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Gary Anderson

George Criner

Anthony Davis

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Richard Kersbergen

Gary Anderson

George Criner

Anthony Davis

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Richard Kersbergen
Extension Professor, University of Maine Cooperative Extension

Dr. Gary Anderson
Associate Extension Professor, University of Maine Cooperative Extension

Dr. George Criner
Director & Professor, School of Economics

Anthony Davis
Graduate Student, School of Economics

College of Natural Sciences, Forestry & Agriculture
5782 Winslow Hall
University of Maine
Orono, ME 04469-5782

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Cover photo by Edwin Remsberg.

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INTRODUCTION

The dairy industry in Maine contributes more than \$570 million dollars annually to the state's economy and generates more than \$25 million dollars to state and municipal government taxes each year. Maine dairy farms that sell to the wholesale market range in size from 10 to 1,700 milking cows, and they control 700,000 acres of fields, pastures, cropland, and small woodlots. These open spaces are important to tourism, one of the state's largest industries. In particular, these farms contribute significantly to the integrated economy of recreation, including such activities as hunting, fishing, hiking, and snowmobiling. Additionally, the Maine dairy industry supports more than 4,000 industry-related jobs, such as grain dealers, equipment dealers, animal health professionals, milk processors, and other specialists (Governor's Task Force 2009). In 2010, dairy products accounted for nearly \$108.5 million in farm receipts or about 18% of Maine's total farm receipts (USDA ERS 2011a).

In 1985, there were approximately 1,000 commercial dairy farms in Maine; by 2010, there were only 315. During this period, many farmers left the industry due to economic and other forces. This decline also appears to be a result of the aging of the farming population coupled with low numbers of incoming farmers. Interestingly, the volume of milk produced in the state has remained relatively constant throughout these changes in farm numbers, reflecting an increase in production per cow and movement of the best cows from farms going out of business to those still in business (i.e., while farm numbers went down, the production of the remaining farms went up). Since the dairy industry is integrally related to many other industries and is important to rural and urban communities statewide, it represents a critical component to the overall economic health of the region.

Historically, there has been a cyclical pattern of dairy prices characterized as "boom and bust" (Figure 1) for U.S. average milk prices received by farmers. This national pattern, which was mirrored in Maine, contributes to diminished financial stability for Maine dairy farms.

In 2002 and 2003, average milk prices were historically low, followed by significantly high prices in 2004 and 2005. In 2006 and 2009, prices again dropped to new low levels. These large price swings are generally not observed in most goods-and-services markets, and the fluctuations pose an economic hardship on producers.

In 2004, the state responded to the large milk price fluctuations by implementing the Dairy Stabilization Program, or "Tier Program," which was designed to provide stability to the industry by establishing a safety net during periods of low milk prices (LD 1945). According to Maine Revised Statutes, Title 7, Section 3153-B, if the market price of milk falls below the cost of production, supplemental payments must be made to dairy farms to reduce losses and improve financial stability. Payments are based on the differential between the base price and the target price specific to the tier or cumulative production (in terms of pounds of milk) of the farm. Dairy producers, farm-equipment businesses, other industries associated with agriculture, and milk processors benefit from such price supports because they offer Maine dairy farmers a price based on costs along with a predictable return for their production. The Tier Program established price supports at increasing levels of production, or tiers, under the assumption that low levels of milk production are more costly than higher levels (on a per cwt basis).

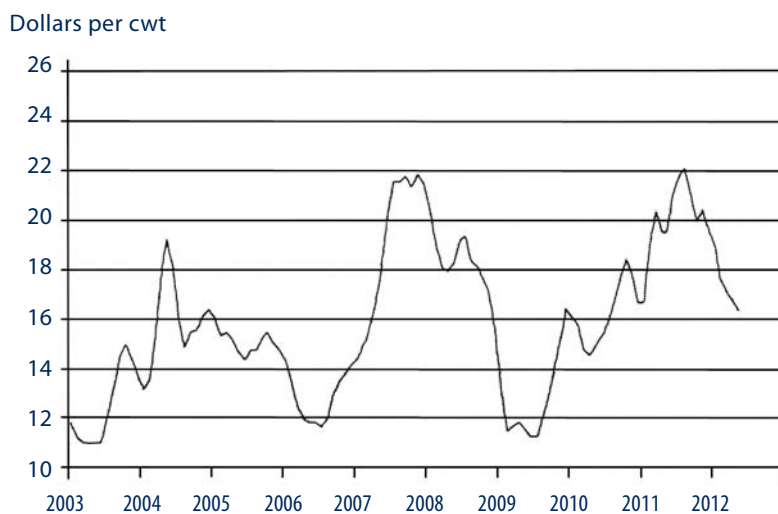


Figure 1. Prices received for milk by month—United States.

Source: USDA-NASS 8/31/2012 www.nass.usda.gov/Charts_and_Maps/Agricultural_Prices/pricemk.asp

The Maine Tier Program bases target prices on the short-run break-even cost of milk production (SRBE). The SRBE includes out-of-pocket milk-production expenses such as costs of grain, mineral supplements, fuel costs, labor inputs (including a return for unpaid family labor and management), taxes paid, equipment repairs, and other direct expenses. The SRBE does not include depreciation of equipment or other costs associated with long-term expenses. As such, it provides a level of price support that allows for the continuation of operations only in the short term.

When the program started in 2004, there were 381 dairy farms in Maine producing milk. From 2004 to 2007, the Tier Program paid dairy farmers \$13.9 million. In July 2007, the target prices and tier levels were changed to reflect a higher cost of production. From 2007 to 2009, the Tier Program has paid \$30 million to Maine dairy farmers. Evidence suggests that Maine's Tier Program has helped save farms, given the larger percentage losses in our neighboring states. Table 1 compares the loss of dairy farms in Maine, Vermont, and New Hampshire during the period from 2004 to 2010. New Hampshire and Vermont lost significantly more dairy farmers than Maine (Drake 2011).

Table 1. Number of dairy farms in northern New England.

State	2004	2010	% loss
Maine	381	306	-19
Vermont	1460	700	-52
New Hampshire	241	130	-46

Source: Drake 2011.

In 2009, the Maine Department of Agriculture assembled a task force to address the sustainability of Maine's dairy industry. The task force examined current problems confronting the dairy industry and developed recommendations to address vulnerabilities associated with economic forces originating from both within and outside the state. The task force also assessed the viability of the Tier Program. The task force, using data from a 2008 cost-of-production study, concluded that the existing tier categories needed revision, and suggested the adoption of a fourth tier to reflect the different costs of producing milk for small producers, medium

producers, large producers, and very large producers. The four categories established in 2009 are based on the cumulative quantity of milk produced per year. The categories are identified by the hundredweight (cwt) of milk sold annually (Table 2). As farms produce milk, they move through the tiers and receive a price support specific to that tier. Farms are commonly labeled by the tier in which they finish a year's production (i.e., a tier I farm is a farm that did not produce more than 16,700 cwt in a year).

The adoption of MRSA, Title 7, Section 2952-A (An Act to Implement the Recommendations of the Task Force on the Sustainability of the Dairy Industry in Maine) in February of 2010 by the 124th Legislature, requires the Maine Milk Commission (MMC) to conduct cost-of-production inquiries no less than every three years. The present study reports on a survey conducted for the MMC to determine the cost of production for 2010. This assessment was undertaken sooner than the normal three-year update because of the difficult economic climate for dairy farms in Maine.

Table 2. Tier categories of Maine dairy farms.

Category	Tier	Annual Milk Production Level (cwt)
Small	1	< 16,000
Medium	2	16,700–49,070
Large	3	49,070–76,800
Very Large	4	> 76,800

METHODOLOGY

Data Collection

The 2010 survey used a different methodology than previous cost assessments. Past cost-of-production studies relied on farm information gathered solely from mail surveys. The mailed questionnaire asked farmers to provide a series of cost information and to return their responses by mail. Although past researchers and studies took steps to validate the data, remove outliers, and verify the values, the Maine Dairy Industry Association (MDIA) and the MMC determined an alternative survey method was warranted for the 2010 study; the bid process requested that the survey contractor collect and analyze individual farm data.

Of 308 commercial dairy farms shipping milk to the wholesale market, 160 responded to an initial survey in 2011. From those responses, we worked with MMC to select farms from each tier to include in the detailed collection of cost data. The number of farms selected in each tier approximated the distribution of farms by size in Maine. We initially selected 42 dairies, representing four levels of annual milk production (as established under MRSA, Title 7). Managers of these farms participated in on-farm interviews conducted by University of Maine Cooperative Extension (UMCE) and University of Maine School of Economics (UM) staff. Several of the selected farms withdrew from the process, and some were replaced with other farms to fit the appropriate tiers. Farms withdrew because of personal (health issues) or catastrophic situations (barn collapse). A total of 39 (14% of the total dairy farms in operation in 2010—17 in Tier 1, 11 in Tier 2, four in Tier 3, and seven in Tier 4) participated in the detailed data-collection process, which used the Cornell Dairy Farm Business Summary (CDFBS) as a template. Farm records, 2010 tax returns, and other financial data available from the farm (Farm Credit, Farm Service Agency, USDA Agricultural Statistics Service) provided the primary data for the analysis. During the farm visit, interviewers asked questions to complete any missing data values. The analysis and discussion of the data in this report are based on the data furnished by these farms, which are considered representative of the industry.

Budgeting Approach

Cost of production estimates are comprised of three major categories of information: annual operating expenses, annual overhead expenses, and annual depreciation and interest expenses. The first two categories taken together represent the approximate variable and operating, or short-run, cost of production; the latter represents the fixed cost of production.

Annual operating expenses are those costs that vary with production and for this study included labor, purchased feed, livestock expenses, crop and pasture expenses, maintenance and equipment expenses, milk-check deductions, and interest on working capital. We divided labor costs into three additional categories: unpaid family labor, hired labor, and management expense. The budgeting method included a cost for unpaid family labor and an expense for

labor and management for the owner/operator. This is consistent with past studies conducted for the Maine Milk Commission (Dalton and Bragg 2003; Bragg and Dalton 2006) and is how we defined the SRBE cost of production.

Since unpaid family labor is a significant cost of production, especially among smaller farms (MacDonald et al. 2007), it is important to review unpaid labor valuation when calculating cost of milk production for accurate assessments of the overall profitability of dairy farms in Maine. The 2010 survey used a value of \$35,000 for the owner/operator return, which although less than other recent studies, appears to be a reasonable and appropriate estimate for farm management (Parsons 2006). Non-management unpaid family labor is valued at \$10/hour. The inclusion of unpaid labor reflects standard economic analysis for calculating the cost of milk production on dairy farms in Maine. By identifying and assigning a value to this unpaid family labor, we are able to more accurately evaluate the overall cost of production. For farms with legal structures other than sole proprietorships, we converted the farm to a sole proprietorship by assigning an expense of \$35,000 for labor and management to one of the members of the corporation or partnership and removing \$35,000 from the total compensation paid to the partners or shareholders in the corporation.

COST-OF-PRODUCTION RESULTS

Characteristics of study farms by the four tiers are shown in Table 3. Average annual milk production ranged from a low of 8,850 cwt for Tier 1 to a high of 112,493 cwt for Tier 4. Average herd size ranged from 54 cows for Tier 1 farms to 454 cows for Tier 4 farms.

Table 4 shows cost information for the four tiers. Costs in the final column (SRBE costs and inflation), which include operating costs, management, inflation,

Table 3. Characteristics of farms in the four tier categories.

Tier	Number of Farms	Average Annual Production (cwt)	Herd Size Range (Cows)	Average Herd Size (Cows)
1	17	8,850	30–84	54
2	11	25,848	65–250	129
3	4	64,788	200–342	271
4	7	112,493	353–680	454

Table 4. 2010 average costs of milk production in Maine by tier expressed in dollars per hundredweight (\$/cwt).

Tier	Factors Included in Cost of Production Calculation					
	Cash Operating Costs	Cash Operating Costs & Inflation*	Cash Operating Costs & Depreciation Expense	SRBE Costs**	SRBE Costs** & Depreciation Expense	SRBE Costs** & Inflation*
1	\$19.64 Range (\$13.90–\$23.43)	\$22.25	\$21.94	\$25.57	\$27.80	\$28.14
2	\$20.36 Range (\$14.30–\$25.80)	\$23.76	\$22.13	\$21.88	\$23.66	\$24.09
3	\$18.01 Range (\$17.23–\$18.75)	\$20.78	\$19.63	\$18.56	\$20.18	\$21.33
4	\$17.83 Range (\$15.49–\$22.31)	\$20.60	\$19.29	\$18.18	\$19.63	\$20.96

*Based on a 30% increase in feed costs and a 44% increase in fuel costs as observed between May 2010 and May 2011. In December 2010, the Maine Milk Commission accepted 2011 average SRBE costs which included increased feed and fertilizer costs for 2011.

** Family labor valued at \$10/hr plus \$35,000 return for management and labor for single owner/operator added to each farm.

and unpaid family labor, are of particular interest since the MMC sets tier prices based upon these SRBE figures. Overall, as expected, larger farms exhibit lower costs than smaller farms.

The cash cost of production was lower for Tier 1 farms than for Tier 2, which can be explained by labor costs. Most of the small farms in Tier 1 relied on family as a primary source of labor. Often this labor was either not paid or was underpaid. When farms expand cow numbers with associated increase in annual production, hired labor becomes a larger factor and labor costs increase as shown in the results from the farms in Tier 2. When we “mechanically” added the value for unpaid family labor and a return to management for the owner/operator, we see the traditional increase in production costs commonly associated with increasing herd sizes and operational efficiency as shown in the SRBE column.

The cost of purchased feed per cwt rose with increasing herd size and average production level in our study. While purchased feed costs are one of the major expenses on dairy farms in the Northeast, and in this study larger farms have higher feed costs per cwt, the differences in labor costs per cwt between tier levels are much more significant when calculating the cost of production.

The source of lower costs in larger farms seems to lie mostly in the size-economy from increasing the cows-per-worker ratio. Although feed costs are a major expense for all dairy farmers, the real difference in ef-

iciency of production comes from costs associated with labor expenses or cows per worker. Though inputs such as purchased feed per cow increase in larger farms, larger farms are more cost efficient because of their increased cows per worker. Further, larger farms produce more milk per cow (Table 5).

To better understand factors influencing profitability, we divided the farms, regardless of size, into three profitability groups. Figure 2 shows the average cost of production with the farms divided into these three equal-numbered groups (13 farms in each group) based on low, medium, and high cash costs of production. Figure 3 shows feed costs for these groups, which reveals that as cost of production per cwt goes down, so does feed cost per cwt. This is an obvious efficiency, and it would most likely indicate a better-managed forage program and cow-nutrition management.

Table 5. Average feed cost per cow, lbs of milk per cow and purchased feed per cwt for the four tier levels.

Tier	Average Purchased Feed Cost per Cow (\$)	Average Pounds of Milk per Cow	Purchased Feed Cost per cwt (\$)
1	1092	16,426	6.65
2	1502	20,079	7.48
3	1751	23,951	7.31
4	2035	24,793	8.20

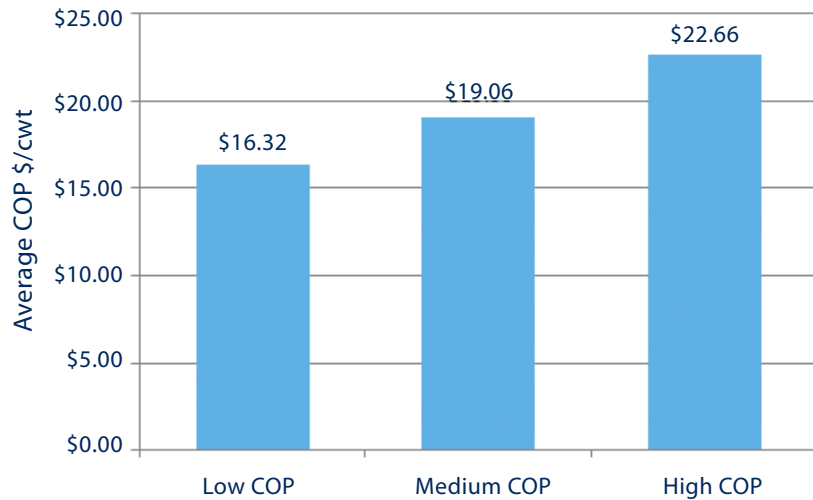


Figure 2. Maine farms grouped by low, medium, and high cost of production (COP) (cash operating costs).

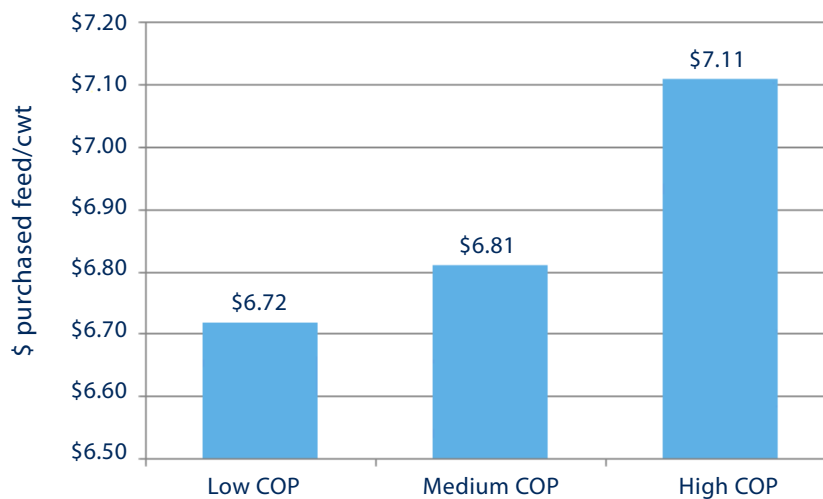


Figure 3. Purchased feed costs per cwt for low, medium, and high cost-of-production (COP) farms (based on cash operating costs) in Maine, 2010.

Figure 4 shows the average pounds of milk shipped per full-time-equivalent worker (FTE), for the three cost-of-production groups. Similar to other studies, we have used 230 hours of labor per month to equal one FTE. Once again, the production efficiencies associated with the larger farms stand out with higher production per FTE. Farms with medium costs of production produce 7.6% more milk per FTE than those with high costs of production. Farms with low costs of production produce close to 20% more milk per FTE than farms with medium

costs and close to 30% more than farms with high costs of production. Farms with the lowest cost of production shipped the most pounds of milk per FTE.

Since hired labor is a major input cost, we compared Maine's data with other summaries throughout the Northeast. When we compare Maine data with those of farms participating in the 2010 Cornell Dairy Farm Business Summary and the 2010 Farm Credit Northeast Dairy Farm Summary (Table 6 and Figure 5), we see a similar pattern, i.e., increasing numbers of cows per

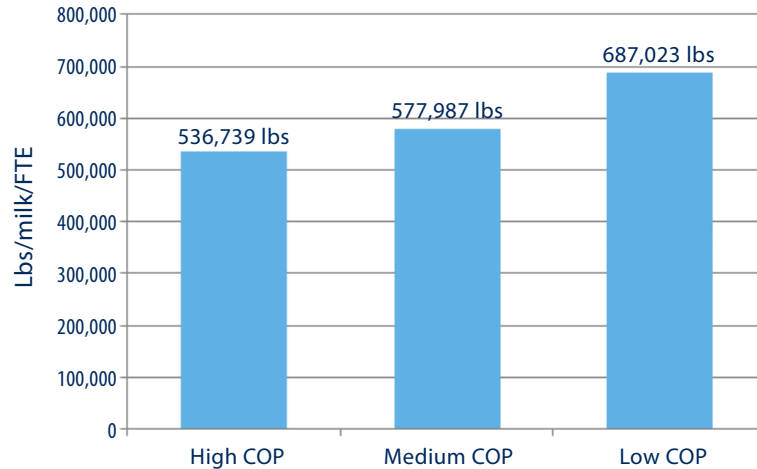


Figure 4. Pounds of milk shipped per FTE by low, medium, and high cost-of-production (COP) farms (based on cash operating costs).

worker as herd size increases. It is notable, however, that in the Maine study, the number of cows per worker is lower than in the CDFBS and Farm Credit Summary studies, indicating a source for higher costs of production. This difference in worker efficiency can be partly explained by the fact that Maine's study was closer to a random sample of farms, whereas the two other studies involved farms that were part of an accounting program and would more likely represent a higher level of farm management.

SUMMARY AND CONCLUSIONS

When looking at the comparisons among other cost-of-production studies and associated data, Maine farmers have several key areas of higher costs. Purchased feed costs remain the single largest expense on most farms and reflect the higher cost of ingredients in Maine. Labor efficiency is another benchmark for Maine farms that is below other states (CDFBS and Farm Credit studies).

Small farms in this study had a significant amount of unpaid family labor as compared with larger farms. Accounting for these costs is essential when evaluating farm businesses of various sizes. Overall, when SRBE costs are accounted for, the cost of producing milk in Maine for 2011 (based on 2010 cost and inflation estimates for fuel and feed) is \$28.14/cwt for small farms, \$24.09 for medium farms, \$21.33 for large farms, and

Table 6. Average number of cows per worker by herd size.

Avg # of Cows	Cows per Worker		
	Maine	Cornell DFBS	Northeast Farm Credit
54	22	-	-
66	-	-	33
98	-	30	-
115	-	-	38
129	30	-	-
206	-	-	41
271	31	-	-
454	37	-	-
479	-	46	-
701	-	-	50
1283	-	47	-

Sources: Researchers data; Cornell Dairy Farm Business Summary Program, Small and Medium Farms Business Chart 2010; and 2010 Farm Credit Northeast Dairy Farm Summary.

\$20.96 for very large farms, with a weighted average SRBE cost of \$25.03.

A recent report from Connecticut that used 2010 Agricultural Resources Management Survey (ARMS) data for calculating the SRBE cost of production for Maine and Vermont revealed a cost estimate for all

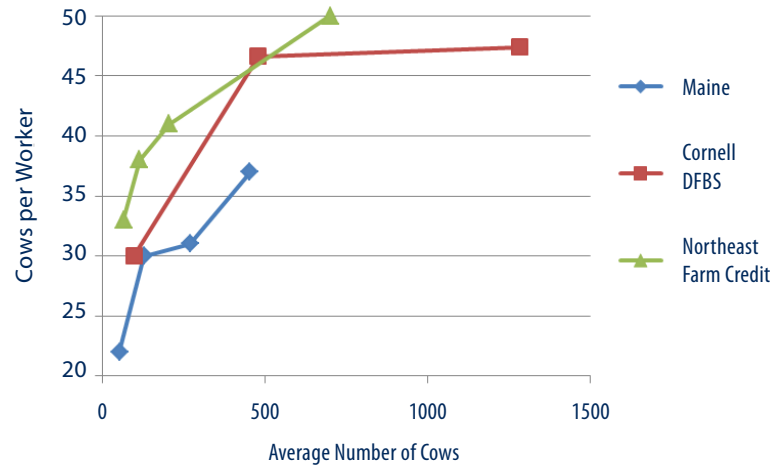


Figure 5. Average number of cows per worker by herd size.

Sources: Researchers data; Cornell Dairy Farm Business Summary Program, Small and Medium Farms Business Chart 2010; and 2010 Farm Credit Northeast Dairy Farm Summary.

farms at \$31.79, \$30.52, and \$31.59 for October, November, and December, 2011, respectively (Rabinowitz and Lopez 2011). These data were based on the USDA 2010 Agricultural Resources Management Survey of milk producers from 2004 and updates using current USDA milk-production-per-cow and production-input indexes. The ARMS data indicate that costs were rising significantly towards the end of 2011. It is important to note that researchers from Connecticut have decided that the ARMS data are not accurate enough for their price-support system. They will adopt data collection for 2012 that is similar to the one used in this Maine study to base their payments to farmers in the future.

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