrated that on-going compost use increases soil carbon levels. However, there are very few longer-term trials that enable the modelling of carbon sequestration associated with compost use. Fortunately however, a considerable number of long-term (50 – 160 yrs) field trials in Europe and North America have demonstrated the benefits of farmyard manure in increasing soil carbon levels. In the short to medium term, a considerably higher proportion of carbon applied in compost is retained in the soil then when carbon is applied in manure. With manure, 5% to 20% of applied carbon is retained, while carbon retention for compost ranges between 10% and more than 50%. Hence, it can be assumed that compost is also considerably more effective in sequestering carbon in the long-term, than manure is.

While it is acknowledged that increases in soil carbon levels will diminish over time and be limited by new carbon equilibria, the current assumption that this point will be reached after about 20 years will have to be revised upward. Soil organic matter levels still showed linear increases after 9 and 12 years of continuous compost use (Figure 2). Over a 12-year period, around 1 tonne of carbon per hectare and year was sequestered for every 10 tonnes of dry matter compost (garden and food organics) applied per hectare. The sequestration of 1 tonne of carbon equates to 3,670 kg of CO_2-e abatement.

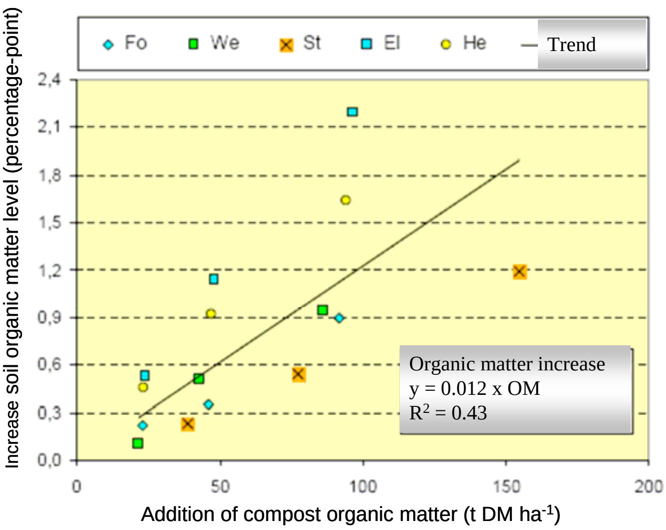

Figure 2 Effect of long-term (9 / 12 yrs) compost use on soil organic matter (0 - 30 cm) in five locations (Fo, We, St, El, He) in Southern Germany (Source: LTZ, 2008)

In line with this, a simple carbon sequestration model for compost use in European conditions predicts that a new equilibrium will be reached only within a time frame of probably 200 and 300 years for annual application rates of 10 and 15 tonnes per hectare, respectively (Figure 3). Annual application rates between 2.5 and 5.0 tonnes per hectare prevent further decline in soil carbon levels.

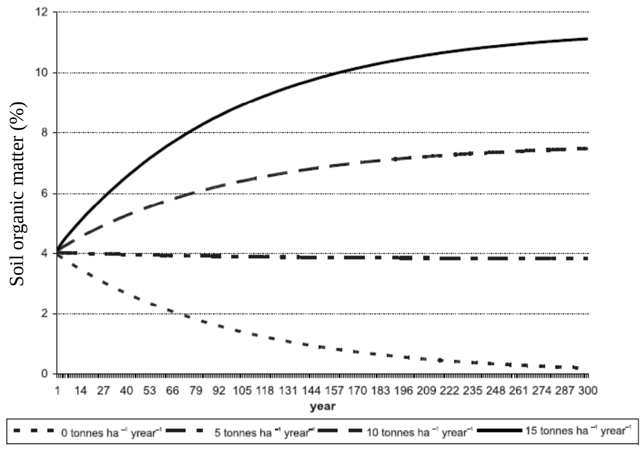

Figure 3 A simple carbon sequestration model for compost use (Source: Favoino and Hogg, 2008)

Based on available research data, it is estimated that 45%, 35% and 10% of carbon contained in mature garden organics compost is retained in the soil over 20, 50 and 100 year timer-frames, respectively. Hence, use of such compost at rates of 10 t DM ha^{-1} will be sequester carbon that is equivalent to around

- 5,000 kg CO_2-e over 20 years
- 3,500 kg CO_2-e over 50 years
- 1,000 kg CO_2-e over 100 years

Replacement of Mineral Fertilisers

The production of mineral fertilisers is quite energy and GHG intensive, particularly for nitrogenous fertilisers. The supply of plant nutrients through compost use allows for a reduction in using mineral fertiliser, and hence also a cut in GHG emissions caused by fertiliser production.

The degree to which this is achieved depends on factors such as nutrient density in compost, nutrient replacement efficiency, compost application rate and the global warming potential allocated to fertilizer manufacturing. If, for example garden organics compost (N: 1.1%, P: 0.2%, K: 0.55%) is applied annually at 10 tonnes dry matter per hectare, it could replace the use of approximately 44kg of N, 20kg of P and 55 kg of K from mineral fertilizer per year. If the use of urea and single superphosphate is reduced accordingly, emissions from fertilizer production will be reduced by around 180 kg CO_2-e. Savings are obviously considerably higher, if compost with higher nutrient concentrations is used, such as products that contain food organics, biosolids or manure. Also, while the above calculation assumes that plants utilise approximately 40% of nitrogen supplied with compost over four years, others (Favoino and Hogg, 2008) have assumed that this amounts to 100%, resulting also in markedly higher GHG savings.

Most nitrogen (> 90%) contained in compost is organically bound, and released slowly over time. Hence, if compost is applied regularly, soil nitrogen and phosphorous reserves will build up in parallel to increasing soil carbon levels. For each tonne of carbon that is stored in the soil, i.e. converted into humus, approximately 85 kg of N, 20 kg of P and 14 kg of S are stored also. These nutrients will be released slowly and become available for plant up-take at a later stage as the humus is mineralized. Over time, nutrient reserves will build up, so that probably 80 kg or more of N per hectare will be supplied annually from the soil nitrogen pool (Figure 4). This resembles farming conditions shortly after land clearing when soil humus levels were still high.

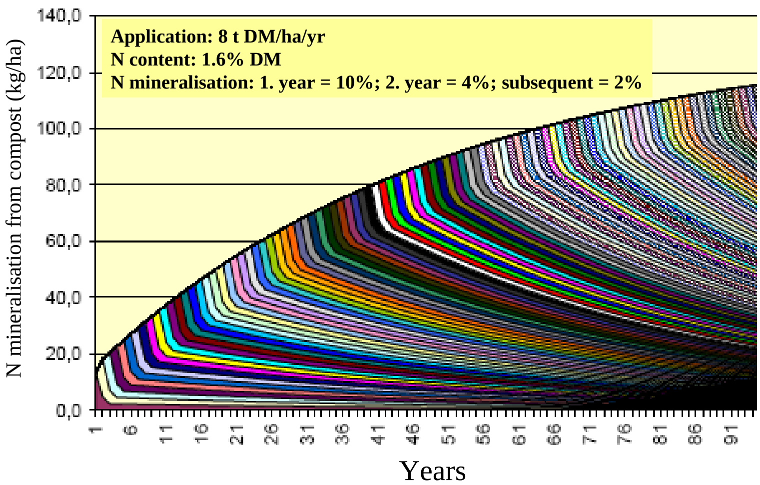

Figure 4 Increasing nitrogen mineralisation due to the long-term annual application of compost [8 t dry matter ha^{-1}] (Source: Amlinger *et al.*, 2003)

Reduction of Nitrous Oxide Emissions

Despite the fact that nitrous oxide (N_2O) emissions represent less than 10% of the mitigation potential from cropland globally, they can have a significant impact, as their global warming potential is almost 300 times higher than that of CO_2. Consequently, increased N_2O emissions from agricultural activities can negate substantial carbon sequestration gains.

The production of N_2O in soil is governed by available mineral nitrogen (both from soil and fertilisation), soil aeration, moisture (water filled pore space), temperature, dissolved and readily degradable carbon, and soil pH and salinity. However, the overarching determinants for N_2O emissions are nitrogen fertilisation, nitrogen use efficiency, and oxygen supply.

The effects of compost use on N_2O emissions are not yet clearly established, probably because compost has the potential to both reduce and enhance emissions. Generally speaking, compost has low nitrogen concentration (ca. 1 – 3% DM), and only a small proportion is present in mineral form (ca. 0 – 10% of total N). Hence, from that perspective, compost poses little risk of causing N_2O emissions. The soil aeration effect of using compost also helps to reduce N_2O release. However, on the other hand, improved soil water holding capacity and the supply of dissolved / readily degradable carbon might enhance N_2O emissions.

Other GHG Savings

The use of compost delivers a further range of other savings on GHG emissions, which are more difficult to measure and quantify. These savings include the following:

- Reduced energy use for irrigation, due to improved water storage and water use efficiency,
- Reduced need for biocides results in reduced GHG emissions associated with biocide production, due to improved soil and plant health,
- Reduced diesel use for soil cultivation, due to improved tilth,
- Increased carbon sequestration from higher biomass production, due to improved soil productivity,
- Reduced nitrogen loss that causes secondary N_2O emissions, due to lower nitrogen surplus and leaching,
- Reduced erosion that causes loss of nutrients and organic matter, resulting in secondary N_2O emissions and those associated with replacing lost nutrients.

Summary and Outlook

Apart from the prevention of methane emissions from landfill and the recovery of key carbon and nutrient resources, the use of mature garden organics compost at a rate of 10 tonnes dry matter per hectare results also in GHG abatement due to carbon sequestration and fertiliser replacement, which is equivalent to 5,200 kg CO_2-e over a 20 year time frame, 3,700 CO_2-e over 50 years and 1,200 kg CO_2-e over 100 years. In addition, there are other, unaccounted reductions of GHG emissions.

Hence, the use of compost

- can contribute to mitigating climate change,
- can help open a window of opportunity (20 – 40 years) to find other means (technologies) of reducing / mitigating emissions,
- is one of the fastest means of improving soil carbon levels,
- is ideally suited as mitigation measure in productive agricultural soils,
- fits easily into the Australian National Carbon Accounting System, and
- can attract carbon credits.

It is important to understand that using compost not only helps to sequester carbon and mitigate climate change, but also delivers many agronomic, environmental and societal benefits. Hence, composting and compost use must be one of the best options available for mitigating climate change, while also enhancing agricultural production.

References

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Dalal, R. C., and Chan, K. Y. (2001). "Soil organic matter in rainfed cropping systems of the Australian cereal belt." Australian Journal of Soil Research **39** (3): 435-464.

Favoino, E. and Hogg, D. (2008). “The potential role of compost in reducing greenhouse gases.” Waste Management & Research **26**: 61-69.

LTZ [Landwirtschaftliches Technologiezentrum Augustenberg] (2008). Sustainable compost use in agriculture. Final Report (in German), 126 pp.

The Organic Force

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COMPOST AUSTRALIA
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The Capability of the Australian Recycled Organics Industry

Our people[i]

- **120 businesses** (approx.) involved in organics recycling and composting
- estimated industry turnover of **$600 million**
- invest more than half a billion **($580,867,000)** in capital
- employ the equivalent of **1,900 full-time people** in addition to creating jobs in transport, distribution and application of products.

Our products[ii]

- recycle more than **5.8 million tonnes** of organic material each year[iii]
- create a range of new products including:
  - composted soil conditioners and mulches
  - potting mixes, playground surfacing and manufactured soils
- recover nutrients equivalent to more than **29,000 tonnes of urea**, **2,900 tonnes of super phosphate** and **14,500 tonnes of potassium sulphate**[iv] that would otherwise be lost to landfill each year
- sequester and abate more than **7.3 million tonnes of carbon dioxide equivalent** of potential and actual greenhouse gas emissions, through diversion of organic matter from landfill, storage of carbon in the soil and avoided fertiliser use.

Our contribution

Compost:

- **builds soil carbon** in agricultural soils, sequestering atmospheric carbon. One tonne of composted garden organics applied to land can sequester approximately 0.5 tonnes of CO_2 equivalent[v].
- **creates biologically healthy soils** that use less water, less fertiliser and fewer pesticides
- **supports resilient farming systems** producing healthy food and supporting Australia's food security
- **buffers the effects of climate change** in agriculture by:
  - reducing soil temperature fluctuations
  - protecting soils against wind and water erosion
  - reducing water loss from soils
- mulch application suppresses weed growth and can **save more than 30% of irrigation water** depending on conditions
- manufacturing **destroys weed seeds and pathogens**, helping to control the spread of weeds and diseases as well as managing biosecurity risks.

Our potential

An additional 13 million tonnes/year of organic material is still available to be diverted from landfill[vi].

Diverting just 2 million tonnes would:

- create more than **650 new jobs**
- increase turnover by up to $400 million and capital investment up to $750 million, depending on the technology employed
- **abate approximately 2 million tonnes of CO_2 equivalent**[vii] and sequester approximately 1 million tonnes of CO_2 equivalent if compost is applied to the soil[viii]. This carbon would be valued at $78 million[ix].
- save **100 GL of irrigation water** (approx.)[xi]
- replace **10,000 tonnes of urea**, **1,000 tonnes of super phosphate** and **5,000 tonnes of potassium sulphate**[x]
- deliver an additional $30 million in revenue due to yield increases in intensive agriculture[xi].

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June 2011

Compost Australia
A Division of the Waste Management Association of Australia

Industry Partners

Jeffries – compost, soil & mulch experts
Peats Soil & Garden Supplies
Van Schaik's Bio Gro
SITA Organics
BioWise
Custom Composts
Richgro – Bring your garden to life
Soilco
Thiess Services
Resource Recovery ZeroWaste
Yates
Global Renewables
Natural Recovery Systems
Gippsland Water Soil & Organic Recycling
YLAD Living Soils – Putting life back into the land
Eclipse Soils
Candy Soil
earthborn – Leaders in organic recycling technology – The way mother nature intended
Bio Wise
NutraRich Premium Compost Products
Landsave Landscape Supplies
purearth … organic environmental solutions.
enviromix
Back to Earth The Mulch Makers
Komptech – Technology for a better environment
Lincom Group

i National Processors Survey 2009-10, researched by the Recycled Organics Unit, published by Compost Australia. This survey does not target businesses processing less than 5000 tonnes p.a. and does not achieve 100% response rate. As such, these figures are conservative, as many on-farm and other small scale organic recyclers are not captured.

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iii Recycled Organics Unit for Compost Australia, *Organics Recycling in Australia, 2008-2009*

iv Adapted from calculations prepared by B. Paulin, Dept of Agriculture and Food, Perth WA (unpublished)

v Based on a 20 year accounting time frame. Sequestration on 100 year accounting time frame approximately 100,000 tonnes CO_2 eq. The Organic Force for NSW Department of Environment and Conservation *The Benefits of Using Compost for Mitigating Climate Change*, March 2011 http://www.environment.nsw.gov.au/warr/RecycledOrganicsPublications.htm#22

vi *National Waste Report 2010*, figures from 2006-07 financial year, Department of Sustainability, Environment, Water, Population and Communities, Australian Government http://www.environment.gov.au/wastepolicy/publications/national-waste-report.html

vii Department of Climate Change and Energy Efficiency, National Greenhouse Accounts Factors, July 2010. Based on diversion of food and garden organics from landfills without LFG collection, flaring or energy production.

viii Based on a 20 year accounting time frame. Sequestration on 100 year accounting time frame approximately 100,000 tonnes CO_2 eq. The Organic Force for NSW Department of Environment and Conservation *The Benefits of Using Compost for Mitigating Climate Change*, March 2011 http://www.environment.nsw.gov.au/warr/RecycledOrganicsPublications.htm#22

ix Assuming carbon is valued at $26/tonne

x Calculated using average 30% water saving and 3.5 GL/yr average irrigation water use. National Water Commission, *Water Account, Australia 2004/05*.

xi Adapted from calculations prepared by B. Paulin, Dept of Agriculture and Food, Perth WA (unpublished)

xi Calculated using average yield increase of 1.5% and return of $20,000 per hectare

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2011 INTERNATIONAL SYMPOSIUM

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ORGANIC MATTER MANAGEMENT & COMPOST USE IN HORTICULTURE

Our Common Responsibility

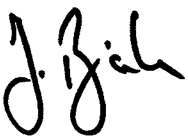
The International Symposium on Organic Matter Management and Compost Use in Horticulture, held recently in Adelaide, brought together more than 150 leading researchers and practitioners from all around the world. Those attending recognised that soil organic matter is vitally important to building long-term soil fertility and improving productivity, and hence safeguarding our future food production.

However, despite overwhelming scientific evidence that demonstrates the multiple benefits of soil organic matter and farming practices that enhance organic carbon levels in soil, sustaining and building soil organic matter is not often recognised as a major component of maintaining and improving horticultural productivity. Recognising this connection, two broad goals were identified by the group:

1. Integrate the proper care and management of organic matter into existing agricultural enterprises
2. Maximise the agronomic, economic and environmental benefits from building and maintaining optimum soil organic matter levels.

In line with this, conference attendees identified the following key objectives and measures as conditional for achieving the above goals:

- provide political and economic (value chain) support that encourages proper management of soil and soil organic matter and ensures our long-term horticultural food production capacity
- develop and deliver mainstream soil organic matter management education and training programs for farmers, advisors and extension staff
- lift organic matter management and compost use into mainstream horticultural and agricultural practices
- build and maintain soil organic matter levels that provide optimum soil fertility and productivity
- quantify soil carbon sequestration benefits from use of external organic residues as soil amendments
- manufacture fit-for-purpose compost and organic soil amendment products that deliver anticipated agronomic outcomes and economic benefits
- minimise human health and environmental risks associated with the use of organic soil amendments
- encourage and foster the production and use of certified and quality-assured recycled organic products
- understand the nutrient dynamics resulting from use of organic soil amendments, and account for organic nutrient inputs in local and regional nutrient budgets
- make best possible environmental and economic use of industrial, commercial and municipal organic residues and guide their recovery, processing and beneficial use through wise regulations



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Symposium Convenor
signed on behalf of;

Dr Robert Prange
Chair, ISHS Commission on Sustainability through Integrated and Organic Horticulture

Prof Dr Michael Raviv
Chair, ISHS Working Group Composting for Horticultural Applications

The Organising Committee

Johannes Biala
The Organic Force, Wynnum, QLD (Chair)
Dr Mark Boersma
ASHS and Tas Inst of Ag Research, Burnie, TAS
Tony Burfield
South Aust Research and Development Institute, Adelaide, SA
Justine Cox
NSW Industry & Investment - Primary Industries, Wollongbar, NSW
Dr Peter Crisp
South Aust Research and Development Institute, Adelaide, SA
Dr Stephen Harper
Qld Primary Industries and Fisheries, Gatton, QLD
Andre Leu
Organic Federation of Australia, Brisbane, QLD
Bob Paulin
Dept of Agriculture and Food, Perth, WA
Peter Slavich
NSW Industry & Investment - Primary Industries, Wollongbar, NSW
Peter Wadewitz
Compost Australia, Sydney, NSW
Dr Kevin Wilkinson
Dept of Primary Industries Victoria, Melbourne, VIC

Keynote Speakers

Dr Jeff Baldock
CSIRO Land and Water, Glen Osmond, Australia
Assoc Prof Dr Sally Brown
College of the Envirnment, University of Washington, USA
Assoc Prof Dr David Crohn
Dept of Environmental Science, Univ of California, Riverside, USA
Mr Simon Gould
Outcomes Australia, Canberra, Australia
Mr Kevin Handreck
Netherwood Horticultural Consultants, Adelaide, Australia
Dr Patricia Millner
US Dept of Agriculture, Beltsville, USA
Prof Dr Michael Raviv
Dept of Environmental Horticulture, Newe Ya'ar Research Centre, Israel
Dr Elke Schulz
Centre for Environmental Research, Halle, Germany
Prof. Dr Peter Stoffella
Dept of Horticultural Science, Univeristy of Florida, USA