

MAINE STATE LEGISLATURE

The following document is provided by the
LAW AND LEGISLATIVE DIGITAL LIBRARY
at the Maine State Law and Legislative Reference Library
<http://legislature.maine.gov/lawlib>



Reproduced from scanned originals with text recognition applied
(searchable text may contain some errors and/or omissions)

L.U.O.

The Cost of Producing Milk in Maine:
A Report based upon the 2002 Dairy Cost of Production Survey

November 12, 2002

A report submitted to the Maine Milk Commission

By

Timothy J. Dalton
Assistant Professor
Department of Resource Economics and Policy
5782 Winslow Hall
University of Maine
Orono, ME 04469-5782
phone: 207-581-3237
fax: 207-581-4278
timothy_dalton@umit.maine.edu

FOREWORD

This report summarizes the results of the 2002 Dairy Cost of Production survey implemented by the University of Maine and the Maine Milk Commission. The write-up of this report is preliminary and subject to revision for clarification and development. The estimated cost of production budget described in Section II and presented in Section III is the best estimate that can be produced without additional survey work. It should be considered as the final estimate.

This report would not be complete without the assistance provided by Lisa Bragg with support from a University of Maine Work Merit award.

Timothy J. Dalton, Ph.D.
University of Maine
Orono, November 12, 2002

H 09282,05
M24
2002

TABLE OF CONTENTS

FOREWORD..... 1

TABLE OF CONTENTS..... 2

INTRODUCTION..... 4

SECTION I: A DESCRIPTIVE STUDY ON THE MAINE DAIRY INDUSTRY..... 4

Demographics..... 4

 Farm establishment..... 5

 Tenure, Education, and Age..... 5

 Legal Structure..... 5

 On-farm Technology Use..... 6

 Herd Size..... 6

Production Systems..... 7

 Milking systems..... 7

 Housing..... 8

Assets..... 8

Livestock, Land Holdings and Crop Production..... 9

 Land Holdings..... 10

 Crop Diversification..... 11

 Crop Inputs..... 12

Livestock Production..... 12

 Forage..... 12

 Concentrated Feed..... 12

 Livestock Health and Breeding..... 13

Labor Use and Off-farm Employment..... 13

Future Outlook..... 14

SECTION II: FARM REPRESENTATION AND BUDGETING APPROACH..... 16

Farm Representation..... 16

Budget Components..... 16

Annual Operating Expense..... 16

 Labor..... 16

 Purchased Feed..... 17

 Livestock Expenses..... 17

 Crop and Pasture Expense..... 17

 Maintenance and Equipment Expense..... 17

 Deduction Charges..... 17

 Working Capital Interest Expense..... 18

Annual Overhead Expense..... 18

Annual Depreciation and Interest Expense..... 18

<i>PART III: DAIRY COST OF PRODUCTION BUDGETS AND IMPLICATIONS</i>	19
Implications for Maine Producers and Budget Simulations.....	22
Energy Costs.....	22
<i>CONCLUSIONS</i>	23
<i>WORKS CITED</i>	24
<i>APPENDIX: PRODUCTION BUDGETS FOR ALL THREE FARM TYPES</i>	25
Appendix Table 1. Cost of Production Budget for Small Farm	25
Appendix Table 2. Cost of Production Budget for Medium Farm	27
Appendix Table 3. Cost of Production Budget for Large Farm.....	29

INTRODUCTION

This report is organized into three sections. Section one provides a descriptive review of the resource and production practices employed in dairy production in the State of Maine. This section provides an overview and summary of the responses from the 2002 Dairy Cost of Production study implemented by the University of Maine and the Maine Milk Commission. Data in this section is the basis for developing dairy cost of production budgets. The second section of the report provides a brief overview of the approach used to develop the cost of production budgets. The third section presents the cost estimates and analyzes their implications for Maine dairy farmers.

The analysis and discussion of the data in this report focuses on four major groups called clusters. Cluster analysis attempts to identify relatively homogenous groups based upon identifying characteristics. This procedure was used to create representative farm types for the cost of production budgeting. 115 survey observations (27 percent of all Maine producers) were used in the cluster analysis. From the onset, organic and very large farms (over 300 cows), were selected for independent analysis apart from the main data set. There were six farms in each of these two categories that were examined independently of the remaining data. The remaining 103 observations were then submitted for cluster analysis using two factors related to size: 1) the number of cows and 2) the number of heifers; three factors related to production technology: 3) milking system 4) housing system, and 5) percentage of forage raised on-farm; three factors related to on-farm income generation: 6) total milk shipped in 2001, 7) total milk sales in 2001, and 8) total livestock sales in 2001 and one categorical factor related to income diversification: 9) the importance of off-farm income. Three clusters were generated from this procedure: small farms, medium farms and large farms. A final cluster representing all farms is titled "State". The data from this cluster includes the small, medium and large farms plus the organic and very large farms. Data from the small, medium and large farms are used to construct the cost of production budgets. The organic and very large farm data is not used in the budget analysis.

SECTION I: A DESCRIPTIVE STUDY ON THE MAINE DAIRY INDUSTRY

Demographics

At the state level, owner/operators who grew up on a farm represent 89 percent of the dairy farmers who are currently dairying in Maine. Better than half, 68 percent, of these farmers continue to operate the same farms they grew up on. Correspondingly, 71 percent of those running a farm have not farmed elsewhere.

The small sized cluster is similar to the state in that 89 percent of these owners indicate they grew up on a farm. Only 59 percent of them are operating the same farm they grew up on. This is reflected in the 76 percent of this group who indicated that they had not farmed elsewhere.

All of the owners of farms in the medium sized cluster indicated they grew up on a farm. The percentages of farmers who are operating the farm they grew up on and have not farmed elsewhere are the same at 82 percent.

It is in the large farm cluster where there is a slight variation from the state levels. Those farmers who grew up on a farm represent 85 percent of this group. Only 30 percent of owners in this group operate the same farm they grew up on and only 38 percent indicated they had not farmed elsewhere before their current operation.

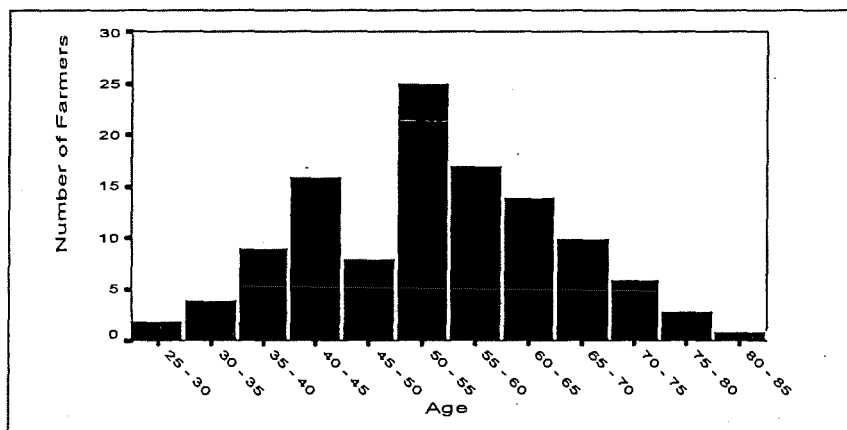
Farm establishment

The small and medium sized farms are the oldest of the three size clusters. The typical farm from these two groups was established in 1914-15. The average for the state cluster is 1919. The average year of establishment for a large farm is 1928. In each of these cases, the mean is earlier than the median indicating that within each cluster the number of older farms is greater than younger farms. These younger farms pull the median year of establishment to 1940/41 for small, large, and the state. The medium sized farms remain the oldest of the clusters with a median age of 1933.

Tenure, Education, and Age

Large size farm owners have been operating their farms since early to mid-1970s. Both small and medium size owners took up operations in late 1970 to early 1980. All of the dairy farmers in Maine have on average a high school education. The distribution around this average is equal for all three farm types indicating there is no significant education level difference among farm types. The average age of a dairy farmer in Maine is 53 years of age. The large scale farm owners are the oldest among all dairy farmers with an average age of 57.

Figure 1: Distribution of average age of farm owner/operator (years)



Legal Structure

Small scale farms are predominantly sole proprietorships or family partnerships. There are no farms of this size that are non-family partnerships. Corporations account for 11.8 percent of the farms in this size category. Medium and large scale farms make use of the same three types of legal structure, but there is a greater use of the corporate structure in these two groups, between 31-32 percent. Sole proprietorships and family partnerships are still the most frequent, between 68-69 percent combined, for both groups. For all groups, businesses indicating they are family partnerships are owned by two families.

On-farm Technology Use

Farms of all scale perform the practice of pre-dipping and post-dipping teats before and after milking, respectively. None of the farms use a seasonal milking program described as a period of two or three months when all cows are dry. All of the farms surveyed do not hire out financial management to a service agency. They conduct their own analysis of their farm’s financial performance.

There are some management techniques and production technologies that are adopted with different frequencies among the farms in the state. Table 1, found below, outlines these differences. Large scale farms make regular use of scheduled veterinary services. For the small and medium scale farms, the usage of scheduled veterinary services is split evenly between used and not used on these farms.

Medium and large scale farms balance the feed rations at least four times per year. These same farms also use total mix ration (TMR) machinery. Small farms on average do not make use of these techniques. Large farms use both the DHIA dairy record program and PC’s to manage their herds. Small and medium farms indicated that these practices are not used on those farms.

Table 1: Management and Production Practices Used (percentage of responses)

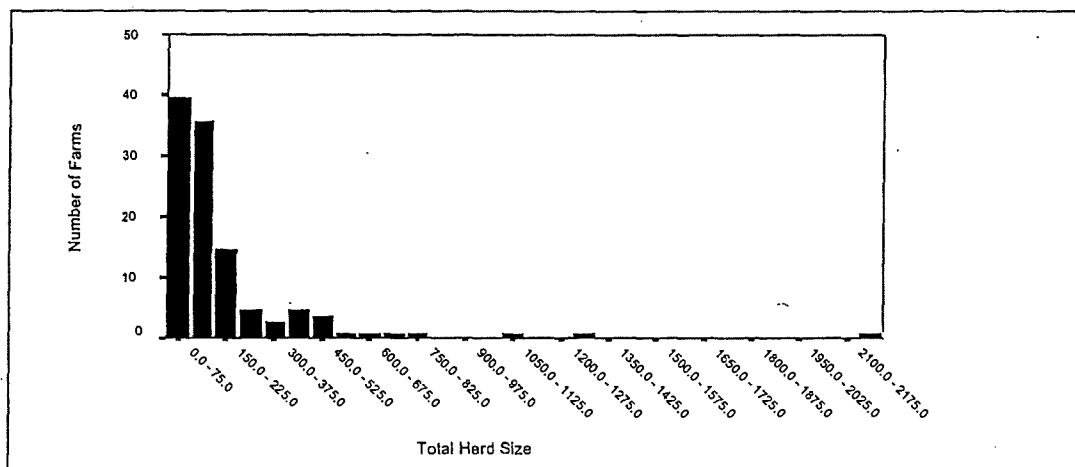
		Small	Medium	Large	State
Scheduled Vet. Services	yes	50.0	50.0	92.3	57.4
	no	50.0	50.0	7.7	42.6
Balance feed rations	yes	45.6	81.8	92.3	60.9
	no	54.4	18.2	7.7	39.1
TMR Machinery	yes	19.1	63.6	84.6	39.1
	no	80.9	36.4	15.4	60.9
DHIA record	yes	35.3	45.5	69.2	44.3
	no	64.7	54.5	30.8	55.7
Herd mgmt. with PC	yes	7.4	27.3	61.5	23.5
	no	92.6	72.7	38.5	76.5

Herd Size

One of the determinants of farm size is the volume of livestock holdings. The “total holdings” category is based on the number of dairy cows (including dry cows), dairy heifers, and dairy calves held on a farm. It should be mentioned that this total is not the same as the “milking herd” category that was used to generate clusters from the survey population.

The total livestock holdings per farm for Maine as a whole are shown in Figure 2. Note the inverse relationship between number of livestock and number of farms. As the herd size increases, the total number of farms holding that amount of livestock decreases. Also note that the state is made up of predominately small and medium sized farms. The ratio of small farms to large farms from the sample surveyed is 5 to 1. What is important to point out here is that 34 percent of the combined herd size among the three clusters is contributed by this one group of large farms.

Figure 2: Distribution of Herd Size by Farm



Production Systems

Milking systems

The stanchion or tie stall barn with pipeline transfer system accounts for 52 percent of the milking systems in the state. The herringbone parlor system is used by 25 percent of the farms in Maine. These two practices represent the most frequently used practices in Maine. Newer technologies such as rotary parlors, parallel parlors, flat parlors, or side-open stall parlors (either tandem or diagonal) are used by approximately 15 percent of the farms at varying levels of frequency. The remaining 10 percent of the farms use the older system of stanchion or tie stall barn with dumping station transfer.

The farms in the small cluster use the more traditional milking systems with greatest frequency. These farms rely predominantly on stanchion or tie stalls with either a dumping station or pipeline transfer. For the medium cluster, a number of farms use the stanchion with pipeline. However, the herringbone parlor is used with greater frequency than in the small farm cluster. The larger farms incorporate both the herringbone parlor and the parallel parlor as their systems. The milking system technology used is connected with cluster size and therefore herd size. As the milking herd size grows larger, the tendency is to employ more labor efficient milking systems.

Milking occurs twice a day for all farms in the state. The average numbers of people who are either milking or helping with milking at one time, for all farms, is two. The total time spent per milking is two hours. The only exception is for the large cluster. In this case, twice as much time, four hours, is spent milking the herd. As a result, the total time spent per milking on average is almost twice the time that all other farms in the state spend in milking.

Five milking units is the typical number of units available for the herds across the state. In general, these units do not have automatic takeoffs. Small farms have four milking units that do not have automatic takeoffs. Medium farms have eight units and also do not have automatic takeoffs. Large farms have sixteen units and they are equipped with automatic takeoffs.

Breaking these numbers down across the clusters shows that the number of units doubles as the cluster size increases.

Housing

The size of the dairy barn for each cluster type as well as the state along with total barn capacity as represented by the number of stalls available in the barn is outlined below in Table 2. The natural correlation of farm size, barn size in square footage, and maximum capacity is evident. As the farm size, indicated by the herd size, grows the housing size and capacity grow as well.

Table 2: Size of Main Dairy Barn (sq. ft.) and Maximum Livestock Capacity (#) by Farm

	Small	Medium	Large	State
Number of stalls available (max. cap.)	49	77	200	60
Size of main dairy barn (sq. ft)	5000	9860	16400	6800

The herd housing types used by farms across the state are stanchion, tie or comfort stall, or cold covered free stall. The only cluster that makes use of a different housing system to any great degree is the large farm that uses a warm enclosed free stall. Without exception, the base surface used in the barn is concrete and the bedding material used is sawdust.

For the most part, farms do not have a separate hospital and/or maternity barn for the herd apart from the main barn. When separate housing is used, it is for the farm's calves. The number of farms having separate calf barns is not significantly different from the number without at the state level. The differences are more easily seen at the cluster level. Small farms generally do not use separate calf barns while medium and large farms do.

The size of these separate calf barns is quite different for these two clusters. The medium farm has a barn that is 1900 sq. ft. and capacity is 40 head. The large farm has a barn that is 3600 sq. ft. and a capacity of 108 head. And, the medium farm calf barn is representative of the state as a whole.

Assets

This section discusses the capital assets of each group and attempts to characterize the typical farm within every cluster. Assets have been broken down into five main categories. These categories are (1) farm land which includes both acreage and personal residence, (2) farm buildings which includes all of the remaining fixed structures on the farm, (3) dairy production equipment, (4) crop production equipment, and (5) farm vehicles and tractors. Total values, as reported by producers, for each for each asset category and farm type are found in Table 3. On average, a \$550/acre price of farmland was estimated from the surveys.

It is recognized that throughout the state, there are individual differences among farms within a cluster and between clusters. However, in order to create a representative description of assets held by farms in each cluster, the asset allocation had to be based on defining a typical asset. In order for an asset to be included in the capital asset report it needs to be held by approximately 50 percent or more of the farms in the cluster. There are assets that are held by handfuls of farms across the state that were not included in the report below. These include a separate hospital/maternity barn, machine barn/shed, silo(s), housing for hired help, and a hutch/super hutch.

In general, the asset values increase by an average factor of two between each cluster. The one exception to this is found in the Farm Equipment category. The asset values increase by

an average factor of three between the small and medium cluster as more of the medium farmers use parlor milking systems. The state cluster consistently falls between the small and medium cluster asset values. The individual differences are a consequence of two issues. The first issue relates to the overall size of the farm described by each cluster. The smaller farm requires a smaller operation to care for a smaller herd when compared to the larger farms. Also, the asset values are a function of the current market value of the asset. Because the smaller farms tend to also be older, the market values of these assets tend to be lower than the younger and larger farms.

Ratio comparison of individual asset categories to the total asset value for each cluster can be done to take a different look at the asset mix. This analysis eliminates the monetary size differences and allows a different assessment through side by side comparison. The ratio analysis in this case shows that the small and medium farms have similar asset allocations. The large farms tend to allocate more assets to Farm Buildings and less to Farm Land than the other two groups.

Table 3: Value of Capital Assets by Farm

	Small	Medium	Large	State
Total Value of all farmland and buildings				
Value of Farmland:	\$160,450	\$330,000	\$373,000	\$249,000
Value of Farm Buildings:	\$62,000	\$135,000	\$395,320	\$116,000
	\$222,450	\$465,000	\$768,320	\$365,000
Total Value of farm equipment				
Value of Dairy production equipment:	\$7,950	\$29,500	\$67,500	\$13,500
Value of Crop Production equipment:	\$17,000	\$53,950	\$131,500	\$23,800
Value of Farm Vehicles and Tractors:	\$30,500	\$109,500	\$178,750	\$50,000
	\$55,450	\$192,950	\$377,750	\$87,300
Total Value of Capital Assets	\$277,900	\$657,950	\$1,146,070	\$452,300

Livestock, Land Holdings and Crop Production

The livestock holdings throughout the state are almost entirely Holstein. Both the medium and large farms hold a small percentage of their herd as Jersey. The small farms show the greatest diversity. While the holdings of Holstein are a significant percentage of their herd, a few of the small farms hold other breeds such as Jersey, Guernsey, Brown Swiss, Ayrshire, and Milking Shorthorn.

The total herd size which is made up of dairy cows (including dry cows), dairy heifers (more than one year old), and dairy calves is detailed in Table 4. A few farms throughout the state may also hold beef cows, feeder cattle, or mature bulls. These exceptions will be discussed separately. This table breaks down the varying herd sizes and resulting value associated with that herd.

It is worthwhile to point out that the average herd size more than doubles between the cluster classifications of small to medium or medium to large. However, the average herd size for the state falls between the small and medium size farms. This is consistent with point discussed earlier that the state consists primarily of small and medium sized farms.

Table 4: Total Herd Size and Value by Farm

	Small			Medium			Large			State		
	# held	Market value (\$ per animal)	Total Value (\$)	# held	Market value (\$ per animal)	Total Value (\$)	# held	Market value (\$ per animal)	Total Value (\$)	# held	Market value (\$ per animal)	Total Value (\$)
Dairy Cows	44	\$1095	\$48,180	95	\$1236	\$117,420	200	\$1152	\$230,400	54	\$1139	\$61,506
Dairy Heifers	15	\$1000	\$15,000	46	\$1100	\$50,600	90	\$1100	\$99,000	22	\$1000	\$22,000
Dairy calves	15	\$400	\$6,000	40	\$450	\$18,000	90	\$250	\$22,500	22	\$400	\$8,800
Total:	74		\$69,180	181		\$186,020	380		\$351,900	98		\$92,306

* Market value based on November 2001 prices.

Livestock holdings, other than those noted above, are varied throughout the state. Less than 10 percent of the farms in the various clusters own beef cows. The number held on each farm ranges from 3 to 20, with the medium farms holding the largest number. The market value is stated at \$600.

Only small and medium farms hold any beef calves or feeder cattle. Again, less than 10 percent of the farms from the clusters indicate that they hold these types of livestock. There is one exception; there are slightly more than 20 percent of farms in the small farm cluster holding beef calves. The feeder cattle hold a market value of \$500 and beef calves are valued at \$225.

Mature bulls are held with greater frequency among the farms but they are not found throughout the state. Between 40-50 percent of the farms in each cluster indicate they hold mature bulls as part of their herd. Typically the small farms hold one bull and medium sized farms hold two, the stated market value is approximately \$500. Large farms hold three bulls with a market value of \$900.

Land Holdings

The value of the land asset has already been discussed briefly in the capital asset section of this report. Table 5 describes the differences in land ownership among the cluster types. The acreage held is based on the median value for each cluster. There is a great deal of variation across the state in regards to land holdings.

The typical acreage for a cluster is based on the same criteria for reporting typical assets. More than 50 percent of farms needed to indicate they owned land of each individual classification. The specific exceptions will be discussed separately.

Also note that the total land figures do not and are not intended to reflect the summation of total land holdings from columns above. This figure, again, represents the typical farm from each cluster by aggregating the total land holdings. This value is also the median value for all farms in the clusters and the range of total farmland held across the state is varies widely.

Table 5: Land Ownership by Farm Type

		Small	Medium	Large	State
Tillable Crop Land: (acre)	Own	97	100	250	115
	Lease		110	160	105
Permanent Hay Field: (acre)	Own	60	95	146	60
	Lease	65	63	98	73
Pasture: (acre)	Own	30	25	43	30
Wood: (acre)	Own	100	235	200	120
Other land: (acre)	Own	5	7	13	6
Total Land: (acre)	Own	249	400	563	295
	Lease	80	155	247	124

Acres listed as owned are lands owned by the farm and include land leased or rented out to others. Acres that are listed as leased are in the form of land owned by someone else but leased, rented in or used at no cost to the farm. All of the farms were also asked about the land that owned but might be rented out to another farmer. The survey results indicate this practice is not used by more than just a few farms in the state. Specifically, there is only one small farm that rents out tillable crop land, permanent hay fields, and pasture lands.

In contrast to that, farms from all clusters augment either their current tillable crop land or hay field land, or both, with leased lands. The pasture land holdings do not correlate with herd sizes. The small farms hold more pasture than medium farms while holding a milking herd that is less than half the size. Woodland held is also not strongly correlated to farm size. Total land holdings increase proportionally with farm size. And, each cluster augments their current holdings with leased lands by at least 30 percent.

Crop Diversification

Crop diversification is not widely done in the state at this time. The two main crops grown are corn for silage and hay or haylage (which includes clover, alfalfa, Timothy, other legumes, small grains, trefoil, triticale, and grass). Other crops such as barley, oats, or corn for grain are grown on only a handful of farms that vary in their size classification.

Hay or haylage is by far the most dominant crop grown. Approximately 90 percent of the farms indicated they grew their own hay for the herd. And, all of the owners indicated they used 100 percent of the hay on their own farms. An average of 178 acres of hay was grown and the range is between 100 acres on the small sized farms and 280 on the large sized farms.

The second most prevalent crop grown is corn for silage. Just a little under half of the farms surveyed, 48 percent, grew corn for silage. The medium and large farms represent the majority of the farms growing corn in the state. Results from the state cluster indicate that the total acreage committed to this crop is 80 acres. If corn is grown on a farm, the range runs between 29 acres on the small farms and 195 on the large farms. All of the corn grown is used on the farm that cultivated the crop.

All of the other crops grown in the state, such as barley, oats, corn for grain, squash, and wheat are grown only on the small and large sized farms. One exception occurs on a medium sized farm that cultivates both barley and oats. None of the farms in the survey indicated that they devoted any acreage to potatoes. Also, custom hired crop production is not commonly done.

Crop Inputs

There are two major categories of crop inputs used throughout the state. Seed is one generalized form of production input that encompasses a number of different types of seed. Corn seed is the most commonly used out of all seed inputs. Also, it is predominantly used on medium and large farms based upon the data reported regarding crops grown in 2001. Due to the range of different means of purchasing any seed, it is difficult to state an average quantity used in each cluster. Other seed inputs include grass, sorghum, and soybean seed.

The other generalized form of input includes all factors used to optimize crop growth. The most common of these inputs are fertilizer, lime, and chemicals/sprays. Other inputs, such as wood ash and manure, are used but only on an infrequent basis in each cluster. Again, due to the varied packaging methods and ways of purchasing these inputs, it is difficult to state an exact amount that is typically used on the farms. It can be said, however, that the quantity of input used is directly proportional to the quantity of land in crop or hay production.

Livestock Production

Forage

In general, forage that is used on the farms for livestock feed is grown entirely on each individual farm. As would be expected, the amount of forage fed is influenced by the herd size. The total tonnage fed in 2001 is 297, 1990, and 5000 for the small, medium, and large farms respectively.

There are a handful of farms from each cluster that do obtain forage from another source. These farms purchase forage for a total cost that ranges between \$3,500 and \$5,300. The purchase was generally through another farmer and the location of the forage source was less than ten miles away.

Storage of the feed on small farms is in the barn or hay shed storage with a total capacity of 345 tons. Both medium and large farms make use of barns and horizontal storage (bunker, trench, and stack) with capacities for each cluster at 2,250 and 5,750 tons respectively. For the state overall, the storage facilities used are both barn and horizontal storage with a total capacity of 775 tons.

The survey results indicate that only one person is involved with feeding and spends between two and three hours feeding the herd for each farm size. Pastures are an important source of feed for small farms but not for medium and large farms. There are two predominant styles for moving herds between pastures. About one third of the farms wait longer than one week to move their herd to fresh pastures. Another third use pasture more intensively and move their herds to fresh pastures after one to three days.

Concentrated Feed

None of the concentrate fed to herds in 2001 was grown on the typical farm in each cluster. The amount of concentrate fed to the herd as well as the total cost is correlated to the size of the herd. The concentrate is purchased from a feed dealer or store in Maine and the farms are located no more than 40 miles from the dealer.

Table 6: Quantity of Concentrate Purchased and Total Cost by Farm

	Small	Medium	Large	State
Commercial concentrate (tons)	120	300	950	150
Total cost of concentrate (\$)	24,500	84,000	182,600	33,00

Livestock Health and Breeding

Half of the small and medium sized farms chose to manage their herd health with scheduled veterinarian services. Small farms receive a total of nine vet visits per year for an annual cost of \$2,100. Medium farms receive thirteen visits per year for a total annual cost of \$3,900. These two groups are representative of the state as a whole. Almost all of the large farms manage their herd with regularly scheduled vet visits. They receive thirty vet visits per year for a total annual cost of \$12,300.

Each group indicated that their vet was located within twenty miles of their farm. Also, each group indicated they did purchase other medicine or health treatments for the herd in 2001 apart from those administered by the vet. There are four methods that are typically used to purchase the extra medication. These are route truck, mail-order through a catalog, farm or feed store, and another local supplier. The farms using another supplier or farm store travel approximately ten miles for the purchase.

The total annual cost for these medications is \$560, \$1,635, and \$3,020 respectively for small, medium, and large. The state cluster falls between the small and medium cluster at a cost of \$950.

Each of the clusters indicated they used artificial insemination (AI) services on their dairy herd in 2001. The cost ranged from \$1,400 for small farms, \$2,750 for medium farms, and \$9,530 for large farms. Again, the state cluster falls between the small and medium clusters at a total cost of \$1,800. The replacement heifers are not contracted to be raised on another farm. The farm owners for each cluster indicated that they raised their own heifers.

Labor Use and Off-farm Employment

The following section discusses the use of farm labor and the importance of off farm income. The farm labor is broken down into two sections; family labor and hired non-family labor. Paid compensation is captured for each group as well as non-paid compensation for hired labor.

The importance of off-farm income sources was evaluated based on four categories. These categories are:

- 1) More important than farm income (greater than 50 percent of total income);
- 2) As important as farm income (about 50 percent of total income);
- 3) Less important than farm income (between 1-50 percent of total income);
- 4) No off-farm income.

It is clear from Table 7 that small farms rely more heavily on off-farm income. Twenty four percent of the farms surveyed indicated that the earnings received from off-farm work was at least as important if not more important than on-farm income. However, a fairly significant portion of the small farms support themselves mainly through on-farm earnings. And, on-farm income plays a larger role in the family budget as the farm size increases. It is key to remember this dependence on income generated primarily through the farm when analyzing the operating budgets.

Table 7: Importance of Income Earned Off-Farm by Rank and by Farm (percent of responses)

	Small	Medium	Large	State
Ranking Options:				
1) More important	15	5	8	12
2) As important	9	10	8	9
3) Less important	37	35	8	32
4) No off-farm income	38	50	77	47

The number of on-farm workers, both family and non-family, and their total annual hours is presented in Table 8. Annual hours are based on the estimated average hours of farm work per week multiplied by the number of weeks that person worked on the dairy farm in 2001. Family and non-family labor hours are combined to generate the total annual labor for each cluster.

Not unexpectedly, the results show that as the farm size increases so does the number of workers, family and non-family, as indicated by the rising number of total labor hours used. Non-family employees play a larger role on the medium and large farms. Only 28 percent of the small farms surveyed indicated they would hire at least one non-family worker.

Table 8: Family and Non-Family Annual Labor Usage by Farm

	Small	Medium	Large	State
Labor Used (hours)				
Family	4160	6240	7175	5148
Non-Family	0	2885	3140	550
Number of Full Time Equivalents (FTE)	1.7	3.2	3.3	2.0
Average Non-Family Hourly Wage (\$)	(na)	\$8.74	\$11.42	\$10.90
Number of Dairy Cows per FTE	27	34	50	30

Average annual wage for non-family employees is a function of average direct compensation of these workers and the hours worked. Compensation takes the form of direct payment through either a cash wage or cash salary or non-paid reimbursement for hours worked. Non-paid reimbursement is defined as housing, calves, beef, etc and is commonly practiced in each cluster. For each cluster, the form of direct compensation for family labor is a cash salary. And, for non-family labor, direct compensation is as a cash wage.

The number of cows per full-time employee (FTE) is a useful measure of labor efficiency. The figure is a ratio based on the total number of dairy cows in the herd and full-time employees on the farm. Efficiency standards are segmented based on milking system. Workers in a tie stall or stanchion systems should be able to handle 30-35 cows per FTE while workers in free stall-parlor systems should be able to handle 40-50 cows per worker (OSU, 2002). Survey results indicate that small farms, which use the tie stall or stanchion systems, are using more labor than recommended. Medium farms, which use both the tie stall and free stall-parlor systems, are more efficient than small farms but still do not maximize efficiency. This may be due in part to the mixture of milking systems used in this cluster. And, large farms, which use the free stall-parlor systems, are at the high end of labor efficiency.

Future Outlook

When asked how long the dairy farm would be operating, the majority of owners, 93.1 percent, indicated that they would not stop milking in 2002. While this sounds encouraging at first, what does this really mean for the dairying industry in Maine? The results in Table 9 points

out that 6.8 percent of farms in the state cluster, which includes 115 farms, do plan to stop milking in 2002. This indicates that eight farms from the survey sample plan to leave the industry by the end of the year. This translates into a total loss of 32 farms through out the state, based on a 25 percent response rate to the survey. Coupled with this is the fact that another 37.8 percent of the owners indicated they would stop milking within the next 5-10 years.

Only slightly more than half of all the owners surveyed indicated their current farm would still be operating over ten years from now. The state should anticipate that the greatest numbers of the farms leaving the milk production industry to be the small-sized farms. In their specific case, 54 percent of the owners surveyed felt they would leave dairy farming within the next ten years. And, 10 percent of these owners will leave dairy farming in 2002.

Once the owners who plan to leave the industry stop milking, the overall number of farms in the state will drop. This is due to the fact that only 13 percent of all the owners surveyed indicated that they would leave dairy farming for another type of farming. Coupled with this is the factor that only 24.5 percent of all the current owners anticipated that they would transfer management of their current farm to another person.

The data shows that a restructuring of the dairy farming landscape will occur. Based on current conditions and feelings among dairy farm owners, the structure will be one in which there are a few larger sized farms producing milk in Maine. It is the owners in this group that feel they will be operating the same farm more than ten years from now and that the management of the farm will be transferred to another person.

Table 9: Future Outlook of Owner/Operators by Farm Responses (percent)

		Small	Medium	Large	State
Future					
How much longer do you expect farm to operate?					
	less than one year	9.8	5	0	6.8
	less than five years	26.2	10	15.4	19.4
	less than ten years	18	15	23.1	18.4
	more than ten years	41.2	70	61.5	55.3
Farm Growth/Changes over next five years					
Add more cows					
	Unlikely/Very unlikely	65	50	38.5	54.8
	Equally likely/unlikely	11.7	10	7.7	13.5
	Likely/Very likely	23.4	40	53.9	31.7
Reduce the Number of Cows					
	Unlikely/Very unlikely	64.9	94.1	88.9	74.5
	Equally likely/unlikely	12.3	0	11.1	10.6
	Likely/Very likely	22.8	5.9	0	14.9
Try another type of farming					
	Unlikely/Very unlikely	70.2	93.3	66.7	77.2
	Equally likely/unlikely	10.5	6.7	22.2	9.8
	Likely/Very likely	19.3	0	11.1	13
Transfer management					
	Unlikely/Very unlikely	66.1	72.2	50	63.8
	Equally likely/unlikely	10.7	11.1	20	11.7
	Likely/Very likely	23.2	16.7	30	24.5

SECTION II: FARM REPRESENTATION AND BUDGETING APPROACH

The cost of producing milk in Maine is estimated using procedures similar to those followed in estimating the cost of processing milk in Maine (Dalton et al., 2001; Dalton et al., 2002). The procedure is also consistent with the guidelines for budgeting approved by American Agricultural Economics Association and the USDA Economic Research Service (AAEA Task Force on Commodity Costs and Returns, 2000).

Farm Representation

Three cost of production budgets are estimated: one for each of the three clusters. These budgets are then combined into one single representative budget by weighting the small, medium and large budgets by the proportion of Maine producers found in each cluster. These proportions were estimated from a list of producers provided by the Maine Milk Commission current to November 1, 2002. According to this list, there were 412 dairy producers in the state on that date. Within the entire population are two groups for which representative budgets were not estimated: the very large farms with greater than 300 dairy cows and the organic producers. There were insufficient surveys returned for each of these groups to generate operation specific budgets.

Fifty two of the 412 farms (12.7%) produce milk for the organic market. The average herd size for these producers is 46 cows. All but two of these farms are smaller than 80 cows. On the other extreme, 4.1% of Maine producers have herds that are considered "large" by USDA standards (greater than 300 cows). 84% of the organic producers were attributed to the small cluster and 16% to the medium cluster. All of the very large farms were attributed to the large cluster. As a result, the composite representative budget is composed of 68.8 % of the small farm budget, 23.7% of the medium farm budget and 7.5% of the large budget.

Budget Components

The cost of production budgets are decomposed into three major categories: annual operating expenses, annual overhead expenses and annual depreciation and interest. The first two categories can be combined to approximate the variable cost of production while the last represents the fixed cost of production. Each category is discussed below.

Annual Operating Expense

Annual operating expenses are those production costs that vary with production. It includes labor, purchased feed, livestock expenses, crop and pasture expenses, maintenance and equipment expense, milk check deductions and interest on working capital. Estimation procedures for each of these components is listed below.

Labor

Labor cost is broken into three categories: family labor, hired labor and management expense. The total quantity of family and hired labor is estimated from survey responses. An average hourly wage for hired labor was also estimated \$8.67/hr from survey response¹. To this

¹ This is the average wage rate for the medium and large farms and not the "State" wage reported in Table 8.

wage is added Social Security, unemployment compensation tax, workers compensation insurance and health insurance charges.

Family labor is treated in two ways. In order to explicitly capture the opportunity cost of family labor, the hired wage rate is used for family labor as well. This approximates the potential family earnings if a dairy producer was employed in an alternative agricultural wage earning activity. Benefits are added to this charge as well. The return to family labor is also calculated at the bottom of each budget. This procedure does not attribute a wage rate to family labor but calculates an implicit wage. This is done by determining short-run and long-run profits without family labor costs, and then dividing this amount by total family labor.

Management expense occurs on the large farm only. This value acts to control for size differences and the value of time that must be allocated to manage labor, scheduling and non-livestock production activities. \$40,000 was attributed only to the large farm because of its size. This fee only adds \$0.07/cwt to labor costs in the composite budget.

Purchased Feed

The purchased feed category includes two components: dairy forage and dairy concentrate. Nearly all farmers who responded to the survey produced 100% of their forage requirements. As a result, there is no cost in this budget line. All costs of production for forage are included in crop and pasture expense, labor and machinery and equipment depreciation. Dairy concentrate includes all composite feeds and this budget line was derived from survey responses.

Livestock Expenses

Livestock expense includes those costs that can be directly attributed to the dairy herd. Included in this category are breeding (artificial insemination), veterinary and medicine, bedding, DHIA record keeping and livestock insurance. Artificial insemination plus veterinary and medicine charges are estimated from the surveys. Bedding costs are engineered based upon the herd size. It is constructed by multiplying the herd size by a fixed bedding coefficient by the cost of sawdust and wood shavings. DHIA expense are estimated at an average cost of \$0.07/cwt. Small farms did not use DHIA record keeping on average while the medium and large did. An average insurance rate of 1.2% is applied to the value of the herd.

Crop and Pasture Expense

Crop and pasture expense includes all variable costs of producing feed and forage. It includes, seeds, crop protection chemicals, fertilizer, lime and "other" costs. Each of these budget lines are derived from survey responses.

Maintenance and Equipment Expense

The fifth category includes those charges associated with the operation of mechanical equipment on the farm. It includes fuel and oil charges for the day-to-day operation and repair expenses for equipment. These costs are derived from survey responses.

Deduction Charges

The sixth category includes charges associated with the marketing and transportation of milk. Milk marketing charges are composed of Federal milk promotion taxes of \$0.150/cwt, Maine Dairy Industry Association fees of \$0.010/cwt, Maine Milk Commission levies of

\$0.025/cwt, and Cooperative fees of \$0.100/cwt. As not all dairy producers are members of cooperatives, this fee is weighted by the percentage of farms marketing their milk through a cooperative. Approximately 1/3 of Maine producers market through a cooperative. Hauling and trucking charges are calculated from survey responses.

Working Capital Interest Expense

The final charge in the operating cost section is an interest charge on working capital used to account for the opportunity cost of input purchase. A 8% short-term interest rate is applied to ½ of the total annual operating expense. This rate is based upon Farm Credit Service rates for operating credit and it is converted to a real interest of 4.7% to control for annual inflation.

Annual Overhead Expense

Annual overhead expenses are costs that are attributed to the farm operation as a whole. They include property taxes, farm insurance, dues and professional fees, utilities and miscellaneous charges.

Property taxes are estimated using the weighted average property tax rates for all dairy producers. This was calculated by matching the municipal mill rates with the location of each producer. Using this procedure, the weighted average property tax rate was 1.795%. This rate was multiplied against the estimated total asset value of the farm. Farm insurance rates are also calculated at a fixed rate of 1.2% of the total value of the farm (Diversified Agrinsurance, 2002).

The final three components of the annual overhead expense section are derived from survey responses. They include dues to professional organization and fees paid to accountants, consultants, legal and other sources. Utility expenses include electricity, fuel oil, propane, water and any other utility charge. The final category is general miscellaneous expense.

Annual Depreciation and Interest Expense

Annual depreciation and interest charges are calculated using an economic engineering approach and applied to land, buildings, machinery and the livestock herd. All land is valued at the average survey reported value of \$550/acre. This value is consistent with values reported for pasture and cropland reported in the Maine State Department of Revenue Property Tax Bulletin No. 18. That report was produced to provide information on the Farm and Open Space Tax law debate. While there is considerable variation in land prices dues to quality and location, these factors cannot be taken into consideration in an average budgeting approach.

Farm buildings and equipment compliments were derived from survey responses. Based upon farmer responses, typical farm building and equipment portfolios were generated. Replacement costs were estimated for each of these components. Buildings costs were estimated using the RSMeans Building Construction Cost Data 2002 guidelines adjusted to the Lewiston/Auburn area. Equipment costs were derived from the budgeting guidelines and equipment dealers (AAEA, 2000).

Based upon these cost estimates, depreciation and interest charges are derived using the capital recovery approach detailed in Dalton et al., 2002. These two components capture the use value of capital and the opportunity cost of investing farm or bank capital into these operations. Interest charges were calculated based upon a 9% loan rate typical for intermediate term assets provided to a farm with an "average" credit history (FCS). This nominal rate was converted to a real rate by dividing by the average inflation rate of 3.1% calculated over the past 20 years. This

resulted in a real interest rate of 5.7%. By explicitly specifying this interest rate, the opportunity cost of investment in dairy production is captured. All budget calculations thus contain what can be considered either as interest recovery on bank equity or the farmer's return to equity.

Depreciation and interest are also calculated over livestock. All animals are valued at the farm estimates from the survey. Dairy cows (the breeding herd) are depreciated over a cull rate of 25% while a death loss of 10% is assumed for the remaining animals in the herd.

PART III: DAIRY COST OF PRODUCTION BUDGETS AND IMPLICATIONS

Budget results based upon the descriptive statistics and information provided in Section I, and the budgeting approach described in Section II, are presented below. They are based upon a representative herd size of 68 cows. These results should be compared with two recent studies that have estimated the cost of producing milk for the Northeast.

In 1999, the cost of producing fluid milk for the New England Milk Market was estimated for the Northeast Dairy Compact Commission (Lass, 1999). This survey collected information from 271 operations located in Maine, New Hampshire, Vermont, Massachusetts, New York, Connecticut, and Rhode Island. Eleven percent of the responses were from Maine. Under an assumed wage rate of \$7.18/hr for farm labor and an 8.05% interest rate on capital, the study estimated a cost of production of \$21.06/cwt.

A second recent study was conducted by the USDA Economic Research Service for the Northern Crescent region. The Northern Crescent region includes all of the Northeast, portions of Pennsylvania, Maryland, Minnesota and Ohio plus all of Michigan and Wisconsin. This study estimated the cost of producing milk at \$20.58 based on a herd size of 68 milk cows. This herd size is identical to the representative model for Maine and it was also estimated based on cost of production information for 2001 (USDA ERS, 2002).

Based upon the farm types and procedures described in the preceding chapters of this report, the total weighted average cost of producing milk in Maine is estimated at \$22.79/cwt (Table 10). This is \$1.73/cwt greater than the value reported in the New England Dairy Compact study and \$2.28/cwt higher than the results calculated by the USDA for the Northern Crescent region². Total annual operating costs are \$13.74/cwt and total overhead cost is \$3.10/cwt. Combined, these two costs represent the short-run cost of production of \$16.84/cwt. Ownership expense is \$5.95/cwt and captures the full economic cost of capital usage plus and explicit real return to investment (producer or bank equity) of 5.4%. Budgets for the small, medium and large farms are found in the Appendix.

In comparison with the USDA estimates for the Northern Crescent, labor costs and purchased feed costs are very similar between the two budgets. With regards to livestock production, veterinary and medicine costs, overall profession service costs, including DHIA record keeping, are lower for Maine producers but bedding costs are similar to the Northern Crescent budgets.

Several factors are distinctly higher for Maine producers than for the Northern Crescent estimates. Fuel, lubrication and utility costs are estimated at \$1.01/cwt for Maine producers but

² Applying the \$7.18 wage rate and 8.05% interest rate used in the Lass study to the budgets estimated in this project would increase the cost of producing milk in Maine to \$23.44/cwt or \$2.38/cwt higher than the Northeast average in the Compact study.

only \$0.54/cwt for the Northern Crescent. Repair costs are also significantly higher for Maine producers which is reflective of the advanced age of the capital assets used by most of the producers in the small and medium clusters. Estimates for Maine producers are \$0.42 higher. In addition to these two categories, taxes and insurance are significantly higher for Maine producers than for the Northern Crescent. Taxes and insurance for the Northern Crescent are only \$0.22/cwt while property taxes alone are \$0.92/cwt for Maine producers. Combined, these three factors account for \$1.59/cwt of additional operating and overhead cost for Maine producers.

Table 10: Cost of production budget for representative Maine farm

Number of Cows		68		
Annual Milk Shipment (cwt)		11,712		
Annual Milk Shipment (lbs/cow)		16,164		
Annual Revenue		<i>Total</i>	<i>Per Cow</i>	<i>Per cwt</i>
Milk Receipts (\$12.57/cwt)	\$	150,646	\$ 2,104	\$ 13.06
Crop and Hay Revenue	\$	3,241	\$ 56	\$ 0.36
Livestock Revenue	\$	7,788	\$ 111	\$ 0.68
"Other" revenue	\$	-	\$ -	\$ -
<i>Total Revenue</i>	\$	161,675	\$ 2,272	\$ 14.10
Annual Operating Expenses		<i>Total</i>	<i>Per Cow</i>	<i>Per cwt</i>
<i>Labor</i>				
Family	\$	46,957	\$ 803	\$ 5.13
Hired	\$	7,943	\$ 72	\$ 0.39
Management fee	\$	2,960	\$ 15	\$ 0.07
<i>Subtotal</i>	\$	57,860	\$ 890	\$ 5.59
<i>Purchased Feed</i>				
Dairy Forage	\$	-	\$ -	\$ -
Dairy Concentrate	\$	46,762	\$ 619	\$ 3.80
<i>Subtotal</i>	\$	46,762	\$ 619	\$ 3.80
<i>Livestock Expenses</i>				
Breeding Fees	\$	2,320	\$ 32	\$ 0.20
Veterinary and Medicine	\$	4,504	\$ 63	\$ 0.39
Bedding	\$	2,412	\$ 35	\$ 0.22
DHIA expenses	\$	501	\$ 4	\$ 0.02
Livestock insurance	\$	1,536	\$ 22	\$ 0.13
<i>Subtotal</i>	\$	11,274	\$ 156	\$ 0.96
<i>Crop and Pasture Expense</i>				
Seeds	\$	2,011	\$ 27	\$ 0.17
Chemicals	\$	745	\$ 13	\$ 0.08
Fertilizer	\$	3,016	\$ 41	\$ 0.25
Lime	\$	1,064	\$ 15	\$ 0.09
Other	\$	1,663	\$ 17	\$ 0.10
<i>Subtotal</i>	\$	8,500	\$ 113	\$ 0.69

<i>Maintenance and Equipment Expense</i>			
Fuel and oil	\$ 6,087	\$ 82	\$ 0.50
Machinery repairs	\$ 11,579	\$ 166	\$ 1.03
<i>Subtotal</i>	\$ 17,666	\$ 248	\$ 1.54
<i>Deduction Charges</i>			
Milk marketing	\$ 2,557	\$ 35	\$ 0.22
Hauling and Trucking	\$ 6,792	\$ 100	\$ 0.63
<i>Subtotal</i>	\$ 9,349	\$ 135	\$ 0.84
<i>Interest (4.7% on 1/2 of total operating expense)</i>	\$ 3,558	\$ 51	\$ 0.32
<i>Total Operating Expense</i>	\$ 154,968	\$ 2,213	\$ 13.74
Annual Overhead Expense			
	<i>Total</i>	<i>Per Cow</i>	<i>Per cwt</i>
Property Tax	\$ 9,296	\$ 145	\$ 0.92
Farm Insurance	\$ 7,330	\$ 112	\$ 0.70
Dues and Professional Fees	\$ 1,123	\$ 16	\$ 0.10
Utilities	\$ 6,274	\$ 97	\$ 0.61
Miscellaneous	\$ 9,607	\$ 127	\$ 0.77
<i>Total Overhead Expense</i>	\$ 33,630	\$ 497	\$ 3.10
Annual Depreciation and Interest Expense			
	<i>Total</i>	<i>Per Cow</i>	<i>Per cwt</i>
Land	\$ 11,210	\$ 186	\$ 1.18
Buildings	\$ 23,774	\$ 355	\$ 2.22
Machinery and Equipment	\$ 11,432	\$ 145	\$ 0.88
<i>Subtotal</i>	\$ 46,415	\$ 685	\$ 4.28
<i>Livestock Herd</i>			
Cows (milking and dry)	\$ 15,161	\$ 212	\$ 1.31
Heifers	\$ 3,215	\$ 43	\$ 0.26
Calves	\$ 1,079	\$ 16	\$ 0.10
Dairy Bulls	\$ 64	\$ 1	\$ 0.01
<i>Subtotal</i>	\$ 19,518	\$ 272	\$ 1.68
<i>Total Ownership Expense</i>	\$ 65,934	\$ 957	\$ 5.95
Total Annual Cost	\$ 254,532	\$ 3,666	\$ 22.79
Long-run net return	\$ (92,857)	\$ (1,395)	\$ (8.69)
Short-run return over variable cost	\$ (26,923)	\$ (438)	\$ (2.74)
Performance Measures			
<i>Breakeven price(\$/cwt)</i>		<i>\$/cow</i>	<i>\$/cwt</i>
<i>Long-run to cover all costs</i>		\$ 3,499	\$ 21.75
<i>Short-run to cover operating and overhead</i>		\$ 2,542	\$ 15.79
Return to family labor			
	<i>Total</i>	<i>Hourly</i>	
<i>Long-run return to family labor</i>	\$ (45,900)	\$ (8.18)	
<i>Short-run return to family labor</i>	\$ 20,034	\$ 4.32	

Implications for Maine Producers and Budget Simulations

The budgets highlight several significant factors in the cost of production. Based upon the statistical uniform price for the first nine months of this year, and adjusting the remaining months of 2003 to similar levels, the average annual price of milk for 2002 is estimated at \$12.57/cwt. When livestock and crop revenue is integrated into total farm revenue, the farm will require a producer milk price of \$21.75/cwt in the long-run or \$15.79/cwt in the short-run to breakeven. The short-run measure does not include depreciation and interest charges and provides a benchmark of the minimum price required to breakeven in the near term. The long-run breakeven price is \$9.18/cwt higher than current prices and \$3.22/cwt higher than the short-run price.

When family labor is not explicitly accounted for with the \$8.67/hr wage assumption, the long-run return to family labor, net of all other costs of production including the return to investment, indicates that dairy families are not receiving any wage for their labor but are losing \$8.18/hr. This hourly loss may be viewed as the amount of money that dairy producers are *paying* to produce milk when all other factors of production are accounted for. In the short-run, that is omitting depreciation and interest from the budget estimates, the return to family labor is only \$4.32/hr.

The return to investment is often implicitly derived rather than explicitly accounted for as in these budgets. When this assumption is changed, and no interest is charged to the farm investment, the long-run cost of production drops to \$19.34/cwt and the short-run remains unchanged. Approximately \$3.45 of the cost of producing milk is tied to the interest cost of farm investment leaving \$2.50 to depreciation. Even without an explicit return to capital, the breakeven price is significantly higher than current price levels.

Energy Costs

Energy costs were identified as being significantly higher for Maine producers than from Northern Crescent producers. Electricity prices for Maine are similar to those found in New Hampshire and Vermont but higher than those found in Massachusetts. Two rates are compared in Table 11 from data compiled by the Energy Information Agency: residential and small commercial rates for 2000 (EIA, 2002).

Table 11: Average electricity prices in 2000 for four New England states (\$/kwh)

	Residential	Commercial
Maine	0.1292	0.1077
Vermont	0.1230	0.1061
New Hampshire	0.1314	0.1087
Massachusetts	0.1053	0.0922

Source: EIA, 2002

Average residential rates for electricity are higher in New Hampshire than in Maine. In addition, commercial rates were also lower in Vermont and Massachusetts. On average, the greatest price differences existed between Massachusetts and Maine where residential rates were 23% lower (\$0.0239/kwhr) and commercial rates were 12% lower (\$0.0155/kwhr). Overall this illustrates that not only Maine, but northern New England, has higher electricity price than Massachusetts.

Energy cost estimates used in the budgets were derived from 2001 data which were lower than current energy prices. Data is available from the Energy Information Administration only to July 2002. Information from several monitors of daily gasoline prices indicate that current price levels for gasoline are sharply higher, approximately 28%, than one year ago (MaineGasPrices, 2002). Based upon this evidence, a conservative twenty-five percent increase in the cost of energy was simulated in the cost of production budgets. This increase added \$0.15/cwt to the cost of producing milk.

CONCLUSIONS

This project has derived a representative cost of production estimate for Maine dairy farmers. This estimate is based upon responses from the 2002 Cost of Production survey implemented by the University of Maine and the Maine Milk Commission. These surveys were used to develop typical farm units to represent the dairy farming population as a whole. From these characteristic farms, economic engineering budgeting approaches were applied to value all factors used in dairy production following best practice budgeting approaches.

Overall, when all factors of production are accounted for, including variable operating expenses, overhead, depreciation and interest, the long-run cost of producing milk is estimated at \$22.79 for Maine dairy producers. When depreciation and interest are omitted, the short-run cost of production is \$16.84.

Several factors contribute to the higher cost of production of Maine producers over Northern Crescent producers as a whole. Comparison of the two budgets indicates that three factors: energy costs, property taxes and repair expenses account for \$1.59/cwt of additional operating and overhead cost to Maine producers. Dairy producers are price-takers with the first two factors; that is they operate under set rules and regulations that are beyond their control. Producers do have control over repair expenses but in order to reduce this cost, investment in new equipment is required. Under current price conditions in the dairy sector, capital formation for these purchases will be difficult making cost savings in this component difficult to realize.

At current milk prices, the returns to farm labor are negative indicating that dairy producers will be forced to reduce inventories or liquidate farm assets to remain in operation. Based upon the results of these budgets, this situation will only become more exacerbated as petroleum prices are approximately 25% higher now than when the survey data was collected.

Future analysis will examine alternative strategies to reduce costs for Maine dairy farmers. This includes determining appropriate strategies for small, medium and large farms. While the medium and large farms indicated that they are considering herd expansion as a strategy to benefit from economies of scale, small farmers indicated that they are not interested in expanding. An alternative strategy may lie in modernization of milking systems to reduce labor demand and increase labor efficiency.

WORKS CITED

- AAEA Task Force on Commodity Costs and Returns. Commodity Costs and Returns Estimation Handbook. 2000. Ames IA: AAEA.
- Dalton, T.J., Criner, G.K. and J. Halloran. 2002. Fluid Milk Processing Costs: Current State and Comparisons. *J. Dairy Sci.* 85: 984-991.
- Dalton, T.J., Criner, G.K. and J. Halloran. 2001. 2000 Fluid Milk Processing Costs in Maine. MAFES Technical Bulletin 181, December 2001.
- Diversified Agrinsurance. 2002. <<http://www.dfsfin.com/directory/default.asp>>. Accessed 8/06/2002.
- EIA. 2002. Energy Information Administration various data on energy prices. Available: http://www.eia.doe.gov/emeu/states/main_me.html). Accessed 10/31/2002.
- Lass, D.A. 1996 Cost of Production in the New England Milk Market. Unpublished manuscript prepared for the Northeast Dairy Compact Commission. Available: <http://www.dairycompact.org/costprod.htm>. Accessed 11/15/2001.
- MaineGasPrices. 2002. Available: <http://www.mainegasprices.com/>. Accessed 11/06/2002.
- OSU. 2002. Dairy Excel's 15 Measures of Dairy Farm Competitiveness: Measure 1: Rate of Production. Available: http://ohioline.osu.edu/b864/b864_4.html. Accessed 10/14/2002.
- USDA ERS. 2002. Dairy Cost and Return Estimates for 2000-2001. Available: <http://www.ers.usda.gov/Data/CostsAndReturns/>. Accessed 4/13/2002.

APPENDIX: PRODUCTION BUDGETS FOR ALL THREE FARM TYPES

Appendix Table 1. Cost of Production Budget for Small Farm

Number of Cows	44		
Annual Milk Shipment (cwt)	6,611.6		
Annual Milk Shipment (lbs/cow)	15,026		
Revenue (0=reported, 1=calculated)	1		
Annual Revenue	<i>Total</i>	<i>Per Cow</i>	<i>Per cwt</i>
Milk receipts*	\$ 89,391	\$ 2,031.61	\$ 13.52
Crop and Hay Revenue	\$ 2,651	\$ 60.25	\$ 0.40
Livestock Revenue	\$ 4,316	\$ 98.09	\$ 0.65
"Other" revenue	\$ -	\$ -	\$ -
Total Revenue	\$ 96,358	\$ 2,190	\$ 14.57
Annual Operating Expenses	<i>Total</i>	<i>Per Cow</i>	<i>Per cwt</i>
<i>Labor</i>			
Family	\$ 40,142	\$ 912	\$ 6.07
Hired	\$ -	\$ -	\$ -
Management Fee	\$ -	\$ -	\$ -
Subtotal	\$ 40,142	\$ 912	\$ 6.07
<i>Purchased Feed</i>			
Dairy Forage	\$ -	\$ -	\$ -
Dairy Concentrate	\$ 24,000	\$ 545	\$ 3.63
Subtotal	\$ 24,000	\$ 545	\$ 3.63
<i>Livestock Expenses</i>			
Breeding Fees	\$ 1,400	\$ 32	\$ 0.21
Veterinary and Medicine	\$ 2,583	\$ 59	\$ 0.39
Bedding	\$ 1,500	\$ 34	\$ 0.23
DHLA expenses	\$ -	\$ -	\$ -
Livestock insurance	\$ 893	\$ 20	\$ 0.14
Subtotal	\$ 6,376	\$ 145	\$ 0.96
<i>Crop and Pasture Expense</i>			
Seeds	\$ 960	\$ 22	\$ 0.15
Chemicals	\$ 660	\$ 15	\$ 0.10
Fertilizer	\$ 1,500	\$ 34	\$ 0.23
Lime	\$ 600	\$ 14	\$ 0.09
Other	\$ 400	\$ 9	\$ 0.06
Subtotal	\$ 4,120	\$ 94	\$ 0.62
<i>Maintenance and Equipment Expense</i>			
Fuel and oil	\$ 3,200	\$ 73	\$ 0.48
Machinery repairs	\$ 6,843	\$ 156	\$ 1.04
Subtotal	\$ 10,043	\$ 228	\$ 1.52

<i>Deduction Charges</i>			
Milk marketing	\$ 1,444	\$ 33	\$ 0.22
Hauling and Trucking	\$ 4,430	\$ 101	\$ 0.67
<i>Subtotal</i>	\$ 5,873	\$ 133	\$ 0.89
<i>Interest (4.7% on 1/2 of total operating expense)</i>	\$ 2,128	\$ 48	\$ 0.32
<i>Total Operating Expense</i>	\$ 92,682	\$ 2,106	\$ 14.02
Annual Overhead Expense			
Property Tax	\$ 6,667	\$ 152	\$ 1.01
Farm Insurance	\$ 5,011	\$ 114	\$ 0.76
Dues and Professional Fees	\$ 664	\$ 15	\$ 0.10
Utilities	\$ 4,386	\$ 100	\$ 0.66
Miscellaneous	\$ 4,500	\$ 102	\$ 0.68
<i>Total Overhead Expense</i>	\$ 21,229	\$ 482	\$ 3.21
Annual Depreciation and Interest Expense			
Land	\$ 9,092	\$ 207	\$ 1.38
Buildings	\$ 15,440	\$ 351	\$ 2.34
Machinery and Equipment	\$ 4,928	\$ 112	\$ 0.75
<i>Subtotal</i>	\$ 29,460	\$ 670	\$ 4.46
<i>Livestock Herd</i>			
Cows (milking and dry)	\$ 8,687	\$ 197	\$ 1.31
Heifers	\$ 1,603	\$ 36	\$ 0.24
Calves	\$ 651	\$ 15	\$ 0.10
Dairy Bulls	\$ 46	\$ 1	\$ 0.01
<i>Subtotal</i>	\$ 10,988	\$ 250	\$ 1.66
<i>Total Ownership Expense</i>	\$ 40,448	\$ 919	\$ 6.12
Total Annual Cost	\$ 154,359	\$ 3,508	\$ 23.35
Long-run net return	\$ (58,001)	\$ (1,318)	\$ (8.77)
Short-run return over variable cost	\$ (17,553)	\$ (399)	\$ (2.65)
Performance Measures			
<i>Breakeven Revenue per cow and price(\$/cwt)</i>		\$/cow	\$/cwt
Long-run to cover all costs		\$ 3,350	\$ 22.29
Short-run to cover operating and overhead		\$ 2,431	\$ 16.18
Return to family labor			
	Total	Hourly	
Long-run return to family labor	\$ (17,859)	\$ (4.29)	
Short-run return to family labor	\$ 22,589	\$ 5.43	

*Based upon an average blended price of \$12.57/cwt

Appendix Table 2. Cost of Production Budget for Medium Farm

Number of Cows		95		
Annual Milk Shipment (cwt)		17,136.3		
Annual Milk Shipment (lbs/cow)		18,038		
Revenue (0=reported, 1=calculated)			1	
Annual Revenue		Total	Per Cow	Per cwt
Milk receipts*	\$	199,189	\$ 2,096.73	\$ 11.62
Crop and Hay Revenue	\$	5,980	\$ 62.95	\$ 0.35
Livestock Revenue	\$	14,750	\$ 155.26	\$ 0.86
"Other" revenue	\$	-	\$ -	\$ -
Total Revenue	\$	219,919	\$ 2,315	\$ 12.83
Annual Operating Expenses		Total	Per Cow	Per cwt
<i>Labor</i>				
Family	\$	60,055	\$ 632	\$ 3.50
Hired	\$	25,013	\$ 263	\$ 1.46
Management fee	\$	-	\$ -	\$ -
<i>Subtotal</i>	\$	<i>85,068</i>	<i>\$ 895</i>	<i>\$ 4.96</i>
<i>Purchased Feed</i>				
Dairy Forage	\$	-	\$ -	\$ -
Dairy Concentrate	\$	70,686	\$ 744	\$ 4.12
<i>Subtotal</i>	\$	<i>70,686</i>	<i>\$ 744</i>	<i>\$ 4.12</i>
<i>Livestock Expenses</i>				
Breeding Fees	\$	2,750	\$ 29	\$ 0.16
Veterinary and Medicine	\$	6,723	\$ 71	\$ 0.39
Bedding	\$	3,538	\$ 37	\$ 0.21
DHIA expenses	\$	1,200	\$ 13	\$ 0.07
Livestock insurance	\$	2,378	\$ 25	\$ 0.14
<i>Subtotal</i>	\$	<i>16,588</i>	<i>\$ 175</i>	<i>\$ 0.97</i>
<i>Crop and Pasture Expense</i>				
Seeds	\$	4,050	\$ 43	\$ 0.24
Chemicals	\$	650	\$ 7	\$ 0.04
Fertilizer	\$	5,500	\$ 58	\$ 0.32
Lime	\$	2,000	\$ 21	\$ 0.12
Other	\$	3,200	\$ 34	\$ 0.19
<i>Subtotal</i>	\$	<i>15,400</i>	<i>\$ 162</i>	<i>\$ 0.90</i>
<i>Maintenance and Equipment Expense</i>				
Fuel and oil	\$	9,586	\$ 101	\$ 0.56
Machinery repairs	\$	19,000	\$ 200	\$ 1.11
<i>Subtotal</i>	\$	<i>28,586</i>	<i>\$ 301</i>	<i>\$ 1.67</i>
<i>Deduction Charges</i>				
Milk marketing	\$	3,741	\$ 39	\$ 0.22
Hauling and Trucking	\$	9,254	\$ 97	\$ 0.54
<i>Subtotal</i>	\$	<i>12,995</i>	<i>\$ 137</i>	<i>\$ 0.76</i>

<i>Interest (4.7% on 1/2 of total operating expense)</i>	\$ 5,389	\$ 57	\$ 0.31
Total Operating Expense	\$ 234,712	\$ 2,471	\$ 13.70
Annual Overhead Expense			
Property Tax	\$ 13,330	\$ 140	\$ 0.78
Farm Insurance	\$ 10,782	\$ 113	\$ 0.63
Dues and Professional Fees	\$ 1,500	\$ 16	\$ 0.09
Utilities	\$ 9,056	\$ 95	\$ 0.53
Miscellaneous	\$ 18,471	\$ 194	\$ 1.08
Total Overhead Expense	\$ 53,139	\$ 559	\$ 3.10
Annual Depreciation and Interest Expense			
Land	\$ 14,531	\$ 153	\$ 0.85
Buildings	\$ 36,460	\$ 384	\$ 2.13
Machinery and Equipment	\$ 20,860	\$ 220	\$ 1.22
Subtotal	\$ 71,851	\$ 756	\$ 4.19
Livestock Herd			
Cows (milking and dry)	\$ 22,841	\$ 240	\$ 1.33
Heifers	\$ 5,532	\$ 58	\$ 0.32
Calves	\$ 2,005	\$ 21	\$ 0.12
Dairy Bulls	\$ 93	\$ 1	\$ 0.01
Subtotal	\$ 30,470	\$ 321	\$ 1.78
Total Ownership Expense	\$ 102,322	\$ 1,077	\$ 5.97
Total Annual Cost	\$ 390,173	\$ 4,107	\$ 22.77
Long-run net return	\$ (170,254)	\$ (1,792)	\$ (9.94)
Short-run return over variable cost	\$ (67,931.89)	\$ (715.07)	\$ (3.96)
Performance Measures			
<i>Breakeven Revenue per cow and price(\$/cwt)</i>		<i>\$/cow</i>	<i>\$/cwt</i>
Long-run to cover all costs		\$ 3,889	\$ 21.56
Short-run to cover operating and overhead		\$ 2,812	\$ 15.59
Return to family labor	Total	Hourly	
Long-run return to family labor	\$ (110,199)	\$ (17.66)	
Short-run return to family labor	\$ (7,877)	\$ (1.26)	

*Based upon an average blended price of \$12.57/cwt

Appendix Table 3. Cost of Production Budget for Large Farm

Number of Cows		200		
Annual Milk Shipment (cwt)		41,916.0		
Annual Milk Shipment (lbs/cow)		20,958		
Revenue (0=reported, 1=calculated)			1	
Annual Revenue		Total	Per Cow	Per cwt
Milk receipts*	\$	566,721	\$ 2,833.61	\$ 13.52
Crop and Hay Revenue	\$	-	\$ -	\$ -
Livestock Revenue	\$	17,875	\$ 89.38	\$ 0.43
"Other" revenue	\$	-	\$ -	\$ -
Total Revenue	\$	584,596	\$ 2,923	\$ 13.95
Annual Operating Expenses		Total	Per Cow	Per cwt
<i>Labor</i>				
Family	\$	69,006	\$ 345	\$ 1.65
Hired	\$	27,224	\$ 136	\$ 0.65
Management fee	\$	40,000	\$ 200	\$ 0.95
Subtotal	\$	136,230	\$ 681	\$ 3.25
<i>Purchased Feed</i>				
Dairy Forage	\$	-	\$ -	\$ -
Dairy Concentrate	\$	182,400	\$ 912	\$ 4.35
Subtotal	\$	182,400	\$ 912	\$ 4.35
<i>Livestock Expenses</i>				
Breeding Fees	\$	9,527	\$ 48	\$ 0.23
Veterinary and Medicine	\$	15,319	\$ 77	\$ 0.37
Bedding	\$	7,325	\$ 37	\$ 0.17
DHIA expenses	\$	2,934	\$ 15	\$ 0.07
Livestock insurance	\$	4,841	\$ 24	\$ 0.12
Subtotal	\$	39,947	\$ 200	\$ 0.95
<i>Crop and Pasture Expense</i>				
Seeds	\$	5,284	\$ 26	\$ 0.13
Chemicals	\$	1,850	\$ 9	\$ 0.04
Fertilizer	\$	9,200	\$ 46	\$ 0.22
Lime	\$	2,400	\$ 12	\$ 0.06
Other	\$	8,500	\$ 43	\$ 0.20
Subtotal	\$	27,234	\$ 136	\$ 0.65
<i>Maintenance and Equipment Expense</i>				
Fuel and oil	\$	21,800	\$ 109	\$ 0.52
Machinery repairs	\$	32,000	\$ 160	\$ 0.76
Subtotal	\$	53,800	\$ 269	\$ 1.28
<i>Deduction Charges</i>				
Milk marketing	\$	9,152	\$ 46	\$ 0.22
Hauling and Trucking	\$	20,958	\$ 105	\$ 0.50
Subtotal	\$	30,110	\$ 151	\$ 0.72

<i>Interest (4.7% on 1/2 of total operating expense)</i>	\$ 11,038	\$ 55	\$ 0.26
<i>Total Operating Expense</i>	\$ 480,758	\$ 2,404	\$ 11.47
Annual Overhead Expense			
Property Tax	\$ 20,941	\$ 105	\$ 0.50
Farm Insurance	\$ 17,938	\$ 90	\$ 0.43
Dues and Professional Fees	\$ 4,200	\$ 21	\$ 0.10
Utilities	\$ 15,000	\$ 75	\$ 0.36
Miscellaneous	\$ 28,825	\$ 144	\$ 0.69
<i>Total Overhead Expense</i>	\$ 86,903	\$ 435	\$ 2.07
Annual Depreciation and Interest Expense			
Land	\$ 20,425	\$ 102	\$ 0.49
Buildings	\$ 60,941	\$ 305	\$ 1.45
Machinery and Equipment	\$ 41,852	\$ 209	\$ 1.00
<i>Subtotal</i>	\$ 123,217	\$ 616	\$ 2.94
Livestock Herd			
Cows (milking and dry)	\$ 50,953	\$ 255	\$ 1.22
Heifers	\$ 10,823	\$ 54	\$ 0.26
Calves	\$ 2,100	\$ 10	\$ 0.05
Dairy Bulls	\$ 139	\$ 1	\$ 0.00
<i>Subtotal</i>	\$ 64,015	\$ 320	\$ 1.53
<i>Total Ownership Expense</i>	\$ 187,232	\$ 936	\$ 4.47
Total Annual Cost	\$ 754,894	\$ 3,774	\$ 18.01
Long-run net return	\$ (170,297)	\$ (851)	\$ (4.06)
Short-run return over variable cost	\$ 16,935	\$ 85	\$ 0.40
Performance Measures			
<i>Breakeven Revenue per cow and price(\$/cwt)</i>		\$/cow	\$/cwt
Long-run to cover all costs		\$ 3,685.09	\$ 17.58
Short-run to cover operating and overhead		\$ 2,748.93	\$ 13.12
Return to family labor			
	Total	Hourly	
Long-run return to family labor	\$ (101,291)	\$ (14.12)	
Short-run return to family labor	\$ 85,941	\$ 11.98	

*Based upon an average blended price of \$12.57/cwt