

Economics of Manure Handling

Iowa State University Extension and Outreach

Kristen Schulte, Farm and Agribusiness Management Specialist; Larry Tranel, Dairy Field Specialist

Greg Brenneman and Dan Huyser, Agricultural Engineers, Iowa State University Extension and Outreach

Cost Summary

	\$ per Cwt	Cummulative	\$ per Cow	Cummulative	See table at right for ranges and explanation.
Net Cost to Store and Handle Manure	\$0.699	\$0.699	\$209.71	\$209.71	
Net Cost to Haul Manure	\$0.433	\$1.132	\$130.01	\$339.73	
Nutrient Value of Manure	\$0.682	\$0.450	\$204.62	\$135.10	

Herd and Financial Assumptions

Units

Instructions or Reference Values

Herd Size	1,220	no. cows	Enter herd size, lactating and dry
Milk Production Per Cow Annually	30,000	per Cow	Annual Rolling Herd Average
	Tons Solid	1,000 Gallons	
Manure Produced Annually Per Farm	500	14,000	Annual for Farm, see Manure Calculator
Labor Rate for Handling/Hauling Manure	\$15.00	\$ per hour	Typical rate is \$10 - \$18 with benefits

Manure Storage Costs (from barn to storage)

Manure Storage Structure Investment	\$1,600,000	total	Investment in storage structure and related equipment, see Investment Calc.
Manure Storage/Handling Equipment Investment	\$48,500	total	Between 11 and 40 years
Structure Depreciation 25 years	\$64,000	per Year	Between 5 and 10 years
Equipment Depreciation 7 years	\$6,929	per Year	Based upon interest rate
Interest 5.0 %	\$82,425	per Year	Typical rate is 2% of investment cost
Repairs 2.0 %	\$32,970	per Year	Typical rate is 1% of investment cost
Taxes 1.0 %	\$16,485	per Year	Typical rate is 0.5% of investment cost
Insurance 0.5 %	\$8,243	per Year	Include non-fixed expenses and misc
Annual Operating Expenses (fuel, supplies, etc.)	\$1,000	per Year	Include time for handling manure (barn scraping, maintenance, etc.)
Labor Hours for Manure Storage	2920	hours, annual	
Labor Cost for Manure Storage	\$43,800	total	
Manure Storage Structure Costs	\$255,851	per Year	
Annual Manure Storage Costs per cwt. of milk	\$0.70	per cwt.	Target cost is \$0.50-\$1.00/cwt.

Manure Handling and Applying Costs (from storage/bedded pack/tie-stall barn to field)

Equipment Investment for Handling and Applying	\$301,126	total	Investment in handling/applic equip.
Depreciation 7.0 years	\$43,018	per Year	Between 5 and 10 years
Interest 5.0 %	\$15,056	per Year	Based upon interest rate
Repairs 2.0 %	\$6,023	per Year	Typical rate is 2% of investment cost
Taxes 1.0 %	\$3,011	per Year	Typical rate is 1% of investment cost
Insurance 0.5 %	\$1,506	per Year	Typical rate is 0.5% of investment cost
Annual Operating Expenses (fuel, supplies, etc.)	\$45,000	per Year	Include non-fixed expenses and misc
Labor for Manure Handling	3000	hours, annual	Including time for all processes to get the manure out of storage and to field
Labor Cost for Manure Handling	\$45,000	total cost	ISU Custom Rate Survey for related cost
Custom Manure Handling Costs	\$0	per Year	
Manure Handling Costs	\$158,614	per Year	
Equipment Handling Costs per cwt. of milk	\$0.43	per cwt.	Target cost is \$0.30-\$0.75/cwt

Total Manure Storage and Handling Costs

	\$ value	\$ per cow	\$ per cwt. of milk produced
Total Manure Storage and Handling Costs	\$414,465	\$339.73	\$1.132

Value of Nutrients in Manure to be Credited

Nutrients Per Unit	1 Ton Solid	1,000 Gal Liquid	Dollar Value/Pound	
Nitrogen	12	10.1	\$0.45	Use manure nutrient values based on test results or book values. Value per pound is based on local fertilizer rates
Phosphorus	6	11.8	\$0.55	
Potassium	12	22	\$0.43	

Value of Nutrients Applied

			Nutrient Valuation of Application per Acre	
			Tons Solid	1,000 Gal
Nitrogen	\$899.91	\$21,207.88	Manure Applied per Acre	15
Phosphorus	\$1,650.00	\$90,860.00		10
Potassium	\$2,580.00	\$132,440.00		
Total Manure Nutrient Valuation	\$5,129.91	\$244,507.88	Nutrient Value per Acre	\$153.90
Manure Nutrient Valuation/Unit	\$10.26	\$17.46		\$174.65

The authors have used their best judgement and shall not be liable for any use of this software decision-making aid.

ISU Extension and Outreach DAIRY DECISION TOOL

MANURE PRODUCTION CALCULATOR

Livestock, Type	No Head	Solid Manure		Liquid Manure	
		Tons/Animal/Yr	Total Tons/Year	1,000 Gal/Animal/Yr	Total 1,000 Gal/Year
Cows, Lactating	200	14	2800	6.3	1260
Cows, Dry	40	7	280	3	120
Heifers	120	6	720	3	360
Total Housing	360		3800		1740
Milk House Waste					438
Total with Milk House			3800		2178
Additional Lots, Runoff, Precipitation			0		10
Total Manure			3800		2188

MILK HOUSE WASTE PER COW

Milking Frequency	Liquid Manure Gallons/Cow/Day
2X Milking	5
3x Milking	7.5
Robotic Milking	3

*highly variable depending on herd size and washing procedures
 *wash procedures including holding pens may use 10 gal/cow/day
 *farms using recycled water will use less
 *robotic milk usage varies by brand

ADDITIONAL STORAGE REQUIREMENTS

OUTSIDE LOTS, RAINFALL

For every 100 square feet of outside area that will drain into storage, **add 62 gallons or 3890 pounds per inch of rainfall**

Example: 50 x 100 foot lot with a 3 inch rain

50 feet x 100 feet x 3 inches x 62 gallons per inch of rain per 100 square feet = 9,300 gallons

UNCOVERED STORAGE, RAINFALL

For every 100 square feet of uncovered manure storage, **add 62 gallons or 3890 pounds per inch of rainfall.**

SPRINKLER SYSTEMS

For sprinkler systems, add 1/3 gallon of water per cow per cycle multiplied by cycles per hour and hours used.

Example: 100 cows with a system cycling 5 times an hour for 2 weeks.

100 cows x 0.33gallons x 5 cycles per hour x 24 hours x 14 days = 55440 gallons of water added to storage.

ISU Extension and Outreach DAIRY DECISION TOOL

FACILITY and EQUIPMENT VALUE CALCULATOR

1220 Cows

Manure Storage Structure	Value (1)	% Use (2)	Dairy Allocation (3)
Earthen Lagoon/Runoff Structure	\$1,500,000	100%	\$1,500,000
Formed Concrete Structure	\$50,000	100%	\$50,000
Settling Basin/Collection Pit	\$50,000	100%	\$50,000
Dry/Stacking Pad	\$0	100%	\$0
Other	\$0	100%	\$0
Total	\$1,600,000	100%	\$1,600,000
Value/Cow			\$1,311

This portion is for movement of manure into storage structure

Manure Storage Equipment	Value (1)	% Use (2)	Dairy Allocation (3)
Scraper System (Auto)	\$25,000	0%	\$0
Skid Steer/Loader Tractor	\$20,000	100%	\$20,000
Skid Steer/Loader Attachment	\$3,500	100%	\$3,500
Flush Flume Equipment	\$18,000	100%	\$18,000
Transfer Pump	\$7,000	100%	\$7,000
Other	\$0	100%	\$0
Other	\$0	100%	\$0
Other	\$0	100%	\$0
Total	\$73,500	66%	\$48,500
Value/Cow			\$40

Total Manure Storage Investment	\$1,673,500	99%	\$1,648,500
Value/Cow			\$1,351

This portion is for movement of manure from storage/bedded pack/tie-stall barn to field

Manure Handling/Application Equipment	Value (1)	% Use (2)	Dairy Allocation (3)
Tractor	\$45,000	25%	\$11,250
Tractor	\$90,000	25%	\$22,500
Pit Agitator	\$40,000	100%	\$40,000
Manure Spreader, Dry	\$14,000	100%	\$14,000
Manure Spreader, Tank	\$60,000	100%	\$60,000
Injection Equipment	\$15,000	100%	\$15,000
Drag Line	\$126,720	80%	\$101,376
Pump	\$17,000	100%	\$17,000
Incorporation Equipment	\$0	100%	\$0
Skid Steer	\$0	100%	\$0
Other--Transfer Pumps	\$20,000	100%	\$20,000
Total Manure Handling/Equipment Investment	\$427,720	70%	\$301,126
Value/Cow			\$247

Economics of Manure Handling

Iowa State University Extension and Outreach

Kristen Schulte, Farm and Agribusiness Management Specialist; Larry Tranel, Dairy Specialist

Greg Brenneman and Dan Huyser, Agricultural Engineers, ISU Extension and Outreach

Herd and Financial Assumptions

Herd Size		no. cows	Enter herd size, lactating and dry
Milk Production Per Cow Annually		per Cow	Annual Rolling Herd Average
		Tons Solid 1,000 Gallons	
Tons of Manure Produced Annually Per Farm			Annual for Farm, see Manure Calculator
Labor Rate for Handling/Hauling Manure		\$ per hour	Typical rate is \$10 - \$18 with benefits

Manure Storage Costs (from barn to storage)

Manure Storage Structure Investment		total	Investment in storage structure & equip
Manure Storage/Handling Equipment Investment		total	see Investment Calculator cells E12 & 24
Structure Depreciation	years		Between 11 and 40 years
Equipment Depreciation	years		Between 5 and 10 years
Interest	%		Based upon interest rate
Repairs	%		Typical rate is 2% of investment cost
Taxes	%		Typical rate is 1% of investment cost
Insurance	%		Typical rate is 0.5% of investment cost
Annual Operating Expenses (fuel, supplies, etc.)		per Year	Include non-fixed expenses and misc
Labor Hours for Manure Storage		hours, annual	Include time for handling manure (barn scraping, maintenance, etc.)

Manure Handling and Applying Costs (from storage/bedded pack/tie-stall barn to field)

Equipment Investment for Handling and Applying		total	See Investment Calculator cell E42
Depreciation	years		Between 5 and 10 years
Interest	%		Based upon interest rate
Repairs	%		Typical rate is 2% of investment cost
Taxes	%		Typical rate is 1% of investment cost
Insurance	%		Typical rate is 0.5% of investment cost
Annual Operating Expenses (fuel, supplies, etc.)		per Year	Include non-fixed expenses and misc
Labor for Manure Handling		hours, annual	Including time for all processes to get the manure out of storage and to field
Custom Manure Handling Costs		per Year	ISU Custom Rate Survey for related cost

Value of Nutrients in Manure to be Credited

Nutrients Per Unit*	1 Ton Solid	1,000 Gal Liquid	Dollar Value/Pound	
Nitrogen	12	25	\$0.45	Use manure nutrient values based on test results or book values. Value per pound is based on local fertilizer rates
Phosphorus	6	12	\$0.55	
Potassium	12	20	\$0.43	

*Numbers are estimates-use actual manure analysis if possible

Nutrient Valuation of Application per Acre

		Tons Solid 1,000 Gal	
Values of Manure Applied per acre are max rates ----->	Manure Applied per Acre	15	6

The authors have used their best judgement and shall not be liable for any use of this software decision-making aid.