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

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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 22 organic grass-fed dairies annually from 2018-2020 using Dairy TRANS, a dairy financial analysis tool (https://www.extension.iastate.edu/-dairyteam/files/page/files/DairyTRANS44.pdf). Dairy farms from NH, 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 as calculated in Dairy TRANS. The Dairy TRANS method includes unpaid labor at $40,000 per person, inventory change (to factor in change in herd size or equipment inventory and value), and a standardized 4% equity cost instead of depreciation and loan interest payments. This standardization allows farms with no debt or farms with significant debt to be compared on a more level playing field. Three groups were created representing low (<$38), medium ($38-$45), and high (>$45) production costs on a hundredweight equivalent (cwt eq.) basis. This method transforms additional non-milk income (i.e. crops, calves, etc.) into the equivalent number of milk hundredweights which is then added to the acual hundredweights of milk sold. 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 are reported at the bottom of Table 1.

Farm Demographics

Participating farms were selling milk to Organic Valley (50.0%), Maple Hill Creamery, (47.0%), or other local markets (3.0%). The herd size ranged from 23 to 200 milking cows with an average of 62 cows per farm. Farms were managing an average of 336 acres resulting in 5.56 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 (32%) and herds milking once per day or three times in two days (17%).

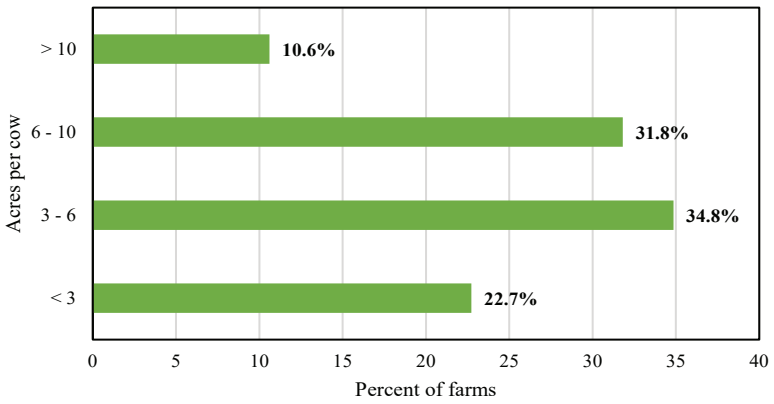

Figure 1. Distribution of acres per cow for participating farms

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 513,950 lbs of milk per year (Table 1). Milk production averaged 8,360 lbs per cow per year, but the range spanned from 4,041 to 14,990 lbs per cow per year. The average pay price that farms received for their milk was $38.34 but ranged from $29.13 to $46.18 per cwt of milk sold. There were several different milk buyers which pay different 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 $195,140 from milk sales plus an additional $26,950

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

	Low cost < $38 per cwt eq. Average (n = 22)	Medium cost $38-$45 per cwt eq. Average (n = 20)	High cost >$45 per cwt eq. Average (n = 24)	All Average (n= 66)
Farm Information				
Herd size	70	72	46	62
Acres	325	400	294	336
Acres per cow	4.50	5.65	6.46	5.56
Fertilizer & seed expenses ($/cow)	$123	$86	$136	$116
Fertilizer & seed expenses ($/acre)	$36	$22	$23	$27
Purchased forage expenses ($/cow)	$457	$259	$239	$315
Purchased forage expenses ($/acre)	$182	$84	$54	$103
Milk Information				
Total milk sold (lbs/year)	667,275	544,706	347,772	513,950
Milk per cow (lbs/cow)	9,945	7,662	7,490	8,360
Milk per acre (lbs/acre)	2,981	1,996	1,335	2,084
Fat per cow (lbs/cow)	441	315	353	372
Fat per acre (lbs/acre)	134	71	67	90
Labor efficiency				
Full time equivalents (FTEs)	2.54	2.52	2.11	2.38
Cows per FTE	30	30	24	28
Milk sold per FTE (CWT eq.)	3419	2529	1978	2625
Hired labor ($/CWT eq.)	$1.81	$1.88	$2.69	$2.15
Unpaid labor (hours)	6,387	6,580	5,910	6,272
Unpaid labor ($/CWT eq.)	$6.52	$8.34	$13.10	$9.47
Return to labor	$75,073	$25,470	-$9,041	$29,455
Labor earnings ($/hr)	$12.21	$7.73	$0.05	$6.11
Farm Income				
Milk price ($/CWT)	$37.45	$37.88	$39.54	$38.34
Gross milk income	$247,652	$205,318	$138,523	$195,140
Gross cull, calf, & livestock sales	$8,807	$12,294	$4,867	$8,431
Gross crop sales	$670	$1,465	$3,032	$1,770
Other income*	$20,722	$14,726	$14,794	$16,749
Total gross income	$277,850	$233,803	$161,216	$222,090
Net				
Net cash income (NCI)	$107,716	$81,155	$34,837	$73,166
Inventory change	$6,617	-$15,619	-$16,212	-$8,423
Net farm income from operations (NFIFO)	$114,333	$65,537	$18,625	$64,743
4% equity	$39,260	$40,067	$27,666	$35,289
Rate of return on assets (ROA)	11.02%	1.89%	-3.92%	2.82%
Operating profit margin (OPM)	25.22%	7.56%	-22.16%	2.64%
Asset turnover ratio (ATR)	46.17%	27.07%	23.89%	32.28%
Time period (years)	2.82	4.44	4.79	4.06
Dairy TRANS total expense ($/CWT eq.)	$32.97	$41.06	$55.42	$43.59

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

of other income (i.e., cow sales, crop sales, maple syrup, beef). 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 $43.59, and the average pay price per cwt of milk sold was $38.34. The additional non-milk income per farm ($26,950 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 1/3 of farms, had a total cost cwt eq. of $32.97, below the average pay price of $38.34. The other two groups, constituting the remaining 2/3 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). The largest expense on farms was purchased feed (forages, minerals, and energy supplements) which accounted for 18.1% 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 14.8% of cash expenses. Other major expenses across all years included supplies, repairs, and other expenses. Acreage ranged from 1.7 to 11.7 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 0.78% and 1.52% of cash expenses respectively.

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

	Low cost < $38 per cwt eq.	Medium cost $38-$45 per cwt eq.	High cost >$45 per cwt eq.	All
Breeding fees*	$0.15	$0.11	$0.31	$0.20
Custom hire **Machine rentals** **Land rentals**	$2.69	$2.01	$2.87	$2.55
Supplies	$2.65	$2.86	$5.05	$3.59
Farm insurance	$0.45	$0.82	$1.26	$0.86
Fuel, gas and oil	$1.15	$1.68	$2.00	$1.62
Hired labor	$1.81	$1.88	$2.69	$2.15
Property taxes	$0.85	$1.05	$1.71	$1.22
Purchased forage **Minerals** **Energy supplements**	$4.57	$4.87	$4.51	$4.64
Repairs	$1.69	$3.00	$3.82	$2.86
Seed & fertilizer	$1.06	$1.00	$1.66	$1.26
Utilities	$0.75	$0.87	$1.39	$1.02
Veterinary & medicine	$0.25	$0.29	$0.60	$0.39
Stop & hauling **Other**	$2.03	$3.05	$3.62	$2.91
Total cash expense ($/CWTeq.)**	$20.43	$23.50	$32.23	$25.65
Total cash expense ($/cow)	$2,407	$2,045	$2,708	$2,407
Total cash expense ($/farm)	$170,134	$152,648	$126,379	$148,924
Total expense ($/CWT eq.)***	$32.97	$41.06	$55.42	$43.59

*Costs and cost grouips 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

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 hired labor cost.

Labor

The average number of full time equivalent (FTE) employees operating a farm was 2.37. A 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 27.6. This metric had an enormous range from 9.70 to 66.1 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 2,625 cwt eq. with a range from 719 to 6,520 cwt eq. 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 themseleves 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 $64,743 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 $10.60 and ranged from -$15.24 to $29.90 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 2.82%, however it ranged from -3.92% in the high-cost group to 11.02% in the low-cost group. This indicates that on average grass-fed dairy farms are generating 2.82 cents of profit on every dollar of assets on the farm. Operating Profit Margin (OPM) averaged 2.64% but ranged from -22.16% in the high-cost group to 25.22% 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 2.64 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 the next tax year (2021) 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.