Achieving Economic and Environmental Benefit through Agricultural and Municipal Cooperation in Co-composting Green Waste with Animal Manure

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Background

In 2003, the EPA awarded Sustainable Conservation a $29,000 grant to demonstrate and evaluate the technical and economic feasibility of co-composting green waste and dairy manure in the Central Valley.

One potential method for increasing the value of green waste compost is to mix green waste with manure which is higher in nutrients. This is feasible in the Central Valley because many dairies are in relatively close proximity to urban areas, particularly around the cities of Stockton, Visalia, Fresno, Merced, Modesto and Sacramento. Marrying the more urban generators of green waste with rural sources of manure are a natural convergence of interest, as there is a potential economic and environmental benefit for both sectors.

San Joaquin Valley cows

It was anticipated that this project would demonstrate an economically viable and technically practical strategy for capturing manure nutrients and safely utilizing them for agricultural production in the Central Valley.

Methods

Given it's proximity to dairies and their successful green waste composting program, the Merced County Highway 59 Landfill was selected for the project demonstration site. The Highway 59 Landfill green waste composting program currently diverts approximately 30,000 tons of organic waste from the landfill per year. Regionally, the dairy industry and agriculture features prominently in the Merced County landscape.

Samples of green waste, manure and finished compost were analyzed for nutrient content by A & L Western Agricultural Laboratories, using industry standard analysis for organic amendments. This facility was selected because they routinely analyze the Highway 59 Landfill's green waste compost, hence results from analysis of the co-compost could be compared with results typical of green waste-only compost.

Economic feasibility of this project was evaluated by interviewing project partners to identify appropriate market rates for manure and compost, quantifying actual costs of composting, and factors that affect costs, such as nutrient content and distance transported.

Sustainable Conservation contracted with the Kenneth Stone and Family Spreading Service to deliver dairy manure (490 yd3 or 313 tons) from two nearby farms to the Highway 59 Landfill green waste composting site (Figure 1), where it was mixed with Highway 59's Wildcat Windrow Turner with 960 yd3 (183 tons) of screened and chipped green waste (Figure 5). As trucks delivered the manure, and as the manure was unloaded, the material was sprayed with water to minimize dust (Figure 2).

Figure 1. Delivery of dairy manure trucks (front) mixed with green waste truck (back) to form windrows.

Figure 2. Highway 59 Landfills' Wildcat Windrow Turner mixing manure and green waste.

Project Results

Compost Quality

The green waste and dairy manure co-composting project demonstrated that green waste co-composted with dairy manure increased the nutrient content, and therefore should increase the market value of the green waste compost. Table 1 lists laboratory analysis results for manure, green waste and the finished co-compost product. The addition of manure to green waste (50% by volume) increased the final nitrogen concentration of the green waste by 13%, while phosphorus, potassium and sulfur concentrations doubled. Organic matter concentrations increased by over 25%, and calcium concentrations increased by a third.

Report of Analysis	Green Waste Pre-Compost	Dairy Manure Pre-Compost	Finished Co-Compost	Typical Finished Green Waste Compost
% Concentration				
Nitrogen	1.69	2.02	1.46	1.29
Phosphorus	0.23	0.46	0.52	0.27
Potassium	1.21	2.21	2.12	1.05
Sulfur	0.2	0.35	0.54	0.2
Magnesium	0.7	0.45	0.89	0.64
Calcium	1.5	1.75	3.21	2.05
Sodium	0.1	0.57	0.45	0.09
Organic Matter	62.55	55.57	34.02	27.08
Moisture	32.18	61.17	29.17	?
(PPM)				
Iron	7061	5,267	7,412	15,345
Aluminum	6,993	6,011	4,368	16,915
Manganese	239	139	359	388
Copper	23	86	83	42
Zinc	104	175	219	131
Boron	60	67	92	71
C:N Ratio	21:01	16:01	14:01	13:01
Total Coliform (MPN/1g)	?	?	Below Detectable Limit	Below Detectable Limit

Table 1 (left). Lab analysis results for nutrients, carbon to nitrogen (C:N) ratio, total and fecal coliforms and salmonella from green waste and dairy manure (pre-composting) and typical finished green waste compost.

Table 2 (below). Preliminary direct and net costs of green waste compost and green waste co-composted with dairy manure at the Highway 59 Landfill in Merced County, CA.

Economic Analysis

Costs and estimated project revenues are detailed in Table 2. Critical factors in determining the economic feasibility of mixing dairy manure with green waste compost include:

- Cost for delivery of manure which is dependent on distance hauled and moisture content
- Tipping fee for green waste
- Sale price of finished product, which varies according to volume purchased.
- Cost of regulatory compliance (not included in Table 2).

Processing Costs at the Highway 59 Landfill	Green Waste Compost Cost ($/ton)	Green Waste + Manure Co-Compost ($/ton)
Material Preparation: (receiving,cleaning,grinding, hauling)	8.30	3.00*
Windrow Composting	3.00	3.00
Screening	1.50	1.50
Storage (curing prior to sale)	2.00	2.00
Loading	0.50	0.50
Total Direct Costs	**15.30**	**10.00**
Adjusted (for Expected Tonnage Loss After Screening)**	**18.00**	**12.00**

*Manure does not need to be cleaned or ground, hence preparation costs are lower.
**Typically about 10 to 20% on a weight basis

Summary

The proximity of green waste to dairy manure and the high levels of agricultural production in the region make the Central Valley an ideal place to recycle manure and green waste nutrients via co-composting. This project demonstrated that

- the addition of manure to green waste compost increases the nutrient value of the final product
- if a higher price can be obtained, the production of co-compost can be economically feasible if manure and green waste sources are in close proximity to the landfill.

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