

Heather Darby¹
 Sarah Flack²
 Sara Ziegler¹

Cost of Production on Grass-fed Dairy Farms in the Northeast

1 University of Vermont, St. Albans, VT
 2 Sarah Flack Consulting, Fairfield, VT

Introduction and Methods

Organic grass-fed dairy production has grown rapidly in the US, expanding by over 400% since 2016. In a grass-fed production system, the ration does not contain any grain or grain byproducts; the nutrient needs of the animals are met with grazed and stored forages. Farms are permitted to supplement these forages with minerals, molasses, and other non-grain derived energy sources. As more dairies consider transitioning to this production system, it is important to understand the costs of producing 100% grass-fed milk.

To establish a cost of production benchmark for grass-fed dairies, financial data were collected on an average of 21 organic grass-fed dairies annually from 2018-2020. Researchers used the Dairy TRANS financial analysis tool to collect data with a standardized method (<https://www.extension.iastate.edu/dairyteam/files/page/files/DairyTRANS44.pdf>).

The Dairy TRANS method includes an unpaid labor charge of \$40,000 per full-time worker (3000 hours), inventory change adjustments (to factor in changes in herd size or equipment inventory and value), and a 4% charge on the farm's assets instead of interest payments. These standardizations allow farms with no debt and farms with significant debt to be more evenly compared. The unpaid labor charge of \$40,000 standardizes owner/worker income allowing for fair comparison between owners who draw an income, and those who rely on off-farm income or another enterprise to cover living expenses. This method also transforms dairy-related non-milk income (i.e., crop sales, calf sales, etc.) into an equivalent number of milk hundredweights which is then added to the milk hundredweights sold, and in total provides the milk hundredweight equivalents (cwt eq.) over which the total expenses are distributed.

Dairy farms from NY, PA, and VT that had been 100% grass-fed for at least 2 years were eligible to participate in the study. Data are presented as an overall average for all farms across all three years and also divided into groups by total cost of production. Three groups were created representing low (<\$45), medium (\$45-\$60), and high (>\$60) production costs on a cwt eq. basis. While the focus of this article is on the cost to produce grass-fed milk, the data collected included information on changes in inventory (herd, equipment, etc.), and asset values so net farm income from operations (NFIFO), return on assets (ROA), and operating profit margin (OPM) could be calculated. These data are reported in Table 1.

Farm Demographics

Participating farms were selling milk to Organic Valley (48.4%), Maple Hill Creamery, (48.4%), or other local markets (3.1%). The herd size ranged from 32 to 220 milking cows with an average of 61 cows per farm. Farms were managing an average of 338 acres resulting in 5.66 acres available per mature cow (Figure 1).

Herds were mainly composed of crossbreeds, however there were farms milking pure-bred Holstein, jersey, and other breeds which differ in milk and fat production. While most farms milked year-round, there were some fully seasonal herds (30%) and herds milking once per day or three times every two days (17%).

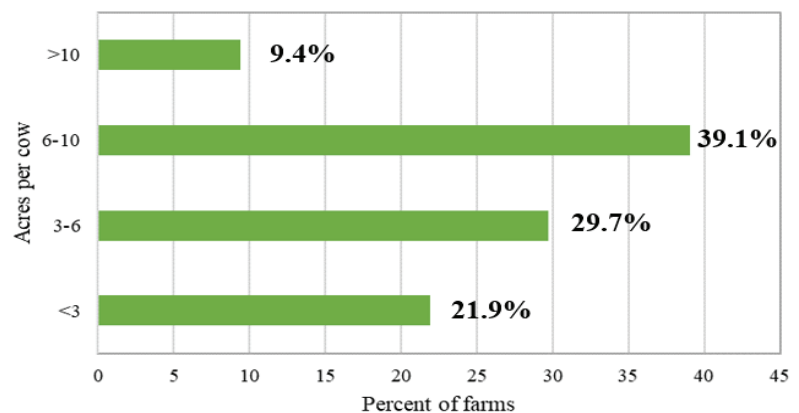


Figure 1. Distribution of acres per cow for participating farms

Income and Expenses

Farm production practices and management varied widely among the farms and for obvious reasons this influenced farm income and expenses. Farms shipped an average of 525,211 lbs of milk per year (Table 1). Milk production averaged 8,784 lbs per cow per year, but the range spanned from 4,484 to 14,990 lbs per cow per year. The average pay price that farms received for their milk was \$38.43 but ranged from \$29.13 to \$46.18 per cwt of milk sold. There were several different milk buyers which pay different

Table 1. Average farm summary statistics by total cost group 2018-2020.

	< \$45 per cwt eq. Average (n = 26)	\$45-\$60 per cwt eq. Average (n = 22)	>\$60 per cwt eq. Average (n = 16)	Average (n= 64)
Farm Information				
Herd size	76	50	51	61
Acres	356	278	393	338
Acres per cow	4.79	5.34	7.53	5.66
Fertilizer & seed expenses (\$/cow)	\$129	\$100	\$129	\$119
Fertilizer & seed expenses (\$/acre)	\$35	\$24	\$21	\$27
Purchased feed expenses (\$/cow)	\$570	\$408	\$370	\$464
Purchased feed expenses (\$/acre)	\$194	\$140	\$56	\$141
Milk Information				
Total milk sold (lbs/year)	718,155	410,388	369,559	525,211
Milk per cow (lbs/cow)	10,065	8,307	7,357	8,784
Milk per acre (lbs/acre)	2,816	2,111	1,047	2,131
Fat per cow (lbs/cow)	423	379	297	374
Fat per acre (lbs/acre)	123	91	46	91
Labor efficiency				
Full time equivalents (FTEs)	2.3	2.4	2.6	2.4
Cows per FTE	34	22	22	27
Milk sold per FTE (CWT eq.)	3,702	2,108	1,757	2,668
Hired labor (\$/CWT eq.)	\$2.02	\$1.88	\$2.95	\$2.21
Unpaid labor (hours)	5,375	6,610	7,334	6,289
Unpaid labor (\$/CWT eq.)	\$10.13	\$19.01	\$24.17	\$16.69
Return to labor	\$68,294	\$19,768	-\$11,633	\$31,631
Labor earnings (\$/hr)	\$12.84	\$3.41	-\$0.50	\$6.27
Farm Income				
Milk price (\$/CWT)	\$38.06	\$38.17	\$39.39	\$38.43
Gross milk income	\$270,037	\$155,693	\$145,237	\$199,531
Gross cull, calf, & livestock sales	\$13,332	\$4,973	\$5,525	\$8,507
Gross crop sales	\$643	\$1,637	\$3,366	\$1,666
Other income*	\$16,784	\$12,888	\$22,491	\$16,871
Total gross income	\$300,796	\$175,192	\$176,618	\$226,575
Net				
Net cash income (NCI)	\$105,549	\$57,929	\$49,867	\$75,259
Inventory change	\$1,912	-\$8,862	-\$23,185	-\$8,066
Net farm income from operations (NFIFO)	\$107,461	\$49,067	\$26,682	\$67,193
4% equity	\$39,167	\$29,299	\$38,315	\$35,562
Rate of return on assets (ROA)	9.8%	0.4%	-3.8%	3.2%
Operating profit margin (OPM)	21.5%	1.1%	-16.1%	5.1%
Asset turnover ratio (ATR)	43.9%	29.0%	20.6%	32.9%
Time period (years)	2.8	3.8	5.5	3.9
Dairy TRANS total expense (\$/CWT eq.)	\$38.13	\$52.05	\$66.29	\$49.95

*COVID-19 related grant funds were not included in the data, however, other government dairy program income was included in other income

premiums and base rates, and it is important to note that some of the farms included were not receiving a grass-fed premium and therefore were receiving a lower price per cwt. Gross farm income averaged \$226,575 from milk sales plus an additional \$27,044 of other income (i.e., calf sales, crop sales, beef and other income.). Note that COVID-19 related grant funds were not included in the data, however, other government dairy program income was included in the other income category.

Average total cost per cwt eq. across all farms and years was \$49.95, and the average pay price per cwt of milk sold was \$38.43. The additional non-milk income per farm (\$27,044 per year per farm on average) may be due to farmers trying to diversify their income with other enterprises which can subsidize the dairy business. The lowest cost group, representing approximately 40% of farms, had a total cost cwt eq. of \$38.13, slightly below the average pay price of \$38.43. The other two groups, constituting the remaining 60% of farms had a total cost of production which exceeded the average pay price.

Looking at some of the expenses in more detail, cash expenses ranged widely across farms (Table 2). Note that in Dairy TRANS interest expense is not included in the cash expenses. The largest cash expense on farms was purchased feed (forages, minerals, and energy supplements) which accounted for 18.9% of cash expenses. To better understand feed costs, forages, minerals, and energy supplements were collected separately in 2019 and 2020. In these years, purchased forages alone accounted for 12.8% of cash expenses. Other major expenses across all years included repairs, supplies, and other expenses. In 2018, other expenses included stop and hauling charges which can be significant on some farms and therefore was separated out in 2019 and 2020.

Table 2. Average of cash expenses (\$/cwt eq.) by total cost group

	Low cost < \$45 per cwt eq.	Medium cost \$45-\$60 per cwt eq.	High cost >\$60 per cwt eq.	All
Breeding fees*	\$0.15	\$0.23	\$0.25	\$0.20
Custom hire				
Machine rentals	\$3.07	\$1.96	\$2.77	\$2.62
Land rentals				
Supplies	\$2.16	\$2.63	\$4.02	\$2.79
Farm insurance	\$0.47	\$0.78	\$1.29	\$0.78
Fuel, gas and oil	\$1.22	\$1.43	\$1.87	\$1.45
Hired labor	\$2.02	\$1.88	\$2.95	\$2.21
Property taxes	\$0.81	\$1.06	\$1.82	\$1.15
Purchased forage				
Minerals	\$4.98	\$4.46	\$4.43	\$4.67
Energy supplements				
Repairs	\$1.86	\$3.09	\$4.09	\$2.84
Seed & fertilizer	\$1.16	\$1.07	\$1.57	\$1.23
Utilities	\$0.75	\$1.10	\$1.26	\$1.00
Veterinary & medicine	\$0.28	\$0.49	\$0.45	\$0.39
Stop & hauling	\$2.76	\$4.25	\$4.10	\$3.61
Other				
Total cash expense (\$/CWTEq.)**	\$21.97	\$24.93	\$31.30	\$25.32
Total cash expense (\$/cow)	\$2,525	\$2,382	\$2,571	\$2,488
Total cash expense (\$/farm)	\$195,247	\$117,263	\$126,752	\$151,316
Total expense (\$/CWT eq.)***	\$38.13	\$52.05	\$66.29	\$49.95

*Costs and cost groups expressed on a \$/CWT eq. basis adjusted for additional non-milk income.

**As calculated in Dairy TRANS; interest expenses are not included

***includes 4% equity and \$40,000 per person unpaid labor expenses

Acreage ranged from 1.7 to 10.34 acres per mature cow, with some farms purchasing a significant portion of their forages, while other farms produced all their own feed and even sold hay. Interestingly, some of the lowest expense categories included breeding fees and veterinary expenses which accounted for 0.77% and 1.5% of cash expenses respectively. Grass-fed farms have been anecdotally noting that they experience fewer health concerns and therefore fewer veterinary visits. These data support these claims. Many farms in the study had a significant amount of (unpaid) family labor, contributing to the lower average cash expense for hired labor.

Labor

The average number of full time equivalent (FTE) workers operating a farm was 2.4. One FTE is defined as 3,000 labor hours per year and includes both paid and unpaid labor. Therefore, the average number of cows managed by 1 FTE was 27. This metric had an enormous range from 15 to 66 cows per FTE, indicating large differences in labor efficiency. However, we must also consider milk production to better understand the economic implication of these labor differences. The average milk sold per FTE was 2,668 cwt eq./FTE with a range from 984 to 6,520 cwt eq./FTE. As grass-fed dairy farms work to find ways to be financially sustainable, labor efficiency is clearly one of the areas that will benefit from additional focus.

Farm Financial Health Metrics

The Net Cash Income (NCI) is the farm’s total gross income minus the farm’s total cash expenses. Dairy TRANS does not include the farm’s interest expense in NCI, instead it uses a 4% equity charge on assets in the calculation of total cost. The calculation of NCI also does not include adjustments for inventory change, principal payments on loans, or unpaid labor (family living expense). Assigning a 4% equity charge and assigning \$40,000 per FTE of unpaid labor allows farms’ total cost of production to be compared on a more level playing field. Hence, farms that have high debt load, farms that don’t pay themselves at all, and farms that pay themselves a larger amount can all be compared.

Net Farm Income from Operations (NFIFO) is the farm’s NCI plus inventory change, depreciation, and other capital adjustments. So, this calculation includes changes in numbers and value of feed, livestock, machinery, equipment, accounts payable and receivable, and real estate from the beginning to the end of the year. The average NFIFO was \$67,193 but ranged from -\$56,531 to \$185,177. For easier interpretation, this value can be looked at per cwt of milk sold. In doing so the average NFIFO was \$11.16 per cwt eq. and ranged from -\$9.82 to \$23.96 per cwt eq. The NFIFO is not farm profit; it is just what is left over after cash expenses and inventory changes to pay the opportunity costs of unpaid family labor and unpaid equity.

Return on Assets averaged 3.2%, however it ranged from -3.8% in the high-cost group to 9.81% in the low-cost group. This indicates that on average grass-fed dairy farms are generating 3.2 cents of profit on every dollar of assets on the farm. Operating Profit Margin (OPM) averaged 5.1% but ranged from -16.1% in the high-cost group to 21.5% in the low-cost group. The OPM is the percentage of profit generated from every dollar of output prior to paying interest and equity costs. This means on average grass-fed dairies are generating 5.1 cents of profit on every dollar of output before interest and equity payments are made. However, in both ROA and OPM calculations here, it is important to remember that the total cost calculation used does not reflect the farm's actual family living expense or interest but instead uses the standardized \$40,000 per operator and 4% equity charge.

Next Steps

This report provides only a snapshot of some of the data on cost of production from a small group of grass-fed organic dairy farms in the Northeast. Data will also be collected for additional years and may be expanded to include additional grass-fed farms. Additional analyses will be conducted to investigate how production practices and management systems correlate to costs and financial sustainability.

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For the purposes of this publication, grass-fed dairy is defined as dairy production in which the ration does not contain any grain or grain byproducts. Nutrient needs on these farms are met with grazed and stored forages.