

Economics of Dairy Manure Management in Iowa

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Summary and Implications

Dairy producers have many duties to carry out in their dairy operations, one of which is storing, handling and applying manure. Manure handling can be a significant cost on most dairies even when considering the value of the nutrients in the manure. Seldom do producers consider their costs of handling and applying manure on a per hundredweight (cwt) of milk sold basis like they do with many of their other costs.

This project encompassed surveys of manure management systems and nutrient management practices on 22 Iowa Dairy Farms, including economic costs and returns. Key findings are that the cost of storing, hauling and applying manure averaged \$306.13 per cow or \$1.33 per / cwt. If we subtract the nutrient value of the manure applied (using book values and assuming perfect utilization) the net cost of storing, hauling and applying manure averaged \$104.10 per cow or \$0.45 per / cwt. The tie stall barns had a cumulative cost per cwt. of \$1.42; the mattress/waterbed barns had a cumulative cost per cwt. of \$1.50; the 2 stage sand systems had a cumulative cost per cwt. of \$0.97; the 1 stage sand systems had a cumulative cost per cwt. of \$1.44; and the dried manure solid barns had a cumulative cost per cwt. of \$1.24.

Introduction

The 2012 Iowa Dairy Survey showed 46% of producers planned to upgrade nutrient storage, with ½ of these doing it within 5 years. After recent DNR-EPA inspection announcements, discussions have shown many producers were seeking proactive on-farm assessment tools and strategies. The ISU Dairy Team embarked on a long term educational project to assist dairy producers better assess manure management options for handling, storing, and applying dairy manure. This initial part was to develop, validate, and then conduct surveys on Iowa dairy farms to categorize and characterize different farm systems and practices as well as assess economic costs and returns.

Programmatic Response

Iowa State University Extension & Outreach Dairy team developed an "Economics of Manure Management" spreadsheet tool to determine cost of handling, storing and applying manure, less the cost of the nutrients gained in the manure. ISU Extension and Outreach surveyed 22 dairy

producers in Eastern Iowa to compile cost data and help producers understand their cost for handling, storing and applying manure. The farms ranged from tie-stall barns to freestall barns with sand, dried manure solids, mattresses, and waterbeds utilizing a single or 2 stage manure system. Thus, a wide range of systems were part of the data. The whole of the data on the following page was averaged in the first two columns but it was also compiled into five separate groups named above but with the mattress and waterbed farms combined into one.

Result and Discussion

The average farm in the study milked 188 cows with an annual production per cow of 23,578. The farms produced and applied 7 thousand gallons of liquid manure per cow and 10.35 tons of solid manure per cow. Costs of handling manure were broken into two groups. The first group of costs were those incurred in handling manure from the time the cow dropped it until the time the manure was in storage. The second group of costs were those incurred in getting the manure from storage and applied in the field.

For group one costs, the average farm had \$364.79 invested in manure storage per cow and \$147.45 in storage and handling equipment. Structure and equipment depreciation combined for a cost of \$35.65 per cow with interest adding \$25.61 per cow. Repairs, taxes and insurance (most just used common percent values) equaled \$15.22 per cow and other expenses such as fuel and supplies added another \$11.89 per cow. Labor hours per cow averaged 2.18 hours or \$32.13 per cow annually. So, the total group one costs for getting the manure into storage was \$120.50 per cow or \$0.53 per cwt.

Group two costs included costs associated with getting the manure from storage to application. This phase had equipment values of \$452.67 per cow. Depreciation of this investment value equated to \$64.67 per cow with interest adding another \$22.63 per cow. Repairs, taxes and insurance combined added \$15.84 per cow. Other expenses added \$16.11. Labor hours average 1.85 per cow or \$27.30 per cow annually. Custom Handling costs added another \$39.08 per cow to this group. So, the total group costs for getting the manure from storage through to application was \$185.63 per cow or \$0.80 per cwt.

As these 22 farms are broken down into five groups based on type of manure storage or handling system, the representative sample is too small to fairly compare one system relative to another. With a high risk of error in mind, the bottom line was that the manure solids group had the lowest costs (only used costs for getting manure to separator as separator costs were attached to the bedding system costs). This may or may not be an unfair advantage. The dried manure solids system had a cost of \$242.39 per cow before nutrient value considered. The costs of the two

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stage sand system was similar at \$257.01 per cow. The other systems all cost over \$300 per cow.

As producers consider using this data to make farm management decisions, also realize the wide range of costs even with each system type. For instance, when considering the Net Cost – (minus) Nutrient Value/cow in the 1 Stage Sand System Ranges column, notice the difference of -\$101.02 to \$296.94 equating to a \$397.96 per cow difference in costs. Also, note that there were four farms in the tie stall group; five farms in the mattress/waterbed group; five farms in the 2 stage sand group; 6 farms in the 1 stage sand group; and only 2 farms in the dried manure solids group.

Summary

Key findings are that the cost of storing, hauling and applying manure averaged \$306.13 per cow or \$1.33 per hundredweight. If we subtract the nutrient value of the manure applied (using book values and assuming perfect utilization) the net cost of storing, hauling and applying manure averaged \$104.10 per cow or \$0.45 per hundredweight. The tie stall barns had a cumulative cost per cwt. of \$1.42; the mattress/waterbed barns had a

cumulative cost per cwt. of \$1.50; the 2 stage sand systems had a cumulative cost per cwt. of \$0.97; the 1 stage sand systems had a cumulative cost per cwt. of \$1.44; and the dried manure solid barns had a cumulative cost per cwt. of \$1.24. As producers consider using this data to make farm management decisions, also realize the wide range of costs even with each system type.

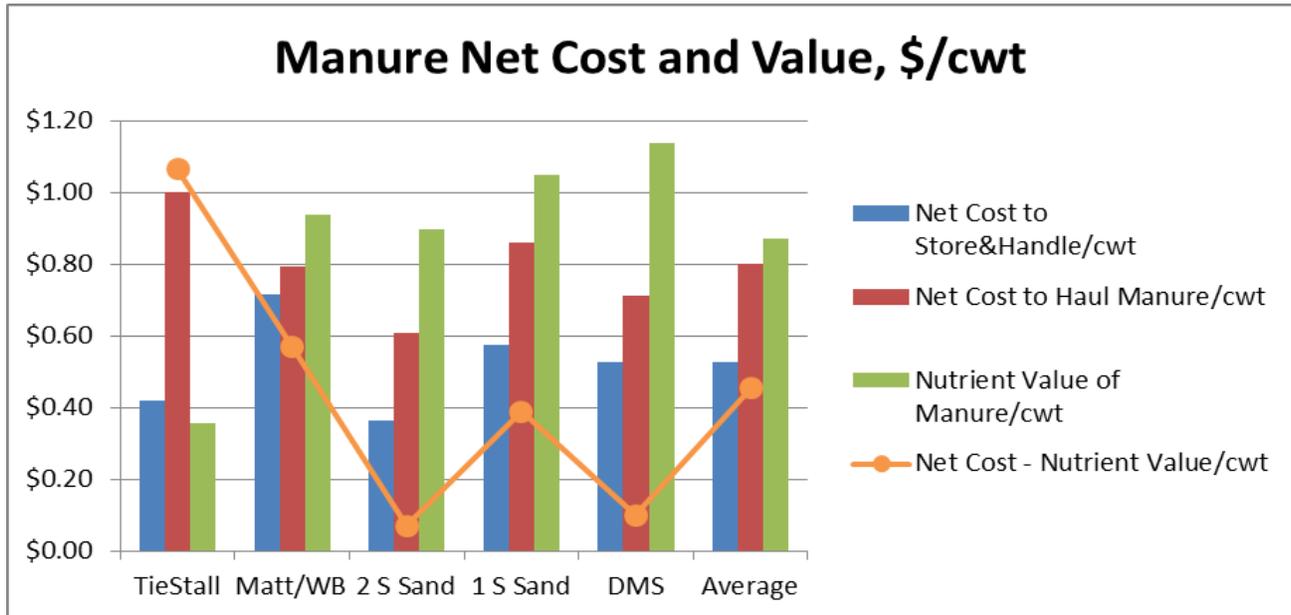
There are many significant costs incurred in storing, handling and applying manure. Producers are encouraged to understand their manure handling costs and how it affects their costs of production. This survey may be used as a general guide but with caution due to the low numbers of producers in each group.

For more information on manure, nutrient management, and other dairy concerns visit:

www.extension.iastate.edu/dairyteam

Acknowledgements

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	TieStall	Matt/WB	2 S Sand	1 S Sand	DMS	Average
Herd Size, no. cows	94	225	220	168	265	188
Annual Milk Production, pounds/cow	23,688	23,520	26,572	22,252	20,000	23,578

Matt/ WB = mattresses and waterbeds; 2S and 1S sand are 2 stage and 1 stage manure storage; DMS = dried manure solids

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Economics of Manure Handling 2014																	
Iowa State University Extension and Outreach Dairy Team																	
Survey of 22 NE/SE Iowa Farms	Totals Average	Total /cow	Average	Tie Stall Ranges	Average /cow	Average	Mattress/WB Ranges	Average /cow	Average	2 Stage Sand Ranges	Average /cow	Average	1 Stage Sand Ranges	Average /cow	Average	Manure Solids Ranges	Average /cow
Net Cost to Store&Handle/cow	\$120.50		\$98.15	\$64.24-\$117.43		\$161.56	\$66.68-\$239.10		\$95.39	\$76.13-\$126.55		\$127.28	\$76.61-\$230.86		\$104.96	\$97.96-\$111.95	
Net Cost to Haul Manure/cow	\$185.63		\$227.95	\$66.07-\$367.63		\$187.94	\$130.99-\$241.77		\$161.63	\$141.97-\$199.51		\$191.57	\$57.70-\$266.00		\$137.43	\$104.14-\$170.72	
Manure Nutrient Value/cow	\$202.03		\$86.38	\$29.90-\$193.65		\$219.84	\$159.70-\$303.84		\$239.31	\$197.61-\$294.64		\$225.15	\$199.93-\$235.43		\$226.22	\$216.99-\$235.45	
Net Cost - Nutrient Value/cow	\$104.10		\$239.72	\$64.32-\$443.59		\$129.67	-\$26.77-\$255.83		\$17.70	\$19.00-\$92.55		\$93.71	-\$101.02-\$296.94		\$16.17	-\$19.36-\$51.69	
Net Cost to Store&Handle/cwt	\$0.53		\$0.42	\$0.26-\$0.53		\$0.71	\$0.25-\$1.27		\$0.36	\$0.26-\$0.49		\$0.58	\$0.26-\$1.05		\$0.53	\$0.51-\$0.54	
Net Cost to Haul Manure/cwt	\$0.80		\$1.00	\$0.26-\$1.67		\$0.79	\$0.73-\$0.97		\$0.61	\$0.53-\$0.69		\$0.86	\$0.34-\$1.32		\$0.71	\$0.47-\$0.95	
Nutrient Value of Manure/cwt	\$0.87		\$0.36	\$0.12-\$0.75		\$0.94	\$0.65-\$1.13		\$0.90	\$0.76-\$1.02		\$1.05	\$0.74-\$1.38		\$1.14	\$1.07-\$1.21	
Net Cost - Nutrient Value/cwt	\$0.45		\$1.07	\$0.25-\$2.02		\$0.57	-\$0.10-\$1.11		\$0.07	-\$0.04-\$0.36		\$0.39	-\$0.59-\$1.35		\$0.10	\$0.09-\$0.29	
Herd Size	188.23		94	70-112		225.00	90-375		220.40	125-400		168.33	100-320		265.00	170-360	
Annual Milk Production/Cow	23,578		23,688	20,000-25,750		23,520	18,000-27,000		26,572	24,860-29,000		22,252	17,000-30,990		20,000	18,000-22,000	
Manure -- Liquid/1,000 gallons	1,453	7.00	209	0-703	1.93	1,802	600-3,000	7.67	1,915	1,278-1,787	8.42	1,384	880-2,586	8.25	2,122	1,444-2800	8.14
Manure -- Solid Tons	1,749	10.35	2,720	2,051-3,625	29.11	1,620	480-2,952	7.63	2,082	0-6,000	7.28	965	0-4,766	4.08	1,650	1,000-2,300	6.14
Manure Handling Labor Rate	\$14.50		\$15.00	\$15.00		\$13.40	\$10-\$15		\$15.00	\$15.00		\$14.50	\$14.50-\$15.00		\$15.00	\$15.00	
Storage Structure Value	\$66,864	\$364.79	\$2,500	\$0-\$10,000	\$25.00	\$142,800	\$64,000-\$365,000	\$735.90	\$39,400	\$38,000-\$50,000	\$210.95	\$75,000	\$10,000-\$165,000	\$454.52	\$50,000	\$40,000-\$60,000	\$232.03
Storage/Handling Equip Value	\$27,040	\$147.45	\$15,175	\$9,200-\$31,500	\$156.03	\$34,580	\$25,000-\$54,000	\$201.28	\$24,725	\$6,250-\$80,000	\$87.01	\$25,108	\$12,000-\$45,000	\$145.76	\$43,500	\$20,000-\$67,000	\$151.88
Structure Depreciation	\$2,675	\$14.59	\$100	\$0-\$400	\$1.00	\$5,712	\$1,600-\$14,600	\$29.44	\$1,576	\$1,200-\$2,000	\$8.44	\$3,000	\$400-\$6,120	\$18.18	\$2,000	\$1,600-\$2,400	\$9.28
Equipment Depreciation	\$3,863	\$21.06	\$2,168	\$1,314-\$4,500	\$22.29	\$4,940	\$1,929-\$7,714	\$28.75	\$3,532	\$893-\$11,429	\$12.43	\$3,587	\$571-\$6,429	\$20.82	\$6,214	\$2,857-\$9,571	\$21.70
Interest	\$4,695	\$25.61	\$884	\$460-\$1,575	\$9.05	\$8,869	\$3,250-\$20,020	\$46.86	\$3,206	\$2,263-\$5,900	\$14.90	\$5,005	\$1,100-\$9,900	\$30.01	\$4,675	\$4,000-\$5,350	\$19.20
Repairs	\$1,792	\$9.29	\$354	\$184-\$630	\$3.62	\$3,168	\$1,300-\$8,008	\$14.52	\$1,283	\$905-\$2,360	\$5.96	\$2,002	\$440-\$3,960	\$12.01	\$1,870	\$1,600-\$2,140	\$7.68
Taxes	\$757	\$3.37	\$152	\$92-\$315	\$1.56	\$1,394	\$0-\$4,004	\$5.15	\$641	\$453-\$1,180	\$2.98	\$668	\$0-\$1,1980	\$3.26	\$935	\$800-\$1,070	\$3.84
Insurance	\$470	\$2.56	\$88	\$46-\$158	\$0.91	\$887	\$325-\$2,002	\$4.69	\$321	\$226-\$590	\$1.49	\$501	\$110-\$990	\$3.00	\$468	\$400-\$535	\$1.92
Other Expenses (fuel, etc.)	\$2,010	\$11.89	\$1,188	\$250-\$2,000	\$14.32	\$1,940	\$1,200-\$2,500	\$10.64	\$2,072	\$1,000-\$3,300	\$10.31	\$1,983	\$500-\$3,000	\$12.33	\$3,750	\$1,500-\$6,000	\$12.75
Labor Hrs for Manure Storage	360.65	2.18	278	183-365	3.03	314	50-265	1.53	501	183-728	2.59	297	100-600	1.91	483	365-600	1.91
Labor Cost for Manure Storage	\$5,269	\$32.13	\$4,170	\$2,745-\$5,475	\$45.40	\$4,255	\$600-\$5,475	\$21.52	\$7,517	\$2,738-\$10,950	\$38.88	\$4,318	\$1,500-\$5,475	\$27.67	\$7,238	\$5,475-\$9,000	\$28.60
Manure Storage Structure Costs	\$21,530	\$120.50	\$9,103	\$6,424-\$13,153	\$98.15	\$31,164	\$18,551-\$59,941	\$161.56	\$20,147	\$10,037-\$30,454	\$95.39	\$21,064	\$7,659-\$37,854	\$127.28	\$27,149	\$19,032-\$35,266	\$104.96
Annual Storage Costs per cwt.	\$0.53		\$0.42	\$0.26-\$0.53		\$0.71	\$0.25-\$1.27		\$0.36	\$0.26-\$0.49		\$0.58	\$0.26-\$1.05		\$0.53	\$0.51-\$0.54	
Equip. Value to Handle&Apply	\$75,420	\$452.67	\$56,188	\$20,000-\$89,000	\$654.01	\$82,090	\$23,500-\$116,800	\$380.61	\$83,635	\$18,675-\$185,000	\$350.80	\$85,646	\$19,000-\$109,200	\$543.76	\$46,000	\$38,000-\$46,000	\$211.60
Depreciation	\$10,774	\$64.67	\$8,027	\$2,857-\$12,714	\$93.43	\$11,727	\$3,357-\$16,686	\$54.37	\$11,948	\$2,668-\$26,429	\$50.11	\$12,235	\$2,714-\$21,286	\$77.68	\$6,571	\$5,429-\$7,714	\$30.23
Interest	\$3,771	\$22.63	\$2,809	\$1,000-\$4,450	\$32.70	\$4,105	\$1,175-\$5,840	\$19.03	\$4,182	\$934-\$9,250	\$17.54	\$4,282	\$950-\$7,450	\$27.19	\$2,300	\$1,900-\$2,700	\$10.58
Repairs	\$1,508	\$9.05	\$1,124	\$400-\$1,550	\$13.08	\$1,642	\$470-\$2,336	\$7.61	\$1,673	\$374-\$3,700	\$7.02	\$1,713	\$380-\$2,980	\$10.88	\$920	\$760-\$1,080	\$4.23
Taxes	\$754	\$4.53	\$562	\$200-\$890	\$6.54	\$821	\$235-\$1,168	\$3.81	\$836	\$187-\$1,850	\$3.51	\$856	\$190-\$1,490	\$5.44	\$460	\$380-\$540	\$2.12
Insurance	\$377	\$2.26	\$281	\$100-\$445	\$3.27	\$410	\$118-\$584	\$1.90	\$418	\$93-\$925	\$1.75	\$428	\$95-\$745	\$2.72	\$230	\$190-\$270	\$1.06
Other Expenses (fuel, etc.)	\$3,286	\$16.11	\$1,675	\$1,000-\$3,500	\$17.23	\$2,300	\$1,500-\$2,500	\$13.25	\$7,679	\$396-\$30,000	\$24.25	\$2,117	\$501-\$3,200	\$13.38	\$1,500	\$0-\$1,500	\$8.82
Labor Hrs to Handle Manure	284.76	1.85	354	70-645	4.11	295	75-365	1.49	304	60-600	1.50	230	30-509	1.25	240	160-320	0.92
Labor Cost to Handle Manure	\$4,183	\$27.30	\$5,306	\$1,050-\$9,675	\$61.69	\$4,177	\$900-\$7,800	\$21.26	\$4,556	\$900-\$7,650	\$22.45	\$3,323	\$450-\$7,635	\$17.96	\$3,600	\$2,400-\$4,800	\$13.73
Custom Handling Costs	\$9,318	\$39.08	\$0	\$0-\$0	\$0.00	\$16,628	\$0-\$30,690	\$66.70	\$6,169	\$0-\$19,346	\$34.99	\$7,167	\$0-\$22,400	\$36.33	\$24,000	\$0-\$48,000	\$66.67
Manure Handling Costs	\$33,972	\$185.63	\$19,784	\$6,607-\$31,054	\$227.95	\$41,810	\$15,655-\$65,279	\$187.94	\$37,461	\$17,746-\$79,804	\$161.63	\$32,121	\$5,779-\$50,517	\$191.57	\$39,581	\$17,704-\$61,459	\$137.43
Equipment Handling Costs/cwt.	\$0.80		\$1.00	\$0.26-\$1.67		\$0.79	\$0.73-\$0.97		\$0.61	\$0.53-\$0.69		\$0.86	\$0.34-\$1.32		\$0.71	\$0.47-\$0.95	
Total Storage & Handling Costs	\$55,501	\$306.13	\$28,887	\$13,031-\$39,711	\$326.10	\$72,974	\$38,638-\$109,062	\$349.50	\$57,609	\$27,783-\$110,257	\$257.01	\$53,185	\$13,441-\$88,371	\$318.86	\$66,731	\$36,736-\$96,725	\$242.39
*Total Nutrient Value--Liquid	\$26,875	\$128.60	\$3,169	\$0-\$10,686	\$29.26	\$33,982	\$10,864-\$56,736	\$144.27	\$35,903	\$19,867-\$75,649	\$157.11	\$25,251	\$16,098-\$45,852	\$151.28	\$38,819	\$26,416-\$51,222	\$148.83
*Total Nutrient Value--Solid	\$14,714	\$73.42	\$5,581	\$2,861-\$11,003	\$57.11	\$17,504	\$6,338-\$28,388	\$75.57	\$19,298	\$9,188-\$42,209	\$82.20	\$12,812	\$7,445-\$27,131	\$73.86	\$20,254	\$13,611-\$26,896	\$77.39
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*Nutrients values, for the most part, were determined using book values for nutrient content with utilization rates determined by ISU Extension publications, assuming appropriate distribution when spread.																	