

# MODELING MANURE COMPOSTING TO ENHANCE DAIRY FARM VIABILITY

Dozens of farms are working at using composting as part of their manure management system. Composting can reduce manure volume by up to 50% and reduce odors, weed seeds and pathogens. This makes making storage and handling more convenient and creates a salable product. Composted solids can be sold as a soil amendment or used to replace bedding.

For all its advantages, deciding whether composting fits into a particular dairy operation is not easy. To help producers with this decision-making process, a compost decision-making model called "Co-Composter" was developed and refined by Cornell University's Department of Biological and Environmental Engineering, Department of Applied Resource Economics, Cornell Cooperative Extension and Cornell Waste Management Institute (CWMI). By using it, producers can answer many technical, economic, and labor requirement questions associated with implementing composting.

To make the Co-Composter model more accurate, a team of Cornell researchers studied four representative dairies to measure compost production factors such as costs, equipment use and space requirements:

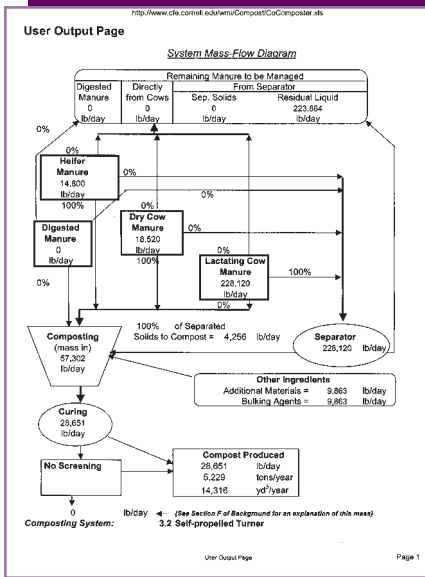
**Farm One** - This 115-head dairy receives tipping fees from municipalities, landscaping companies, restaurants, supermarkets, businesses and schools. It uses a skid steer and payloader to form and turn windrows. Finished compost is screened and used on site or sold in bags or bulk.

**Farm Two** - This farm with 570 dairy cows and 670 heifers produces 31,000FYd<sup>3</sup> of separated manure annually. It employs an aerated static pile compost system, producing bedding. Manure solids are conveyed to a compost building with a concrete floor with forced air. A pump transports liquids to a lagoon. The dairy uses 90% of the finished product for bedding and sells the excess.

**Farm Three** - This 100-cow dairy imports manure from a 1,000-head heifer facility. Manure is transferred to a manure spreader, where it is mixed with straw and/or wood chips. It is then formed into windrows and turned with a loader. Compost is sold in bulk or used on-site.

**Farm Four** - This 500-cow dairy digests manure in an anaerobic digester. Liquids are separated and transported to a lagoon for spreading or irrigation. Solids are trucked to a pad on-site and formed into windrows using a loader. A compost turner turns the windrows. Finished compost is sold in bulk or bag.

When the Co-Composter model projections were compared to an economic spreadsheet analysis using data from the four dairies, economic projections of the model matched well with the actual farm analyses. This model and guidance on its use are available at no cost on the CWMI website at: <http://www.cfe.cornell.edu/wmi/Composting.html> or at (606) 255-1187.



**Total Costs (by operation & per unit)**

The total costs include operation and maintenance, labor, pad and pond construction, turning, handling (including separating), material cost/fees, and screening costs.

Loader Option	Annual Costs			
	Loader 1	Loader 2	Loader 3	Loader 4
Handling Cost	not feasible	\$23,301	\$20,409	\$17,684
Turning Cost	not feasible	\$19,991	\$19,991	\$19,991
Screening Cost	No Screening	No Screening	No Screening	No Screening
Separating Cost	not feasible	\$10,070	\$10,070	\$10,070
Pad Cost	not feasible	\$2,344	\$2,344	\$2,344
Pond Cost	not feasible	\$4,692	\$4,692	\$4,692
Materials:				
Input:				
Tipping Fees	not feasible	\$0.00	\$0.00	\$0.00
Costs	not feasible	\$0	\$0	\$0
Output:				
Value of final product	not feasible	\$0	\$0	\$0
<b>Total Annual Cost*</b>	not feasible	<b>\$60,397</b>	<b>\$57,506</b>	<b>\$54,780</b>
Input				
Cost per Ton Input	not feasible	\$5.78	\$5.50	\$5.24
Cost per Yd <sup>3</sup> Input	not feasible	\$2.11	\$2.01	\$1.91
Output				
Cost per Ton Output	not feasible	\$11.55	\$11.00	\$10.48
Cost per Yd <sup>3</sup> Output	not feasible	\$4.22	\$4.02	\$3.85

\* If profit exists, results will appear in parenthesis to represent profits from tipping fees, total annual profit, or profit per Input/Output.

**Fixed Costs**

Loader Option	Loader 1	Loader 2	Loader 3	Loader 4
<b>FIXED COSTS</b>				
<b>Capital</b>				
Pad Construction	\$17,080	\$17,080	\$17,080	\$17,080
Pond Construction	\$34,133	\$34,133	\$34,133	\$34,133
Building Construction	\$0	\$0	\$0	\$0
Aeration Cost	\$0	\$0	\$0	\$0
<b>TOTAL COSTS</b>	\$51,183	\$51,183	\$51,183	\$51,183
<b>ANNUAL TOTAL COSTS</b>	\$6,012	\$6,012	\$6,012	\$6,012
<b>Equipment</b>				
Small loader 40 hp, 103 yd bucket	Not feasible	\$19,792	\$39,148	\$39,098
85 hp tractor, loader, 1 yd bucket		\$30,000	\$50,000	\$50,000
Front loader, 125 hp, 3 yd bucket		\$113,000	\$113,000	\$113,000
Other loader, User specified	\$0	\$0	\$0	\$0
Separator, Pipes and Pumps	\$0	\$0	\$0	\$0
No tractor needed	\$113,000	\$113,000	\$113,000	\$113,000
Self-propelled Turner	\$0	\$0	\$0	\$0
Screeners	\$0	\$192,752	\$222,148	\$207,098
<b>TOTAL COSTS</b>	Not feasible	\$324,010	\$299,194	\$295,625
<b>ANNUAL TOTAL COSTS</b>	Not feasible	\$4,679	\$5,467	\$5,077
Annual Insurance	Not feasible	\$203,945	\$273,329	\$263,880
<b>TOTAL FIXED COSTS</b>	Not feasible	\$34,701	\$40,662	\$37,714
<b>ANNUAL TOTAL FIXED COST</b>	Not feasible			
<b>VARIABLE COSTS</b>				
<b>Operating and Maintenance</b>				
Small loader 40 hp, 103 yd bucket	\$18,391	\$10,104	\$8,071	\$8,091
85 hp tractor, loader, 1 yd bucket				
Front loader, 125 hp, 3 yd bucket				
Other loader, User specified	\$2,196	\$2,196	\$2,196	\$2,196
Separator, Pipes and Pumps				
No tractor needed	\$2,372	\$2,372	\$2,372	\$2,372
Self-propelled Turner	\$0	\$0	\$0	\$0
Screeners	\$0	\$0	\$0	\$0
Labor	\$30,901	\$10,070	\$3,899	\$5,852
Electrical	\$306	\$306	\$306	\$306
Materials	\$0	\$0	\$0	\$0
Cost	\$0	\$0	\$0	\$0
Income Received	\$0	\$0	\$0	\$0
Tipping Fees	\$0	\$0	\$0	\$0
Final Compost Sales	\$0	\$0	\$0	\$0
<b>ANNUAL TOTAL VARIABLE COST</b>	Not feasible	\$25,087	\$16,842	\$17,000
<b>TOTAL ANNUAL COST</b>	Not feasible	\$60,397	\$57,506	\$54,780



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