ECONOMIC ANALYSIS OF MANURE TECHNOLOGIES

Prepared For:

AMMTO
(Advanced Manure Management Technologies For Ontario)

Prepared By:

Lynn Marchand and Ken McEwan
Ridgetown College, University of Guelph

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AMMTO
Advanced Manure Management Technologies for Ontario

Ridgetown College
UNIVERSITY of GUELPH
RIDGETOWN • ONTARIO

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Executive Summary

The purpose of this program is to conduct economic analysis of different manure technologies. Users can compare the economic costs and benefits of a traditional manure management system with a new technology or compare new technologies with each other. Three stages of manure management will be considered and they are manure collection/storage, manure treatment and manure handling. Assessing the costs and benefits at each stage provides a more detailed analysis.

The spreadsheet offers default values to assist the user but is flexible enough to allow individual user data to be incorporated.

The tabs along the bottom of the spreadsheet (i.e. background, storage, etc.) reflect various stages of data input. Background refers to general farm characteristics such as commodity type, manure production and characteristics, etc. Manure storage refers to the costs and benefits associated with the collection and storage of the raw manure. The manure treatment page provides an opportunity to assign values for costs and benefits of a technology. The end use page refers to the final handling of manure or other end products. A summary page is provided which shows the results of the analysis. Help buttons are provided throughout and the manual should be used when detailed instructions are needed.

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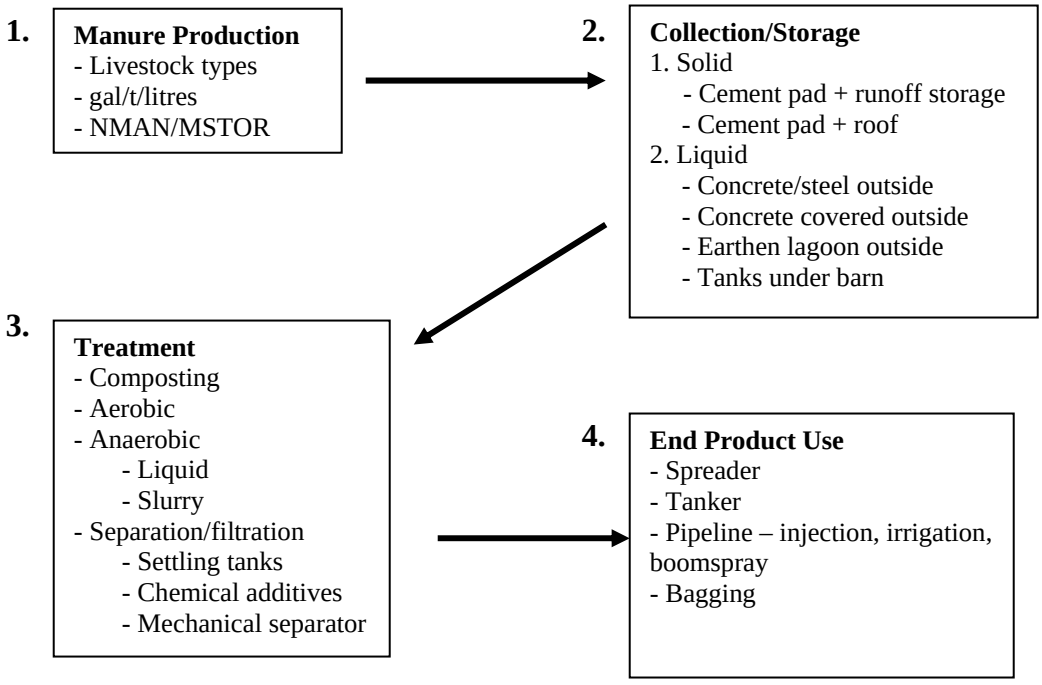
1.0 Introduction

Manure management is a very important issue. The application of manure to crop land has been a common occurrence for generations. It has been widely accepted until recently with events such as Walkerton that have brought agricultural practices into the public spotlight. Livestock operators in particular are now faced, more than ever, with pressures to further improve farm practices, reduce odour, protect the water and so on. As a result, many new manure technologies have been developed as possible solutions to manure-related issues. Some of these technologies are simple and require little capital investment. Others are more complicated and require significant capital investment and some may provide the opportunity for a farm to generate additional income as a result.

The purpose of this program is to provide an opportunity to compare the economic viability of various manure technologies. The user is able to compare a current system with an alternative system or simply compare different technologies. In order to adequately consider the manure management process a series of stages were identified: manure production; manure storage/collection; manure treatment; and end product use. This is shown visually below in Figure 1 with examples of specific information, equipment or technologies included at each stage. Considering each stage of manure management separately provides the opportunity to carefully and accurately assess the costs and benefits associated with each.

Figure 1: The Stages of Manure Management



To complete an economic analysis of various manure technologies the program provides an opportunity for the user to indicate the capital costs, operating costs and any potential revenue generated at each stage. Also included is a worksheet for land-related considerations and a summary worksheet which provides the final economic comparison. Along the way there are

Help buttons that take the user to information specific to the topic. A listing of default values for some variables are provided later in this document.

2.0 Details of the Program

2.1 Methodology

The intention of the spreadsheet is to enter information related to one technology first and then enter information for the second technology after. This may mean entering information related to the technology currently used on the farm first and then entering data that would apply if a new technology was implemented. This will also apply if there is more than one type of animal or manure involved. Each time an analysis is completed, the file should be saved with a new name. This will enable the user to go back into each analysis at a later time, adjust variables and compare results. The user may enter farm specific information in the white spaces provided. As an entry is made, the number will turn blue. Specific information can also be entered onto the lines drawn beside variables such as facilities, equipment, energy or inputs to identify detailed farm-related entries. Specific measurements used in the program focus primarily on litres, tonnes and Imperial gallons.

The file was created in Excel and each worksheet within the file represents different stages of data input as outlined in the introduction section above. The tabs along the bottom indicate each stage. If you wish to be in a particular section of the spreadsheet it is possible to do so by simply pointing the mouse to the correct tab and clicking on it. The worksheets appear in the following order:

1. Background – this sheet requests general farm and manure related information as well as particular costs associated with the farm and the values for end products that may be available for sale.
2. Storage – this sheet is designed for manure collection and storage expenses and revenue.
3. Treatment – this sheet compiles expenses and revenue for the manure treatment stage.
4. Land – this sheet looks at the implication manure technologies have on land requirements.
5. End Product Storage or Sale – this sheet collects information on the expenses, revenue and other benefits that might accrue to the farm when a technology is used.
6. Summary – this is a summary sheet used to compare the economic results of the various manure technologies.

The storage, treatment and end product worksheets are set up in a partial budget type manner. Information related to each worksheet is explained below.

2.2 Background

This page requests general farm characteristics such as type of commodity on the farm, type and volume of manure produced and annual marketing information. A description of each data request is provided below:

Type of Operation – this refers to the main commodity for which the analysis applies to. The species listed include: beef, dairy, poultry and swine. The user may select only one.

More Specifically – this seeks additional information related to unique production systems which may exist within some commodity groups. This includes: cow-calf, feedlot, layers, meat birds, sow, nursery and finishing.

Manure Type and Nutrient Value – this refers to information related to manure produced on the farm. The data can be obtained from the user's own numbers or from Table 1 below. The user should input the percent dry matter, percent nitrogen, phosphorus (or phosphate) and potassium (or potash) in the line corresponding to the type of manure (liquid, solid, combination liquid/solid). If there is more than one type of manure the analysis must be done for each type separately.

Table 1: Nutrient Content of Manure

	% D.M.	% N	% P	% K
Dairy – solid	20.4	0.52	0.14	0.50
Dairy – liquid	6.3	0.28	0.07	0.27
Beef – solid	27.5	0.66	0.16	0.64
Beef – liquid	5.3	0.25	0.08	0.18
Swine – solid	26.7	1.17	0.70	0.96
Swine – liquid	3.8	0.38	0.12	0.18
Poultry – solid	47.6	20.8	0.97	1.15
Poultry - liquid	7.9	0.75	0.27	0.32

Source: NMAN/MSTOR 2001, Version March 18, 2002

Annual Production – this is the total amount of manure produced annually on the farm in terms of gallons, litres or tonnes and will be used in the final summary to determine the cost per unit of manure. The user can use their own number or calculate it using Table B1 in Appendix B. The Help section within the program also shows these values.

Type of Storage(s) – this provides examples of various types of storages which might be used to store manure on the farm. The user may select more than one type of storage.

Annual Marketing Units or Output Units – this number should reflect the annual farm marketing or output such as number of head, birds, pigs, eggs, litres of milk, and pounds marketed. This number will be used in the summary section to provide a cost per head, cost per egg, cost per litre of milk, etc.

Costs Associated With The Farm – The user is asked to input values for variables such as farm cost of nitrogen fertilizer, cost for electricity used on the farm, property taxes, etc. These costs will be used in other places throughout the spreadsheet as needed. This will prevent the user from having to input this information multiple times. With respect to property taxes, it is important that the user allocate the percentage of total property taxes that would be attributed to the farm buildings and the percentage attributed to the land. These allocations will be used in formulas in the program.

Some manure technologies provide the opportunity for income generation. Examples of this include the sale of compost, manure and biogas. The user should input the values associated with these sales on this sheet as well which can then be used in formulas in other parts of the program.

Once all information has been entered in this worksheet, it is time to move to the "Storage" worksheet. This can be done by clicking on the "Storage" tab near the bottom of the screen with the mouse.

2.3 Manure Collection/Storage

This worksheet provides an economic analysis of the collection and storage of manure. Information is broken down into capital costs (facilities and equipment), annual operating expenses and potential revenue. A description of the variables is provided below. It is important to identify at the top of this worksheet (beside "System") a term or name to identify which system is being analysed. Terms such as current, traditional, digester, and etc. can be entered and will be used in the summary analysis to assist the user in comparing the results of the economic analyses of the various technologies.

2.3.1 Capital Costs

This section is broken down into facilities and equipment purchases as well as the sale of capital assets that might not be required if a particular technology is used. For example, new facilities might include a concrete or steel tank, tank cover, concrete pad, cover for solid manure storage, and etc. The user may enter values as lump sum entries or enter the number of square feet (or gallons) and the value per square foot (or gallon). Costs associated with laneway construction or improvements may be included with the building cost or itemized separately. New equipment may include pumps, transfer pipes and fans. Depending on the type of manure technology being analysed capital items such as tanks not needed as a result of a new system would be included in "the sale of capital assets".

Within the facilities and equipment subsections are the opportunities to define parameters for interest and depreciation calculations that will be automatically calculated and included in the annual operating expenses section. For both the facilities and equipment purchases, users can indicate the interest rate and the length of the term as well as the salvage value (as a percentage) and length of time to depreciate. The straight-line method of depreciation has been used and is calculated on the new capital items and interest is calculated on the net capital costs.

2.3.2 Annual Operating and Maintenance Expenses

This section includes the following:

i) Interest and depreciation – this calculation is performed automatically based on data entered in the capital cost section.

ii) Insurance – this is the portion of the farm insurance that can be attributed to this particular stage of the manure system.

iii) Labour for maintenance – this labour should be that which is devoted to general maintenance of the manure system at this stage and not the day-to-day operation of it. This may require a higher skilled individual and the opportunity is provided to include the hours worked per week, the wage per hour and the weeks per year that would be involved. These numbers will be used to calculate an annual cost for this labour.

iv) Maintenance/repairs – this category could include expenses for supplies, parts, lubricants, welding and etc. Several lines are provided in order to provide the user with the opportunity to enter specific items.

v) Energy – this includes hydro, fuel, oil, propane, and natural gas.

vi) Labour for general operating – this labour is devoted to the ongoing, day-to-day operation of the manure collection/storage part of the system. Similar to labour for maintenance above, the user can enter the hours worked per week, wage per hour and weeks worked per year. An annual labour expense value will then be calculated based on this information.

vii) Inputs – if there are any inputs that need to be added to the system at this stage they should be included here.

viii) Property taxes – based on the percentage of property taxes allocated to buildings entered into the Background worksheet, the user should allocate a percentage of that to this stage of the process. For example, if total property taxes amounted to $1,000 and the building allocation was 70% of the total and the allocation to the manure collection/storage stage was 10% the result would be $1,000 x .7 x .1 = $70.

ix) Operating interest – this is the portion of total farm operating interest that could be attributed to this stage.

2.3.3 Potential Revenue

This allows the user to include any potential revenue that could be generated at this stage if a particular technology is used. For example, if two farmers decide to purchase a digester and one farmer must have a larger manure storage to hold manure from both farms then the other farmer may pay a fee to help offset this added cost.

2.4 Manure Treatment

This worksheet considers the costs and potential income associated with treating the manure. This can be done by composting, separating, digesting, etc. the manure. All variables listed in the collection/storage worksheet are included here and interest and depreciation are calculated in the same way. Examples of variables included specifically for this stage are listed below. Please refer to Section 2.3 for variables not listed below.

2.4.1 Capital Costs

Facilities – this may include buildings to house treatment systems, concrete floor, composting channels, curing area, and etc.

Storage (part of facilities section) – this would include settling tank, unit for carbon source, manure, water, etc.

Equipment – this may include compost turner, separator, aerator, transfer pipes, pumps, membrane filter equipment, electrical generator or boiler, filter tower/bed, etc.

2.4.2 Annual Operating and Maintenance Expenses

Most of these expenses have been discussed in the storage section. Only variables not discussed in the Manure Collection/Storage section will be outlined below.

Equipment lease or rental – this will be the annual cost if the user rents or leases a piece of equipment (e.g. tractor). This value should not be included in the capital cost section.

Inputs – at this stage inputs such as straw, wood chips, chemicals, bacteria, leaves, etc. should be accounted for.

2.4.3 Potential Revenue

The user has the opportunity to include any revenue that results from this stage of the manure handling process. An example would be if the farmer receives a "tippage fee" for taking certain types of carbon sources that could be used in a composting system.

2.5 Land

It is possible to by-pass this section of the analysis, however, using particular manure technologies may result in the user needing more land or less land for manure or other nutrient application. Several options are considered and within each option there are sometimes many variables that can be taken into account. The user may enter information for as many variables as desired. The user should select only one option for each analysis. The following options are considered.

2.5.1 Increased Land Requirements for Manure (or other nutrient) Application

Option 1 – Increased use of existing land base. This will be selected when the user has a sufficient land base to handle all of the nutrients produced on the farm. An example might be when a farmer owns 300 acres of land and under the existing system he has been using only 150 acres to spread manure on. With the new system he will need to use another 50 acres and he can do so by utilizing more of his existing land base.

Factors that are taken into account are changes in manure transportation costs and changes in fertilizer costs. The user must decide if there is a distance change for hauling manure to this land base, the amount of manure involved (tonnes or gallons) and the cost per tonne or gallon for hauling it. The default values provided are $3 per tonne and $0.015 per gallon. This is for

the first kilometer from the barn. If the change in distance is greater than one kilometer the subsequent distance is valued at $2 per tonne per kilometer and $0.001 per gallon per kilometer. As well, if there is a change in the cost of fertilizer as a result of applying manure on this acreage this must be entered as well as the number of acres affected.

Option 2 – Purchase land. The user may have to, or may choose to, purchase additional land in order to meet increased land requirements. The user must take into account a possible change in manure transportation costs (increase or decrease in haulage distance, the amount of manure applied to this new land and the costs to haul it as outlined in Option 1 above). As well, it is possible that there could be a change in feed costs as a result of growing crops for feed on this land compared to having to purchase the same crop for feed. The user must include information on the variable costs to grow a crop on this acreage and the fixed costs associated with owning the land. These costs will be compared to the cost of purchasing the crop to result in a net savings or increase in feed costs.

If the user wants to assess the impact of growing crops on this acreage they have the opportunity to take into account a three year crop rotation. Variable costs per acre must be entered for the crops grown in this rotation. Sample costs are provided in the Help section of the program and are also shown below for grain corn, soybeans and winter wheat. These costs were derived from the OMAF 2002 Crop Budgets. The program averages the variable costs entered by the user to determine the total average variable costs for the acreage involved. The following provides a detailed overview of the expenses included:

Table 2: Grain Corn Variable Costs Per Acre

Seed	$49.90	Seed Treatment	$2.00
Fertilizer – MAP	10.40	Fuel	15.60
Muriate of Potash	8.50	Repairs/maintenance	19.60
28-0-0 UAN	46.20	Crop insurance	11.60
Grass herbicide	20.30	Custom work (nitrogen)	9.00
Broadleaf herbicide	8.10	Custom work (chemicals)	7.10
Insecticide	15.40	Interest on operating loan	5.60
Total			**$229.30**

Table 3: Soybean Variable Costs Per Acre

Seed	$30.75	Fuel	$12.00
Fertilizer	11.50	Repairs/maintenance	16.50
Grass herbicide	18.30	Crop insurance	10.60
Broadleaf herbicide	24.40	Interest on operating loan	3.20
Seed Treatment	3.00		
Total			**$130.25**

Table 4: Winter Wheat Variable Costs Per Acre

Seed – white	$35.45	Repairs/maintenance	$18.50
Fertilizer – liquid	14.00	Crop insurance	6.55
Fertilizer – urea	27.20	Custom work	9.00
Broadleaf herbicide	5.10	Interest on operating loan	3.60
Fuel	9.35		
Total			**$128.75**

The user must also decide if there is the potential to sell crop from this new land purchase by entering the number of bushels and value per bushel for each crop indicated in the three year rotation. The final entry is related to the annual land inflation rate that will affect the value of the land.

Option 3 – Rent land from others. The user may decide to increase the land base by renting land from others. Similar to option 2 above, the user must realize any potential change in manure transportation costs and any savings or increase in feed costs. See option 2 above for more detail. The user must also consider the direct rental costs and potential sale of crop from this additional acreage.

2.5.2 Reduced Land Requirements for Manure (or other nutrient) Application

Option 1 – Retain land and crop it. If less land is needed for manure application the user must consider the change in manure transportation costs. For example, the potential change in haulage distance, the decreased amount of manure (tonnes or gallons) and the costs to haul that manure. The default values are $3 per tonne for the first kilometer and then $2/tonne for each kilometer after that. Similarly, for liquid manure the default value is $0.015 per gallon for the first kilometer and then $0.001 per gallon after that. If less manure is available for application, the user may be faced with increased fertilizer costs on the number of acres not receiving manure. The user must enter the number of acres affected (i.e. those that will not be receiving manure but were previously) and the cost of the additional fertilizer.

Option 2 – Retain land and rent land out. The net cost or benefit of this option is the difference between the land rental income that could be received compared to the potential cropping net income that could be realized if the user decided to grow crops on the land.

Option 3 – Sell land. The user will compare the opportunity to invest the money received for selling the land against the feed cost or savings.

The net effect of the selected land option will be shown in the Summary analysis section.

2.6 End Product Storage or Sale

The purpose of this worksheet is to analyse the final stage of the manure handling process. This may be the application of manure to crop land, the sale of compost, the sale of nutrients, biogas, electricity, and etc. Also considered at this stage are any savings that the farm might have as a result of less compaction, the use of electricity generated, the value of fertilizer or nutrients applied to the farm's land, etc.

The worksheet is set up similar to manure collection/storage and manure treatment. The revenue generated section is larger and there is a section outlining other potential savings and economic benefits. The following variables provide further detail and examples.

2.6.1 Capital costs

Variables relating to interest and depreciation calculations must be input for facilities and equipment separately (within each subsection).

Facilities – this could include storage for methane, compost, storage tanks, tank covers, liner, concrete pad, and etc. The user may input the size of the facility and the cost per square foot or input a lump sum value. If any capital items are no longer needed and can be sold at this stage they should be included in the "sale of capital assets" section as well as the value related to the sale.

Equipment – this could include tanker, spreader, pipes, pumps, injection unit, spray boom, dribble bar, drag hose, unit for bagging compost for retail, tractor, compost screen, etc.

2.6.2 Annual Operating and Maintenance Expenses

Many of the variables are the same as those discussed in previous sections. Only variables unique to this stage are provided below.

Custom application – A user may have manure or other nutrients custom applied to their farm. A volume or amount (units) and cost of application ($/unit) must be entered. For example, the custom rate for liquid manure may be $0.015/gal and solid manure may be $3/t.

Marketing costs – Some manure technologies provide an opportunity for the user to market an end-product. For example this could be compost bagged in 30 litre bags, sold to nurseries. In order to do this it may be necessary to incur costs associated with marketing such as the cost of the bags, imprinting a logo, and etc.

Disposal fees – Some technologies may have wastes that must be disposed of off the farm. For some wastes there may be a fee associated with this disposal.

2.6.3 Calculation of Potential Savings for Farm

The use of some manure technologies may result in savings to the farm. Manure or other nutrient application to crops results in savings in fertilizer costs. If a technology produces electricity, heat or water that can be used on the farm rather than purchased then savings can be realized. Also, if there is less compaction on fields it is possible that savings can result. Further explanations are provided below.

Savings due to less compaction – If there is less compaction on fields it may result in higher yields. The user must input the yield advantage due to less compaction (the number of bushels that the average yield may increase by), the number of acres affected and the price per bushel for the crop grown on the acreage.

Savings due to use of heat – This will be used if a technology produces an end-product that can be used as a source of heat on the farm. Savings will be calculated when the user inputs the annual amount normally spent on heat and the percentage of that amount that is expected to be saved by using the on-farm heat source.

Savings due to use of water – A technology may provide an opportunity for water in manure to be treated and then used again in the farming operation. This may result in savings from having to purchase municipal water or drawing water from a well. The user must input the number of gallons of water that this might involve. The value associated with each gallon of water is assumed to be the number included on the Background page.

Value of manure or nutrients applied to farm – The $/t values for N, P and K come directly from calculations done on the Background page. The user must input the amount of gallons applied per acre and the number of acres receiving the manure/nutrients.

2.6.4 Other Potential Economic Benefits for Farm

It is possible that the reduction of odour or greenhouse gases, destruction of pathogens, etc. may represent a certain monetary value. At this time there are no default values available to assist the user and they must determine a value they feel is acceptable and accurate.

2.7 Summary

The Summary page presents the results of the economic analysis. A summary of revenue generated and the annual operating and maintenance expenses are shown for the Storage, Treatment and End Use pages. The net effect of land is itemized as well as the net savings to the farm (including the other potential economic benefits). If the revenues are greater than the expenses, the resulting number will show in the "Net Benefit" line otherwise the number will show in the "Net Cost" line. The "Total" does not include the other potential economic benefits (e.g. greenhouse gas credits, value of odour reduction, etc.). The net value per unit (e.g. head, pig, litre of milk, etc.) is based on the number of units input on the background page. This is also how the net value per unit of manure is calculated – it is based on the entry made in the annual manure production cell. The Technical Ranking Index is a calculation used to compare one technology against the other. It is determined in the following manner: total net capital cost (the addition of net capital cost from the storage, treatment and end use pages) divided by the net benefit/cost excluding other potential economic benefits. The technology that results in the largest number (i.e. most positive) should be considered the most viable from an economic viewpoint. The payback period in years is also provided when the analysis shows that the manure technology provides a net benefit.

If multiple analyses will be undertaken it is necessary to save the file with a unique filename and then complete the next analysis in a new file and so on. This permits line by line review and comparison between technologies and allows the user to go back and alter any of the variables within an analysis. If the user wishes to have the summary results side by side this is possible by doing copy, paste special and paste "values" for each of the technologies into one file.

Appendix A
Default Values

Table A1: Default Values

Tank - concrete open	$0.11/gal		Compost turner	$175,000
Tank - steel round	$0.28/gal			
			Tower/bed membrane filter	
			Separator	
Tractor (2WD)	$600/HP		Digester	
Tractor (4WD)	$700/HP			
Excavation cost	$0.90/$m^3$		Boiler	
Liner	$1.50/sq ft		Wood chips	$0
Tank cover – solid concrete			Straw	$0.04/lb
or slatted floor	$5/sq ft			
Tank cover – floating			Leaves	$0
Tank cover – inflatable			Corn stover	$0.015/lb
bubble				
Concrete pad	$3/sq ft		Chemicals	
Roof for concrete pad	$10/sq ft			
Free stall scraper				
Transfer pipes				
Fans			Electric motor	5 HP = $980
Transfer pumps			Spreader – hydra push	$1,379/$m^3$
			Spreader – conveyor box	$1229/$m^3$
Custom rate – hauling,	$3/t or $0.015/gal		Spreader – end-gated	$2,347/$m^3$
spreading manure				
Cost of electricity			Liquid manure spreader	$1.26/l
Cost of propane			Vacuum manure spreader	$1.49/l
Cost of natural gas			Injection unit	
Cost of water			Spray booms	
Cost of fuel oil			Dribble bar	
Farm cost of Nitrogen			Drag hose	
Farm cost of Phosphorus			Skilled labour	$15/hr
Farm cost of Potassium			Unskilled labour	$12/hr
Marketing costs for retail	$2.15/30 litre bag		Land rent	$140/ac
sale of compost				
			Land purchase/sale	$4,500/ac
Revenue				
Tippage fees				
Compost values	$3/30 litre bag retail, $30/t wholesale			
Biogas				
Electricity exported to grid	$0.06/kWh			

Sources used:
Manure and Nutrient Management Suite 2000, OMAF and University of Guelph, August 2000
MARVEL Composting Technology – A System to Compost Liquid Swine Manure (Fleming, R. and MacAlpine, M.), March 2002
Personal references

Appendix B
Manure Produced Per Animal Per Day

Table B1: Manure Produced Per Animal Per Day
(includes wastewater, manure, etc.)

	Manure Type	Animal Type	Average Weight (lb)	Total Manure L/day	gal/day	t/100 animals/day[1]	% Dry Matter
Swine	**Solid**	Feeder	118.3	5.664	1.246	0.565	13.2
		Sow & litter	400	16.992	3.738	1.695	14.6
		Dry Sow/Boar	300	14.160	3.115	1.413	14.6
		Weaner	35	2.549	0.561	0.254	13.5
	Liquid	Feeder	118.3	8.496	1.869	0.848	5
		Sow & Litter	400	22.656	4.984	2.261	2.7
		Dry Sow/Boar	300	16.992	3.738	1.695	2.7
		Weaner	35	2.832	0.623	0.283	2.7
Beef	**Solid**	Backgrounder	683.3	19.826	4.361	1.978	21.9
		Calf	325	8.496	1.869	0.848	21.9
		Finisher	800	22.656	4.984	2.261	21.9
		Finisher, all in/all out	800	14.160	3.115	1.413	21.9
		Mature cow	1300	35.684	7.850	3.560	21.9
		Shortkeep	1100	31.153	6.854	3.108	21.9
	Liquid	Backgrounder	683.3	22.656	4.984	2.261	9
		Calf	325	11.328	2.492	1.130	9
		Finisher	800	25.489	5.607	2.543	9
		Finisher, all in/all out	800	16.992	3.738	1.695	9
		Mature cow	1300	42.481	9.346	4.238	9
		Shortkeep	1100	36.817	8.100	3.673	9
Dairy	**Solid**	Calf	200	5.664	1.246	0.565	21.2
		Heifer	650	16.992	3.738	1.695	18.3
		Mature cow	1400	59.473	13.084	5.934	21.2
	Liquid	Calf	200	5.664	1.246	0.565	11
		Heifer	650	19.824	4.361	1.978	11
		Mature cow	1400	73.634	16.199	7.347	9.1
Chickens	**Solid**	Breeder pullet	1.6	0.082	0.018	0.008	57.5
		Broiler	1.3	0.076	0.017	0.008	60
		Laying hen	3.5	0.099	0.022	0.010	20
		Breeder pullet, all in/all out	1.6	0.065	0.014	0.006	57.5
Turkeys	**Solid**	Breeder tom	35	0.680	0.150	0.068	57.5
		Meat turkey <5kg	3.7	0.105	0.023	0.010	57.5
		Meat turkey >10kg	25.7	0.736	0.162	0.073	57.5
		Meat turkey 5-10kg	14.7	0.425	0.093	0.042	57.5
		Meat turkey 5-10kg all in/all out	14.7	0.340	0.075	0.034	57.5
		Turkey breeder layer	20	0.396	0.087	0.040	57.5
		Turkey pullet 0-6 wks	1.5	0.085	0.019	0.008	57.5
		Turkey pullet 6-15 wks	9.7	0.275	0.060	0.027	57.5
		Turkey pullet 6-15 wks all in/all out	9.7	0.218	0.048	0.022	57.5

Source: NMAN/MSTOR 2001, Version March 18, 2002

[1] Note: These numbers are based on tonnes per 100 animals per day.