THE COST BENEFITS OF COMPOST USE

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1 INTRODUCTION
1.1 Background
The diversion of organic waste from landfill disposal is a key objective in New Zealand’s waste management policy framework (MfE, 2002). Reasons for the focus on organic wastes (amongst others) include the generation of the potent greenhouse gas methane during anaerobic degradation and the fact that organic waste makes up a high proportion of the solid waste stream.

Unlike many other parts of the waste stream, organic waste is to some degree unavoidable. There will always be some waste from primary production/food processing and it is unlikely that it is possible to eliminate garden waste where gardens are maintained for aesthetic or practical purposes. However, it is also possible to extract value from organic waste through the beneficial reuse (taking advantage of soil conditioning benefits and nutrient value) and/or energy recovery (anaerobic digestion or bioenergy).

In considering the range of alternatives to landfill disposal available, a number of factors need to be taken into account:
- Ease of collection of the organic waste
- Storage and transport issues (largely related to potential for anaerobic degradation to occur resulting in offensive odour)
- Technical feasibility of processing/recovery including odour control
- Financial viability of diversion system (collection – transport – storage – processing)
- Markets for finished product(s)

A comprehensive discussion of all of these factors is a major exercise and is beyond the scope of this paper. However, it should be noted that the most critical key factors for any organic waste recovery programme are odour control (technology selection) and marketing of finished product. Of these marketing is by far the greater challenge.

This paper provides a brief summary of issues for organic waste diversion in New Zealand and summarises the results of a research project carried out for The Living Earth Company and the Ministry for the Environment titled “The cost-benefits of applying biosolid composts for vegetable, fruit, and maize/sweetcorn production systems in New Zealand” (Landcare, 2004).
1.2 Organic Waste Diversion Initiatives In New Zealand

Industry and local authorities have identified a range of opportunities relating to organic waste diversion in New Zealand and there is a range of activities currently undertaken. Examples include:

- Collection of greenwaste at waste transfer stations (local authorities and industry)
- Composting of greenwaste (local authorities and industry)
- Co-composting greenwaste and biosolids (local authorities with industry)
- Kerbside collection of greenwaste (industry)
- Kerbside collection of mixed greenwaste and kitchen scraps (local authority)
- Enclosed composting of putrescible waste (industry)

The New Zealand Ministry for the Environment is working with key stakeholders from both industry and local government to identify and address barriers to the diversion of organic waste from landfill. Given the predominance of composting as a solution to organic waste disposal the focus to date has been on issues of relevance for this set of technological options. This does not preclude adoption of other strategies including bioenergy (supported through the Climate Projects mechanism) and anaerobic digestion (projects, could work well with composting) for parts of the organic waste stream.

Ministry initiatives relating to composting include:

- Working with Standards New Zealand and key stakeholders on the adaptation of AS 4454:2003 (Compost, soil conditions and mulches) for New Zealand.
- Working with WasteMINZ to provide regular workshop style forums to discuss key issues for the organic waste recycling sector.
- Supporting the Zero Waste Academy as they work with stakeholders to increase capacity in the organics recycling sector.
- Co-funding (with industry and researchers) initial work on defining the cost benefits of compost use in horticultural systems in New Zealand [the subject of this paper].

1.3 The New Zealand Policy Context For Organic Waste

In considering issues for the diversion of organic waste from landfill it is important to take into account the national framework for waste minimisation and management in New Zealand. The New Zealand Waste Strategy (MfE, 2002) lays out the overall policy framework with several acts of parliament regulating specific aspects of waste management. The Resource Management Act 1991 (RMA) regulates the effects of waste disposal while the Local Government Act 1974 (LGA) defines the roles of regional and territorial authorities including their roles and responsibilities relating to waste management.
1.3.1 The New Zealand Waste Strategy
The New Zealand Waste Strategy (MfE, 2002) includes several targets relating to the diversion of organic waste from landfill to ‘beneficial use’. These are:

- By December 2005, 60 percent of garden wastes will be diverted from landfill and beneficially used, and by December 2010, the diversion of garden wastes from landfill to beneficial use will have exceeded 95 percent.
- By December 2007, more than 95 percent of sewage sludge currently disposed of to landfill will be composted, beneficially reused or appropriately treated to minimise the production of methane and leachate.
- By December 2010, the diversion of commercial organic waste from landfill to beneficial reuse will have exceeded 95 percent.

The Review of the Targets in the New Zealand Waste Strategy (MfE, 2004) provides an update on the implementation of the New Zealand Waste Strategy and provides additional interpretation and guidance on meeting the targets. The review concluded that the Waste Strategy provides a useful focus for action by central and local government but that some targets would be difficult to achieve.

1.3.2 The Resource Management Act 1991
The environmental effects of waste management and disposal are controlled by regional and district councils under the Resource Management Act 1991 (RMA). District councils have the responsibility for controlling the use of land while Regional Councils control discharges to the environment (such as leachate and odour from composting activities).

1.3.3 The Local Government Act 1974
The Local Government Act (LGA) requires local authorities to promote effective and efficient waste management considering both economic and environmental costs and benefits. The primary tool for meeting this requirement is the waste management planning process including the mandatory development of a district waste management plan. Some local authorities make use of bylaws for licensing waste operators (transport, sorting/handling and/or disposal) and levying waste disposal to fund implementation of their waste management plans.
2 THE BENEFITS OF COMPOST USE
2.1 Soil health
The use of compost in horticultural (and other productive) land uses has a range of benefits. These include improvements in soil workability when compared with land treated with conventional fertiliser due to improvements in soil structure. Soil treated with compost can also be expected to allow improved root penetration/growth and therefore improved plant growth performance and yield.

These advantages are particularly important for intensive landuse such as cropping and market gardening where crops are grown continuously with little or no time for soil to fallow or put into long-term pasture to restore soil structure and and organic matter content. While composts provide less immediately available nutrients when compared with conventional fertilisers the long term availability of nutrients and the positive effects on soil structure counteract short term issues.

Given the well establish benefits from using compost in horticultural production systems it is surprising that there is still limited take-up of compost use at any significant scale in New Zealand or internationally. This may be due to the general reliance placed on chemical fertilisers to maintain soil fertility and limited availability of bulk compost and limited knowledge on integration of this into soil fertiliser recommendations.

The study undertaken by Landcare (Landcare 2004) reviewed international literature and locally available data in an attempt to correlate the benefits described above with financial returns. The key question for the study was:

If I spend $500 on applying compost, will I get more than $500 benefit for my trouble i.e. will I break even or make a profit?

Landcare found that in general information in the international literature was limited with respect to the financial benefits of applying compost in horticultural production systems. There were plenty of articles regarding soil health, structure and long term benefits but extremely limited information on impacts (long or short-term) on product yield or financial returns. Where yield data was available the various sources were inconclusive when considered as a whole.

There has however been some interest work done in New Zealand considering the impacts of long term degradation in soil structure. As structure degrades, increasing quantity and complexity of soil amendments are required to achieve similar or evening decreasing yields. In the context compost application looks attractive due to both nutrient contribution and longer term improvements/renewal of soil structure.
Growers using compost in New Zealand are generally enthusiastic about the benefits but again unable to quantify yield increases or financial returns. In some cases they even struggle to identify the full costs of application due to the use of existing spreading equipment and labour.

2.2 Evaluating new approaches

The focus of the Landcare research project was to determine through a review of available literature whether there was adequate information to determine the cost-benefits of using compost in horticultural production systems. This is a pertinent exercise due to the need to provide relevant information to potential large scale users of compost as part of larger scale exercise to build markets for diverted organic waste in New Zealand. In this context it is worthwhile to briefly consider how growers make decisions about the use of ‘systems’ for their production.

One discussion quoted in the Landcare report suggests that growers use five general criteria in determining whether to test or adopt a new system or technology. These are:

- **Relative advantage:** the extent to which an innovation is better than its predecessor. Often people think only of the financial advantage of any given technology but improved ease of farm operation and other less direct benefits may be considered.
- **Trialability:** the degree to which a technology can be experimented with on a limited basis.
- **Observability:** the degree to which the technology and its use are visible. Although Biosolids compost has been used on some sites it is not widely accessible to the community.
- **Complexity:** is the extent to which farmers perceive both using the technology and managing the effects of using the technology, to be complex.
- **Compatibility:** how well using the technology sits with the values and past experiences of the potential adopter.

The Landcare reported focussed on Relative Advantage by using Gross Margin Analysis to determine the comparative financial performance of traditional and compost amendment horticultural production systems.

2.2.1 Gross margins

Gross margin analysis is useful as a first step in comparing the profitability of different enterprises. With this approach, fixed costs are ignored and the financial implications of making changes in an existing system, such as comparing compost use with conventional fertilisers, can be readily evaluated.
A gross margin (Gross Margin) is calculated by deducting the sum of the direct costs (DC) from the revenue (TR) associated with a given enterprise:

\[ \text{Gross Margin} = TR - DC \]

For comparison purposes the Gross Margin is expressed in terms of a limiting resource (such as land, or labour) on a fixed time basis, usually 1 year. This allows two different enterprises to be easily compared based on their financial merits. Gross Margin can also be used in situations where there is uncertainty about the data being used. Due to paucity of available data on yield increases associated with compost use the gross margin analysis presented in the Landcare report is preliminary in nature, but does provide a useful introduction to the concept and assist in identifying areas requiring further clarification.

Based on a review of international literature, on interviews with key compost users in the horticultural community, and on limited New Zealand data using gross margins (total revenue less total costs), the Landcare study indicated an increase in gross margin with the application of compost when compared with conventional fertiliser use. The main cause of this was the large difference in the purchase price of the composts compared with the various conventional fertilisers. Sensitivity analysis showed the gross margins for each of the compost-amended crops were sensitive to both yield and spreading cost, when compared with crops grown with conventional fertiliser use. However, this analysis has not considered the potential for combined applications or long-term benefits of compost use such as benefits from improved soil structure.
3 Conclusions

The literature review undertaken by Landcare indicated that:

- There is extremely limited data on effect of compost on yield
- Internationally, the soil science community is developing understanding of compost effects on soil health
- The use of compost can clearly deliver sustained benefits for growers, although quantifying these benefits in terms of yield or financial return has not been done
- Those growers currently using compost in horticultural production systems perceive real benefits from using compost.

The Gross Margin Analysis undertaken by Landcare was preliminary in nature, however the following conclusions and recommendation can be drawn from this exercise.

- The addition of compost in horticultural systems improves gross margins assuming the same yield
- Any increase in yield associated with the addition of compost when compared with conventional fertilisers increases the benefits of compost use
- In the analysis undertaken, the gross margins are not sensitive to the cost of compost and compost application
- There is a need to improve our understanding of the relationship between compost use and yield in horticultural production systems.
- There is a need to improve our understanding of the relationship between compost use and produce quality in horticultural production systems
- There is a need to improve our understanding of how the nutrients present in compost become available for plant growth
- There is a need to relate the documented improvements in soil structure/health to long term yield improvements and ultimately financial returns
4 REFERENCES
